Proceedings of the 36th International Congress of the ISAE

Proceedings of the 36th International Congress of the ISAE
Edited by Paul Koene and the Scientific Committee of the 36th ISAE Congress
Wageningen, the Netherlands, 2002

Published by Paul Koene for the Organising Committee of the 36th ISAE Congress
Printed by Ponsen and Looijen, Wageningen, the Netherlands

Contents

Credits

Proceedings

Editors

Paul Koene
Scientific committee

Scientific Committee

Berry Spruijt (chair)
Dinand Ekkel
Frank Ödberg
Hans Spoolder
Harry Blokhuis
Kees van Reenen
Paul Koene
Ruud van den Bos
Willem Schouten

Referees

Alain Boissy
Bart Houx
Bas Rodenburg
Beat Wechlser
Berry Spruijt
Bjorne Forkman
Bonne Beerda
Christian Krohn
Claudia Vinke
Dinand Ekkel
Donald Broom
Eberhard von Borell
Eddie Bokkers
Edmund Pajor
Elisabetta Canali
Francien de Jonge
Georgia Mason
Hanno Wurbel
Hans Hopster
Hans Spoolder
Harry Blokhuis
Heleen Van de Weerd
Herman Vermeer
Ian Duncan
Ian Inglis
Ingrid de Jong
Jan Ladewig
Johan Schrama
Kees Van Reenen
Lena Lidfors
Lene Munksgaard
Linda Keeling
Lindsay Matthews
Marina Verga
Mark Bracke
Marko Ruis
Mateus Paranhos da Costa
Mellie Oitzl
Mette Herskin
Michael Cockram
Morten Bakken
Paul Koene
Pierre Le Neindre
Robert M. Murphey
Ruud van den Bos
Sandra Edwards
Shusuke Sato
Stefan Gunnarson
Sylvie Cloutier
Willem Schouten
Xavier Boivin

Design and layout

Paul Koene

Cover Design

Paul Koene

Conference

Organising Committee

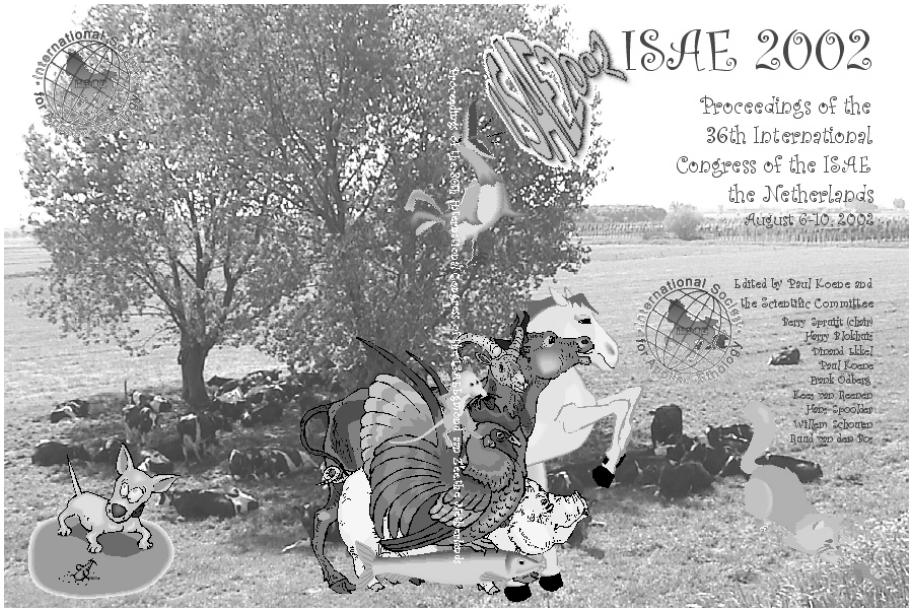
Harry Blokhuis (chair)
Hans Hopster
Herman Vermeer
Ingrid de Jong
Lenny van Erp-van der Kooij
Liesbeth Bolhuis
Marc Bracke
Marko Ruis
Nicoline Geverink
Paul Koene

Technical Support

Bart Houx
Raymond de Heer

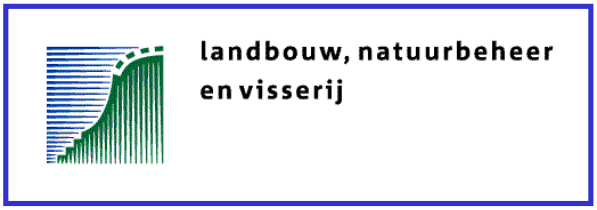
Conference organisation

Monique Arts



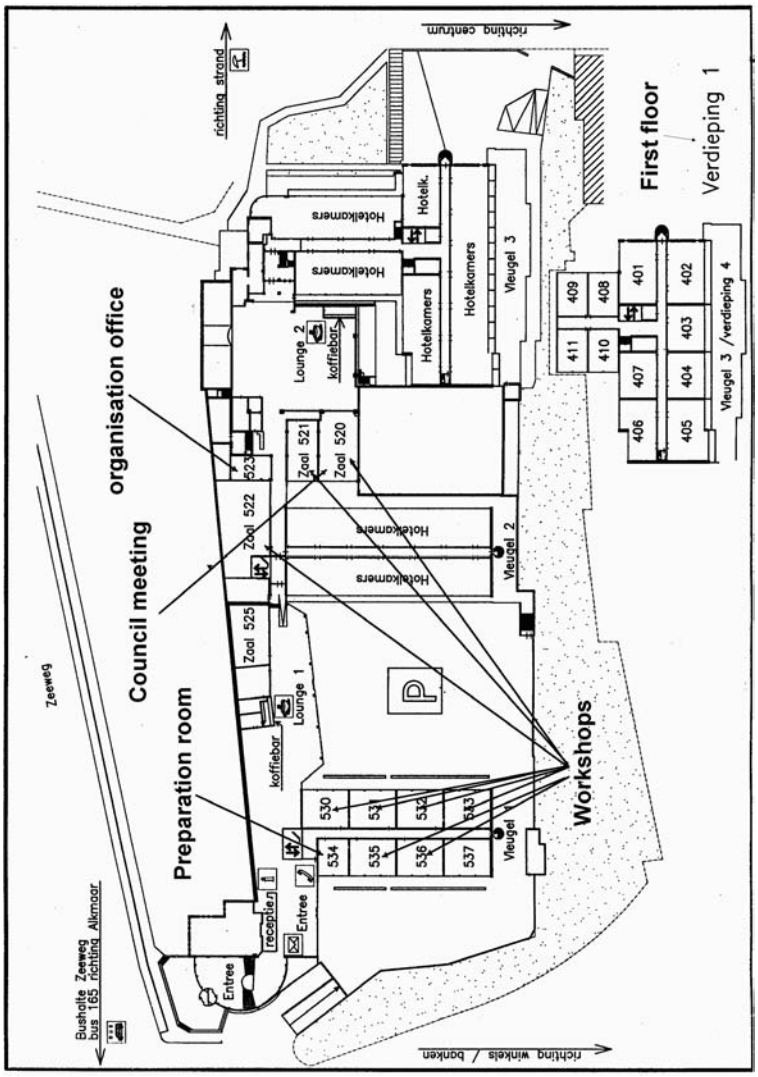
Conference Sponsors

The organisers gratefully thank the sponsors

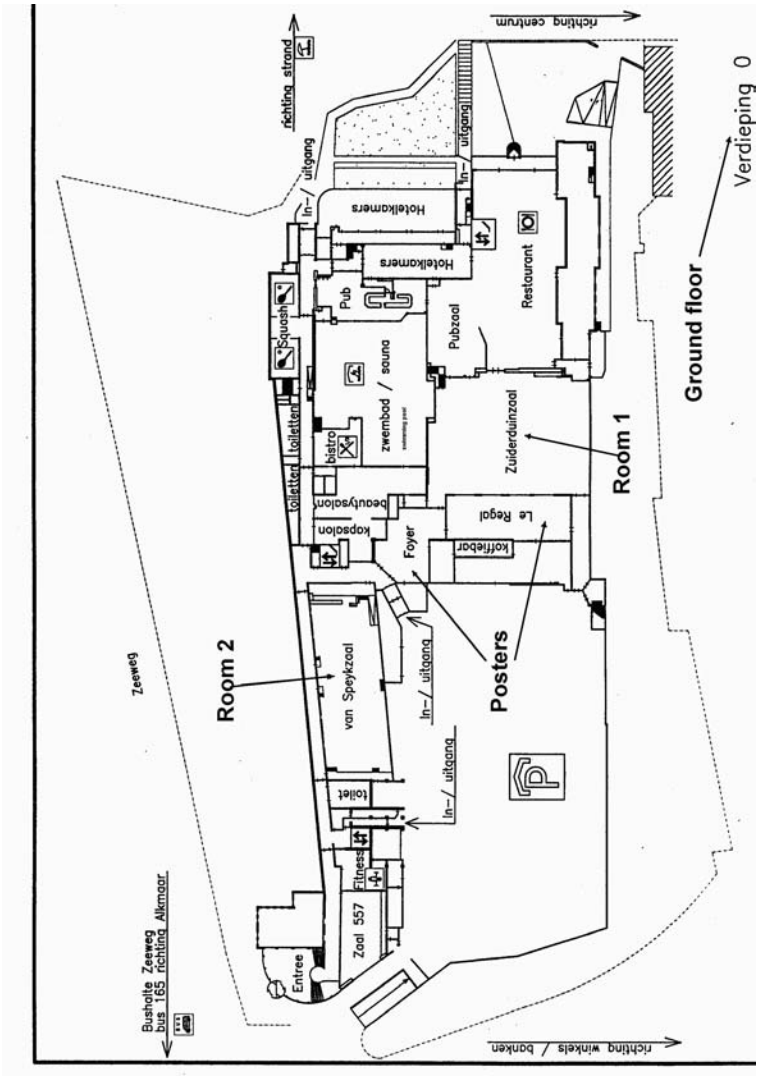


Zuiderduin

First floor



Ground floor



General information

Two session rooms will be available for us in hotel 'Zuiderduin' during the congress. All plenary sessions will be held in the 'Zuiderduinzaal. The other sessions will be held in the 'Zuiderduinzaal' and the 'Van Speykzaal'. Room nr. 534 will be available as speaker preparation room. An extra room will be available for us during the congress, where 10 PC's with Internet connection will be stationed ('Internet room'). Here it will be possible to check your e-mail, surf on the Internet or work on your Power Point presentation. Additional rooms will be available for the workshops (see first floor)..
Room 523 is the office of the organisation.

Presentations

Invited Speakers

Invited speakers will have 45 minutes for their oral presentation, 8 minutes will be allowed for discussion and questions and 2 minutes for room changes.

Oral presentations

Two types of oral presentation will be given, 'long' and 'short' presentations. Oral presenters with a 'long' presentation will have 15 minutes for their talk, 8 minutes will be allowed for discussion and questions and 2 minutes will be allowed for room changes and set up time for the next presenter. For the 'short' presentations this schedule will be 10 minutes for the talk, 3 minutes for discussion and questions and 2 minutes for room changes. The time schedule will be followed strictly.

Speaker preparation room (534)

We have arranged one speaker preparation room with 2 laptop computers with Power Point, and a slide projector. The laptops in this room are meant for checking of files only. If you want to edit your presentation, please use the Internet computers in the Internet room.

Guidelines for posters

The posters will be on display during the entire congress. Poster presenters must be at their posters for questions and discussion during the sessions noted on the program. Posters must not exceed 110 cm (width) x 140 cm (height).

Final programme

Scientific Programme

The scientific programme includes plenary, long and short oral parallel and poster sessions and workshops. Prof. Frederick M. Toates accepted our invitation to present the Wood-Gush memorial lecture. The programme will focus on animal behaviour and welfare and is concentrated around 4 main topics. Each topic is introduced by an invited speaker

Main Topics

1) The relevance of natural behaviour - natural behaviour, essential or a luxury, reduction of stress by natural behaviours, implementation in practice

2) Integration of research on human welfare and animal welfare: neurobiology of depression, anxiety, addiction, social and conduct disorders, stereotyped behaviours, chronic stress

3) Behaviour and welfare assessment in farm animals: behavioural indicators, validation, monitoring, animal oriented, models Aquaculture and fish - perception, cognitive abilities, sensory systems, stress & health, killing of fish

4) Aquaculture and fish - perception, cognitive abilities, sensory systems, stress & health, killing of fish

Tuesday, August 6, Day 0

09:00 Dedomestication and feralization: ethology meets ethics: a satellite symposium

09:30 ISAE Council meeting (Room 520)

14:00 Registration, Poster installation

20:00 Welcome (Aula)

Wednesday, August 7, Day 1

07:30 Registration, Poster installation

09:00 Opening Congress and Wood-Gush lecture

	The D.G.M. Wood-Gush Memorial Lecture Room 1: Zuiderduin Chair: Spruijt, B.M.	
09:30	Toates, F. Cognition, motivation, emotion and action: a dynamic and vulnerable interdependence Wood-Gush lecture 01	

10:30 Coffee break

11:00 Short oral session

	Room 1: Zuiderduin	Room 2: Van Speyk
	Behaviour and welfare assessment in farm animals Assessment I Chair: Newberry, *R.*C.	Free papers Free I Chair: Wechsler, B.
11:00	Sandilands, V. Objectively measuring broiler leg health: motivating birds to walk along a 1.8 m race Short oral 01	Cloutier, S. Differences in skeletal and ornamental traits between laying hen cannibals, victims and bystanders Short oral 07
11:15	King, L.A. Quantitative Assessment of Stereotypic Pecking in Broiler Breeders Short oral 02	Kobelt, A.J. A survey of housing conditions and behaviour problems of domestic dogs in suburban Australia Short oral 08
11:30	Rasmussen, D.K. Motivation of group-housed sows for using feeding stalls in the mating area outside feeding hours Short oral 03	Shields, S.J. Dustbathing substrate preference in broiler chickens: implications for animal welfare Short oral 09
11:45	Boyle, L. Effect of leaving piglets' teeth intact on sow behaviour and welfare in farrowing crates Short oral 04	Pickup, H.E. An investigation into postural communication between ewes and lambs and its role in maintaining ewe-lamb proximity Short oral 10
12:00	Van Driel, K.S. Development of an ear sensor to measure body temperature and heart rate in pigs Short oral 05	Spinka, M. Nursing sychronization and milk ejection success in lactating sows: Don't suckle your babies alone Short oral 11
12:15	Van de Weerd, H.A. Defining characteristics of species-specific environmental enrichment for pigs Short oral 06	Illmann, G. Why there is a synchronization of nursings bouts in lactating sows? Short oral 12

12:30 Lunch Break

13:30 Plenary and long oral session

	The relevance of natural behaviour Natural I Chair: Ladewig, J	
13:30	Matthews, L. Behavioural priorities for natural behaviours: a critical review and way forward Plenary 01	Free papers Free II Chair: Forkman, B.
14:15	Murphey, R.M.M. Allonursing: Group Selection or Selection Failure?. Long oral 01	Tuyttens, F. A. M. Effects of castration on the welfare and social behaviour of pigs: a review Long oral 03
14:40	Goodwin, D. Promoting Natural Foraging Behaviour in Stabled Horses Long oral 02	Latham, N. From House Mouse to Mouse House Long oral 04

15:05 Tea Break

15:30 Short oral session

	The relevance of natural behaviour Natural II Chair: Murphey, R.M.	Free papers Free III Chair: Sherwin, C.M.
15:30	Jensen, M.B. Operant conditioning as a method to assess lying motivation in dairy heifers Short oral 13	Galindo, F. Behavior of Spotted Dolphins (Stenella attenuata) during Tuna Fishing Sets in the Eastern Tropical Pacific (ETP) Ocean Short oral 20
15:45	Mollema, E. Quantifying the contact patterns of a Heckcattle population in the Netherlands with regard to transmission of bovine herpesvirus 1 (BHV) Short oral 14	Waiblinger, S. Human-cow interactions during milking and their relation to cows' behaviour and to production Short oral 21
16:00	Holm, L. Measuring social motivation in calves by operant conditioning: effect of type of social contact Short oral 15	Erhard, H.W. Observations on laterality (side-preference) in a T-maze Short oral 22
16:15	Stephen, J.M. Individual differences in the behavioural signs of stress in kennelled dogs Short oral 16	Van Hierden, Y.M. Feather pecking and coping strategy in chicks from a high and low feather pecking line of laying hens Short oral 23
16:30	Koene, P. Wild koniks or tame tarpans? A behavioural comparison between the konik horses from Popielno, Poland and koniks in nature reserves in the Netherlands Short oral 17	Forkman, B. What's in a chicken brain? A review of the cognitive abilities of chickens Short oral 24
16:45	Van Dierendonck, M. Affiliative behaviour and spatial organisation in a large herd (containing castrated males) of Icelandic horses in semi feral conditions Short oral 18	Yngvesson, J. Cannibalism in laying hens - Effect of early access to perches on escape behaviour Short oral 25
17:00	Pedersen, L.J. Substitutability of different rooting materials to pigs: assessed by the cross point between two demand functions Short oral 19	

18:00 Dinner

19:30 Workshops

19:30	Workshop 01 Room 520	De Bree, J., Van Reenen, C.G. and Engel, B. Biologist-friendly statistics workshop
19:30	Workshop 02 Room 531	Day, J.E.L. Towards a consensus view on the future of non-confinement farrowing systems Workshop
19:30	Workshop 03 Room 530	Rodenburg, T.B., Van Hierden, Y.M., Buitenhuis, A.J. and Riedstra, B. Feather pecking in laying hens: new insights?
19:30	Workshop 04 Room 521	Hopster, H. Consequences of grazing for the welfare and health of dairy cows
19:30	Workshop 05 Room 535	De Jonge, F.H. Workshop on scientific advice and decision-making processes: the Animal Needs Index as a tool
19:30	Workshop 06 Room 522	Stefanowska, J. Pros and cons of different animal-directed methods to evaluate housing systems for farm animals

Thursday, August 8, Day 2

8:30 Plenary and long oral session

	Room 1: Zuiderduin	Room 2: Van Speyk
	Integration of research on human welfare and animal welfare Integration I Chair: Keeling, L.J.	
08:30	Wolffgramm, J. Integration of Research on Human Welfare and Animal Welfare Plenary 01	Free papers Free IV Chair: Cooper, J.
09:15	Van der Harst, J.E. Anticipation to reward: a therapy for chronically stressed animals? Long oral 05	De Jong, I.C. Parameters to measure hunger in broiler breeders Long oral 07
09:40	Kjaer, J.B. Effects of haloperidol, a dopamine D2 antagonist, on feather pecking behaviour in laying hens: Evidence of a stereotyped stress response Long oral 06	Nielsen, B.L. Behavioural aspects of feeding constraints: Do broilers follow their gut feelings? Long oral 08

10:05 Poster session (Odd numbered posters) – Coffee

10:05	Presenting author	Poster label and number
10:05	Berk, J. Free range, behaviour of male turkeys and its effect on the spatial variability of phosphorus	Assessment poster 01
10:05	Chiku, F. Visiting periodicity of milking cows to an automatic milking system	Assessment poster 03
10:05	Colson, V. Behavioural and performance of piglets weaned at 3 and 4 weeks	Assessment poster 05
10:05	Fazio, E. Effect of long distance road transport on serum total and free iodothyronine levels of limousine calves: correlation to temperament and body weight loss	Assessment poster 09
10:05	Guy, J.H. The Pig Mobile: a simple environmental enrichment device for growing pigs in barren pens	Assessment poster 11
10:05	Hörning, B. Behaviour of outdoor housed sows and piglets in single or group farrowing paddocks	Assessment poster 13
10:05	Kisac, P. The effect of sire line on behaviour of heifers in the maze and open-field tests	Assessment poster 15
10:05	Korhonen, H.T. Behavioural and adrenocortical responses to swimming deprivation in mink	Assessment poster 17
10:05	Lay Jr., D.C. Behavior of feeder pigs housed in deep-bedded 'hoop' structures	Assessment poster 19
10:05	Lewis, E. Effect of different floor types in farrowing crates on sow welfare	Assessment poster 21
10:05	Merrill, R.J.N. Dustbathing behaviour of caged laying hens on novel floor types	Assessment poster 23
10:05	Orgeur, P. Prolificacy and welfare in pig: fostering and early weaning of supernumerary piglets	Assessment poster 25
10:05	Rodarte, L.F. Effect of environmental enrichment on the behaviour and salivary cortisol of piglets weaned at 14d of age	Assessment poster 27
10:05	Smith, E.L. Effect of supplementary ultraviolet lighting on the behaviour and circulating corticosterone of Japanese quail	Assessment poster 29
10:05	Stehulová, I. Dominance status in beef cattle: does it affect aggressivity?	Assessment poster 31
10:05	Vinke, C.M. Do family group housing systems improve the welfare of farmed mink?	Assessment poster 33
10:05	Zeltner, E. The use of free range area during rearing and laying by hens of different genetic strains	Assessment poster 35

10:05	Presenting author	Poster label and number
10:05	Inglis, I.R. Do laboratory rats choose to spend time together ?	Free poster 37
10:05	Arnould, C. Behaviour and emotional reactivity of quails reared in stable or unstable groups	Free poster 39
10:05	Bolhuis, J.E. Behavioural responses in a Restraint test of pigs with different Backtest classifications	Free poster 41
10:05	Christensen, J.W. Deficiency of calcium in the diet did not increase foraging activity by broilers in outdoor areas	Free poster 43
10:05	De Groot, J. Social stress impairs induction of immunological memory in young male pigs	Free poster 45
10:05	Edwards, S.A. Overground enrichment - A possible alternative to nose ringing in outdoor pigs?	Free poster 47
10:05	Geverink, N.A. Individual differences in response to short-term restraint stress in breeding gilts	Free poster 49
10:05	Kristensen, H.K. The effects of light colour and illuminance on the behaviour and fear responses of broilers	Free poster 51
10:05	Ligout, S. Twin recognition and phenotype matching among artificially reared lambs	Free poster 53
10:05	Morita, S. Changes of the utilization of automatic milking machine after the transfer cows to automatic milking system	Free poster 55
10:05	Ödberg, F.O. Odour from horse chestnuts (Equus caballus) on toys increases playing time in Beagles	Free poster 57
10:05	Rekilä, T. Behaviour toward man during the pre-mating period and temperament affect on reproduction in farmed mink	Free poster 59
10:05	Sato, S. Daily Home Ranges and Distances between Those were Stable in Cattle	Free poster 61
10:05	Takita, N. Effects of hand-touch for foal on behavior against human through and after suckling period	Free poster 63
10:05	Ungerfeld, R. LH and testosterone response of experienced and inexperienced rams to the presence of estrous ewes during the non-breeding season	Free poster 65
10:05	Van Erp-van der Kooij, E. Individual behavioural and immunological differences in pigs	Free poster 67
10:05	Visser, E.K. Horses differ in learning performances using two different learning tests	Free poster 69
10:05	Edwards, P.C. Behavioral problems reported in dogs and cats brought to the Universidad Nacional Autónoma de México (UNAM) Veterinary Hospital	Integration poster 71
10:05	Greenwood, V.J. Does the flicker frequency of fluorescent lighting affect the welfare of captive birds?	Integration poster 73
10:05	Ledger, R.A. Owner-dog matching procedures and their effect on dog re-homing success at rescue shelters	Integration poster 75
10:05	Tuchscherer, M. Effects of repeated social isolation on immunological, behavioural and endocrine responses in piglets	Integration poster 77
10:05	Ahola, L. Effects of social and physical environment on the welfare of juvenile farmed silver foxes	Natural poster 79
10:05	Ejvegård, S. How do laboratory dogs of different breeds utilise an enriched housing?	Natural poster 81
10:05	Pyykönen, T. Parental behaviour of group-housed farmed silver foxes in semi-natural environment	Natural poster 83
10:05	Shingu, Y. Difference of grazing behavior and distribution of Horses and Cattle on woodland pasture	Natural poster 85
10:05	Vichova, J. Does the pre-orbital gland opening signal hunger of red deer calves?	Natural poster 87

11:00 Short oral session

	Integration of research on human welfare and animal welfare Integration II Chair: Kjaer, J.	Free papers Free V Chair: Edwards, S.A.
11:00	Jarvis, S. Maternal deprivation of piglets does not alter the reactivity of their hypothalamic-pituitary-adrenal (HPA) axis later in life Short oral 27	Hänninen, S. The effects of family housing on welfare of juvenile farmed mink (Mustela vison) Short oral 32
11:15	McMullin, L. Behavioural consequences of ovariohysterectomizing bitches Short oral 28	Dwyer, C.M. Is behavioural development in the neonatal lamb a function of maturity at birth? Short oral 33
11:30	Tanida, H. Cross-cultural study of behaviour of the general public towards guide dog owners and guide dogs in Japan and the UK Short oral 29	Marchant Forde, J.N. The effects of Ractopamine – a beta-adrenergic agonist – on behaviour, heart rate and stress hormones of finishing pigs Short oral 34
11:45	Lerner, H. Welfare and well-being in animals: towards a richer conceptual framework and a better agreement between human and animal science Short oral 30	Van Loo, P.L.P. Male management - Coping with aggression problems in male laboratory mice Short oral 35
12:00	Winckler, C. Social behaviour of commercial dairy herds as a parameter for on-farm welfare assessment Short oral 31	Lindqvist, C. Red jungle fowl have more contrafreeloading than White Leghorn layers: effects of food deprivation and consequences for information gain Short oral 36

12:15 Preparation for the excursions

12:45 Excursions

Friday, August 9, Day 2

8:30 Plenary and long oral session

	Room 1: Zuiderduin	Room 2: Van Speyk
	Behaviour and welfare assessment in farm animals Assessment II Chair: Von Borell, E.	
08:30	Veissier, I. Assessing welfare: how can we get access to the mental world of animals ? Plenary 01	Free papers Free VI Chair: Zimmerman, P.H
09:15	Jensen, P. Ethology meets genomics: Trade-off between behaviour and other fitness related traits in fowl indicate limits to selection and evolution Long oral 09	Freire, R. Development of spatial cognition and hippocampus structure in the domestic chick Long oral 11
09:40	Spoolder, H.A.M. Applied research to support welfare policy making: a study to investigate solid floors for pigs Long oral 10	Sherwin, C.M. Cage colour preferences of laboratory mice and effects on emotionality Long oral 12

10:05 Poster session (Even numbered posters) - Coffee

	Presenting author	Poster label and number
10:05	Chaloupková, H. Effect of housing system of lactating sows on piglets' behaviour	Assessment poster 02
10:05	Coe, B.L. Free farmed: a united states farm certification program emphazing animal welfare	Assessment poster 04
10:05	Creighton, E. Matching Horses for Courses: Development of robust tests of equine temperament to optimise equine welfare	Assessment poster 06
10:05	Désiré, L. A cognitive approach to emotions: are the responses to suddenness and novelty different?	Assessment poster 08
10:05	Guesdon, V. Influence of sawdust distribution frequency on the motivation for dust-bathing in laying hens	Assessment poster 10
10:05	Hopster, H. Behavioral and physiological consequences of deprivation from nightly lying in dairy cows	Assessment poster 12
10:05	Houx, B. Infrared thermotracking as tool for assessing welfare: Synergy of behavioural and physiological measurement	Assessment poster 14
10:05	Koba, Y. Is rewarding necessary for heifers to choose familiar herd members in a Y-maze?	Assessment poster 16
10:05	Kranendonk, G. Methodological considerations on pharmacological validation of a novel object test in piglets	Assessment poster 18
10:05	Leeb, Ch. On-farm monitoring of lameness in pregnant sows	Assessment poster 20
10:05	Loberg, J. The effect of Automatic Milking Systems compared to tie stall system on the human-animal interaction in dairy cows	Assessment poster 22
10:05	O'Callaghan, K.A. The effect of lameness treatment on daily activity levels, daily milk yield and locomotion of dairy cattle	Assessment poster 24
10:05	Reed, B.T. Provision of space and not substrate facilitates maternal behaviour in primiparous sows	Assessment poster 26
10:05	Schulze Westerath, H. Learning ability and fearfulness in broilers kept in barren or enriched housing	Assessment poster 28
10:05	Stefanowska, J. Pros and cons of different evaluation methods for flooring systems in cowsheds	Assessment poster 30
10:05	Terrazas, A. "Evidence for maternal selective behavior recovery in goats following two years of anosmia"	Assessment poster 32
10:05	Wolf, F.M. Influence of age at weaning on the behaviour of piglets raised outdoors	Assessment poster 34
10:05	Lambooij, E. Criteria for assessment of slaughter methods of eel (Anguilla anguilla) and African catfish (Clarias gariepinus)	Fish poster 36

	Presenting author	Poster label and number
10:05	Álvarez, L. The relationships between social dominance in female goats and response to male effect	Free poster 38
10:05	Baranyiova, E. Intraspecies aggression and bite wounds in dogs	Free poster 40
10:05	Broucek, J. Effects of feeding method from the second week to weaning on locomotor behavior of heifers	Free poster 42
10:05	Dahlborn, K. Environmental and social enrichment in laboratory mice: Effects on exploration, weight gain and urine corticosterone	Free poster 44
10:05	Decker, E.L. Running operant conditioning equipment, or whatever, from any old PC	Free poster 46
10:05	Eguchi, Y. Jumping ability of Japanese wild boars	Free poster 48
10:05	Kohari, D. Who initiates maternal behaviour, a cow or a calf ?	Free poster 50
10:05	Lansade, L. Effect of early handling on the behaviour of young horses	Free poster 52
10:05	Meijer, M.K. Environmental enrichment as a tool for the reduction of acute stress in laboratory mice	Free poster 54
10:05	Newberry, R.C.C . Behavioural assessment of pain in cats following onychectomy and tenectomy	Free poster 56
10:05	Petherick, C. Relationships between measures of beef cattle temperament and some blood parameters	Free poster 58
10:05	Ruis, M.A .W. Aggressive interactions between breeding does are related to degree of familiarity	Free poster 60
10:05	Seo, T. Can Individual vibratory pagers be used to leading cows to concentrate feeding stations efficiently?	Free poster 62
10:05	Tanaka, T. A computer-control operant conditioning system for visual discrimination tests with dogs	Free poster 64
10:05	Van den Bos, R. Replacing stimulus animals by scent-filled cups in the rat social discrimination test?	Free poster 66
10:05	Vermeer, H.M. Distribution of fattening pigs in a two-level choice pen: can future welfare regulations be met by providing existing pens with a second floor?	Free poster 68
10:05	Yayou, K. The role of endogenous CRH in stress responses in calves	Free poster 70
10:05	Gomm, M.K. Rats' ability to recognise humans in a laboratory setting: limited exposure is enough	Integration poster 72
10:05	Horii, T. Stress assessment by dogs' behavior and urinary catecholamine concentrations under animal-assisted activity	Integration poster 74
10:05	Okamoto, K. Case report –Effect of therapeutic riding by handicapped persons on the behaviour of Kiso horses	Integration poster 76
10:05	Valsecchi, P. Dogs' behavior in two different Italian shelters: environmental influence on behavior	Integration poster 78
10:05	Augustsson, H. Could “physical fitness” be part of the animal welfare concept?	Natural poster 80
10:05	Hansen, S.W. Reward duration – a matter of concern in relation to the construction of demand curves	Natural poster 82
10:05	Rundgren, M. The behaviour of foals before and after weaning in group	Natural poster 84
10:05	Takeda, K. Reduction of peeling damage to shade tree in a free barn caused by rubbing of cattle	Natural poster 86

11:00 Short oral session

	Behaviour and welfare assessment in farm animals Assessment III Chair: Lawrence, A.B.	The relevance of natural behaviour Natural III Chair: Goodwin, D.
11:0	Gilbert, C.L. Effect of space restriction on pre- and postpartum maternal behaviour in the pig Short oral 37	Van der Mheen, H.W. Rooting area for sows to prevent pasture damage Short oral 43
11:15	McIntyre, J. Preference for blood and behavioural characteristics of known tail biting pigs compared to control penmates Short oral 38	Loberg, L. Behaviour in tied dairy cows with different amount of exercise Short oral 44
11:30	Hänninen, L. Predicting calf`s sleep from the resting behaviour: The correlation between EEG findings and a resting body postures Short oral 39	De Leeuw, J.A. Effect of feeding in a foraging substrate on the welfare of restricted-fed sows Short oral 45
11:45	Kristensen, H.H. Light quality and the visual acuity of broiler chickens Short oral 40	Zimmerman, P.H. Navigational ability in the domestic fowl Short oral 46
12:00	Väisänen, J. Social coherence tendency vs. foraging motivation - environmental and social adaptation capacity in young red jungle fowl and white leghorn layers Short oral 41	Docking, C.M. The effect of age on the use of potential enrichment objects by pigs Short oral 47
12:15	Canali, E. Assessment of equine welfare at farm level: first steps, problems and perspective Short oral 42	Vandenberg, C.M. Aggressive Responses of Roosters Toward a Model Rooster Illuminated by Different Light Sources Short oral 48

12:30 Lunch break

13:30 Short oral session

	Behaviour and welfare assessment in farm animals Assessment IV Chair: Jensen, P.	Free papers Free VII Chair: Nielsen, B.L.
13:30	Rodenburg, T.B. Feather pecking and open-field response in an F2 cross of high and low feather pecking lines of laying hens Short oral 49	Damm, B.I. Prepartum nest removal increases plasma cortisol and heart rate, and alters maternal behaviour in sows Short oral 56
13:45	Sheppard, K.C. Nesting behaviour in broiler breeder fowl: Effects of light type and level of illumination on nest site selection Short oral 50	Valros, A. Oxytocin, prolactin and somatostatin in lactating sows; associations with body resource mobilisation and maternal behaviour Short oral 57
14:00	Lawrence, A.B. Lactation-induced hypo-responsiveness of the pituitary-adrenal axis may reduce the stress response of lactating sows to the farrowing crate Short oral 51	Andersen, I.L. Crushing of piglets – a matter of maternal protectiveness and personality? Short oral 58
14:15	Croney, C.C. Odor Learning and Match to Sample in Micro pigs (Sus scrofa) Short oral 52	Lidfors, L. Does larger enriched cages have an effect on behaviour of two strains of laboratory rats? Short oral 59
14:30	Break (little walk)	
14:45	Bracke, M.B.M. Decision support system with semantic model to assess the risk of tail biting in pigs Short oral 53	Jung, J. Teat choice and suckling patterns in Bos indicus calves – optimal foraging and begging Short oral 60
15:00	Breuer, K. Interrelationships between exploratory and harmful social behaviours in the weaner pig Short oral 54	Kerbrat, S. Improved method for detecting estrus behavior in dairy cows Short oral 61
15:15	O'Connell, N.E. Influence of predisposition and rearing environment on the performance of harmful social behaviour by gilts Short oral 55	Bratbo Sørensen, D. Aggression and emotionality in two lines of a phenylethanolamine-n-methyl-transferase (pnmt) overexpressing transgenic mouse model Short oral 62

15:30 Annual General Meeting (AGM)

20:00 Banquet

Saturday, August 10, Day 4

8:30 Plenary and long oral session

	Room 1: Zuiderduin	Room 2: Van Speyk
	Aquaculture and fish Fish I Chair: Blokhuis, H.J.	
08:30	Verreth, J.A.J. Welfare in Fish Farming Plenary 01	Free papers Free VIII Chair: De Jong, I.C.
09:15	Conte, F.S. Establishing Mechanisms to Increase Aquaculture Producer Cognizance and Adoption of Aquatic Animal Welfare Objectives Long oral 13	Bokkers, E.A.M. Eating behaviour and satiety in male broiler- and layer chicks Long oral 15
09:40	Chandroo, K.P. The Welfare Status of Farmed Fish: Sentience and Pain Perception Long oral 14	Marchant Forde, R.M. The effects of analgesia on behaviour and heart rate during dehorning in calves Long oral 16

10:05 Poster session (all) - Coffee

11:00 Short oral session

	Aquaculture and fish Fish II Chair: Verreth, J.A.J.	Behaviour and welfare assessment in farm animals Assessment V Chair: Jarvis, S.
11:00	Eriksen, M.S. Fluctuating asymmetry and malformations as welfare indicators in aquaculture Short oral 63	Paranhos da Costa, M.J.R. Mating strategies by Nelore bulls under natural breeding Short oral 69
11:15	Almazán-Rueda, P. Group size and space availability affect behaviour and stress parameters in African catfish (Clarias gariepinus) Short oral 64	Von Borell, E. Monitoring the frequency and duration of outside run visits by laying hens of different genotype Short oral 70
11:30	Van de Vis, J.W. Assessment of slaughter methods of turbot (Psetta maxima), eel (Anguilla anguilla) and African catfish (Clarias gariepinus) by behavioural observation and post mortem analysis Short oral 65	Wechsler, B. Space requirements of horned and hornless goats at the feed barrier Short oral 71
11:45	Broom, D.M. Pain and adrenal function in fish Short oral 66	Bonde, M. What does lying behaviour by group housed sows tell us about sow welfare? Short oral 72
12:00	Sneddon, L.U. Pain perception in the rainbow trout Short oral 67	Langford, F.M. The electrophysiological recognition of sleep behaviour in sheep Short oral 73
12:15	Kristiansen, T.S. Well-being of reared Atlantic halibut (Hippoglossus hippoglossus L): high fish densities increase swimming activity and reduce feeding and growth rates. Short oral 68	Tosi, M.V. Stockperson-husbandry interactions and animal welfare in the extensive livestock industries Short oral 74

12:30 Conference closing

12:45 Lunch

David Wood-Gush Memorial Lecture

Cognition, motivation, emotion and action: a dynamic and vulnerable interdependence

Toates, F.

The Open University, Milton Keynes MK7 6AA, UK

A model is proposed in which behaviour is determined by a number of identifiable processes such as 'on-line' direct links between stimuli and responses and 'off-line' cognitions. It is suggested that, under natural conditions, the weight attached to these processes varies as a function of circumstances, reflecting adaptive considerations. Under unusual environmental conditions an abnormal relative weight can become associated with one or more of the component processes, leading to abnormal behaviour.

A model is suggested and it is argued that the relative weight of the factors determining behaviour will vary as a function of:

- ontogeny and age. With development, the weight that can be attached to off-line processes increases. Senility can be associated with some loss of this capacity.
- phylogeny. For example, primates have a particularly refined capacity to exploit cognition and have thereby can exhibit the most autonomy from direct stimulus control.
- learning. With repetition of a given task, control can shift from organization by off-line cognitive processes into a more automatic mode.
- brain damage. Given that certain brain structures can be identified as the embodiment of the processes underlying the control of behaviour, their damage can be associated with a shift of control. For example, the hippocampus and prefrontal cortex are specialized at the task of performing off-line cognitive control. Damage to a brain region can affect one factor in behavioural control but spare another. For example, damage to the prefrontal cortex tends to limit the capacity to exhibit off-line control.
- chemical factors. A disturbance to the brain's chemical environment can disturb one process more than another. For example, evidence suggests that maintaining prefrontal cortical levels of catecholamines within a narrow range is a necessary condition for performing certain cognitive tasks

The problem of performing a course of single coherent goal-directed action involves a process of competition between candidates for behavioural control. The physical base of this competition and action-selection appears to be the basal ganglia. The model invites speculation on the role of dopamine in such action selection.

Both motivation and emotion need to be understood in terms of multiple levels of control. It is suggested that motivational and emotional inputs to the control of behaviour occur at both low- and high-levels. A distinction between dopamine-mediated

wanting and non-dopamine-mediated liking is discussed. In determining behaviour, it is suggested that there can be some competition between levels of motivational control. The relevance of this to the so-called 'misbehaviour of organisms' is discussed. The model can be applied to the control of exploration and with its help the roles of the hippocampus and nucleus accumbens better identified.

An impoverished developmental history can lead to a relative weakness of cognitive control in the face of more direct triggers to behaviour. It is suggested that this is reflected in the increased tendency to stereotypies exhibited under these conditions. It is suggested that in adult animals even with a normal developmental history, stereotypies arise from a shift in weight of control between levels. The question is raised as to whether stereotypies serve any function in terms of their feedback consequences (e.g. to maintain an optimal level of arousal).

The model that is proposed suggests some reconciliation of 'hard' mechanistic and 'soft' cognitive models of behaviour since these capture two different aspects of the control of behaviour. Animals can be seen to incorporate features of automatons but also to exhibit a capacity to experience feelings and suffering.

Keywords:	cognition, motivation, emotion, action, stereotypy, abnormal behaviour
Species:	general
Session, type, nr	The D.G.M. Wood-Gush Memorial Lecture, Wood-Gush lecture 01
For information contact	Fred Toates or email F.Toates@open.ac.Uk

Plenaries

Behavioural priorities for natural behaviours: assessment and implications for animal welfare

Matthews, L. and Gregory, R.

Animal Behaviour and Welfare, AgResearch, Private Bag 3123, Hamilton, New Zealand

The aims of this paper are to: critically review methods for quantifying behavioural priorities; identify common deficiencies with these methods; propose a way forward based on theoretical and empirical information about behavioural and physiological adaptations to challenge, and to show how this information can be used in the design of appropriate environments in which to keep animals.

There is a burgeoning scientific interest in quantifying the relative importance of different behaviours, so that high priority activities can be identified and accommodated in facility design. In much of this work, it is often assumed that behaviours have a fixed value, and that activities can be rank-ordered on a uni-dimensional scale based on this value (or priority).

These assumptions, which imply that the value of one activity is independent of its association with other behaviours and physiological processes, are rarely true and, thus, categorising activities into “luxuries” and “necessities” is not sensible. Amongst other things, the numbers of alternative responses available to satisfy a particular requirement, and the relative cost of accessing those alternatives, influence the measures of value.

- For example, the value of pecking/scratching in an experimental situation as measured by demand elasticity (-0.48), was lower than that for dust-bathing (-0.14), most likely because pecking/scratching, but not dust-bathing, could be performed at other times. Activities, such as feeding, become increasingly valued as simultaneously available alternatives become more costly.
- Further, in a recent study investigating the relative values of resting, feeding and standing with cattle,, we observed that the priority for standing at increasing levels of food deprivation differed depending on the level of lying deprivation (i.e. standing priority declined in rested animals and increased in lying-deprived cattle, $p<0.05$).

These results suggest that: measures of behavioural priority are likely to be situation specific; and, that measures obtained using methodologies in which the effects of alternative responses are quantified will be most useful and applicable to a wide variety of environments. Abnormal behaviours are common in animals kept in many intensive production environments. It is often assumed that such behaviours are a consequence of the inability of animals to display a range of particular (important) behaviours. While this is most likely true in some cases, the role of physiological processes is often overlooked in the search for the causes of, and remedies for, abnormal behaviours.

It will be argued that behavioural priority assessments, in conjunction with an understanding of essential physiological processes and their functions, is likely to provide the best way to identify appropriate environments for animals.

Keywords:	behavioural priorities, assessment,, environmental requirements, welfare
Species:	general
Session, type, nr	Relevance of Natural Behaviour, Plenary 01
For information contact	Lindsay Matthews or email lindsay.matthews@agresearch.co.nz

Integration of research on human welfare and animal welfare

Wolffgramm, J.

Section of Addiction Research, University Hospital of Psychiatry, University of Tübingen, Germany

Mental disorders that become apparent in altered behaviour can be found in both human beings and other vertebrate species. Parallels can either be due to analogous symptoms that are not biologically related to each other (convergence) or to a homology between human and animal disorder. Homology means that the disorders are related to the same causes, develop in the same way with the same mechanisms, and are based on the same phylogenetic roots. For animal models of human disorders, the homology aspect is extremely important since the development of causal therapeutic strategies can only be done by use of homologous models.

A comparison between human and animal mental disorders does not reveal a homogeneous picture. There is at present no striking evidence for schizophrenia in laboratory rodents. Personality disorders in rats or mice might be induced by perinatal disturbances, but evidence is still poor. Probably, animals can develop depression, even major depression, but no “endogenous” type of depression could yet be proven. Best evidence for homology exists in the fields of fear (especially phobia) and addiction. The lecture will focus on results concerning the development of addictive behaviour in rats, mice and man.

First question: Why do human and nonhuman subjects take psychotropic substances ?

There are two possible, alternative answers. Either the subject uses the substance to achieve a desired change of mood (rewarding effect, or relief of an adverse emotional state like anger, anxiety or depression) or the substance user takes the drug according to an irresistible, conscious or non-conscious urge for the drug. In the first case, self-administration depends on personality, situation (especially social variables), mood and other circumstances (e.g. the taste of an alcoholic drink). It is controlled by neural pathways that mediate behavioural reinforcement and can at any time be reduced or terminated according to adverse circumstances. This mode of alcohol or drug taking can be called "controlled consumption". In the second case, the drug user has lost control over substance intake. Drug seeking has become compulsive. Both loss of control and a persistent “addiction memory” that causes relapses even after long abstinence characterize addictive disorders. Alcohol-addicted rats, for instance, take alcohol solutions even after adulteration with a bitter tasting additive and continue alcohol intake when an attractive sucrose solution is presented as an alternative.

Second question: Which is the course of addiction development ?

In both human beings and laboratory rodents, the development of an addictive disorder runs through four subsequent phases. The first one includes the initial experiences with the psychotropic substance. By means of learning processes, the subject experiences the drug’s dose-dependent effects and the consequences of different temporal patterns

of intake. The second phase is the period of controlled consumption, it may last lifelong in those subjects which never become addicted. Its characteristics have been described above. In part of the subjects, controlled consumption leads after some time to a transition phase and then to loss of control. The latter step includes a “point of no return”, i.e. it is almost impossible for an addicted subject to regain control again.

Third question: Which factors cause addiction ?

At present, there are two alternative hypotheses: neuroadaptation and memory of addiction. The neuroadaptation hypothesis assumes that some regulatory adaptive changes on the cellular level that are induced by chronic or intermittent administration of the drug, persist after the end of drug supply. These changes might be responsible for loss of control. The memory of addiction hypothesis postulates that stimulus-dependent learning processes are involved. A decision between these hypotheses can be achieved by comparing subjects that were given a continuous free choice between water and drug solutions with those that had been forced to take the drug. The latter animals become physically dependent on the drug (withdrawal syndrome) but do not develop addictive behaviour. Neuroadaptation can therefore not be regarded as a sufficient condition for addiction. Instead, an experience – based addiction memory must be involved.

Fourth question: When does addiction emerge ?

A comparison between the drug consumption data of later opiate-addicted and non-addicted rats reveals no differences between these animals during the phases of first experiences and controlled consumption. Then, from one week to another, the later addicts increase their opiate does up to the fourfold to six fold of the previous values. The later non-addicts do not change their does. With d-amphetamine, the results are very similar. In experiments with alcohol, no such transition period with increased doses is visible. The existence of a “hidden” transition period can, however, be proven by means of experiments with varying time intervals of alcohol supply. Only rats with free alcohol choice over a period of more than 40 weeks become addicted.

Fifth question: What happens during the transition period ?

Provided that the drug is withdrawn during a sensitive period, the animal becomes addicted. An addiction memory is formed that is highly resistant to extinction. If, however drug supply is continued, the transition period ends after 6-8 weeks and leads again to controlled consumption. During the sensitive period, the brain seems to develop an elevated level of neuroplasticity. The combination of a “sensitive period”, resistance of the memory contents to erasure and compulsive consequences of the memory on behaviour resemble in their entirety to an imprinting process that is similar to sexual imprinting.

Keywords:	addiction, mental disorder, human welfare, animal welfare
Species:	general
Session, type, nr	*Integration of research on human welfare and animal welfare, Plenary* 02
For information contact	Jochen Wolffgramm or email jochen.wolffgramm@medimod.com

Assessing welfare: how can we get access to the mental world of animals ?

Veissier, I., Boissy, A. and Désiré, L.

URH-ACS, INRA-Theix, F-63122 Saint Genès Champanelle, France

Welfare can be defined as a state of harmony between an individual and its environment, which is met when this environment fulfils all the individual's needs and preference (Hughes, 1976). When the environment is not ideal coping strategies help the animal to reduce the mismatch between the ideal and the actual environment (Spruijt et al., 2001). When the mismatch is too large or prolonged then coping strategies can be overwhelmed, and suffering can lead to behavioural or physiological disorders. However such a scheme is not specific to animals since plants also have mechanisms to adapt to their environment and these mechanisms can also be overwhelmed. What is believed to be specific to animals, and is the reason for considering animal welfare, is that animals evaluate their environment and feels emotions (Wiepkema, 1987; Dawkins, 1990). For instance, emotions have been demonstrated to be the central key between aggressors and stress responses of an animal (Mason, 1971).

The coping efforts of an animal (and its corresponding state of suffering if they are not sufficient) are generally assessed through behaviour, stress physiology, and body state. We often look for similar responses to various negative situations. However, results are sometime opposed. For instance, in animals submitted to chronic stress, some authors report an increase in cortisol release after ACTH administration while others report a decrease (Friend et al., 1985; Ladewig & Smidt 1989). Again, some authors report an increased behavioural reactivity when others report a decrease (Broom 1987; Boissy et al. 2001). At best, these discrepancies are interpreted a posteriori, e.g. according to the control the animals have on their environment. However, the way animals evaluate their world is seldom questioned directly.

To access the mental world of animals, we propose to develop a strategy derived from theories in cognitive psychology for which emotions are the result of an appraisal process. This appraisal is performed according to a series of checks (assessment of the novelty, pleasantness, correspondence to expectancies, and controllability of the situation) that can be processed at different levels (sensorimotor / schematic / conceptual) (Scherer, 2001). There is some evidence that animals used in farming can use these checks. However, whether this appraisal leads to emotions need to be clarified by searching specific emotional reactions (variations in the activation of the SNA, behavioural expressions…). A further question will be how far animals can distinguish between checks, and consequently how broad is the range of emotions they can feel. These studies should be undertaken by submitting the animals to various situations for which the appraisal have been experimentally oriented (that is by making a priori hypotheses on this appraisal) and by the same time monitoring the internal

state of the animal (e.g. activation of the SNA) and recording behaviours, either gross activity like startle responses or fine postures.

We believe such an approach could greatly help to define the exact welfare requirements of animals.

References

Boissy, A., Veissier, I., Roussel, S., 2001. Emotional reactivity affected by chronic stress: an experimental approach in calves subjected to environmental instability. Anim. Welf.,10:S175-185.

Broom, D.M., 1987. Applications of neurobiological studies to farm animal welfare. In: P.R. Wiepkema and P.W.M. Van Adrichem, Biology of Stress in Farm Animals: An Integrative Approach, Martinus Nijhoff Publishers, Dordrecht/Boston/Lancaster, pp. 101-110.

Dawkins, M.S., 1990. From an animal point of view: motivation, fitness, and animal welfare. Psychol. Sci., 13:1-9.

Friend, T.H., Dellmeier, G. R. and Gbur, E. E., 1985. Comparison of four methods of calf confinement. I. Physiology. J. Anim. Sci., 60:1095-1101.

Hughes, B.O., 1976. Behaviour as an index of welfare. In: Proceedings of the Fifth European Poultry Conference, Malta, pp. 1005-1018.

Ladewig, J. and Smidt, D., 1989. Behavior, episodic secretion of cortisol and adrenocortical reactivity in bulls subjected to tethering. Horm. Behav., 23:344-360.

Mason, J.W., 1971. A re-evaluation of the concept of 'non-specificity' in stress theory. J. Psychiat. Res., 8:323-333.

Scherer, K.R., 2001. Appraisal considered a process of multi-level sequential checking. In: K.R. Scherer, A. Schorr and T. Johnstone (Eds), Appraisal Processes in Emotion: Theory, Methods, Research. Oxford University Press, New-York/Oxford, pp. 92-120.

Spruijt, B. M., van den Bos, R. and Pijlman, F. T. A., 2001. A concept of welfare based on reward evaluating mechanisms in the brain: anticipatory behaviour as an indicator for the state of reward systems. Appl. Anim. Behav. Sci.,72:145-171.

Wiepkema, P.R., 1987. Behavioural aspects of stress. In: P.R. Wiepkema and P.W.M. Van Adrichem, Biology of Stress in Farm Animals: An Integrative Approach, Martinus Nijhoff Publishers, Dordrecht/Boston/Lancaster, pp. 113-133.

Keywords:	
Species:	general
Session, type, nr	*Behaviour and welfare assessment in farm animals, Plenary* 03
For information contact	Isabelle Veissier or email veissier@clermont.inra.fr

Welfare in fish farming

Verreth, J.A.J., Komen, J. and Schrama, J.W.

Fish Culture and Fisheries Group, Wageningen University, P.O.Box 338, 6700 AH Wageningen, The Netherlands

Aquaculture is the most rapid growing food producing sector in the world, with average annual growth rates around 10% over the past 20 years (FAO, 2000). This growth is the result of expanding areas brought into culture and of increased intensification of the production. Levels of intensification and associated handling of animals differ widely, depending upon species, type of production system and geographical area. Fishes are raised in ponds, pens, cages, raceways and tanks, and densities and handling vary accordingly. Depending upon species, either low or high densities may lead to increased agonistic behaviour or may yield other indicators for impaired welfare. Water quality, an obvious potential source of environmental stress, is strongly affected by the fish density and husbandry system in use. In the more natural pond systems, fish densities might be lower, but fish have to cope with high daily fluctuations in water quality. In the super-intensive recirculation systems, very high densities are used, but water quality can be controlled and maintained at optimal levels. In addition, fish seem to have a well developed adaptive capacity. Recent research shows that repeated stress results in an inhibition of the physiological stress response in fish, making it difficult to assess the stress response objectively.

Animal welfare is often associated with the presence of emotions, either of distress or of pleasure. Scientific literature presents conflicting views to the question whether fish can perceive emotions such as fear and pain. In a recent review, Rose (2002) concluded that fish brains lack the functional regions associated to the awareness of pain and fear and therefore he considers these emotions as impossible in fish. However, fish do display behavioural, endocrinological and metabolic responses to noxious stimuli. Therefore, in the absence of psychological indicators, welfare assessment in farmed fish must rely on the mentioned stress responses and on even more robust indicators for impaired welfare, such as the incidence of diseases, pathological disorders and mortality. Using the latter, hatching, the larval period, metamorphosis, grading, pre-harvest and harvest handlings, transport, culling and spawning induction can be considered as elements in the production cycle with high risk for impaired welfare.

To date, scientific information on welfare in fish reflects mainly the measurement of physiological responses to handling stress related to grading, transport, harvesting and slaughtering procedures (e.g., netting, crowding, transport, anaesthetising, stunning) and to stocking densities. Few data are available on behavioural responses to the various phases in the production cycle with high risk of welfare impairment. Yet the few available data indicate that also fish show increased behavioural alterations when subjected to stress. In view of the fact that stress-free measurement of metabolic and endocrinological responses are nearly impossible (usually netting and anaesthetisation is needed to sample blood), such behavioural studies are badly needed.

In conclusion, assessing welfare in fish farming remains difficult because of (a) the high diversity in farming conditions and in species; (b) the lack of knowledge on the neuropsychological background of pain, fear and pleasure in fish; (c) the lack of objective measurements for assessing welfare in fish. An interesting line to pursue for managing welfare in fish farming might be to produce high or low stress responders by selective breeding.

Keywords:	fish, animal welfare, adaptive capacity, welfare assessment, ethology
Species:	fish
Session, type, nr	*Aquaculture and Fish, Plenary* 04
For information contact	Johan Verreth or email Johan.Verreth@Alg.VenV.WAU.nl

Long orals

Allonursing: group selection or selection failure?

Murphey, R.M.M.

Department of Psychology, University of California, One Shields Avenue, Davis, California 95616-8686 USA

Allonursing occurs when females nurse offspring of other females. The behavior presents theoretical challenges and is of practical importance when mothers of young animals reject them, die or are otherwise incapacitated. From an evolutionary perspective, valuable resources such as milk should not be given away unless doing so benefits individual donors. If the behavior is maladaptive for donors, natural selection should eliminate or make it infrequent in a population. When an apparently maladaptive behavior is common and characteristic of a species, it is often assumed to be adaptive in some latent or non-obvious way, or thought to be maintained by undiscovered pleiotropy, balanced polymorphism, gene linkage or design stasis. An adaptationist approach might propose kin selection or group selection as causal agents in allonursing. Water buffalo (Bubalus bubalis), an excellent model for investigating this ostensibly altruistic behavior, frequently nurse one another's young and adopt orphans, presumably benefiting their own herd and the entire species. The kin selection hypothesis was discredited when it was found that only 13 cows in a herd of 30 water buffalo and their calves were responsible for 97% of the allonursing, that the behavior was not reciprocated among individuals, and that it was not related to kinship between donors and recipients. Because allonursing probably benefits the group in which it occurs, its existence might be attributable to group selection, a concept that is based on problematic assumptions and is difficult to demonstrate empirically. It is not necessary to invoke natural selection in general or group selection in particular in order to explain allonursing. It can be shown algebraically that successful selection is not possible when its reliability is too low to discriminate among individuals. Paradoxically, failure to select against allonursing could give it the false appearance of being the product of group selection.

Keywords:	allonursing, evolution, group selection, water buffalo
Species:	water buffalo
Session, type, nr	*Relevance of Natural Behaviour, Long oral* 01
For information contact	Robert Murphey or email rmmurphey@ucdavis.edu

Promoting natural foraging behaviour in stabled horses

Goodwin, D., Davidson, H.P.B. (1) and Harris, P. (1)

University of Southampton, New College, SO17 1BG, UK., (1) Equine Studies Group, c/o WCPN, Waltham-on-the-Wolds, LE14 4RT, UK

Four preliminary trials investigated foraging behaviour in stabled horses provided with multiple forages (in press Equine Veterinary Journal). These trials suggested that stabled horses were using foraging behaviour strategies previously recorded in free-ranging and feral horses, and other large grazing herbivores. Patch grazing strategies allow herbivores to select a better than average diet from a heterogeneous resource. The preliminary trials also compared the behaviour of horses in a single stable with an otherwise identical stable containing six forages. Horses exhibited less searching behaviour and less stereotypical behaviour in the multiple forage environment than the same horses in an identical stable containing a single forage.

In the four replicated choice trials reported here, up to 12 competition horses were allowed 5 minutes access to two otherwise identical stables containing single or multiple forages. Horses were subsequently allowed to choose between the stables during a 5 minute liberty test. In two of the trials the single forage presented was hay and in two the single forage was a previously preferred forage. In Trial 1 and 3 (single forage=hay), the horses showed a strong preference for the multiple forage stable (Chi-squared S/S, S/M, M/M: Chi-squared=16.4 (Trial 1) and 22.00 (Trial 3), df=2, $p<0.0001$). In Trials 2 and 4 (single forage=preferred) the horses also showed a preference, though less significant, for the multiple forage environment (S/S, S/M, M/M (Trial 2) Chi-squared=4.7, df=2, $p=0.09$ and (Trial 4) Chi-squared=5.6, df=2, $p=0.06$).

The preliminary trials indicated that foraging enrichment prompted exhibition of wild-type foraging behaviour in stabled horses. The four choice trials showed these stabled horses selected an enriched over a restricted forage environment through a locational choice. This provides further evidence to support foraging enrichment of the stable environment to facilitate highly motivated behaviour in a restricted domestic environment.

Keywords:	horse, foraging behaviour, environmental enrichment, domestication, feral
Species:	horse
Session, type, nr	*Relevance of Natural Behaviour, Long oral* 02
For information contact	Deborah Goodwin or email D.Goodwin@soton.ac.uk

Effects of castration on the welfare and social behaviour of pigs: a review

Tuyttens, F. A. M.

Ministry of the Flemish Community, Department of Mechanisation - Labour - Buildings - Animal Welfare and Environmental Protection (CLO-DvL), Agricultural Research Centre, B. Van Gansberghelaan 115, 9820 Merelbeke, Belgium

Mainly as a strategy to prevent boar taint in pork, it is common practice to surgically castrate male piglets.

The aim of this study is to review the scientific literature about the ethical implications of castration from an animal welfare perspective.

Adhering to the principle of caution and/or to the analogy postulate, there is adequate scientific evidence that castration, and the severing/tearing of the spermatic cords in particular, causes acute pain. Variables (e.g. method of castration, use of local anaesthetics, age) which may influence the amount of stress experienced during the entire procedure, or during castration specifically, are discussed. Although it has been hypothesised that the stress or altered hormonal patterns due to castration may compromise the immune system, the evidence that castration is associated with increased morbidity or mortality is scant. There are also few studies that have evaluated the long-term consequences of castration on the social behaviour of pigs. Hands-on experience from pig-keepers suggests, however, that barrows are less aggressive and show less sexual behaviour than boars. Studies on other mammals provide support to these reports but also suggest that, in social and intelligent species, these behavioural changes could be strongly influenced by many factors. For example, the influence of age of castration on subsequent behavioural changes would be an interesting topic of study, as it is known that the sexualization of male nervous mechanisms in boars develops slowly during the prepubertal period. The behavioural consequences of alternative solutions such as immunocastration or sperm sexing are also insufficiently known.

Evaluating the animal welfare implications of not castrating male piglets requires the delicate balancing of an abolishment of a short-term pain sensation, the preservation of the animal's integrity, and a potentially lower morbidity and mortality, on the one hand, against a likely increase in agonistic behaviour on the other.

Keywords:	animal welfare, boar taint, castration, health, pig, social behaviour, well-being
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Long oral* 03
For information contact	Frank Tuyttens or email frank.tuyttens@clo.fgov.be

From house mouse to mouse house

Latham, N. and Mason, G.

Zoology Department, Oxford University, South Parks Road, Oxford, OX1 3PS

Millions of mice are used throughout the world in laboratory research each year. Many of these are maintained in single sex groups in small, featureless cages within uncontrollable, environmentally monotonous stock rooms. Unfortunately housing conditions are often determined by the needs of technicians, researchers and research establishment accountants and are usually poorly suited to the natural adaptations and behavioural wants and needs of mice. However the use of such housing conditions has increasingly been called into question by both the public and the scientific community due to concerns about the welfare of laboratory animals and the effects of such housing on experimental validity. Indeed recent years have seen an explosion of research into the effects of 'enriching' the environment of mice, but the results as far as welfare is concerned have been varied and sometimes even contradictory.

A necessary precursor to understanding and improving the welfare of captive animals is to have a clear understanding of how animals view their world (and how that perception differs from ours) and how they live and behave in it. Therefore the first part of this talk will discuss the sensory biology, physiology and behaviour of free living house mice (Mus musculus) – the progenitor of the modern day laboratory mouse. The second part of the talk will review some of the enrichment studies carried out to date. We will then assess these enrichments from a mouse's point of view and by doing so we hope to explain why mice find some enrichments genuinely enriching, why others are not and give possible explanations for the disparity between different studies or expected results. The third and final section of the talk will address those aspects of the captive environment which require further research as suggested by the sensory biology and behaviour of the house mouse.

Keywords:	house mouse, Mus musculus, welfare, laboratory mice, environmental enrichment
Species:	mouse
Session, type, nr	Free papers, Long oral 04
For information contact	Naomi Latham or email naomi.latham@zoo.ox.ac.uk

Anticipation to reward: a therapy for chronically stressed animals?

Van der Harst, J.E., Kapteijn, C. and Spruijt, B.M.

Ethology & Animal Welfare, Utrecht University, Yalelaan 17, 3584 CL Utrecht, The Netherlands

We investigated whether the effects of chronic stress can be counteracted by regular announcements of a reward. It is known that chronic social stress such as defeat followed by isolation impairs the anticipatory response to an announced sucrose reward: anhedonia (Von Frijtag et al. 2000).

It is hypothesized that frequent induction of anticipatory behavior during 3-month-isolation after defeat in rats can prevent anhedonia and therefore serves as a therapy.

The anticipatory response was elicited by repeated pairing of an initial neutral stimulus (CS) with the delayed delivery of a sucrose solution (unconditioned stimulus; US). Anticipatory behaviour was observed between the CS and the US as an enhanced display of activity. After 3 months the non-therapy group was also subjected to the conditioning paradigm and, as expected, these animals had lost the ability to display anticipatory behaviour. The therapy-group still showed anticipatory behaviour for sucrose after 3 months of regular announcements. To assess whether the therapy was effective for other types of reward as well, anticipation to access to an enriched cage was used. Surprisingly, the non-therapy group now also developed an anticipatory response: an equally strong increase in anticipatory activity as seen in the therapy-group was observed in the non-therapy group (within-subjects: $p<0.001$; between-subjects $p>0.05$).

It seems that their previous anhedonic response is limited to the first reward applied (sucrose) and is not general for all types of reward. Another possibility is that the first sucrose test for assessing anhedonia followed by the second test (repeated access to enriched housing) has the impact of a therapy itself.

Concluding, both repeated announced access to sucrose and repeated announced access to an enriched environment may counteract the consequences of chronic stress.

At present, a second experiment is conducted to investigate which of the above-mentioned possibilities caused reversal of the anhedonic state.

Keywords:	animal welfare, anticipatory behaviour, reward, conditioning, stress, anhedonia, therapy, environmental enrichment
Species:	rat
Session, type, nr	*Integration of research on human welfare and animal welfare, Long oral* 05
For information contact	Johanneke Van der Harst or email J.E.vanderHarst@las.vet.uu.nl

Effects of haloperidol, a dopamine D2 antagonist, on feather pecking behaviour in laying hens: evidence of a stereotyped stress response.

Kjaer, J.B., Hjarvard, B.M., Jensen, K.H., Hansen-Møller, J. (1) and Naesbye Larsen, O. (2)

Danish Institute of Agricultural Sciences, Dept. of Animal Health and Welfare, P.O. Box 50, DK-8830 Tjele, Denmark., (1) Danish Institute of Agricultural Sciences, Dept. of Analytical Chemistry, P.O. Box 50, DK-8830 Tjele, (2) Centre for Sound Communication, Institute of Biology, University of Southern Denmark, Odense, DK-5230 Odense M, Denmark

Imbalances of the hypothalamus-adrenocortical axis have been implicated in the patho-physiology of feather pecking and might be coupled to dopamine. The relation between the dopamine system and stereotypies in different species of birds is well documented. The motor patterns of feather pecking are quite similar to those of stereotyped pecking, but hitherto no experimental evidence supports the suggestion of a common physiological mechanism. To test this hypothesis, the effects of subcutaneous injections with the dopamine D2 antagonist haloperidol (HAL) to adult laying hens were investigated. In a pilot dose-response experiment doses up to and inclusive 0.5 mg HAL did not produce any sedative effect, while 1.0 mg HAL clearly did. The main experiment was performed to investigate pecking behaviour specifically. A total of 48 ISA Brown hens aged 118 weeks were used as experimental subjects. Each subject bird was paired with one 82-week-old White Leghorn hen chosen at random and both were housed in battery cages. Feather pecking and aggressive pecking were recorded for periods of 50-min prior to and after HAL injections. Feather pecking was significantly reduced in the 0.5 mg/kg HAL treatment (0.23 vs. 1.70 bouts per bird per hour, Wilcoxon Signed Rank Test N=18, $p<0.01$; 0.73 vs. 10.1 pecks per bird per hour, WSRT N=18, $p<0.01$). Aggressive pecking was not affected by treatment. Thus, the observed changes in feather pecking behaviour in response to HAL can be regarded as mediated through the dopamine system. In some adult hens feather pecking might become fixed to such an extent, that it could be classified as a stereotypy. Alternatively, feather pecking might be due to disturbed processing of external stimuli caused by malfunctions of the dopamine system, which in the present experiment was alleviated by the HAL-treatment.

Keywords:	abnormal behaviour, aggression, poultry, welfare
Species:	chicken
Session, type, nr	*Integration of research on human welfare and animal welfare, Long oral* 06
For information contact	Joergen Kjaer or email j.kjaer@agrsci.dk

Parameters to measure hunger in broiler breeders

De Jong, I.C., Van Voorst, S. and Blokhuis, H.J.

Institute for Animal Science and Health, Division of Animal Sciences, Animal Welfare Group, PO Box 65, 8200 AB Lelystad, The Netherlands

The severe degree of food restriction used in commercial flocks of broiler breeders has a negative effect on bird welfare, as the birds are continuously hungry. To evaluate new management systems or feeding programmes that may improve bird welfare, clear parameters to measure hunger in broiler breeders are needed. In this experiment potential parameters to measure hunger in broiler breeders were tested.

Individually housed broiler breeders (Hybro G, Nutreco; n=10 per treatment) were reared at different degrees of food restriction (25%-35%-50%-70%-90% of ad libitum, and ad libitum), thus inducing different levels of hunger, from 3 to 8 weeks of age. Plasma corticosterone, free fatty acid (NEFA) and glucose concentrations were measured, and the behaviour of the birds in the cage was observed at 7 weeks of age. At 8 weeks of age, the so-called 'food intake motivation test (FIM test)' was carried out. In this test, restricted fed birds were suddenly fed ad libitum and the food intake per kg metabolic weight was determined. A general analysis of variance model was used to study treatment effects. Relationship between plasma corticosterone concentrations and the level of restriction was determined by regression analysis.

A significant effect of restriction level on physiological parameters, FIM test response and object pecking was found ($p<0.05$ at least). Glucose:NEFA ratio, FIM test response and the time spent object pecking increased with increasing level of restriction. A 3rd grade hyperbolic relationship was found between plasma corticosterone concentrations and the level of restriction. Plasma corticosterone concentrations were lowest in ad libitum fed birds, intermediate for birds fed at 90%, 70% and 50% of ad libitum, higher for birds fed at 35% and highest for birds fed at 25%.

In conclusion, the response in the FIM test, the glucose:NEFA ratio and the time spent object pecking are clear parameters to measure hunger, whereas the relationship between plasma corticosterone concentrations and hunger is less clear.

Keywords:	broiler breeder, hunger, physiology, behaviour
Species:	chicken
Session, type, nr	*Free papers, Long oral* 07
For information contact	Ingrid De Jong or email i.c.dejong@id.wag-ur.nl

Behavioural aspects of feeding constraints: Do broilers follow their gut feelings?

Nielsen, B.L.

Danish Institute of Agricultural Sciences, Department of Animal Health and Welfare, PO Box 50, DK-8830 Tjele, Denmark

Selection for high growth rates, increased feed conversion efficiency and more breast meat in broiler chickens have led to other, associated changes in physiological, anatomical and behavioural characteristics which may affect welfare, health, and longevity as well as production.

One such change was proposed by Burkhart et al. (1983; Behav. Gen., 13:295-300). They compared fast and slow growing chickens with or without ventromedial hypothalamic (VHM) lesions, and found no changes in the fast growing strain, and increased fat deposition in the slow growing strain. This paper has been cited widely as evidence that selection for fast growth has resulted in alterations to satiety mechanisms in the brain leading to excessive food intake and compulsive feeding behaviour. However, no behavioural measures were examined, and a reduction in activity of the slow growing line as a result of the VHM lesions would offer an alternative, and simpler, explanation of the results.

The above example highlights the importance of incorporating behavioural traits when interpreting genetic aspects of growth and feeding. Selection for fast, lean, efficient growth has resulted in a marked reduction in activity compared to slower growing strains (e.g. Reiter and Bessei, 1998, Arch. Geflügelk. 62:247-253). This may reflect the constraints facing the modern broiler when allocating resources to maintenance, growth and activity. Studies which include feeding behaviour may expose some of the underlying mechanisms. One reason for the paucity of trials which incorporate behavioural aspects of feeding may be, that feeding behaviour in the broadest sense straddle two quite diverse scientific objectives: One is concerned with satiety and the mechanisms behind intake control. The other measures daily feed intake in terms of the resulting growth and efficiency. However, behavioural aspects of feeding often play an important role in the interpretation of results, examples of which will be given.

Keywords:	chickens, feeding behaviour, constraints, genetic selection
Species:	chicken
Session, type, nr	*Free papers, Long oral* 08
For information contact	Birte Nielsen or email birte.nielsen@agrsci.dk

Ethology meets genomics: trade-off between behaviour and other fitness related traits in fowl indicate limits to selection and evolution

Jensen, P., Schütz, K., Pizzari, T., Kerje, S.(1), Carlborg, Ö. (1), Jacobsson, L. (1), and Andersson, L.(1)

Swedish University of Agricultural Sciences, Department of Animal Environment and Health, Skara, Sweden, (1) Swedish University of Agricultural Sciences, Department of Animal Breeding and Genetics, Uppsala, Sweden

During evolution, the allocation of limited resources (such as energy) to different life processes is optimised so that fitness is maximized under prevailing environmental constraints. During artificial selection, some environmental constraints are relaxed and preferential allocation to production traits may be artificially favoured over allocation to other fitness-related traits. To test this hypothesis we compared the behaviour of jungle fowl and White Leghorn layers, selected for egg mass (and indirectly for growth). We predicted that layers would use less energy demanding strategies in different challenging situations. Consistent with our predictions we found that jungle fowl had a more active and energy costly behaviour in social, anti-predatory and feeding tests. Such behavioural differences indicate adaptive reallocation of energy from behaviours which do not translate into evolutionary benefits in the captive environment, thus suggesting adaptation to the captive environment. To examine the genetic mechanisms underlying these behavioural differences, we searched for quantitative trait loci (QTL) affecting behaviour (related to stress coping and adaptation) and production traits in 751 F2- jungle fowl*White Leghorn intercrosses. Nineteen significant or suggestive QTL for different behavioural variables were located and several of these coincided with QTL for growth or egg production, indicating that QTL with pleiotropic effects may generate trade-offs between behaviour and other energy-demanding life processes. Evolutionary trade-offs may also occur when genes that confer a reproductive advantage to one sex reduce the fitness of the opposite sex. We tested this hypothesis by investigating the genetic correlation between male and female reproductive traits in the F2-crosses and, consistent with the idea of inter-sexual trade-offs, found a lack of a positive genetic correlation between testes size in males and egg production in females. In conclusion, our results indicate that evolutionary constraints on the independent development of different traits may limit the scope for artificial selection in animals.

Keywords:	QTL, genes, selection, fear, feeding, social, fowl
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Long oral* 09
For information contact	Per Jensen or email per.jensen@hmh.slu.se

Applied research to support welfare policy making: a study to investigate solid floors for pigs

Spoolder, H.A.M., Hoofs, A.I.J., Hulsegge, B.(1) and Hopster, H.(1)

Research Institute for Animal Husbandry, Runderweg 6, PO Box 2176, 8203 AD, Lelystad, The Netherlands, (1) ID-Lelystad, Edelhertweg 15, PO Box 65, 8200 AB, Lelystad, The Netherlands

Advising policy makers on welfare issues may involve more than straightforward data presentation. An amendment to the Dutch welfare laws proposes an increase in solid flooring for finishing pigs to 60% of the total 1.0 m2 area per pig. A solid floor is assumed to provide more comfort when lying. However, questions were raised about the effects of such a measure on pen fouling, ammonia emission, animal health and farm economics. A study was carried out to advise policy makers on this issue.

Four housing systems were compared, three with 60% and one with 40% solid floor ('control'). Each system had two rooms, each room containing 144 animals in 6 or 12 pens. Data was collected over two consecutive rounds. They showed that the percentage of pen fouling increased slightly with the amount of solid floor area ($p<0.05$). This fouling was worse in the summer than in the winter ($p<0.001$). The level of ammonia emissions was not reduced in 60% systems despite the smaller emitting surface area under de slats. The number of pigs lying down was not influenced by the housing system, but in winter the pigs lay on the slatted floor less than in summer ($p<0.05$). The proportion of pigs lying on the slats was more affected by temperature differences of a few degrees, than by the percentage of slats. Pig performance and health were not affected by solid floor area ($p>0.05$). The costs of constructing new pig houses with 60% solid floor were found to be similar to those of constructing conventional pig houses and the calculated cost price for pig meat did not differ between the systems.

To translate the science into advise for policy makers, there has to be consensus that all relevant parameters were considered. Furthermore, to reach a conclusion based on the data, a relative importance ('weighting') of the different parameters has to be agreed. After considering the above, the authors suggest that there is insufficient reason for a change in legislation.

The authors would like to thank the Dutch Ministry of Agriculture, Nature management and Fisheries for their financial support.

Keywords:	welfare research, policy making, housing systems, finishing pigs
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Long oral* 10
For information contact	Hans Spoolder or email h.a.m.spoolder@pv.agro.nl

Development of spatial cognition and hippocampus structure in the domestic chick

Freire, R., Cheng, H-W. and Nicol, C.J. (1)

USDA-ARS, Purdue University, West Lafayette, IN47906, USA., (1) Department of Clinical Veterinary Science, University of Bristol, Langford House, Langford, Bristol BS40 5DU, UK

Broiler chickens in large groups do not space themselves evenly but instead crowd in particular areas, which may increase mortality and exacerbate welfare problems arising from social stress. One contributing factor may be a deficit in spatial memory arising from the absence of essential environmental factors during routine rearing. Experiments were conducted to examine the development of spatial memory, as part of a broader interest in the use of developmental plasticity to improve the match between animals and their captive environments.

At around 11 days of life, domestic chicks show a tendency to move out of sight of their mother before returning and regaining social and visual contact. We manipulated out of sight experience by imprinting chicks to an object and using wooden screens to provide chicks with the opportunity to move out of sight (occlusion-experienced treatment).

Occlusion-experienced chicks correctly relocated a visually displaced imprinting stimulus (Binomial test, $p<0.05$) whereas occlusion-naive chicks performed at chance levels. In a test requiring chicks to detour around an opaque screen, occlusion-experienced chicks made fewer orientation errors (defined as moving away from the out-of-view imprinting stimulus) in the first and subsequent trials (Kruskal-Wallis, $p=0.07$ and 0.05 respectively) compared to occlusion-naive chicks.

Dendrites in the hippocampus (involved in spatial processing) were longer (ANOVA, $F_{1,14}=7.4$, $p<0.05$) and had more spines (ANOVA, $F_{1,14}=10.6$, $p<0.01$) in occlusion-experienced compared to occlusion-naive chicks. Lastly, occlusion-experienced chicks moved more than occlusion-naive chicks when released into a large novel pen (ANOVA, $F_{1,14}=11.9$, $p<0.01$), though no difference in dispersal or use of the centre of the pen was found between the two treatments.

Results presented here suggest that active experience of moving out of sight improves spatial memory in the chicken, and indicate that manipulation of experience during rearing could be a useful method in reducing deleterious behavioural patterns.

Keywords:	development, cognition, chickens
Species:	chicken
Session, type, nr	*Free papers, Long oral* 11
For information contact	Rafael Freire or email freire@purdue.edu

Cage colour preferences of laboratory mice and effects on emotionality

Sherwin, C.M. and Glen, E.F

Centre for Behavioural Biology, Department of Clinical Veterinary Medicine, University of Bristol, Langford House, BS40 5DU

Environmental enrichment studies for laboratory mice have given little attention to the material construction of the cage. Mice prefer opaque cages to transparent, but preferences for cage colour have not been investigated. This could have considerable importance as studies with humans indicate that environmental colour can influence emotionality.

Seventy-one mice were housed from three weeks of age in home-cages painted red, black, green or white (N=6 cages/colour). The colour preferences of one mouse from each cage (i.e. N=24 mice) were tested by placing the animal individually into a central cage connected to four preference cages, one of each of the home-cage colours. The mouse remained in the preference apparatus for four days whilst the cage positions were changed every 24 hours. At 24 weeks of age, all 71 mice were tested in a raised plus maze as a measure of emotionality.

Each mouse showed a significant preference for one of the cage colours. Twelve mice preferred white, 5 green, 5 black, and 2 red (Chi-squared=9.0, 3, df, $p<0.05$). Overall, occupancy of the most preferred cage was twice that of the second most preferred colour and four times the least preferred. Nine mice chose the red cage as the least preferred. Home-cage colour had a significant effect on performance in the raised plus-maze. Mice reared in red cages spent the greatest proportion of time in the closed arms and those reared in white the least (ANOVA, $F=3.3$; 3, 57 df; $p=0.02$), indicating that mice reared in red cages were more anxious. These data show that laboratory mice have strong preferences for cage colour, and home-cage colour can have a significant effect on their emotionality.

Acknowledgements: C.M. Sherwin received the UFAW Research Fellowship during this study.

Keywords:	mice, cage, colour preferences, emotionality
Species:	mouse
Session, type, nr	*Free papers, Long oral* 12
For information contact	Chris Sherwin or email chris.sherwin@bristol.ac.uk

Establishing mechanisms to increase aquaculture producer cognizance and adoption of aquatic animal welfare objectives

Conte, F.S.

Department of Animal Science, University of California Davis, 1 Shields Ave., Davis, California 95616 USA

Aquaculture encompasses a wide-range of aquatic species, including two Kingdoms and more than five Phyla. This diversity comprises differences in morphology and physiology; and elicits different public responses to segments of aquaculture. Lack of definitive information combined with public confusion about aquatic animal pain and cognition among production species creates uncertainty and often disregard among aquaculturists about proper approaches to animal welfare.

Most aquaculture animal welfare issues involve finfish. Areas receiving greatest attention among animal welfare advocates are animal density and animal slaughter. Knowledge of stress physiology, cognition and pain perception for aquatic species is increasing, and the environmental parameters for aquatic production systems are well defined. The latter includes many specific visual and physiological markers that identify animal stress and onset of stressful environmental conditions that can facilitate the producer's ability to help establish welfare guidelines. Among the more valuable databases are those that include specific pathological events and their corresponding environmental linkages.

Major objectives among educators are to influence aquaculture producers to adopt economic management protocols in concert with animal welfare concepts. Producers are aware of the economic costs of fish stress related to depressed growth, disease and mortality. However, application of this knowledge is not universal and it is seldom linked to animal welfare concepts. This neglect can potentially elicit negative public response and result in aquaculture market loss. Producer response to animal welfare concerns will not be driven by the producer's social concern, but will be driven by economics. Aquaculture can prevent aquatic animal welfare concerns from becoming major social issues and a potential economic loss by (a) establishing and expanding producer education about the effects of animal stress and economic loss (b) strengthening aquatic animal health programs, and (c) improving dialog among producers and animal welfare professionals to create aquatic animal welfare guidelines.

Keywords:	aquaculture, aquaculture production, aquatic animal welfare, producer motivation
Species:	general
Session, type, nr	*Aquaculture and Fish, Long oral* 13
For information contact	Fred Conte or email fsconte@ucdavis.edu

The welfare status of farmed fish: sentience and pain perception

Chandroo, K.P., Moccia, R.D. and Duncan, I.J.H.

Department of Animal and Poultry Sciences, University of Guelph, Ontario, Canada, N1G 2W1

Unlike other forms of livestock agriculture, there is a paucity of scientific information on the welfare of teleost fish raised under intensive aquacultural conditions. Conclusions that these

animals are non-sentient, and therefore not capable of conscious experiences such as pain, are often based on limited reviews of the scientific literature. In this review, we present new neurophysiological data and evaluate the anatomical, physiological, and behavioural evidence for the existence of sentience in fish, and in particular their ability to perceive pain.

Specific central nervous system (CNS) structures and systems that are associated with affective states, emotions and motivated behaviour in “higher” vertebrates are present in

teleost fish. These neural components include forebrain nuclei, thalamic, limbic system, and spinal cord system components. Not only do these neural structures demonstrate functional similarities with “higher” vertebrates, but they are also involved with learning processes that demonstrate a level of cognitive development in fish suggestive of sentience. In addition, there is anatomical and behavioural data to suggest that nociception in fish is not limited to a reflexive signal in the spinal cord, but is relayed to higher CNS structures, where they are subject to cognitive processes. This suggests that fish may have the capacity to perceive pain, and that welfare consideration for farmed fish should take such conscious experiences into account.

There is strong evidence to suggest that fish are sentient animals. Therefore, the concepts of animal welfare can be applied legitimately to fish. The welfare of farmed fish should include, but range beyond basic life-support, and should be extended in a manner appropriate for the cognitive abilities that fish possess.

Funding for this research was provided by a grant from the Ontario Ministry of Agriculture, Food and Rural Affairs to R.D.M.

Keywords:	fish, aquaculture, sentience, pain
Species:	fish
Session, type, nr	*Aquaculture and Fish, Long oral* 14
For information contact	Kristopher Chandroo or email kchandro@uoguelph.ca

Eating behaviour and satiety in male broiler- and layer chicks

Bokkers, E.A.M. and Koene, P.

Ethology group, Department of Animal Sciences, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

The satiety mechanism can be expressed as the positive correlation between meal length and the length of the preceding (preprandial) interval; the hunger mechanism as the positive correlation between meal length and the length of the succeeding (postprandial) interval. It has been suggested that broilers have a disturbed hunger and satiety mechanism. This may be reflected especially in the preprandial correlations since Burkhart et al. (1983, Behav. Genet. 13, 295-300) suggested that selection for increased body weight damaged the hypothalamic satiety mechanisms leading to a failure to diminish the hunger drive and consequently to overconsumption. An experiment was conducted to measure length of eating bouts and intervals to calculate pre- and postprandial correlations of male broiler- and layer chicks.

Eight male broiler- and 8 male layer chicks were housed individually and visually isolated in pens (1 m2/ pen) on wood shavings at two weeks of age. From 4 through 7 weeks of age, eating behaviour of each bird was recorded for four hours, once a week. An interval between two eating bouts was defined as an interruption of ten seconds or more between two pecks in the feeder. Before and after each observation bird and feeder were weighed. The first ten eating bouts of each observation were used for the analysis.

Over all weeks, five out of nine significant preprandial ($r=0.38$-0.56, $n=32$, $p<0.05$) correlations and no postprandial correlations were found for broilers. For layer chicks no significant pre- or postprandial correlations were found. Broilers had longer (187.7 vs. 118.2 s; $F_{1,56}=6.19$, $p<0.05$) but less eating bouts (11.6 vs. 17.0 bouts/observation; $F_{1,48}=11.46$, $p<0.005$) and longer intervals (981.8 vs. 498.2 s; $F_{1,56}=12.25$, $p<0.001$) than layer chicks. Broilers had a higher feed consumption in total and per eating bout (0.50 vs. 0.95 g/bout; $F_{1,47}=106.48$, $p<0.001$).

The typical eating behaviour of broilers and the calculated preprandial correlations have given new indications that hunger and satiety mechanisms in broilers have changed compared with layer chicks.

Keywords:	broilers, layer chicks, eating behaviour, satiety, hunger
Species:	chicken
Session, type, nr	*Free papers, Long oral* 15
For information contact	Eddie Bokkers or email eddie.bokkers@etho.vh.wau.nl

The effects of analgesia on behaviour and heart rate during dehorning in calves

Marchant Forde, R.M., Marchant Forde, J.N. and Weary, D.M.

DMU, USDA-ARS, University of British Columbia, Canada

This study aimed to examine whether a non-steroidal anti-inflammatory (Ketoprofen) reduces post-operative distress in hot-iron dehorned calves. Twenty Holstein calves, 4-8 weeks old, were assigned to either; dehorning with pre- and post-operative Ketoprofen (Trt 1) or, dehorning without Ketoprofen (Trt 2). All calves underwent a sham dehorning before being dehorned 72 hours later. During sham and actual dehorning, Trt 1 received Ketoprofen in milk whereas Trt 2 just received milk. Two hours after first Ketoprofen administration, calves on both treatments were injected with Xylazine sedative and local anaesthetic, Lidocaine. Once this had taken effect, the dehorning iron was applied, either cold (sham) or at 600°C (actual). Behaviour and cardiac activity was recorded for 12, 30-min, periods over 11 days. Data were analysed using a GLM. Pre-procedure, there were no differences in activity levels between treatments. However, immediately after first Ketoprofen administration, Trt 1 were more active ($p<0.05$). Activity decreased ($p<0.05$) after dehorning and remained depressed for 7d post-dehorning, but did not differ between treatments. Trt 2 calves were more vocal for 3d post-dehorning ($p<0.05$). HR was not affected by treatment but did decrease significantly after both sham and actual dehorning. At 6h, 1d, and 3d post-dehorning, HR tended to be elevated but returned to baseline values by 7d post-dehorning. Time domain measures of heart rate variability (HRV) indicated that Trt 2 had lower levels of overall HRV immediately post-dehorning ($p<0.05$), suggesting lower parasympathetic input into cardiac control. There were some effects of treatment on vocal response which suggests that Ketoprofen may help reduce immediate post-operative pain. However, this was short lived (24h). The trends in cardiac activity also indicate few long-term benefits. Overall, behavioural responses suggest that some post-operative distress may still be evident at 7d post-dehorning whereas cardiac activity returns to near normal levels at 3d post-procedure. Ketoprofen helps to reduce some immediate post-dehorning distress but this distress may persist for up to 7d after dehorning.

Keywords:	cattle, pain, dehorning
Species:	cattle
Session, type, nr	*Free papers, Long oral* 16
For information contact	Ruth Marchant Forde or email rforde@dmu.ac.uk

Short orals

Objectively measuring broiler leg health: motivating birds to walk along a 1.8 m race

Sandilands, V. and Savory, C.J.

Avian Science Research Centre, Scottish Agricultural College, Ayr, KA6 5HW, Scotland

Monitoring lameness in broiler chickens currently relies on a subjective gait scoring method (Kestin et al, 1992, Vet. Record 131:190-194), and thus there is a need for a suitable objective method. This work tested ways of motivating broilers to cross a 1.8m race, which will be part of a system for measuring walking parameters objectively with a force plate.

Ross broiler chicks were group reared either without (trial 1) or with (trial 2) races which they had to traverse in order to pass between feeders and drinkers. At age 5 weeks, 80 birds (half male, half female, with no detectable lameness) in each trial were deprived of one of the following: food (48h), water (24h), companions (30 min in trial 1, 60 min in trial 2), or control (n=20 per treatment, per trial). Each bird was placed individually in a start box at one end of the race. Food, water, and companions were visible at the other end. A limit of 15 min in the start box and 5 min in the race was given for each bird. Times taken for each bird to enter and traverse the race were measured.

Analyses (Chi-squared and logistic regression) were done based on numbers of birds that entered and completed the race within 5, 10, and 20 min. Males and females did not differ in their likelihood to enter and complete the race at any time ($p>0.05$). More birds reared with races entered and completed the race at all times examined than those reared without ($p<0.02$). Over both trials, significantly more water- and food-deprived birds entered and completed the race at all times than did socially-deprived or control birds ($p<0.001$).

Although rearing birds with a race increased the likelihood of birds completing the race in the test environment, there were still 45% of birds that did not complete the race within 20 min. Further trials will incorporate a moving board that comes behind the bird to encourage forward movement.

Keywords:	broiler, leg health, objective measurements
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 01
For information contact	Victoria Sandilands or email V.Sandilands@au.sac.ac.uk

Quantitative Assessment of Stereotypic Pecking in Broiler Breeders

King, L.A.

University of Oxford, Linacre College, St. Cross Road, OX1 3PS, Oxford, UK

Broiler breeders reared in commercial husbandry perform repetitive, non-functional object pecking, previously described as a stereotypy; however foraging pecks are also stereotypic in form. This experiment quantitatively compared stereotypic pecking morphology of pecks delivered to objects (pen walls) and the litter floor. 16282 Ross 308 broiler breeder pullets were reared from hatch to 14 weeks old, in six pens in three houses on a commercial farm. There were no significant differences in housing and husbandry between pens, throughout rear. At 14 weeks, on one day, pecking data was collected from individual birds by video. Cameras were placed at bird head height. Focal birds were identified as the individual pecking at a pre-determined section of floor or wall at the time of data collection. Video recording, 1.5 minutes per sample, was repeated four times per pen per day, with a total of 24 samples collected. Three measures of pecking behaviour were collected: 1) number of pecks delivered per minute; 2) co-efficient of variation of inter-peck interval; 3) the 'target score', a measure of spatial variation. To determine the target score, a 'target' shape of concentric circles was laid over the video image on the computer screen. The target corresponded with a real spatial distance of 2cm between each line. For each sample, a point was awarded each time a line was crossed between pecks. The 'target score' = raw score/ total pecks delivered. A GLM of y ~ pen (house) + house + resource revealed significant differences in the stereotypic structure of pecking directed at objects versus the floor. Wall-directed pecks were more frequent (154.25 pecks/minute, compared with 61.50 to the litter floor), ($F(1,4)=576.00$, $p<0.001$). Wall pecking showed less temporal ($F(1,4)=125.89$, $p<0.001$) and spatial variation ($C=2.17$, $df=5$, $p=0.05$). Object, or wall-directed, pecking is therefore significantly more stereotypic in form than litter-directed pecking behaviour.

Keywords:	broiler, breeder, stereotypy, behaviour assessment
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 02
For information contact	Lesley King or email

Motivation of group-housed sows for using feeding stalls in the mating area outside feeding hours

Rasmussen, D.K., Jensen, K.H.(1) and Larsen, O.N.(2)

Centre for proper housing of ruminants and pigs, Swiss, Federal Veterinary Office, 8356 Taenikon, Switzerland, (1) Department of Animal Health and Welfare, Danish Institute, of Agricultural Sciences, P.O. Box 50, 8830 Tjele, Denmark, (2) Institute of Biology, University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark

One alternative group-housing system for sows consists of an area with deep litter and of individual feeding stalls. Sows have been observed to use the feeding stalls extensively outside feedings. The present study investigated whether the extended visits could be attributed to room temperature, to aggressive or mounting behaviour, or to explorative behaviour.

The use of feeding stalls outside normal feeding hours was examined in ten groups (N,winter=5; N,summer=5) of 11 to 15 group-housed sows. The individuals were observed continuously during five days in the mating area. Their behaviour of the sows was recorded before and after entering the feeding stalls and assessed according to three motivational categories: 'rest', 'escape' and 'exploration' .

The results demonstrated a significantly higher frequency and longer bouts of resting in the feeding stalls in summer than in winter (Mann Whitney, $p<0.05$). The sows probably used the concrete floor in the stalls to cool themselves and to escape the warm bedding. A positive correlation between resting bouts and room temperatures (Spearman Rank, winter=0.6, $p<0.01$, N=24; Spearman Rank, summer=0.63, $p=0.001$, N=24) supported this hypothesis.

The frequency of visits to the feeding stalls following aggression was highest on the day of mixing (Kruskal Wallis, $p<0.01$) both winter and summer due to ranking fights. As regards mounting, visits to the feeding stalls was significantly more frequent during pre-heat and heat (Kruskal Wallis, $p<0.01$) than before. Generally though, escape visits to feeding boxes was less than one visit per day per sow, indicating that the stalls only occasionally were used as refuge.

Explorative visits to feeding stalls were significantly more frequent in winter than in summer (Mann Whitney, $p<0.05$) since the housing system at that time had only been in use for half a year compared to for almost one year in summer.

It was concluded that the sows were using the feeding stalls outside feeding hours especially by exploring them and to cool off themselves in the stalls.

Keywords:	sows, loose housing, mating area, feeding stalls, motivation
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 03
For information contact	Dorthe Rasmussen or email dorthe.rasmussen@fat.admin.ch

Effect of leaving piglets' teeth intact on sow behaviour and welfare in farrowing crates

Boyle, L., Boyle, R., B.

Pig Production Department, Moorepark Research Centre, Fermoy, Co. Cork, Ireland., (1) Trinity College, Carmarthen SA31 3EP, Wales.

New EU legislation recommends that reduction of piglets' corner teeth must not be carried out routinely but only where there is evidence that sows' teats are being injured. The objective of this study was to assess the effect of intact teeth on teat lesions and postures adopted by sows in farrowing crates and piglet behaviour directed towards the udder. Litters of twenty-three post-parturient multiparous sows in farrowing crates were assigned to two treatments on the basis of litter size. The deciduous canines and third incisors of newborn piglets were either CLIPPED (n=12) or left INTACT (n=11). Sows' teats were inspected for lesions 1, 5, 10, 15 and 28 (wean) days post-partum. Sow posture and the number of piglets in each litter engaged in behaviour directed towards the udder was recorded every 5mins during a 2hr observation on the same days. More INTACT sows had scratched teats on days 5, 10, 15 ($p<0.05$) and at weaning ($p=0.07$). They also had a higher percentage of teats affected by different lesions on day 5 ($p<0.05$). Within both treatments, the percentage of teats per sow affected by different lesions increased during lactation ($p<0.001$). There were fewer observations of INTACT sows lying laterally on day 5 ($p<0.05$). No other differences in sow posture were observed. There was no effect of treatment on the number of piglets engaged in behaviour directed towards the udder ($p>0.05$). Sow welfare in farrowing crates was adversely affected by leaving piglets' teeth intact as they caused injury to the teats. The problem was worse in early lactation causing sows to decrease piglet contact with the udder by reducing lateral lying. However, this had no effect on the number of piglets engaged in behaviour directed towards the udder.

Keywords:	teeth clipping, behaviour, welfare, sow, piglets, farrowing crate
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 04
For information contact	Laura Boyle or email lboyle@moorepark.teagasc.ie

Development of an ear sensor to measure body temperature and heart rate in pigs

Talling, J.C., Van Driel, K.S., Yoon, D.C. (1), Chesmore, D. (1), Inglis, I.R. and Lake, M. (2)

Animal Welfare Team, Central Science Laboratory, Sand Hutton, York, YO41 1LZ, UK, (1) Electronics Dept, University of York, Heslington, York, UK, (2) Bishop Burton College, Bishop Burton, Hull, UK

A miniature biotelemetry sensor that can be simply placed within the ear canal of the subject animal, measure heart rate and body temperature, and radio the information to a receiver is being developed.

The first objective of this study was to determine behavioural responses of pigs to insertion of a sensor in the ear canal. Four groups of five pigs were used for the study, two pigs from each group had implants, and two pigs from each group were handled in a similar manner but without the implant being inserted. The implants were made from yellow foam and were stuck into the pigs' ears with prosthetic glue. Instantaneous scans of behaviour were made once every 15 minutes for twelve hours after the implants were inserted. In addition, total number of head shakes performed during the first, second, seventh, nineteenth and twenty fifth hour for the pig with the implant and the control pig were determined. The implants stayed in the ears for a mean of 3 days, range 24 hours to 7 days. The only observed difference between the control and implanted pigs was a significant increase in the incidence of head shakes (repeated measures GLM $F_{1,14}=18.02$, $p=0.001$) which showed a decrease over time (repeated measures GLM $F_{1,14}=15.349$, $p=0.002$).

These results suggest that placing a sensor in the ear of a pig would have negligible effects and therefore the ear is a suitable location for a non-invasive temperature and heart rate monitor. Preliminary results from a temperature sensor placed in a pigs' ear show no significant difference (paired t-test $t=-0.25$, $df=7$, $p=0.81$) with vaginal temperature readings.

Assessment of physiological indices of welfare could be greatly facilitated using an ear sensor, being non-invasive and easy to use.

Keywords:	pigs, biotelemetry, non-invasive
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 05
For information contact	Katja Van Driel or email j.talling@csl.gov.uk

Defining characteristics of species-specific environmental enrichment for pigs

Van de Weerd, H.A.(1), Docking, C. (1), Day, J.E.L. (1), Avery, P.J. (2) and Edwards, S.A.

University of Newcastle, Department of Agriculture, King George VI Building, Newcastle upon Tyne, NE1 7RU, UK, (1) ADAS Terrington, Terrington St. Clement, King's Lynn, Norfolk, PE34 4PW, UK, (2) University of Newcastle, Department of Statistics, Merz Court, Newcastle upon Tyne, NE1 7RU, UK

The present experiment aimed to identify the characteristics of enrichment which best satisfy the behavioural needs of pigs. The intensity of interactions with 73 different types of objects was studied in order to find the characteristics that the favoured objects had in common. Each object was tested 3 times, presenting it each time to both a group of 3 weaner pigs (approx liveweight=12kg) and 3 grower pigs (approx liveweight=50kg) for a period of 5 days. The behaviour of the pigs was recorded using video and sampled to determine the level of object directed behaviour on day 1 and 5. Each object was described using 27 descriptors (e.g. fixed/moveable, destructible/indestructible) and these were correlated with the behavioural observations obtained from the videos.

The weaner pigs showed a longer latency to interact with an object when it was first presented than the grower pigs (mean seconds±SEM: 2541±194 vs 1259±176, $p<0.001$). Overall, the weaner pigs had shorter bouts of interactions with the objects (43.0s±1.6 vs 53.0s±1.6, $p<0.001$). Stepwise regression analysis was used to identify which of the 27 characteristics played a major role in determining the level of object directed behaviour. The emergent characteristics on day 1 reflected the initial attraction of an object and five characteristics emerged (e.g. chewable, odorous, R-sq=26%). Characteristics for day 5 reflected sustained attention for an object and five characteristics emerged (e.g. ingestible, destructible, R-sq=30%). These characteristics suggest a relation with foraging and exploratory behaviour.

The main characteristics will be incorporated in newly designed enrichment, which besides safeguarding welfare, should also be inexpensive and practical to use. In the next stages of the project, the effect of the enrichment on the performance and behaviour of pigs will be investigated.

Financial support was received from: DEFRA, BOCM PAULS, PIC, GE Baker UK Ltd (Quality Equipment), QMScotland, Tesco.

Keywords:	enrichment, behavioural need, feeding, pig
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 06
For information contact	Heleen Van de Weerd or email heleen.vandeweerd@adas.co.uk

Differences in skeletal and ornamental traits between laying hen cannibals, victims and bystanders

Cloutier, S. and Newberry, R.C.C.

Center for the Study of Animal Well-being, College of Veterinary Medicine, Washington State University, Pullman WA 99164-6520, USA

We compared the size of skeletal and ornamental traits, and asymmetries in bilateral skeletal traits, between victims of cannibalism, cannibals and bystanders within small groups (N=16) of 4-5 caged female White Leghorns at the time of cannibalistic attacks (i.e. injurious pecks resulting in bleeding). We hypothesised that victims of cannibalism have discernible morphological traits that predispose them to cannibalistic attack. We predicted that victims would have smaller skeletal traits (body length, ulna length, metatarsus length and width, toe length), lower body weight, poorer body condition, smaller combs and more asymmetrical bilateral skeletal traits than their flock mates.

Contrary to our prediction, victims of cannibalistic attacks to the head/neck area (N=23) tended to have larger combs than their flock mates (Wilcoxon matched-pairs signed-ranks test, S=59, p=0.037, NS after sequential Bonferroni adjustment). The cannibals were more asymmetrical than non-cannibalistic bystanders (metatarsus length, S=48, p=0.011 and composite asymmetry, S=62.5, p=0.0016, significant after sequential Bonferroni adjustment). In agreement with our prediction, victims of cannibalistic attacks to other body parts (N=27), including the back, wings, rump, tail, cloaca, abdomen and toes, were more asymmetrical (composite asymmetry, S=78, p=0.0223, significant after sequential Bonferroni adjustment) and tended to have lower body weights (S=79.5, p=0.029, NS after sequential Bonferroni adjustment) than their flock mates. The cannibals did not differ in skeletal or ornamental traits from the non-participating bystanders.

The results suggest that large combs either elicit attacks to the head and neck area or increase vulnerability to injury during such attacks. Attacks to other body parts appear to be directed towards birds with signs of weakness relative to their flock mates. In these attacks, there were no distinguishing features separating cannibals from bystanders.

Keywords:	domestic fowl, asymmetry, skeletal traits, comb size, cannibalism
Species:	chicken
Session, type, nr	*Free papers, Short oral* 07
For information contact	Sylvie Cloutier or email scloutie@vetmed.wsu.edu

A survey of housing conditions and behaviour problems of domestic dogs in suburban Australia

Kobelt, A.J., Hemsworth, P.H.(1), Barnett, J.L.(1) and Coleman, G.J. (2)

Animal Welfare Centre, University of Melbourne and, (1) Agriculture Victoria, Victorian Institute of Animal Science, 600 Sneydes Rd, Werribee, Victoria, 3030, Australia, (2) Department of Psychology, Monash University, PO Box 197, Caulfield East, Victoria, 3145, Australia

There has been an increasing emphasis in Australia on confining dogs to the owners' properties (household backyards) as a solution to problems of dog aggression. Therefore, there is a need to determine the social and physical conditions that make up the dog's backyard environment and how these factors may affect dog behaviour and welfare.

The aim of this study was to provide an overview of the conditions provided to dogs in suburban Melbourne (Australia) and any behavioural problems believed to be associated with these conditions.

A survey of 203 dog owners across suburban Melbourne was conducted. The questionnaire consisted of questions relating to demographics, the dogs' routine and confinement and what behaviours the owners observed in their dogs. The relationships between some of the environmental factors and the occurrence of problem behaviour reported by owners were analysed by biserial, Pearson or partial correlation analysis.

The main behaviours identified as problems by owners were overexcitement (63%) and jumping up on people (56%).

Some of the factors that were correlated with the occurrence of the reported behaviours included how well the dog obeyed commands ($p<0.01$), whether the person had owned a dog before ($p<0.01$) and how much time was spent with the dog ($p<0.01$). Dogs that had obedience training were more likely to obey commands than those that that did not ($p<0.01$) and large dogs were more likely to have received training than small dogs ($p<0.01$).

These findings provide an interesting insight into some of the factors that may be related to the occurrence of behaviour problems in dogs.

Keywords:	dogs, behaviour, animal welfare, survey, environmental conditions
Species:	dog
Session, type, nr	*Free papers, Short oral* 08
For information contact	Amanda Kobelt or email Amanda.Kobelt@nre.vic.gov.au

Dustbathing substrate preference in broiler chickens: implications for animal welfare

Shields, S.J., Mench, J.A. and Garner, J.P.

Department of Animal Science, University of California, One Shields Avenue, Davis, CA 95616, USA

Broiler chickens often suffer from severe leg abnormalities due to their rapid growth rate. Providing broilers with the opportunity to express more natural behaviors (such as perching and dustbathing) can improve their ability to walk normally (Mench et. al, 2001), thus improving their welfare. The aim of this study was to stimulate increased dustbathing behavior by determining the preferred dustbathing substrate. Most work on dustbathing substrate preference has been done in laying hens and little is known about broiler preferences.

We selected 4 bedding types (pine wood shavings, rice hulls, construction grade sand, and a recycled paper product) that are either already in widespread use in poultry houses in the U.S. or are being considered as alternative poultry bedding. Broilers were housed in two floor pens bedded with wood shavings. Four broilers were randomly selected each week for 6 weeks (N=24 total) for dustbathing substrate choice tests. Tests were conducted in four experimental pens (measuring approximately 1.52 meters per side) containing a different substrate in each corner. Birds were observed for 1 hour three times per week. Broilers performed significantly more vertical wing shakes per hour (19.6, repeated measures ANOVA: $F_{3,36}=13.52$; $p<0.0005$), spent a greater proportion of their total time (31%, repeated measures ANOVA: $F_{5,60}=5.15$; $p=0.001$), in sand, and also had significantly shorter latencies to enter sand (2.6 minutes, GLM: $F_{3,18}=7.26$; $p=0.002$), than any of the other substrates (ricehulls: 1,15%, 5.31; paper: 18.02, 9.6%, 16.87; and woodshavings: 15.24, 18.5%, 10.34 respectively). A preference for sand was apparent the first week, and this preference was stable with age.

The results of this study suggest that sand is attractive to broilers and a potent stimulus for dustbathing. Further work is needed to determine if adding dustbathing boxes containing sand to commercial poultry houses will improve the leg condition of broilers, and thus improve their welfare.

Mench et al., 2001. In: Proc. 6th European Symp. Poultry Welfare, p. 152.

Keywords:	broiler chicken, dustbathing, welfare, leg abnormalities
Species:	chicken
Session, type, nr	*Free papers, Short oral* 09
For information contact	Sara J. Shields or email sshields@ucdavis.edu

An investigation into postural communication between ewes and lambs and its role in maintaining ewe-lamb proximity

Pickup, H.E. and Dwyer, C.M.

Animal Behavioural Sciences Department, Animal Biology Division, SAC-Edinburgh, West Mains Road, Edinburgh, EH9 3JG, UK

The 'head-up' posture has been identified as a means of communication between ewes and their lambs, signalling when lambs may approach and/or suck. Two breeds of ewe, Suffolk and Scottish Blackface, are known to differ in proximity to their lamb, Blackface ewes maintaining a closer spatial relationship. The aim of this study was to investigate the relationship between the performance of head-ups and ewe-lamb distance.

32 ewes (18 Suffolk, 14 Blackface) and their lambs were observed between birth and weaning (12 weeks). Pure and reciprocal crossbred lambs were used to control for breed effects on lamb behaviour. Focal observations were made on individual ewes and their lambs to record lamb behaviour following a head-up. In total, 855 head-ups were recorded in 36 (+/-0.615) 15-minute observations/ewe.

Blackface ewes were closer to their lambs throughout lactation (mean distances (m): Blackface=16.16+/-1.36, Suffolk=28.72+/-3.303; REML, $p<0.01$) and performed a higher frequency of head-ups than Suffolk ewes (Blackface=0.737/observation, s.e.m.=0.12, Suffolk=0.345/observation, s.e.m.=0.052; REML, $p<0.01$). The proportion of head-ups performed at close ewe-lamb proximity remained high in Blackface ewes (Chi-squared=22.65; DF=4; $p<0.001$) but decreased over time in Suffolk ewes (Chi-squared=46.71; DF=4; $p<0.001$). Lambs were more likely to respond to head-ups performed at close proximity (Friedman: S=7.26; DF=1; $p<0.01$). The most common lamb responses were identical for both breeds: none; approach and suck. However lambs with a Blackface dam showed fewer non-responses (% non-response: Blackface=52.99%, s.e.m.=4.30, Suffolk=71.70%, s.e.m.=3.53; REML, $p<0.001$) and more approaches to suck than those with a Suffolk dam (Blackface=18.74%, s.e.m.=2.00, Suffolk=9.80%, s.e.m.=1.68; REML, $p<0.01$).

The greater tendency for lambs with a Blackface dam to approach following head-ups may explain the shorter ewe-lamb distance in this breed. The closer ewe-lamb proximity whilst performing head-ups, and the higher rate of performance, may also contribute to the increased lamb response rate received by Blackface ewes, compared to Suffolk ewes.

Keywords:	sheep, maternal behaviour, communication
Species:	sheep
Session, type, nr	*Free papers, Short oral* 10
For information contact	Helena Pickup or email h.pickup@ed.sac.ac.uk

Nursing sychronization and milk ejection success in lactating sows: Don't suckle your babies alone

Spinka, M., Gonyou, H.W. (1) and Li, Y. (1)

Research Institute of Animal Production, Prague, Czech Republic, (1) Prairie Swine Center, Saskatoon, Canada,

In lactating sows housed in indoor rooms, nursings tend to occur in synchrony. At the same time, a substantial proportion of nursings are non-nutritive (NNN - without milk ejection). Neither of these phenomena is well understood. This study had two aims: to quantify the nursing synchronization on a large-scale commercial farm and to analyse how nursings synchronization affects whether a nursing will be nutritive (NN - with milk ejection) or non-nutritive. Sows were housed in rooms with 14 farrowing crates and farrowed within 2-4 days of each other. On days 8 and 15 p.p., nursing synchronization of all 14 sows per room was observed for 2 hours and nursing synchronization and nursing success of 3 focal sows per room for 6 hours. Altogether 2231 nursings in 504 sows were recorded. The nursings synchronization had a bimodal distribution. The nursings occurred most frequently in bouts of 5-6 or 9-10 synchronized sows (out of 14). When a sow was nursing, the median number of sows nursing within the same "wave" (a bout of overlapping nursings) was 6. Only 5% of nursings occurred without any overlap with other nursings. Nursing synchronization influenced the success of nursings. In the nursings that were synchronized (i.e. started within 3 min of each other) among the 3 focal sows, the proportion of NNN was 22%, whereas in the non-synchronized nursings, ejection failed in 49% ($p<0.001$, Mantel-Cochran-Haenszel statistics). Moreover, the latency of milk ejection was longer in the non-synchronized NN than in the synchronized NN (127 vs. 106 s, paired t-test, $p<0.01$). However, neither the probability of NNN nor the ejection latency was different between synchronized nursings that occurred early or late in a nursing wave. Synchronization among two sows did not depend on the distance between their crates. We conclude that nursing synchronization occurs in acoustically mediated waves and strongly affects the probability of milk ejection failure with possible practical consequences in milk production.

Keywords:	pigs, lactation, suckling, synchronization
Species:	pig
Session, type, nr	*Free papers, Short oral* 11
For information contact	Marek Spinka or email spinka@vuzv.cz

Why there is a synchronization of nursings bouts in lactating sows?

Illmann, G., Smazalová, Z. (1) and Spinka, M.

Ethology Group, Research Institute of Animal Production, Prague, Czech Republic, (1) Czech University of Agriculture, Faculty of Agronomy, Prague, Czech Republic

In group-housed lactating sows and in wild pigs, piglets can suckle sows that are not their biological mothers (allo-suckling). We examined whether nursing synchronization (NS, a nursing of two sows within two min) could be a strategy to control the frequency of allo-suckling. The aim of this study was to test the following hypotheses: (i) nursing synchronization (NS) is higher when piglets can allo-suckle, compared to a situation where they cannot. (ii) NS decreases allo-suckling. (iii) NS decreases the proportion of non-nutritive nursings.

Pairs of lactating sows with equally-aged litters were housed in two neighbouring pens. Their litters had access to both sows from day 10 post partum. The behaviour of 10 pairs of sows with their litters was videotaped for 6 hours on days 9, 10, 16 and 24 post partum. The NS, allo-suckling and massage of alien teats were analysed for individual observation days.

The analysis showed: (i) NS between two sows was significantly higher when piglets had access to both sows than when they were housed individually (ANOVA, $F=4.23$ $p<0.05$). (ii) Surprisingly, allo-suckling was rare. However, piglets showed often massaging an alien teat. Piglets massaged alien teats significantly less before milk ejection during synchronized than during non-synchronized nursings, but the difference was significant only on day 24 (n=10 pairs of sows, Cochran-Mantel-Haenszel (CMH) statistic; $p<0.05$). (iii) The proportion of non-nutritive nursings was lower among synchronized than during non-synchronized nursings on all observation days (n=10 pairs of sows, CMH statistic; $p<0.05$). Furthermore, alien piglets massaging a teat before milk ejection significantly increased the probability that the nursing will be non-nutritive (n=10 pairs of sows, CMH statistic; $p<0.05$).

The results suggest that sows can probably control the frequency of allo-suckling trough NS. Moreover, NS increases the probability to have a nursing with milk ejection. NS seems to be a strategy to have an optimal milk transfer to the own piglets.

Keywords:	pig, allosucking, ontogeny, non-nutritive nursings, maternal investment
Species:	pig
Session, type, nr	*Free papers, Short oral* 12
For information contact	Gudrun Illmann or email Spinka@vuzv.cz

Operant conditioning as a method to assess lying motivation in dairy heifers

Jensen, M.B., Munksgaard, L., Pedersen, L.J., Ladewig, L. (1) and Matthews, L. (2)

Danish Institute of Agricultural Sciences, Research Centre Foulum,Tjele, Denmark, (1) Royal Veterinary and Agricultural University, Frederiksberg, Denmark, (2) AgResearch, Ruakura Agricultural Research Centre, Hamilton, New Zealand

To validate operant conditioning as a method to measure lying motivation in dairy cattle, the prediction that intensity of demand, but not elasticity of demand, is affected by the length of lying deprivation was tested. Furthermore, the effect of reward duration (lying time) on the demand was examined.

Eight heifers were housed in tether stalls and trained to press a panel for the opportunity to lie down. The heifers were deprived of lying down daily for either 2 x 3 hours (1800 – 2100 & 0700 – 1000 hours) or 2 x 6 hours (1500 – 2100 & 0400 – 1000 hours). During rewards the heifers could lie down for either 10 or 20 minutes. Treatments were presented in a cross over design. When deprived of lying down each heifer was equipped with a girth that prevented the lying down movement. The girth included an opening mechanism that was activated after a given number of presses on a panel (FR 10, 20, 30, 40, 50). The panel was presented to the heifers daily from 1000 to 1300 hours.

As predicted length of deprivation affected the intensity ($p<0.001$), but not the elasticity of the demand curve. The heifers earned more rewards when deprived for 2 x 6 hours (demand function: $y=8.8 – 0.03x$) compared to 2 x 3 hours ($y=6.0 – 0.03x$). However, reward duration affected both intensity ($p<0.001$) and elasticity ($p<0.01$) of the demand function. The heifers earned more rewards when given 10 minutes of access (intercept=8.6) compared to 20 minutes of access per reward (intercept=6.2), but the demand was more elastic for 10 compared to 20 minutes of reward (slopes of –0.05 vs. –0.02). These results indicate that we have developed a sensitive technique for quantifying the importance of resting behaviour to cattle, that lying behaviour has a high priority after relatively short periods of lying deprivation and that a shorter resting period is less valuable than a longer period.

Keywords:	demand functions, operant conditioning, methods, motivation, behavioural needs, cattle
Species:	cattle
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 13
For information contact	Margit Bak Jensen or email

Quantifying the contact patterns of a Heck cattle population in the Netherlands with regard to transmission of bovine herpesvirus 1 (BHV)

Mollema, E., de Jong, M.C.M. and Koene, P. (1)

Dept. of Quantitative Veterinary Epidemiology, Institute for Animal Science and Health, Edelhertweg 15, 8219 PH, Lelystad, The Netherlands, (1) Ethology Group, Department of Animal Sciences, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

A number of studies has been carried out to quantify the transmission of BHV between domestic cattle. It is unclear, whether the transmission as estimated in these studies also applies to a population of feral cattle. The contact structure of a feral cattle population may differ from a domestic cattle population concerning 1) type of contacts, 2) number of contacts and 3) number of different individuals contacted. Here we are interested in the contact structure of a Heck cattle population in the Dutch nature reserve 'the Oostvaardersplassen'. From serological data it is known that BHV is present in the Heck cattle population. Our main question is whether the contact patterns among Heck cattle are restrictive for transmission of BHV compared to domestic cattle. The methods we used were scan and individual sampling.

From literature we defined a list of contacts that have a relatively high chance at transmission (specific contacts). We distinguished 60 indicator animals (not at random) which we followed during the observations. The Heck cattle population was divided into five animal groups (cow, bull, young cow, young bull, calf). The time the Heck cattle spent on specific contacts and other behaviour was observed, among others, by scan sampling. Focal animals have been observed for 20 minutes for their contact structure.

The mean specific contact rate in autumn was lower than that in summer. Further an animal had mainly specific contacts with animals from a certain animal group. In summer the animals spent on average 5.3% of their time on specific contacts; 63% of such contacts were between a bull and a cow ("herding"). In autumn the animals spent less time on specific contacts; "Sniffing genitals" has the highest percentage (38%). To estimate whether the contact patterns among feral cattle are restrictive for transmission of BHV we used the R0, as has been calculated for domesticated cattle herds. R0 is the number of newly infected individuals infected by one individual during his whole life in a population with susceptible individuals. In domesticated cattle it is known that the contact patterns are not different from random mixing, and thus not restrictive for transmitting the virus. Results show that the contact patterns between Heck cattle are also not restrictive.

Keywords:	BHV, contact structure, feral cattle, transmission
Species:	cattle
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 14
For information contact	Liesbeth Mollema or email E.Mollema@id.wag-ur.nl

Measuring social motivation in calves by operant conditioning: effect of type of social contact

Holm, L., Jensen, M.B. and Jeppesen, L.L. (1)

Department of Animal Health and Welfare, Danish Institute of Agricultural Sciences, Research Centre Foulum, P.O. Box 50, 8830 Tjele, Denmark, (1) Zoological Institute, University of Copenhagen, Tagensvej 16, 2200 Copenhagen N, Denmark

Slopes of demand functions, generated by operant conditioning methods, are used to assess the strength of animals' motivation for different resources. In previous studies of motivation for social contact, animals had access to either visual contact or physical nose-to-nose contact. A methodological discussion concerns the way social contact is provided in operant conditioning studies.

The aim of this study was to investigate calves' motivation for two different types of social contact, head contact and full contact, with a known companion calf. Six test calves and six companion calves, housed in pairs prior to and in isolation during the study, were used. Tests were performed in daily sessions in a cross-over design. For each treatment test calves were exposed to five Fixed Ratio schedules (FR6, 12, 18, 24, 30) within three runs. They worked by pressing a panel and rewards consisted of 3 min. access to social contact. Social activity in the reward periods was recorded continuously.

Results showed a difference between demand functions based on number of rewards obtained per session. The slope for head contact was steeper than for full contact ($p<0.01$), whereas intercepts did not differ. Calves used more time for social activity when tested for full contact compared to head contact ($p<0.001$). Slopes of demand functions based on duration of social activity per session were not different, but intercept was higher for full contact ($p<0.01$). For both head and full contact, slopes were shallower than slopes of demand functions based on number of rewards.

The study shows that type of social contact may influence demand functions. Measured by number of rewards obtained per session, calves were more motivated for full contact. Consequently, full contact should be used in future operant conditioning studies with the aim of comparing calves' motivation for social contact to motivation for other resources.

Keywords:	Operant conditioning, demand functions, behavioural needs, motivation, social contact, calves
Species:	cattle
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 15
For information contact	Louise Holm or email MargitBak.Jensen@agrsci.dk

Individual differences in the behavioural signs of stress in kennelled dogs

Stephen, J.M., Ledger, R.A. and Stanton, N.A.

Design For Animal Welfare, Brunel University, Egham, Surrey, TW20 OJZ, UK

Domestic dogs (Canis familiaris) are known to experience stress upon entering novel kennel environments. Due to individual differences in dog temperament, some dogs will struggle to cope with confinement in kennels and may experience varying degrees of stress.

This survey-based study aimed to investigate the prevalence and onset of behavioural indicators of stress in kennelled dogs, and the variation that exists between breed types.

Staff at 8 dog re-homing centres in the UK were trained in how to recognise key behavioural indicators of stress in dogs. A total of 284 dogs were monitored over 4 months and all behaviours were displayed at some point by some dogs. In the first 2 weeks, excessive barking was displayed most often by dogs (17%), whereas excessive pacing and wall bouncing were both displayed by 7% of dogs (N=100). 63% of dogs showed at least 1 behavioural indicator of stress.

There were differences in whether or not a behaviour was performed between breeds in Week 1 and 2 (Chi-squared exact; play bounce Week 2; $p<0.08$; escape attempts Week1; $p<0.05$; and Week 2; $p<0.07$). The extent to which behaviour was performed revealed that only excessive drinking (Kruskal-Wallis; Week 3; $p<0.044$), escape behaviour (Week 2; $p<0.029$), and excessive barking (week 3; $p<0.011$), were displayed significantly more, by the Labrador breed type compared with other breeds (Dunn's; $p<0.05$ respectively).

High variability in the extent to which individuals display stress related behaviours suggests variation in an individuals ability to cope with the kennel environment.

The limited degree to which breed type explained variance in this study suggests that it is far too complex a situation to predict by breed alone.

Future research will involve identifying those individuals most at risk, and offering practical solutions about how to reduce stress and improve the welfare of dogs in re-homing kennels.

We would like to thank the RSPCA, Battersea at Old Windsor Dogs Home and Pine Ridge kennels for their assistance.

Keywords:	stress, kennelled dogs, re-homing, survey
Species:	dog
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 16
For information contact	Jacqeline Stephen or email jacqueline.stephen@brunel.ac.uk

Wild koniks or tame tarpans? A behavioural comparison between the konik horses from Popielno, Poland and koniks in nature reserves in the Netherlands

Koene, P., Pasmooij, M., Louwerse, J. and Reinders, J.

Ethology Group, Department of Animal Sciences, Marijkeweg 40, 6709 PG, Wageningen, the Netherlands

Large herbivores are often (re)introduced in nature reserves in the Netherlands. It is important to know whether those animals are self-sustainable or need human care. Care may be dependent on the degree of dedomestication of the species involved, ranging from wild to domesticated.

To estimate the degree of domestication 2 bands Konik horses from the Blauwe Kamer (Netherlands), were behaviourally compared with 2 bands Konik horses in Popielno (Poland) and 2 bands of the Oostvaardersplassen (Netherlands). The investigated parameters were a.o. population characteristics (foal mortality, problems during birth, month of birth, group size, adult sex ratio and age ratio) and social structure (frequency of dominance display, percentages of aggressive interactions, leadership and allogrooming). The breeding season in the Blauwe Kamer was extended compared to Popielno ($p<0.05$). More 'snorts' (alertness), 'screams' (aggression) and 'whinnies' (locate or to call a member of the herd) were heard in Popielno. Both could indicate a higher degree of domestication according to literature. The herds of the Blauwe Kamer did not react alert to novel objects (beach ball and pion) and ignored or even approached visiting groups of humans while the herds of Popielno responded more alert to the new objects and ran away from humans.

The stallions from the Oostvaardersplassen showed less snorts, but more screams and whinnies and more social interaction (all $p<0.001$) in comparison to the stallions from the Blauwe Kamer and Popielno. In this nature reserve one big herd of approximately 400 horses was found. Within this herd different group structures were identified, examples are multi harem associations and multiple male bands.

The horses from the three nature reserves showed differences in a number of parameters probably related to the degree of domestication. Large genetic differences could not yet have been developed in 20 years, so differences point to differences in developmental changes and in environment reoccurring each generation.

Keywords:	natural behaviour, dedomestication, Konik, wild, feral, horse
Species:	horse
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 17
For information contact	Paul Koene or email paul.koene@etho.vh.wau.nl

Affiliative behaviour and spatial organisation in a large herd (containing castrated males) of Icelandic horses in semi feral conditions

Van Dierendonck, M., Sigurjónsdóttir, H. (1) and Thorhallsdottir, A.G. (2)

FIRE, Tolnegenweg 39, 3776 PT Stroe, The Netherlands, (1) Iceland University of Education, Stakkahlid, 105 Reykjavik, Iceland, (2) The Agricultural University at Hvanneyri, Iceland

In modern horse management, there is a tendency towards more natural housing and grouping of horses. The rationale is the positive relation between the prevention and treatment of stereotypes and husbandry: providing more natural social contact and freedom of movement. Often these domestic pasture groups contain both females and (relative many) castrated males and are larger than their wild counterparts: multiple-male-bands. In Iceland, large (30-100 animals) domesticated herds composed of females and castrated males of all age classes occur, while no comparable groups with intact males exist. It is important to investigate the (social) behaviour of (sub)groups for such a management system, in order to define their needs and basic requirements. This paper presents the analyses of affiliative and spatial behaviour to test social stability in a herd of Icelandic-horses for 2 non-consecutive years (1997: 23 females, 11 males; 1999: 22 females, 9 males; 18 animals present in both years). This was part of a larger project.

An important form of behaviour was allogrooming, which strengthened the social bond especially between mares. In both years all the animals groomed significantly more with individuals of the same sex-age group (rowwise-partial-tau-KR permutation-test 1997: tau=0.38, n=41, $p<0.001$; 1999: tau=0.36, n=45, $p<0.001$). There was a large overlap (76%) of preferred partners between the respective years. Mares in the same physiological state (pregnant, post-partum, barren) preferred to allogroom within each state group (1997: tau=0.16, n=24, $p<0.0005$; 1999 tau=0.14, n=32, $p<0.0005$).

Spatial grouping occurred in distinct classes: three distinct adult mare state subgroups, while the other ones were organised by age or sex-age: geldings >5 years, sub-adults, 1-3-year-olds or foals. The spatial relations corresponded significantly with the affiliative relations (1997: tau=0.19, n=48, $p<0.001$). The effect of kinship and familiarity, both on spatial relations and allogrooming, as well as implications for domestic herd management will be discussed.

Keywords:	horses, social organisation, affiliative relations, spatial organisation, kinship, natural requirements
Species:	horse
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 18
For information contact	Machteld Van Dierendonck or email m.dierendonck@planet.nl

Substitutability of different rooting materials to pigs: assessed by the cross point between two demand functions

Pedersen, L.J., Jensen, M.B. and Ladewig, J. (1)

The Danish Institute of Agricultural Science, Dept. of Animal health and Welfare, Research Centre Foulum, Box 50, 8830 Tjele, Denmark, (1) The Royal veterinary- and Agricultural University, Dept. of Animal Production and Animal Health, Section of Ethology and Health, Grønnegårdsvej 8, 1870 Frederiksberg C, Denmark

Behavioural demand functions have been used to assess the strength of an animals' motivation for different resources. However, when comparing two partly substitutable resources using a set up allowing the animals access to only one resource at a time there may be a risk of overestimating the demand for each of the resources since the animals are left with no other alternatives. The aim of the present experiment was to measure pigs' motivation for different rooting materials when given the opportunity to consider the relative attractiveness of two different materials simultaneously.

Ten pigs worked in a closed economy test room for 45 minutes daily with two partly substitutable resources available in each side of the pen. One of four different rooting materials (chopped straw, fir branches, peat and long straw) were available on the right side, while long straw was always available on the left side. In order to avoid side preferences the cost of access to the resources varied on both sides according to a set of 5 fixed ratio schedules (FR 8/FR 40, FR16/FR32, FR24/24, FR 32/FR16, FR40/FR8). Each pig went though 4 runs of these 5 FRs set for each material. Demand functions for both resources (the various materials against long straw) were made and the cross point between the two was calculated as the FR value on the side where long straw was always available. A cross point below the cross point for long straw vs. long straw indicates a preference for the alternative substrate. The results showed that materials significantly affected the cross point ($F_{3,22}=7.0$, $p=0.001$), in that the cross point for peat (FR5.3=1.6) and branches (FR11.8=3.6) were significantly lower than the cross point for both long straw (FR29=8.8) and chopped straw (FR29=8.9). The cross point for peat tended to be higher than the cross point for fir branches.

In conclusion, pigs valued branches and peat over long straw and chopped straw as rooting materials.

Keywords:	operant conditioning, rooting behaviour, pigs
Species:	pig
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 19
For information contact	Lene Juul Pedersen or email Lene.juulpedersen@agrsci.dk

Behavior of spotted dolphins (Stenella attenuata) during tuna fishing sets in the Eastern Tropical Pacific (ETP) ocean

Santurtún, E. and Galindo, F.

Departamento de Etología y Fauna Silvestre, Facultad de Medicina Veterinaria y Zootecnia. Universidad Nacional Autónoma de México, Ciudad Universitaria, México, DF. C.P. 0451, México

The tuna purse seine fishery in the ETP has targeted dolphins to capture associated tuna. Currently, dolphin mortality is at sustainable levels, however, there is concern that fishing operations may be causing chronic stress in these animals affecting their populations.

The aim of this study was to assess behavioral changes of dolphins during the fishing sets (chase, capture, encirclement with net, and back-down which is the sinking of the cork-line to release the dolphins from the net) in order to know more about their coping strategies. If dolphins are habituated this will be reflected in their ability to predict events during the fishing set.

Behavioral observations were carried out on dolphins chased and encircled during August-October 2001 in the ETP. A combination of scan and behavioral sampling was carried out in each of the fishing sets through direct observations and video-recording, in order to obtain information on individual and group behaviors.

The percentage of dolphins milling and in passive behaviors were positively related to the duration of the encirclement ($p<0.05$), while the proportion of dolphins in active behaviors was related to the duration of the back-down ($p<0.001$). The frequency/min of jumps was also positively related to the duration of chase ($p<0.05$) and duration of the set ($p=0.05$. When behaviors were compared by school size captured it was found that the proportion of dolphins swimming moderate during the set and the proportion of dolphins engaged in active behaviors during the back-down of the net were significantly greater in small schools than in large schools ($p<0.05$, $p<0.01$; respectively).

From these results we suggest that most dolphins predict the events of the fishing operations, however it still important to understand the function of many of the behaviors recorded and how they relate to physiological responses.

Keywords:	behavior, spotted dolphins, stress, welfare, fisheries, eastern tropical pacific ocean
Species:	dolphin
Session, type, nr	*Free papers, Short oral* 20
For information contact	Francesco Galindo or email esanturtun@yahoo.com

Human-cow interactions during milking and their relation to cows‘ behaviour and to production

Waiblinger, S., Menke, C. and Coleman, G. (1)

Institute of Animal Husbandry and Animal Welfare, University of Veterinary Medicine, 1210 Vienna, Austria, (1) Department of Psychology, Monash University, Caulfield, Vic. 3145, Australia

The aim of this study was to investigate the relationship between man-animal interaction and cows‘ behaviour and milk yield on small, family run dairy farms.

On 30 farms in Austria (loose housing cubicles; 25-50 cows per herd), the following parameters were recorded during one half-day visit including the evening milking: tactile and acoustic behaviour of the stockperson towards the cows while moving and milking; flinch/step/kick responses of the cows during milking; avoidance distance of cows towards an experimenter. Milk production and breeding value records were obtained from the breeding organization. Spearman rank correlation or partial correlations (with milk yield, control variable: breeding value) were calculated.

The behaviour of stock people was strongly correlated with the behaviour of cows and moderately correlated with milk yield. The more positive and the less negative behaviour stock people performed in the milking parlour, the lower were their cows‘ avoidance distances ($r=/.39/$ to $/.47/$; $p<0.01$). Increased use of “neutral” behaviours (moderate use of the hand, moderately loud vocalisations, using a stick softly) was related to more stepping/kicking during milking ($r=.4$, $p<0.01$) and a lower milk yield ($rp=-.43$, $p<0.05$). If stock people used more positive interactions when moving cows to the waiting area, the animals flinched less during milking ($r=-.4$, $p<0.05$). The use of acoustic activating signals (clapping, whistling, knocking with a stick on equipment) when moving the cows was positively related to the number of the cows‘ steps during milking ($r=.45$, $p<0.05$). No significant correlation was found between avoidance reactions towards humans and flinch/step/kick reactions in the milking parlour.

The results indicate a distinct influence of stock people’s interactions with cows on the cows’ relationship to humans, on their behaviour and on milk yield and portend to the activating nature of some acoustic interactions.

We acknowledge financial support from the Fund 200 Years University of Veterinary Medicine Vienna.

Keywords:	human-animal interaction, dairy cows, avoidance distance, milk production
Species:	cattle
Session, type, nr	*Free papers, Short oral* 21
For information contact	Susanne Waiblinger or email Susanne.Waiblinger@vu-wien.ac.at

Observations on laterality (side-preference) in a T-maze

Erhard, H.W., Rae, M.T., Rhind, S.M. and Boissy, A. (1)

Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen AB15 8QH, UK, (1) INRA, LAHM, 63122 St-Genes-Champanelle, France

T-maze tasks are often used to investigate animals' preferences or to study behavioural flexibility. Side-preferences can affect the animals' choices in these tasks.

The data presented here are derived from 2 separate experiments. In experiment 1, we used 71 goats (6 months old) in a study of personality. In experiment 2, we used 64 sheep (18 months old) who were part of a project on the effects of level of nutrition on foetal development. The dams of half the sheep had been fed at 50% maintenance for the first 100 days of pregnancy to mimic levels of nutrition likely to be experienced in extensive production systems (low nutrition), the others at 100% (high nutrition). Both experiments used similar T-mazes, with one exit open, presenting a food reward. In each case, the animals were first individually introduced into the maze by the handler, who led them into the arm with the closed exit first (50% of the animals had the left exit closed, 50% the right one). The side-preference of the animals in the subsequent run, when the animals were alone in the maze, was recorded.

In experiment 1, 83.1% of the goats turned to the right (35 out of 36 with right exit open, 24 out of 35 with left exit open; Chi-squared, $p<0.001$). In experiment 2, 71.9% of the high nutrition sheep turned to the right (53.3% with left exit open, and 88.2% with right exit open), but only 37.5% of the low nutrition sheep (37.5% with left exit open, and 37.5% with right exit open; Chi-squared, $p<0.01$).

Both goats and sheep showed a clear side-preference in the T-maze. The results of experiment 2 suggest that this preference is, at least to some extent, a characteristic of the animals (possibly foetal brain development) and not solely due to external stimuli.

This study was funded by the Scottish Executive Environment and Rural Affairs Department.

Keywords:	sheep, goats, maze, side-preference
Species:	sheep
Session, type, nr	*Free papers, Short oral* 22
For information contact	Hans Erhard or email h.erhard@macaulay.ac.uk

Feather pecking and coping strategy in chicks from a high and low feather pecking line of laying hens

Van Hierden, Y.M.(1), Korte, S.M., Ruesink, E.W., van Reenen, C.G., Korte-Bouw, G.A.H., Koolhaas, J.M. (1) and Blokhuis, H.J.

Division of Animal Sciences, Institute for Animal Science and Health (ID-Lelystad), P.O. Box 65, NL-8200 AB Lelystad, The Netherlands, (1) Department of Animal Physiology, University of Groningen, P.O. Box 14, 9750 AA Haren, The Netherlands

Chicks from a high (HFP) and low (LFP) feather pecking line of laying hens already differ in their propensity to feather peck at an early age. We hypothesized that behavioural differences between these lines may reflect differences in coping strategy, and examined physiological and neurobiological stress responses in chicks of both lines.

We investigated the development of adrenocortical (re)activity in HFP and LFP chicks, at 3, 14, 28, 41 and 56 days of age (N=24 per line per age). We studied dopamine (DA) and serotonin (5-HT) turnover in the brains of 28 days old HFP and LFP chicks (N=15 per line). All chicks were exposed to a manual restraint test (placing the chicks on its side for 5 min), before decapitation. Chicks were housed in litter-floor pens with four birds per line.

No significant interactions between Restraint, Line and Age were found. There were significant effects of Restraint [$F(1,106)=678.6$, $p<.001$], Line [$F(1,106)=32.2$, $p<.001$], and Age [$F(4,106)=92.2$, $p<.001$] on corticosterone levels. On 3 and 56 days of age, HFP chicks showed significantly lower baseline corticosterone levels than LFP chicks. After manual restraint, corticosterone levels were lower in the HFP line compared to the LFP line, on days 3, 14 and 28 of age.

Both 5-HT and DA turnover were significantly lower in the HFP line compared to the LFP line ($t=3.42$, $df=21.69$, $p<0.01$ resp. $t=3.38$, $df=17.82$, $p<0.001$).

In rodents and pigs, differences in HPA-axis reactivity, and DA and 5-HT turnover, have been implicated in the distinction between coping strategies. Our results support the idea that HFP and LFP chicks are representatives of the proactive and reactive coping strategy, respectively, and suggest that proactive birds are more vulnerable to develop feather pecking.

Keywords:	feather pecking, chicks, coping strategy, corticosterone, dopamine, serotonin
Species:	chicken
Session, type, nr	*Free papers, Short oral* 23
For information contact	Yvonne Van Hierden or email y.vanhierden@id.wag-ur.nl

What's in a chicken brain? A review of the cognitive abilities of chickens

Forkman, B.

Department of Animal Science and Animal Health, The Royal Veterinary and Agricultural University, Groennegaardsvej 8, DK-1870 Frederiksberg C, Denmark

To be called a "chicken brain" is an insult in many languages. Until fairly recently most research in cognition focused on humans, primates and the ubiquitous experimental animals: the rat and the pigeon but this has since changed. Knowledge of the mental abilities of farm animals is important, both from a basic science point of view, but also since it affects the value and concern shown for those animals. Finally, knowledge about the cognitive processes of farm animals will also help us keep raise and keep them.

More basic research on the domestic chicken has shown that it is capable of high levels of object permanence (although there is some doubt as to whether they can solve the invisible displacement task, e.g. Kruchensky 1990) and is able to form expectations (Haskell & Forkman 1998). Object permanence is also shown by their ability to complete partly occluded objects (Regolin & Vallortigara 1995, Forkman 1998, but see Sekuler et al. 1996), and the fact that they seem to solve some visual problems in a way similar to our own (Forkman & Vallortigara 1999). Despite earlier failures of demonstrating detour ability (Köhler 1925), later studies report success (e.g. Regolin et al. 1995).

Having object permanence is a prerequisite for having declarative representations. (These representations are sometimes described as mental images or representations that the animal can manipulate and use to predict the outcome of e.g. a behaviour without actually performing the behaviour.) Recent experiments using devaluation protocols show that the chicken is indeed capable of forming declarative representations (Forkman 2000, Cozzutti & Vallortigara 2001). Early experiments purporting to having found a theory of mind in the chicken (Gyger & Marler 1988), have however since been refuted (van Kampen 1994).

Keywords:	chicken, hen, cognition, mental ability, object permanence, declarative representation
Species:	chicken
Session, type, nr	*Free papers, Short oral* 24
For information contact	Björn Forkman or email bjf@kvl.dk

Cannibalism in laying hens - effect of early access to perches on escape behaviour

Yngvesson, J., Nedergård, L. and Keeling, L.J.

Department of Animal Environment & Health, Section of Ethology, P.O.Box 234, SE-532 23 Skara, Sweden

Perches have been found to reduce cannibalism in layers (Fröhlich, 1991, KTBL-Schrift, 344:36-46; Gunnarsson et al., 1999; Brit. Poult. Sci. 40:12-18), but the mechanisms for this are unknown. Spatial ability is improved if chicks are reared with perches (Gunnarsson et al., 2000; Appl. Anim. Behav. Sci. 67:217-228).

To investigate if escape behaviour was affected by rearing with perches, escape was elicited by spraying water at the cloaca of a focal bird to simulate a cannibalistic attack from a flock mate. 100 Lohmann brown chicks were reared in 10 pens with (P+) and 10 without (P-) perches. Perches were placed ten, 20, 30 and 40 cm above the floor. At eight weeks of age all birds were given access to perches and at 12 weeks the birds were trained until all roosted on the perches at night. Escape behaviour was tested at 17 week in a test pen and in the home pen to compare reactions in novel and familiar situations. In the test pen, 31 P+ and 21 P- hens reached the 40 cm perch ($p<0.05$).

Escape behaviour in the home pens was not affected by treatment. Daytime perch use in undisturbed birds was significantly higher at 21 than 18 weeks of age ($p<0.05$). Birds that did not learn to use the perches without training, even if perches were available, did not use perches more than birds reared without perches.

This study demonstrated that early experience with perches affects later escape behaviour and offers a possible explanation to the previously found link between perches and reduced cannibalism in commercial flocks.

Keywords:	laying hens, cannibalism, perches
Species:	chicken
Session, type, nr	*Free papers, Short oral* 25
For information contact	Jenny Yngvesson or email jenny.yngvesson@hmh.slu.se

Maternal deprivation of piglets does not alter the reactivity of their hypothalamic-pituitary-adrenal (HPA) axis later in life

Jarvis, S., Lawrence, A.B., .Calvert, S.K, Stevenson, J., Sumner, B.E.H. (1), Douglas, A.J.(2), Russell, J.A.(2) and Seckl, J.R.(3)

Animal Behavioural Sciences Dept., Animal Biology Division, Scottish Agricultural College, Bush Estate, Penicuik, Midlothian, EH26 0PH, UK, (1) Animal Welfare Research Group, University of Edinburgh, Roslin BioCentre, ROSLIN, Midlothian, EH25 9PS, UK, (2) Laboratory of Neuroendocrinology, Division of Biomedical and Clinical Laboratory Sciences, University of Edinburgh,George Square, Edinburgh, EH8 9XD, UK, (3) Molecular Endocrinology Laboratory, Molecular Medicine Centre, University of Edinburgh, Western General Hospital, Edinburgh, EH24 2XU, UK

Evidence in humans suggests that adverse early life experience (e.g. poor parental care) increases the risk of anxiety, depression, diabetes and heart disease in adult life. Rat studies have shown that maternal deprivation leads to pups becoming more anxious, fearful and HPA axis hyper-reactive adults. A proposed basis is alteration in HPA axis feedback sites and the amygdala. This study investigated early programming of the HPA axis in pigs through manipulation of weaning age as a form of maternal deprivation. 13 unmixed litters of pigs were weaned at either 12 (5 litters), 21 (4 litters) or 42 (4 litters) days old (litter was accounted for in the analysis). From each litter 2-5 female piglets were selected as test animals resulting in 16 test piglets for each weaning age. The behaviour of the test females was recorded for 3 hours, once a week throughout life. On day 90, half of the females from each weaning age were restrained (R) for 30 minutes and then isolated for 90 minutes. All females, including unrestrained pigs (U) were then sacrificed (i.v. pentobarbitone) and plasma and brains collected. 12 and 21 day weaned piglets performed more belly nosing (ANOVA, $F_{2,10}=6.13$, $p<0.05$) across the whole period, whilst performing more aggressive interactions during the post-weaning period ($F_{7,14}=3.77$, $p<0.001$). Weaning age did not affect the maximal binding of glucocorticoid receptors in the hippocampus ($F_{2,40}=2.12$,NS), expression of corticotropin releasing hormone (CRH) mRNA in the hypothalamus ($F_{2,41}=0.08$,NS), plasma cortisol or adrenocorticotropic hormone (ACTH) concentrations at death. However R pigs did have more hypothalamic cells expressing CRH mRNA ($F_{2,41}=16.77$, $p<0.001$) and had higher plasma ACTH and cortisol levels than U pigs.

Maternal deprivation, by varying weaning age, altered the behaviour of piglets up to 90 days of age, however this does not seem to be associated with altered programming of the HPA axis. Changes in the amygdala are being investigated.

Keywords:	pigs, HPA axis, maternal deprivation, early life experience
Species:	pig
Session, type, nr	*Integration of research on human welfare and animal welfare, Short oral* 27
For information contact	Susan Jarvis or email s.jarvis@ed.sac.ac.uk

Behavioural consequences of ovariohysterectomizing bitches

McMullin, L., Bate, L. and Guy, N.

Department of Anatomy and Physiology, Atlantic Veterinary College, Charlottetown, PE, C1A 4P3, Canada

Ovariohysterectomy is one of the most routine surgical procedures performed by veterinary clinicians. Recent research indicates that aggressive behaviours may result as a consequence of ovariohysterectomizing bitches. The objective of this study was to determine the relationship between nonreproductive behaviours, in particular aggression, and spaying.

One hundred and three dog owners were recruited from a cohort of veterinary clientele in the Canadian provinces of New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. Two telephone questionnaires were completed by the dog owners of both ovariohysterectomized (test subjects) and intact bitches (controls). The first questionnaire was completed before the animal was ovariohysterectomized and the second 8 months after ovariohysterectomy. Aggression was determined from the questionnaire results by incidence of growling . Two blood samples were also taken from the dogs, one at the time of spaying, and one 8 months after spaying. Stress leukogram values were measured in the blood as an indicator of long term stress.

Results indicate that keeping a bitch intact versus spaying resulted in a lower incidence of growling ($p=0.06$, $OR=0.05$). Intact bitches were less excitable than spayed bitches ($p=0.04$, $OR=0.09$). There were no significant relationships between the reported appetite of the dogs and spaying. Stress leukogram values did not change as a result of spaying and were not associated with incidence of growling. This suggests that the higher incidence of growling seen in spayed bitches is not associated with long term stress parameters measured in this study.

These results have begun to elucidate clinically important risk factors associated with ovariohysterectomizing bitches. Understanding of these risk factors can help dog caretakers to diminish undesirable behaviours that may result from spaying and in turn improve animal welfare and human-animal interactions.

Keywords:	risk factors, dog, behaviour, aggression, human-animal relationships
Species:	dog
Session, type, nr	*Integration of research on human welfare and animal welfare, Short oral* 28
For information contact	Lynn Patricia McMullin or email Bate@upei.ca

Cross-cultural study of behaviour of the general public towards guide dog owners and guide dogs in Japan and the UK

Tanida, H., Miura, A. (1) and Bradshaw, J.W.S. (1)

Graduate School of Biosphere Science, Hiroshima University, 1-4-4, Kagamiyama, Higashi-Hiroshima, 739-8528, Japan, (1) Anthrozoology Institute, School of Biological Sciences, University of Southampton, Southampton, Bassett Crescent East, Southampton, SO16 7PX, UK

Previous studies suggested that assistance dogs enhance social interactions between their owners and the general public. However, the details of the 'social interactions' have not been demonstrated, and also these studies were conducted only in western countries. This study investigated 'social interactions' qualitatively as well as quantitatively, both in Japan and the UK, by recording people's spontaneous reactions towards guide dog owners and guide dogs under everyday conditions.

Participants were male guide dog owners in each country, who were asked to use public transport (e.g. bus), go to a public place (e.g. shopping mall), and enter at least one shop and one eating place (e.g. café). Two observers followed each owner with a concealed camcorder, and each observation lasted for about 2 hours.

In both countries, conversations between passers-by and the owners (Mean: JP=5.3, UK=3.8) were similar, which were divided into: greetings by acquaintances; chats with people about dogs; and offers to help the owners by passers-by. There were also occasions when an offer of help developed into a chat, for example, a woman who helped the owner in a bus stop started to ask him about his guide dog. However, people were more likely to simply show interest in dogs, rather than to have interactions with the owners, especially in Japan (JP: $p=0.07$, UK: $p=0.10$). Compared to the British, significantly more Japanese people looked at the dog when they passed the owner ($p<0.001$), and people who stared at, talked to, or touched the dog were also more often observed in Japan.

Social interactions between guide dog owners and strangers did occur both in Japan and the UK, however, people who had conversations with the owners were only a small proportion of passers-by. People rather tended to pay more attention in dogs than their owners. The Japanese responded to guide dogs more curiously than the British did.

Keywords:	guide dog, cross-cultural study, human-animal Interaction
Species:	dog
Session, type, nr	*Integration of research on human welfare and animal welfare, Short oral* 29
For information contact	Hajime Tanida or email htanida@hiroshima-u.ac.jp

Welfare and well-being in animals: towards a richer conceptual framework and a better agreement between human and animal science

Lerner, H., Gunnarsson, S. (1), Nordenfelt, L., Vikinge, L. (2), Lindahl B.I.B. (3) and Algers, B. (1)

Dept. of Health and Society, Linköping University, Linköping, Sweden, (1) Dept. of Animal Environment and Health, Swedish University of Agricultural Sciences, Skara, Sweden, (2) Dept. of Religious and Cultural Studies, Linköping University, Linköping, Sweden, (3) Dept. of Philosophy, Stockholm University, Stockholm, Sweden

Welfare concerning animals is often defined in terms of biological functioning (for example see Broom & Johnson, 1993) or subjective experiences (for example see Duncan, 1996). The term 'welfare' is more preferred than the term 'well-being', but the two words are often used interchangeably in animal science. Scientists in human medical science talk about welfare, well-being and quality of life. Quality of life has the least strict definition and is used in a similar way as animal welfare. Human well-being has to do with the subjective experiences and feelings about life. Human welfare, on the other hand, could be defined as an external and/or internal state which contributes to the person's well-being (Nordenfelt, 1994). This difference in using the words between the two sciences is not advantageous if we want to make comparisons between animals and humans.

This study suggests that a separation between the concepts of well-being and welfare in the animal welfare debate should be made. This separation might help create a conceptual framework which clarifies the differences and similarities between the two major animal welfare schools. In this study mental experiences are defined as well-being. Biological functioning, on the other hand, is defined as welfare, which is a prerequisite for well-being. Using this framework we see that the statements by the different schools of animal welfare could be theoretically explained as different sides of the same coin.

Broom, D. M. & K. G. Johnson. 1993. Stress and animal welfare. London, Chapman & Hall.

Duncan, I. J. H. 1996. Animal welfare defined in terms of feelings. Acta Agric. Scand. Sect. A, Animal Sci. Supplementum 27: 29-35.

Nordenfelt, L. 1994. Towards a theory of happiness: a subjectivist notion of quality of life. Pp. 35-57 in: Nordenfelt, L. (ed.). Concepts and measurement of quality of life in health care. Dordrecht, Kluwer Academic Publishers.

Keywords:	animal welfare, human welfare, well-being, concepts of, definition of
Species:	general
Session, type, nr	*Integration of research on human welfare and animal welfare, Short oral* 30
For information contact	Henrik Lerner or email henrik_lerner@ihs.liu.se

Social behaviour of commercial dairy herds as a parameter for on-farm welfare assessment

Winckler, C., Buehnemann, A. and Seidel, K.

Research Centre for Animal Production and Technology, Faculty of Agricultural Sciences, University of Goettingen, Driverstrasse 22, D-49377 Vechta, Germany

The inclusion of social interactions has been recommended for on-farm welfare assessment protocols. Therefore, it was the aim of the present study to develop a feasible method for obtaining reliable and repeatable measures of social behaviour of commercial dairy herds within a farm visit.

Agonistic (e.g. displacements, butting, threatening) and cohesive interactions (e.g. licking, head resting) were recorded on five farms in north-western Germany (herd size 51-113 cows) between the morning and evening milking on three consecutive days. All herds were cubicle loose housed and fed a mixed ration. The observations took place in segments of the barn with on average 20 cows per segment. The duration of continuous observations within each segment was adjusted according to the number of segments so that each segment was observed once per hour. The number of animals within the segment was recorded at the beginning and at the end of each observation period. Data were then analysed as the mean number of events per cow and hour.

When compared with the overall prevalence of social interactions, observations within hours 1+2 and 4+5 showed the lowest deviations from the daytime mean. However, variation between days was lowest for observations after feeding (mean coefficient of variation: 17,1 %/agon., 48,4 %/coh., 17,0 %/total; n=5 farms). In all farms, agonistic interactions peaked within the first two hours after feeding.

In conclusion, it is recommended to record social behaviour for on-farm welfare assessment purposes during at least a 2 h period in the first hours after feeding. However, due to a large inter-day variation the reliability of recording cohesive interactions in a short term may be limited.

Keywords:	dairy cattle, on-farm welfare assessment, social behaviour, animal-oriented parameter
Species:	cattle
Session, type, nr	*Integration of research on human welfare and animal welfare, Short oral* 31
For information contact	Christoph Winckler or email christoph.winckler@agr.uni-goettingen.de

The effects of family housing on welfare of juvenile farmed mink (Mustela vison)

Hänninen, S., Mononen, J., Harjunpää, S., Ahola, L., Pyykönen, T., Mohaibes, M. and Sepponen, J.

University of Kuopio, Institute of Applied Biotechnology, P.O.Box 1627, FIN-70211 Kuopio, Finland

On farms mink litters are separated ("weaned") and male-female pairs are formed when the kits are eight weeks old. Keeping a whole litter together until pelting time would provide the juvenile mink with social enrichment, and housing a litter in a row cage system with several normal cages connected to each other would offer them a more diverse physical environment. We compared traditional pair-housing (PAIR) to family-housing (FAM) in juvenile mink. FAM-group kits were housed in families of five to nine kits and their mother. PAIR-group kits were housed in male-female pairs. Animal density was the same for both groups.

Housing system had no effect on growth of the kits, although feed consumption was lower in FAM- group. Adrenal mass and serum cortisol level after ACTH administration were higher in PAIR-kits. FAM-kits had more bite scars than PAIR-kits. PAIR-group animals spent more time in nest box in the beginning of the study and they were more active in October and November than the FAM- group animals. The difference in the use of nest box disappeared towards the end of the study. Stereotypies were rare in both groups. Group preference index (GPI) is a comparative value for preference for staying in groups. It ranges from 0 (all individuals alone) to 100 (all individuals together) percent. GPI for FAM-group animals was around 40 % in the beginning of July, dropped under 20 % in the beginning of August and then increased gradually, being around 60 % in the end of October and November.

In the wild, mink are solitary animals from 12 weeks of age onwards. It seems that farmed mink kits can tolerate other mink, and might even thrive better when housed in groups, although fighting may cause problems.

Keywords:	mink, welfare, housing, social behaviour, fur farming
Species:	mink
Session, type, nr	*Free papers, Short oral* 32
For information contact	Sari Hänninen or email sari.kasanen@uku.fi

Is behavioural development in the neonatal lamb a function of maturity at birth?

Dwyer, C.M.

Animal Behavioural Sciences, Animal Biology Division, SAC, King's Buildings, West Mains Road, Edinburgh, EH9 3JG, Scotland

In the lamb, birth triggers the onset of independent breathing, thermoregulation and appropriate behavioural responses, which ensure early sucking and survival. Cortisol is involved in foetal lung maturation in preparation for breathing responses and may be involved in thermoregulation and behavioural development in the neonate. This study investigated whether plasma cortisol and body temperature were related to behavioural development in the neonatal lamb.

Data were collected from 78 neonatal lambs of two breeds (42 Blackface, 36 Suffolk). For each lamb the latency to stand and suck after birth, and the frequency of sucking, play, and exploratory behaviour over the first 3 days were recorded. Rectal temperatures and plasma cortisol were measured at birth, 24 and 72h. Relationships between behavioural development and physiological measurements were determined by REML or Kruskal Wallis tests and Spearman's rank correlation.

Cortisol was negatively correlated with body temperature at birth (r_s=-0.55, n=61, $p<0.001$) and 24h (r_s=-0.38, n=69, $p<0.01$). Rectal temperature at birth was higher in lambs that stood (median temperature (°C): lambs standing <30 min=39.77, lambs standing 120+ min=36.22, H=12.47, df=3, $p<0.01$) and sucked quickly ($p<0.005$). Lambs that were slow to suck also had lower temperatures at 24 ($p=0.05$) and 72 h ($p<0.05$), and higher cortisol at 24h (H=6.68, df=3, $p=0.08$). Frequency of play in the first 3 days was negatively correlated with plasma cortisol (r_s=-0.467, n=67, $p<0.001$) and positively correlated with body temperature (r_s=0.48, n=73, $p<0.001$). However, there was no correlation between either exploration or sucking frequency and physiological measurements in the first 3 days.

Rectal temperature may be causally related to behavioural development as temperatures recorded before lambs had stood or sucked were predictive of when the behaviours would occur. High plasma cortisol in neonatal lambs with low body temperature and reduced activity may indicate developmental immaturity in these lambs.

Keywords:	behavioural development, neonate, physiology, lamb
Species:	sheep
Session, type, nr	*Free papers, Short oral* 33
For information contact	Cathy Dwyer or email c.dwyer@ed.sac.ac.uk

The effects of Ractopamine - a beta-adrenergic agonist - on behaviour, heart rate and stress hormones of finishing pigs

Marchant Forde, J.N., Lay Jr., D.C., Richert, B.T. (1), Schinckel, A.P. (1) and Pajor, E.A. (1)

USDA-ARS, Livestock Behavior Research Unit, Poultry Science Building, Purdue University, West Lafayette, IN 47907, USA, (1) Department of Animal Sciences, Lilly Hall, Purdue University, West Lafayette, IN 47907, USA

Ractopamine – a beta-adrenergic agonist – is fed to slaughter pigs in the US and acts as a repartitioning agent, promoting lean tissue deposition. However, there are anecdotal reports of adverse effects on the pigs' behaviour. This study aimed to investigate the effects of ractopamine (RAC) on behaviour and physiology of pigs during handling and transport.

Twenty-four groups of 3 finishing pigs were assigned to one of two treatments, four weeks prior to slaughter; 1) finishing feed plus RAC (9 ppm), 2) finishing feed alone. Behavioral time budgets were determined over a single 24-hour period during each week. Behavioral responses to routine handling and weighing were determined at the start of the trial and at the end of each week. Heart-rate responses to unfamiliar human presence were measured and blood samples were taken from a single pig in each pen on different days during week 4. At the end of week 4, pigs were transported to slaughter. Heart rate was recorded during transport and a further post-slaughter blood sample was taken from those pigs that were previously sampled.

During the weeks 1 and 2, RAC pigs were more active ($p<0.05$), more alert ($p<0.05$) and spent less time lying laterally ($p<0.05$). Initially, there were no differences in responses to handling. However, over each of the next 4 weeks, RAC pigs were more difficult to get out of the home pen and into the weigher. At the end of week 4, RAC pigs had higher heart rates in the presence of an unfamiliar human ($p<0.05$) and during transport ($p<0.05$) and had higher circulating epinephrine ($p<0.05$) and norepinephrine ($p<0.01$) concentrations.

The results show that ractopamine does affect the behavior, heart rate and catecholamine profile of finishing pigs and making them more difficult to handle and potentially more susceptible to handling and transport stress.

Keywords:	pigs,, physiology, feed additives
Species:	pig
Session, type, nr	*Free papers, Short oral* 34
For information contact	Jeremy Marchant Forde or email marchant@purdue.edu

Male management - coping with aggression problems in male laboratory mice

Van Loo, P.L.P., Van Zutphen, L.F.M. and Baumans, V. (1)

Dept. of Laboratory Animal Science, Utrecht University, PO Box 80.166, 3508 TD Utrecht, The Netherlands, (1) Karolinska Institutet, 17177 Stockholm, Sweden

In a laboratory environment, aggressive interactions between male mice may exceed normal levels. This may constitute a problem with negative effects both on the well-being of the animals and on the validity of experimental results. In a series of experiments we have tried to find practical solutions for coping with excessive aggressive behaviour in male laboratory mice by investigating the effects of several husbandry procedures on the level of aggression and stress.

Results from the first experiments indicated that in groups of male BALB/c mice the provision and transfer of nesting material, and a reduction in group size significantly reduced post-cleaning aggression. These measures were subsequently combined and tested for their long term effect on aggression and physiology in males of both the BALB/c and the more aggressive CD-1 strain.

Sixty BALB/c and 60 CD-1 mice were housed in same-strain groups of 3 from 6-22 weeks of age. Half of the groups were standard housed, and half were provided with nesting material that was transferred weekly during cage cleaning. Body weight, food and water intake and wounds were measured weekly. Post-cleaning aggression and urinary corticosterone were measured at three-week intervals and several post mortem parameters were measured

Results indicate that enriched mice had lower corticosterone levels, heavier thymuses, and they consumed less food and water than standard housed mice, all indicative of a reduced stress response. Levels of aggression were found to be low in both strains and housing conditions. This phenomenon is discussed in the light of previous findings, and the results of all studies are evaluated and integrated into practical recommendations concerning the housing and care of male laboratory mice. In short, we recommend optimising group size to three animals per cage, to transfer odour cues from the nesting area during cage cleaning, and to apply nesting material as environmental enrichment. Furthermore, research into the effects of experimental disturbances on aggressive behaviour is recommended.

Keywords:	male mice, aggression, stress, housing, husbandry
Species:	mouse
Session, type, nr	*Free papers, Short oral* 35
For information contact	Pascalle Van Loo or email p.l.p.vanloo@vet.uu.nl

Red jungle fowl have more contrafreeloading than White Leghorn layers: effects of food deprivation and consequences for information gain

Lindqvist, C., Schütz, K., and Jensen, P.

Section of Ethology, Department of Animal Environment and Health, Swedish University of Agricultural Sciences, POB 234, SE-532 23 Skara, Sweden

Contrafreeloading (CFL), i.e. choosing food which requires work over free food, occurs at a higher rate in jungle fowl (Gallus gallus) compared to White Leghorn layers. We examined whether a higher hunger level in Leghorns could explain the lower degree of CFL in Leghorn and whether it affected the information gained about alternative food sources.

In a first experiment, twenty birds of each breed were food deprived for zero, three and six hours and then allowed a choice of feeding from freely available food or food mixed with wood shavings. Jungle fowl had significantly higher degree of CFL at zero hours food deprivation ($p=0.001$) and tended to have higher CFL at six hours of food deprivation ($p=0.08$) compared to Leghorn.

In a second experiment, 20 birds of each breed were trained during three 10 min sessions to forage in a four armed maze, where symbols in each end of the arms indicated the location of four different quality food sources; ”high gain” (freely available food), ”medium gain” (70% food, 30% wood shavings), ”low gain” (30% food), and ”no gain” (100% wood shavings). Each bird was then tested in the same maze when the ”high gain” food source and its symbol had been removed, and the other three sources contained only the symbols and wood shavings. Jungle fowl chose the symbol indicating the best available food source significantly more often ($p=0.004$) than the Leghorns.

The results indicate that the lower CFL in White Leghorns is probably genetically induced as a result of a modified allocation of resources in response to the artificial selection for growth and egg production. Furthermore, the results indicate that Leghorn gain less information about their environment, which may have consequences for their adaptation capacity in a production environment.

Keywords:	jungle fowl, White Leghorn layers, contrafreeloading, food deprivation, resource allocation, information gain
Species:	chicken
Session, type, nr	*Free papers, Short oral* 36
For information contact	Christina Lindqvist or email per.jensen@hmh.slu.se

Effect of space restriction on pre- and postpartum maternal behaviour in the pig

Gilbert, C.L., Burne, T.H.J., Goode, J.A., Murfitt, P.J.E. and Walton, S.L.

MAFF Laboratory of Welfare and Behaviour, The Babraham Institute, Babraham Hall, Cambridge, CB2 4AT, UK

This experiment tested effects of available space on nest-building and maternal behaviour in pigs. Gilts (n=28) on gestation day 105-107 were placed in straw-covered concrete floored pens, with gates allowing 2 floorspace configurations; O=open pen (2.5 x 2.2 m) or C=closed crate (2.5 x 0.6 m). At 16.00h on day 112 gilts were given 10 mg PGF2a i.m., which induced nest-building and parturition 24 - 28 hours later. Pens were in O configuration until PGF2a when half were changed to C. In the following 2 h, O animals showed more components of nest-building than C, including standing, straw carrying, floor rooting and pawing ($p<0.01$). During the 2 h preceding birth there were no significant treatment differences in behaviour.

At the birth of the first piglet, half of the pen configurations were changed and half unchanged for the postpartum period to give 4 groups in a 2 x 2 factorial design (OO, OC, CO and CC). Behaviour was analysed by ANOVA between 0-2, 12-13 and 23-24 h postpartum. There were no significant effects of prepartum floorspace on postpartum gilt or piglet behaviour. Postpartum treatment effects were mostly seen within 0-2 h and diminished thereafter. Gilts in pens postpartum (0-2 h) were motionless more than gilts in crates ($p<0.05$), although CO gilts showed the highest frequencies of postpartum straw gathering ($p<0.05$). In OC and CO gilts (space change at birth), 0-2 h frequencies of postural change, rooting and head shaking were increased, as were durations of stand, sit, kneel and pen fixture-directed activity compared with OO and CC (no space change; $p<0.02$).

In this paradigm prepartum nest-building was sensitive to space allowance. Immediate postpartum behaviour was sensitive to postpartum space and particularly to environmental change at birth but was insensitive to prepartum space allowance and nest-building behaviour.

Keywords:	pig, nest-building, maternal behaviour, environment
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 37
For information contact	Colin Gilbert or email colin.gilbert@bbsrc.ac.uk

Preference for blood and behavioural characteristics of known tail biting pigs compared to control penmates

McIntyre, J. and Edwards, S.A.

Department of Agriculture, University of Newcastle upon Tyne, Newcastle upon Tyne, NE1 7RU, UK

The motivation underlying tail biting behaviour may relate to foraging, aggression and/or exploratory behaviour. This experiment investigated whether known tail biting pigs differed from matched controls in behaviours relating to these motivational systems. Immediately outbreaks of tail biting occurred, the pigs were observed, and the tail biter and a non-tail biting penmate of the same litter, gender and similar weight removed for testing.

Pigs from 11 such pairs were housed individually and presented, over 5 days, with 2 sash cord tail models soaked in pig's blood or distilled water, once daily for 24 minutes. The total chewing and preference scores (PS=number of observations chewing the blood tail/total tail chewing) were calculated. The following day, an 'intruder' pig of the same gender and weight was placed in the pen for 3.5 minutes and the behaviour of the resident animal recorded. For 3 subsequent days a feeding motivation test, following overnight fast, was carried out in a novel environment. Pigs were presented with a known quantity of feed and observed for 15 minutes.

Tail biting pigs showed no difference in total model tail chewing but had a significantly greater preference for the blood soaked model on the first day of testing (PS=0.610 vs. 0.106; paired T=3.24; p=0.002) and maintained this preference over 5 days (p=0.019). There were no significant differences in aggressive behaviour, except that tail biters spent a greater proportion of observations chasing intruder pigs (0.346 vs. 0.159; paired T=2.37; $p<0.05$). No behavioural differences between tail biters and controls were identified in the feeding motivation test.

These results indicate that tail biting pigs are highly motivated to taste blood, suggesting either a metabolic basis to the vice or an acquired taste for blood.

This work was supported by an MLC studentship.

Keywords:	pigs, tail biting, blood preference, feeding motivation, social behaviour
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 38
For information contact	Jayne McIntyre or email jayne.mcintyre@ncl.ac.uk

Predicting calf`s sleep from the resting behaviour: the correlation between EEG findings and a resting body postures

Hänninen, L., Mäkelä, J.(1), Rushen, J. (2), de Passillé, A.M. (2) and Saloniemi, H.

Department of Clinical Veterinary Science, Faculty of Veterinary Medicine, PO Box 57, 00014 Helsinki University, Finland, (1) Military Central Hospital, PO Box 30, 00310 Helsinki, Finland, (2) Dairy and Swine Research and Development Centre, Afri-Food Canada, PO Box 90-2000, Route 108, East Lennoxville, QC J1M 1Z3, Canada

Little is known of sleep in farm animals. Electroencephalography (EEG) is a tool for analysing sleep in laboratory, but is difficult to use in farm conditions. However, the resting posture of calves may be an indicator of the phase of sleep.

We compared behavioural observations of calves with electrophysiological recordings. Four calves (~100 d of age) were adapted to wearing the specially constructed harness for 3 weeks. Electrodes for EEG, electromyography (EMG) and electro-oculography (EOG) were glued to the skin of the head and neck.

Electrophysiological recordings were made and the calves' behaviour (standing, ruminating, lying, resting posture, eyes open or closed, eye movements and twitches of the ears and muscles) was observed simultaneously over a 19h period. The electrophysiological and behavioural data were separately used to classify the calves in each 30s period (EEG/behaviour) as Awake (high frequency, low voltage EEG, active EMG / eyes open), Ruminating (low frequency, rhythmic artefact EEG / rhythmic chewing), Paradoxical sleep (PS)(charasteristic EEG,low-amplitude EMG with rapid muscle twitches or active EOG / resting head relaxed with eyes closed, muscle twitches or rapid eye movements) Slow wave sleep (SWS)(low frequency, high voltage EEG, low activity EMG, inactive EOG / lying silently, eyes closed.

Calves were estimated to sleep for 21% of the day (mean bout duration 9.7± 1.6 min). There was a close correspondence (Kappa-test) between behavioural and electrophysiological recordings in identifying Rumination, Awake and Sleeping (Kappa 0.95, 0.76 and 0.71, respectively, $p<0.001$). However, there was less correspondence in identifying PS and SWS (Kappa 0.43 and 0.30, $p<0.001$). Calf EEG during PS, verified from behaviour recordings, contained more 3-7 Hz activity than is customarily observed in adult humans. Observations of calves' resting behaviour can give an accurate estimate of sleep time, but more work is needed to identify the phases of sleep.

Keywords:	sleep, resting postures, EEG, calves, calf, REM, SWS, behaviour
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 39
For information contact	Laura Hanninen or email laura.hanninen@helsinki.fi

Light quality and the visual acuity of broiler chickens

Kristensen, H.H. (1), Prescott, N.P. (1), Ladewig, J., Perry, G.C. (2) and Wathes, C.M. (1)

Royal Veterinary and Agricultural University, Division of Ethology and Health, Groennegaardsvej 8, 1870 Frederiksberg C. Denmark, (1) Silsoe Research Institute, Bio-Engineering Division, Wrest Park, Silsoe, Bedford MK45 4HS, UK, (2)Bristol University, Division of Animal Health and Husbandry, Langford House, Bristol BS40 5DU, UK

Visual acuity refers to the ability to resolve spatial detail and is vital for the discrimination and recognition of objects. Results vary considerably between previous studies on visual acuity and object recognition in poultry, and none have managed to assess the independent effects of light source, luminance and distance upon acuity.

We assessed the ability of broilers to discriminate between a printed grating (alternating 2.5mm wide black and white stripes) and a uniform grey surface of equal mean brightness and chromaticity in different light environments (two light sources, warm-white fluorescent and spectral sensitivity matched light, each at two luminances, 5 and 100 clux) at different distances (0, 50, 100, 200 cm from the stimuli). Sixteen broiler chicks were trained to run towards either the grating or the grey image for a food reward and their success rates compared between the 16 treatment combinations in a Latin-square design. Hence, all 16 chickens were trained and tested in all treatment combinations.

Distance significantly affected visual acuity (Logistic regression GEE analysis, $p<0.0013$) with average success rates of 97% (+/-2), 82% (+/-5), 62% (+/-5) and 53% (+/-4) at 0, 50, 100 and 200 cm respectively (mean +/-se). Light source had no significant effect upon visual acuity whereas the broilers discriminated significantly better between the two stimuli in 100 clux than in 5 clux (Logistic regression GEE analysis, $p=0.0110$) with average success rates of 76% (+/-5) and 71% (+/-6) respectively.

The results not only establish the possibility of obtaining very high success rates in discrimination studies without using food deprivation but also confirm that the visual acuity of broilers is superior in bright rather than dim light, irrespective of the light source. The results indicate the importance of ensuring a suitable viewing distance and illuminance to ease discrimination and recognition in both husbandry practices and behavioural research.

Keywords:	Light quality, broiler chicken, vision, acuity, training
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 40
For information contact	Helle Kristensen or email hek@kvl.dk

Social coherence tendency vs. foraging motivation - environmental and social adaptation capacity in young red jungle fowl and white leghorn layers

Väisänen, J. and Jensen, P.

Swedish University of Agricultural Sciences, Department of Animal Environment and Health, Section of Ethology, POBOX 234, 53223 Skara, Sweden

Social coherence tendency is an important behavioural characteristic in young fowl and it is considered to be positively related to an underlying social motivation that can be modified by breeding. Our aim was to investigate if released natural selection factors and intensive selection for productive traits in White Leghorn layers has influenced chicks' social coherence vs. exploration motivation compared to their ancestor, Red Junglefowl.

From both breeds, 29 chicks were tested between 4 and 7 weeks of age in four behavioural tests designed to study sociability tendencies. Runway test was carried out to measure social reinstatement motivation. Social coherence motivation vs. exploration tendency was measured in both novel and familiar environments after 0 and 3h food deprivation. The novel environment was a two-armed social-foraging maze and the familiar arena was identical to the chicks' home pens. Both included companion birds in a box and food at the opposite ends of the test arenas. Furthermore, spacing behaviour of groups consisting of three chicks was observed in an open field.

The runway test did not reveal any significant effects of breed on social reinstatement behaviour. In the spacing test, Leghorns tended to move closer to one another compared to junglefowls. When introduced to the social-foraging maze junglefowls moved more whereas Leghorns tended stay more immobile. These differences increased after food deprivation. Deprivation and breed had a significant interaction resulting in remarkably higher amount of time spent feeding by junglefowls after deprivation. However, in the familiar pen, Leghorns responded to deprivation by a higher amount of feeding and staying away from the companion birds.

The results indicate that the adaptability of the birds to their social and physical environment may have been influenced by means of selection for increased production capacity. Leghorns may have greater problems in adapting to a new environment.

Keywords:	Social coherence, adaptability, selection, production, layer, junglefowl
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 41
For information contact	Johanna Väisänen or email johanna.vaisanen@hmh.slu.se

Assessment of equine welfare at farm level: first steps, problems and perspective

Canali, E., Minero, M., Ferrario, A., Gibbelini, A., Leonardi, M. and Mattiello, S.

Istituto di Zootecnica, Facoltà di Medicina Veterinaria. Via Celoria 10, 20133 Milan, Italy

Several methods for assessing welfare at farm level have been developed in recent years but only one study dealt with horses (Bayer, 1998). This could be due to the fact that horses are not perceived as farm animals which live in intensive housing systems. However housing systems and management can affect the welfare of horses. Aim of this research was to develop and validate a method in order to assess horse welfare at herd level.

Environmental parameters (such as dimensions and characteristics of stable and paddocks; type and quality of bedding, feeding management and working schedule) and animal-based parameters (such as body condition score, skin injuries, scars, presence of behavioural problems and reaction to unknown person) were used on 48 establishments for horses (farms, riding centres, training centres). The data were collected by direct observations and questions to the farmers by three experimenters which received a brief training. The assessment scheme had 112 items in total and was carried out within two hours. Preliminary PCA analysis showed that many items gave very few or redundant information and only 32 items were kept. Cluster analysis on these items showed differences between the environments where horses are kept which affected some animal-based parameters (i.e. establishments where horses spent many hours per day in group paddock showed less behavioural problems).

K-n-n analysis on the experimenters showed a cross validated error-rate of 67% which suggests that the scheme has a good reliability. K-n-n analysis on types of establishments showed a cross validated error-rate of 37% which permits a discrimination between housing systems.

The results suggest that the scheme seems to be an objective tool which can be used to evaluate different housing systems however it is just the beginning of a whole assessment method and it will be validated with animal related parameters.

Keywords:	horse, welfare assessment, farm level
Species:	horse
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 42
For information contact	Canali Elisabetta or email elisabetta.canali@unimi.it

Rooting area for sows to prevent pasture damage

Van der Mheen, H.W. and Spoolder, H.A.M.

Research Institute for Animal Husbandry, Runderweg 6, PO Box 2176, 8203 AD, Lelystad, The Netherlands

To assess the effects of a special rooting area on pasture damage by pregnant sows, 4 groups of 4 sows were subjected to 4x4 Latin square design experiment with one replication. Each group was given access to a 160 m2 field for 4 hours per day, over a period of 5 consecutive days. Treatments consisted of different 4 m2 rooting areas per field containing either ploughed dry sand (DrA), ploughed wet sand (WtA), dry sand with 400 g wheat and barley seeds (SeA) or no rooting area (NoA). Following each period new fields were fenced and groups were allocated to a new treatment. Pig behaviour was recorded at 5 minutes intervals, temperature was recorded daily and pasture damage was assessed following each 5 day period.

During the first 15 minutes on pasture sows spent 70% of their time grazing, this was gradually reduced to 20% during the last hour. Increasing temperature resulted in less grazing and more lying and rooting behaviour. Approximately 23% of total time was spent in the rooting area (if present), with no difference between treatments. Of all lying behaviour, 40% was performed in a rooting area. For WtA the use of rooting area was positively correlated with temperature ($p<0.05$). This relationship was not observed in other treatments.

Pasture damage was significantly influenced by treatment (15.3(a), 14.4(a), 6.8(b) and 4.7(b) m2 for NoA, SeA, DrA and WeA respectively; (a) and (b)indicate significant differences $p<0.05$) It appeared that pasture rooting was used to create lying areas. SeA sows used the rooting area to find food, forcing pen mates to lie outside the rooting area. This may have resulted in a higher level of pasture damage for SeA compared to DrA and WtA.

Keywords:	sows, rooting, natural behaviour, pasture damage
Species:	pig
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 43
For information contact	Henk Van der Mheen or email h.w.van.der.mheen@pv.agro.nl

Behaviour in tied dairy cows with different amount of exercise

Loberg, L. and Lidfors, L.

Department of Animal Environment and Health, Swedish University of Agricultural Sciences, P.O. Box 234, SE-532 23 Skara, Sweden

The aim of this study was to compare the effect of different amount of exercise or no exercise on behaviour, lying down movements and milk production.

The study was done on 52 dairy cows tied on short stalls. All cows had the same previous experience and were in their first to fifth lactation. They were matched according to lactation number, milk production and whether they were de-horned or not and randomly assigned to one of the following treatments; exercise every day (E7), twice per week (E2), once per week (E1) and no exercise (E0). The cows were exercised in an outdoor paddock. Behavioural observations were done on focal cows during 65 minutes of exercise twice per month and treatment from November to April using one-zero sampling. Treatment E0 were observed on their stalls during the same time. Lying down movements were recorded during February-March with direct observations. The farm measured the milk yield once per month.

There was an increase of walk/trot ($p<0.001$, GLM) and explorative behaviour ($p<0.001$, GLM) with decreasing amount of exercise. E1 cows had the highest recordings of sniffing and threatening other cows ($p<0.05$, Tukey). All exercised cows both licked themselves ($p<0.05$, GLM) and rubbed themselves ($p<0.01$, GLM) more than E0. The E0 cows spent a higher percentage of observations eating from the manger than exercised cows spent eating from the ground ($p<0.01$, GLM). E7 had the highest mean percentage of standing ruminating ($p<0.05$, GLM), and were the only cows lying ruminating during exercise. There were no differences in the duration of performing lying down movements for the different treatments, nor a difference in milk production.

We conclude that dairy cows build up a motivation for movement with time of confinement and this indicate a rebound effect on this behaviour which means that it's influenced by internal factors.

Keywords:	exercise, cattle, motivation
Species:	cattle
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 44
For information contact	Jenny Loberg or email Jenny.Loberg@hmh.slu.se

Effect of feeding in a foraging substrate on the welfare of restricted-fed sows

De Leeuw, J.A. (2), Ekkel, E.D. (1) and Jongbloed, A.W.

ID TNO Animal Nutrition, P.O. Box 65, 8200 AB Lelystad, The Netherlands, (1) Ethology Group and (2) Animal Nutrition Group, Wageningen Institute of Animal Sciences, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

Aim of this study was to test whether sows that are fed their diet in a substrate on the floor have better welfare than sows that are fed in a trough while substrate is present. Feeding in the substrate may stimulate foraging behaviour.

Forty-eight nulliparous sows were individually housed in 200*155 cm pens, equally divided over three batches and two rooms. Wood-shavings were provided on a 120*155 cm solid floor as foraging substrate (±40 L). Sows were fed twice daily (0630 and 1500h) 900 g of a complete mixed diet (10 mm pellets) either in a trough (T) or in the substrate (S). Lights were on from 0600-1800h. Once per week in weeks 8-12, behaviour was scan-sampled from 0700-0900h, 1000-1200h, and 1300-1500h, with 4 min intervals. Data of the 5 weeks were pooled per animal. Saliva was sampled in week 11, every 2h for 24h and analysed for cortisol. Spontaneously voided morning-urine was sampled in weeks 2, 7 and 12 for determination of adrenaline/creatinine- (A/CR) and noradrenaline/creatinine-ratio's (NA/CR). Hormones were analysed for eight sows per treatment (first two batches).

No differences were found in general visible oral behaviour, pen-manipulation, floor-manipulation (including substrate-manipulation), (sham)chewing, and other oral behaviour (e.g. teeth grinding). S-sows (46.3±3.2% of scores) stood more than T-sows (35.2±3.6%; $p<0.05$), only from 0700-0900h (slightly longer eating-time). No differences were found in 24h-cortisol levels (average 1.02±0.20 ng/ml). T-sows had higher A/CR-ratio's (2.02±0.56 ng/mg) than S-sows (1.65±0.26 ng/mg; $p<0.05$) in week 12, but not in weeks 2 and 7. In contrast, T-sows had higher NA/CR-ratio's (5.05±0.69 ng/mg) than S-sows (4.12±0.45 ng/mg; $p<0.05$) in week 2, but not in weeks 7 and 12.

These results imply that restricted-fed sows that are fed in a substrate do not have better welfare than sows that are fed in a trough while substrate is present.

Keywords:	foraging behaviour, substrate, floor-feeding
Species:	pig
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 45
For information contact	John de Leeuw or email j.deleeuw@idtno.nl

Navigational ability in the domestic fowl

Zimmerman, P.H., Pope, S.J., Guilford, T. (1) and Nicol, C.J.

Department of Clinical Veterinary Science, Langford House, Langford BS40 5DU, UK, (1) Department of Zoology, University of Oxford, Oxford OX1 3PS, UK

Little is known about the navigational abilities of domestic fowl. The question of how laying hens represent and orient in space becomes relevant when they are kept in non-cage systems. Since the sun is known to be the dominant spatial organiser in other diurnal bird species, we started our investigation of the chicken's spatial abilities by subjecting them to a food-searching task with the sun as the only consistent visual cue. Eight ISA Brown chicks were housed in outdoor pens. A separate test arena comprised an open-topped, opaque-sided wooden octagon (2 m wide and 1.5 m high). Eight goal boxes with a food pot were attached to each of the arena sides; a wooden barrier inside each goal box prevented the birds from seeing the food pot before entering. Food residue in every foot pot controlled for the use of olfactory cues and no external landmark cues were visible. After habituation we tested during five daily 5-min trials whether the chicks were able to find food in a systematically allocated goal direction. Every day the boxes were unpredictably assigned to the arena sides and another side faced north, to prevent the chicks from using cues other than the sun's position.

Our criterion was that birds should move in a consistent direction on 3 or more consecutive days. The time taken for birds to reach criterion ranged from 4 to 15 days. Circular statistics showed that 7 out of 8 birds moved significantly in the goal direction.

The most plausible explanation was that the birds used the sun's position to find food. Further work is required to discover whether chickens use the sun as a time-compensated compass, or simply as a beacon. If the sun is a predominant spatial cue then welfare issues may arise in commercial systems where the sun is absent.

Keywords:	domestic fowl, navigational ability, sun compass,
Species:	chicken
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 46
For information contact	Patrick Zimmerman or email p.h.zimmerman@bristol.ac.uk

The effect of age on the use of potential enrichment objects by pigs

Docking, C.M. (1), Van de Weerd, H.A. (1), Day, J.E.L. and Edwards, S.A. (1)

ADAS Pig Research Unit at Terrington, Terrington St. Clement, King's Lynn, Norfolk, PE34 4PW, UK, (1) Department of Agriculture, King George VI Building, University of Newcastle, Newcastle upon Tyne, NE1 7RU, UK

The experiment aimed to identify how a pig's age affected their use of potential environmental enrichment and how this use changed over time. Enrichment may be used to reduce behaviours such as tail biting. Ten different objects were presented to three different ages of pig (3, 5 and 13 weeks old). Objects were selected to present a wide range of physical characteristics. Each object was presented to three different groups of each age for a period of five days in standardised experimental pens. Continuous video recordings were made of the pigs' behaviour and subsequently analysed to determine the level of object directed behaviour on days one and five.

Suckling pigs used the objects to a much lesser extent than either the weaner or grower pigs (mean seconds; 129 vs 1253 vs 1412, respectively, s.e.d. 92.7, $p<0.001$). Overall object use decreased over the five days (mean seconds; 1326 vs 536, for days 1 and 5 respectively, s.e.d. 75.7, $p<0.001$). Grower pigs displayed a shorter latency to approach the objects initially, compared to suckling and weaner pigs (mean seconds; 2153 vs 2660 vs 980, s.e.d. 541.9, $p<0.001$). Gender had no effect on the level of object use or the approach latency. Interactions were found for agexobjectxday ($p<0.001$). For example, on day 1 the suckling pigs used the compost most whilst the weaner and grower pigs used the hanging string most. However, on day 5 all three age groups used the compost most.

Pigs of different ages used the ten objects to varying extents, suggesting that when providing potentially enriching objects, or substrates, the age of the animals should be considered. Object use alters over time and so objects which continue to be used by the animals should be selected.

Funding was provided by ADAS Consultancy Limited.

Keywords:	environmental enrichment, behaviour, age, pigs
Species:	pig
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 47
For information contact	Caroline Docking or email Caroline.Docking@adas.co.uk

Aggressive responses of roosters toward a model rooster illuminated by different light sources

Vandenberg, C.M. and Widowski, T.M.

Department of Animal & Poultry Science, University of Guelph, Guelph, Ontario N1G 2W1, Canada

Light sources vary considerably in their spectral outputs. Since domestic fowl have been shown to differ in their responses to other birds illuminated by different wavelengths of light, it is important to determine the effects of different commercial light sources on social interactions before adopting them into poultry barns. The objective of this experiment was to compare the aggressive responses of mature roosters to a model of a rooster illuminated by either compact fluorescent (CF) or high-pressure sodium (HPS) light.

Twenty-four mature broiler breeder roosters were subjected to a single test on four consecutive days. The test involved a six-minute exposure to a taxidermic model of a young, mature rooster illuminated by either CF (88 lux) or HPS (75 lux) lamps that were iso-illuminant for the birds (98 gallilumens, Prescott and Wathes, 1999, Br. Poult. Sci. 40:332). Each rooster was tested twice with the model under each light source, with order of testing balanced across birds. Data were summed for both test days with each light source.

The numbers of birds (out of 24) that directed aggressive pecks, frontal attacks and waltzing at the model were 5, 3 and 11, respectively, when the model was illuminated by CF and 7, 0, and 7, respectively when illuminated by HPS (Fisher's exact tests, all behaviours: $p>0.10$). Total frequencies of these aggressive acts averaged 5.4 (S.D.=5.8, median=2) when lit by CF and 2.6 (S.D.=6.4, median=2) by HPS (Wilcoxon paired-sample, n=15, $p>0.10$). Mean duration of time spent ground pecking was 267.5 seconds (S.D.=202.34, median=327.0) for CF and 236.7 seconds (S.D.=209.3, median=182.8) for HPS (paired t-test, 23 df, $p>0.10$).

Aggressive and conflict behaviour in response to the model was not influenced by the sources of illumination used in this study.

Keywords:	light quality, rooster, aggressive behaviour
Species:	chicken
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 48
For information contact	Carien Vandenberg or email cvandenb@uoguelph.ca

Feather pecking and open-field response in an F2 cross of high and low feather pecking lines of laying hens

Rodenburg, T.B., Buitenhuis, A.J. (1), Ask, B. (1), Koene, P., van der Poel, J.J. (1) and Bovenhuis, H. (1)

Ethology Group, Department of Animal Sciences, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands, (1) Animal Breeding and Genetics Group, Department of Animal Sciences, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

This experiment aimed to study feather pecking and open-field response in an F2-cross of high (HFP) and low (LFP) feather pecking lines of laying hens at 5 and 6 weeks of age. In other experiments, HFP birds showed more feather pecking and vocalised more than LFP birds, whereas LFP birds showed a stronger physiological stress response. These differences probably reflect different coping strategies. It was hypothesised that a proactive response to an open-field (activity, vocalisations) would be related with gentle feather pecking in a social test.

The HFP and LFP lines were reciprocally crossed to create an F1 generation (n=120). From this F1, 7 males and 28 females were randomly selected to create an F2 generation (n=630). The F2 birds were housed in 10 groups of about 60 birds on wood shavings. Each bird of the F2 cross was subjected to an open-field test (individual, 10 min) at 5 weeks of age and to a social feather pecking test (groups of 5 familiar birds on wood shavings, 30 min) at 6 weeks of age. Both tests were performed in a square open-field (1.25x1.25 m). Behaviour was recorded directly from monitor. Heritabilities and genetic and phenotypic correlations between feather pecking and open-field behaviour were calculated.

For gentle feather pecking, a heritability of 0.12 ± 0.07 was found. Heritabilities of 0.32 ± 0.11 for number of distress calls and 0.36 ± 0.12 for latency to walk were found in the open-field test. A negative genetic correlation for gentle feather pecking with latency to walk (-0.57 ± 0.25) and a strong positive genetic correlation with number of distress calls (0.93 ± 0.17) was found, indicating that a fraction of genes affected both gentle feather pecking and open-field response. As was hypothesised, a relationship was found between a proactive open-field response and gentle feather pecking.

Keywords:	feather pecking, genetics, open-field, laying hens
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 49
For information contact	Bas Rodenburg or email bas.rodenburg@etho.vh.wau.nl

Nesting behaviour in broiler breeder fowl: effects of light type and level of illumination on nest site selection

Sheppard, K.C., Duncan, I.J.H. and Widowski, T.M.

Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada, N1G 2W1

Broiler breeder hens lay more floor eggs than commercial egg layers. This is an economic concern, since floor eggs are not considered suitable for incubation, and may indicate that some hens regard the nest boxes as inadequate. Darkness is suggested to be an attractive property in a nest site.

We tested the effects of light type and level of illumination on nest box usage by broiler breeders. Ross 308 hens (12 pens of 39) were randomly assigned to one of three light treatments, high pressure sodium (HPS), compact fluorescent (CF) and incandescent (IN). Light intensity measurements averaged 108, 52 and 43 lux (122, 68 and 65 gallilumens) for HPS, CF and IN respectively. A unit of 10 nest boxes, in two tiers of five, was hung on either the right or left wall of each pen. Direct illumination into the right or left half of each unit was blocked by hanging an opaque shade between the light source and nest box. Egg numbers and locations were recorded three days a week, every other week, from 27 to 40 weeks of age. Each group of hens was then moved to a new pen in which nest box and shade location was opposite of that in the original pen. Data were recorded as before.

Considering eggs laid in lit or shaded boxes only, 49.6%, 51.7%, and 50.8% were laid in shaded boxes in HPS, CF, and IN respectively. There was no significant difference between numbers of eggs laid in shaded or lit nest boxes across light treatments ($p>0.05$). Floor eggs averaged 8.9%, 11.9%, and 8.8% of total eggs laid in HPS, CF and IN respectively ($p>0.05$).

Results suggest that different properties of light and the presence of shade in the nest box do not affect nest site choice by broiler breeders.

Keywords:	broiler breeder, nesting behaviour, nest boxes, floor eggs, light
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 50
For information contact	Kimberly Sheppard or email ksheppar@uoguelph.ca

Lactation-induced hyporesponsiveness of the pituitary-adrenal axis may reduce the stress response of lactating sows to the farrowing crate

Lawrence, A.B., Jarvis, S., Stevenson, J. and Calvert, S.

Animal Behaviour Sciences Department, Animal Biology Division, Scottish Agricultural College, Bush Estate, Penicuik, Midlothian, EH26 0PH, UK

The EU Scientific and Veterinary Committee has called for research into the welfare of lactating sows housed in farrowing crates. In response we have studied the effects of housing and lactation on pituitary-adrenal (PA) axis function in gilts.

Pregnant gilts were catheterised and housed from 5 days pre- to 29 days post-parturition, in farrowing crates (without straw (C; n=8); with straw (CS; n=8)) or in farrowing pens with straw (PS; n=16). In addition we housed catheterised non-pregnant (N) gilts in housing type PS (n=7) over the same period. Exogenous injections (i.v.) of corticotrophin releasing hormone (CRH) were given on days –8, +2, +8, +15, +22 and +29 relative to the day of farrowing. 9 blood samples were taken from 30 minutes pre- to 240 minutes post-injection and assayed for adrenocorticotrophic hormone (ACTH) and cortisol (CORT). We measured the area under the curve (AUC) for ACTH, CORT and the ratio of CORT: ACTH.

There was no effect of lactation (PS vs. N) on the ACTH response to CRH. However N gilts had a higher CORT response (p=0.016) and a higher CORT:ACTH ratio (mean AUC (s.e.m.) CORT:ACTH ratio: 0.62 (0.08) vs. 0.87 (0.13) for PS vs. N gilts; p=0.002) when challenged with CRH. Within lactating gilts (C, CS, PS) we found no evidence of a housing effect on ACTH response to CRH, only a tendency for a housing effect on CORT (p=0.057), and no indication of a housing effect on the CORT:ACTH ratio.

We have demonstrated that lactation induces hyporesponsiveness of the PA axis in the pig. The lack of evidence for chronic stress in lactating gilts housed in farrowing crates, suggests that this hyporesponsiveness of the PA axis may contribute to reducing the stress response of the gilt to the behavioural constraints imposed by the crate over lactation.

Keywords:	Farrowing crates, lactation, chronic stress, pituitary adrenal function
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 51
For information contact	Alistair Lawrence or email a.lawrence@ed.sac.ac.uk

Odor learning and match to sample in micro pigs (Sus scrofa)

Croney, C.C. and Boysen, S.T. (1)

Department of Animal Sciences, Oregon State University, Corvallis, OR, USA, (1) Department of Psychology, The Ohio State University, Columbus, OH, USA

Animals' psychological needs and their relationship to welfare cannot be determined without first understanding their cognitive capabilities. Complex learning and formulation of abstract concepts have yet to be fully explored in domestic livestock. The micro pig's (Sus scrofa) ability to discriminate between multiple odors and demonstrate an understanding of the concept "same" was investigated using a match-to-sample (MTS) paradigm.

In Expt. 1, four male pigs were trained to select one odor from among 8. Discriminative stimuli included food extracts placed in opaque plastic bottles. Eight problem sets of 25 trials each, were presented sequentially. The pigs were required to select one of two odors, and correct responses were rewarded with food. In the next phase of training, the animals had to discriminate the initial odor from among two others.

This process was repeated until pigs were discriminating the correct odor from 7 others. For all problems, the bottle containing the correct odor was randomly placed within the stimulus array. Criterion performance was 90% correct responses before a new problem was introduced. All subjects successfully advanced to 8-odor discrimination testing, and also achieved the 90% criterion on problem 8 in 100 trials or less. Expt. 2 assessed performance on a match-to-sample (MTS) test with novel odors. For each 2-trial problem, pigs were presented with an odor sample that had to be matched from two simultaneously presented samples. Subjects completed 150 MTS problems, and all performed significantly above chance on Trial 1 of the last 50 problems ($p<.005$).

These results suggest that pigs can learn complex olfactory discriminations and acquire the concept of "sameness."

Keywords:	pigs, cognition, odor-learning, match-to-sample
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 52
For information contact	Candace Croney or email candace.croney@orst.edu

Decision support system with semantic model to assess the risk of tail biting in pigs

Bracke, M.B.M., Hulsegge, I., Keeling, L.J. (1), Jensen, K.H. (2) and Blokhuis, H.J.

Institute of Animal Science and Health (ID-Lelystad), Lelystad, Wageningen University and Research Centre, P.O. Box 65, 8200 AB Lelystad, The Netherlands, (1) Swedish University of Agricultural Sciences (SLU), Department of Animal Environment and Health, P.O. Box 234, SE 53223 Skara, Sweden, (2) Danish Institute of Agricultural Science (DIAS), Department of Animal Health and Welfare, Research Centre Foulum, P.O. Box 50, DK-8830 Tjele, Denmark

Tail biting is a multifactorial problem with important economic consequences. Farmers must deal with tail biting to optimise productivity, while policy makers must also deal with tail biting as part of their concern for animal welfare. To support decision making in this field we constructed decision support system called PIGTAIL, which contains a tail biting model that is based on 133 statements derived from 63 scientific publications. The model was implemented in a computer-based decision support system that takes a description of a housing and management system as input and produces a score for the risk of tail biting as output. A formalized procedure that had previously been used for modelling of animal welfare was used to construct the model. PIGTAIL contains 28 attributes that describe the risk factors for tail biting as have been associated in scientific research with different levels of tail biting in different housing conditions. Examples include the provision of substrate, the docking of tails, gender, breed, feeding-, health- and climate-related factors. PIGTAIL calculates a score for the overall risk of tail biting as a weighted average attribute score, where weighting factors are derived from the various performance criteria that have been measured by scientists such as tail biting behaviour and tail wounds. The decision support system is built so as make explicit the reasoning steps involved tail biting risk assessment and allows upgrading when new scientific information about tail biting becomes available. A meta-analysis of 12 scientific papers describing 50 treatments, which allowed 77 pair-wise comparisons of these 'housing systems', resulted in the detection of 14 sub-optimal cases and a significant Sign test ($p<0.05$). From this we conclude that PIGTAIL may be useful in assessing the risk for tail biting in pigs.

Keywords:	tail biting, risk assessment, index, pigs, housing systems, management
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 53
For information contact	Marc Bracke or email m.b.m.bracke@id.wag-ur.nl

Interrelationships between exploratory and harmful social behaviours in the weaner pig

Breuer, K., Sutcliffe, M.E.M. (1), Mercer, J.T. (2), Rance, K.A. (3), Beattie, V.E. (5,6), O'Connell, N.E. (4), Sneddon, I.A. (6) and Edwards, S.A.

Department of Agriculture, University of Newcastle, Newcastle upon Tyne, NE1 7RU, (1) Rattlerow Farms Ltd, Hillhouse Farm, Stradbroke, Eye, Suffolk, IP21 5NB, (2) Independent Breeding Consultants, Harryburn Stables, Lauder, Berwickshire, TD2 6PD, (3) Department of Agriculture & Forestry, University of Aberdeen, Aberdeen, AB24 5UA, (4) Agricultural Research Institute of Northern Ireland, Hillsborough, County Down, BT26 6DP, (5) Devenish Nutrition Ltd, 96 Duncrue Street, Belfast, BT3 9AR, (6) School of Psychology, Queens University, Belfast, BT7 1NN, UK

The performance of harmful social behaviours (HSBs) is a common problem on pig farms. This experiment investigated interrelationships between exploratory and HSBs using principal components analysis(PCA)on behaviour of 300 piglets.

In a 'tail chew test' (TCT), suggested to identify subsequent tail and ear biters, the interaction of each suckling piglet with 2 pieces of rope and escape attempts from the arena were recorded. HSB was observed four weeks after weaning. Two PCAs (for the TCT and HSB) were used to investigate relationships between 22 measured variables. Factor scores were subsequently calculated and correlated.

The TCT PCA yielded 5 principal-components (Eigenvalues>1) explaining 80% of variance. The first component (29% of variance) had high loadings for all rope-directed behaviours (RDB), the second (16%) had positive loadings for sniffing, and negative loadings for chewing and manipulation behaviours and the third (16%) had high negative loading for escape behaviours (EB).

The HSB PCA yielded 2 principal-components, explaining 72% of variance. The first component (48%) had negative loadings for all pig-directed behaviours with lower loading for belly-genital nosing (BGN), whilst the second component (24%) had high positive loading for BGN.

The second HSB factor was positively correlated ($r_s=0.116$, $p<0.05$) with the third TCT factor. When the measurements from the two tests were pooled, PCA analysis explained 78% of the variation with seven principal components. The first (21%) had high loadings for RDB, but not for HSB. The second (15%)had high loadings only for HSB, and the third (11%) had high loadings only for EB.

Analyses suggested two different motivations underlying HSB, leading to biters or belly-genital nosers. Whilst EB in TCT appeared to identify belly-genital nosers, further research is required to determine predictive tests for the expression of biting HSBs.

Funding from DEFRA and assistance of Rattlerow Farms Ltd is acknowledged.

Keywords:	harmful social behaviour, pigs, tail chew test, tail biting, ear biting
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 54
For information contact	Kate Breuer or email kate_breuer@yahoo.com

Influence of predisposition and rearing environment on the performance of harmful social behaviour by gilts

O'Connell, N.E., Beattie, V.E., Sneddon, I.A. (1), Breuer, K. (2), Mercer, J.T. (3), Rance, K.A. (4), Sutcliffe, M.E.M. (5) and Edwards, S.A. (2)

Agricultural Research Institute of Northern Ireland, Hillsborough, Co. Down, BT26 6DR, UK, (1) School of Psychology, Queens University Belfast, Belfast BT7 1NN, UK, (2) Department of Agriculture, University of Newcastle, Newcastle upon Tyne NE1 7RU, UK, (3) Independent Breeding Consultants, Harryburn Stables, Lauder, Berwickshire TD2 6PD, UK, (4) Department of Agriculture and Forestry, University of Aberdeen, Aberdeen AB24 5UA, UK, (5) Rattlerow Farms Ltd., Hillhouse Farm, Stradbroke, Eye, Suffolk IP21 5NB, UK

Sixty-four gilts were studied in a 2 x 2 factorial design experiment from 7 to 44 weeks of age. The factors (and levels) were predisposition to perform harmful social behaviour (high and low) and rearing environment (barren and enriched). Predisposition was determined in 320 gilts by behaviour in two 'tail chew tests' at 4 weeks of age, and by the performance of harmful social behaviours in the resident pen at 5 weeks of age. The 'tail chew test' involved isolating an individual pig with access to two lengths of rope for a 10 minute period and observing the behaviour of the pig towards the rope. The 10% most predisposed (32 gilts) and the 10% least predisposed (32 gilts) to perform harmful social behaviour were selected. Half of the gilts of each predisposition (16 gilts) were housed in barren and half in enriched environments. Predisposed and non-predisposed gilts were housed separately in groups of eight animals. Therefore there were two groups of eight animals of each predisposition per rearing environment. Behaviour in the resident pen was recorded regularly throughout the experimental period.

Gilts reared in barren environments spent a greater percentage of observation time performing tail and ear biting than gilts reared in enriched environments ($p<0.05$). Predisposed gilts were nosed around the tail area more frequently than non-predisposed gilts ($p<0.05$). There was a significant interaction between predisposition and rearing environment in the time spent nosing other gilts ($p<0.001$). In enriched environments predisposed gilts spent a significantly greater percentage of time nosing other gilts than non-predisposed animals ($p<0.001$), whereas in barren environments there were no significant differences in the time spent nosing other gilts between pre- and non-predisposed animals ($p>0.05$). There were no significant main effects of predisposition or rearing environment on the time spent nosing other gilts ($p>0.05$).

Both predisposition and rearing environment influenced the performance of harmful social behaviour by gilts. Reduced outlets for exploration in barren environments may have led to less divergence in levels of harmful social behaviour between predisposed and non-predisposed gilts. The authors gratefully acknowledge funding from DEFRA.

Keywords:	gilts, harmful social behaviour, predisposition, rearing environment
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 55
For information contact	Niamh O'Connell or email niamh.o'connell@dardni.gov.uk

Prepartum nest removal increases plasma cortisol and heart rate, and alters maternal behaviour in sows

Damm, B.I., Pedersen, L.J. (1), Marchant Forde, J.N. (2) and Gilbert, C.L. (3)

The Royal Veterinary and Agricultural University, Division of Ethology and Health, Grønnegårdsvej 8, 1870 Frederiksberg C, Denmark, (1) National Institute of Agricultural Science, Department of Animal Health and Welfare, P.O. Box 50, 8830 Tjele, Denmark, (2) USDA-ARS, LBRU, Poultry Science Building, Purdue University, West Lafayette, IN 47907, USA, (3)The Babraham Institute, Department of Neurobiology, Babraham, Cambridge CB2 4AT, UK

To determine the effects of feedback from a farrowing nest on sow welfare, as determined by behaviour, hormones and heart rate, 20 gilts housed in central-nest-farrowing-pens were permitted to build a nest of peat, straw and branches. Ten sows then had their nest removed (NR) 10h after the onset of nest-building and again every 4h until parturition, whereas 10 sows were given sham removals (C). Sow periparturient postures, nest-building and responses to piglet-initiated snout contact and time from birth until suckling in piglets were recorded. Periparturient maternal heart rate was measured and blood samples were taken via a jugular catheter every 20 minutes over the last 7h prepartum and analysed for plasma cortisol and oxytocin.

During the last 4h prepartum plasma cortisol was higher for NR than C sows ($p=0.04$). Oxytocin was unaffected by treatment. Overall, treatment had no effect on heart rate. However, as parturition approached, heart rate increased in NR but not in C sows ($p=0.03$), although there were no prepartum treatment differences in postural or nest-building behaviour. Maternal responsiveness towards piglets and frequency of postural changes was higher during the first 2h after birth of the first piglet than in the following 6h (both $p<0.0001$) after which they again increased ($p=0.09$ and $p=0.01$, respectively). NR sows were more responsive towards piglets ($p<0.0001$) and their piglets took longer from birth until first sucking than C piglets ($p=0.05$).

The prepartum increases in plasma cortisol and heart rate in NR sows in the absence of greater postural or nest-building activity, suggested that nest removal was stressful and affected later sow behaviour towards piglets and teat searching in piglets. The observed treatment effects could have resulted from sows perceiving environmental novelty following nest disruption or a specific lack of feedback from the nest. The results emphasise the importance of farrowing environment and the opportunity to construct a nest on sow welfare.

Keywords:	sows, nest-building, maternal responsiveness, heart rate, oxytocin, cortisol
Species:	pig
Session, type, nr	*Free papers, Short oral* 56
For information contact	Birgitte Iversen Damm or email birgittedamm@hotmail.com

Oxytocin, prolactin and somatostatin in lactating sows; associations with body resource mobilisation and maternal behaviour

Valros, A., Rundgren, M. (1), Spinka, M. (2), Saloniemi, H., Hultén, F. (3), Uvnäs-Moberg (4), Tománek, M.(5), Krejcí P. (6) and Algers, B. (7)

Section of Animal Hygiene, Department for Clinical Veterinary Sciences, P.O. Box 57, 00014 University of Helsinki, Finland, (1) Department of Animal Nutrition and Management, Swedish University of Agricultural Sciences, P.O. Box 7024, 75007 Uppsala, Sweden, (2) Ethology Group, Research Institute of Animal Production, P.O. Box 1, 104 01 Prague – Uhrineves, Czech Republic, (3) Department of Obstetrics and Gynaecology, Swedish University of Agricultural Sciences, P.O. Box 7039, 75007 Uppsala, Sweden, (4) Department of Animal Physiology, Swedish University of Agricultural Sciences, P.O. Box 7045, 75007 Uppsala, Sweden, (5) Department of Biology and Reproduction, Research Institute of Animal Production, P.O. Box 1, 104 01 Prague – Uhrineves, Czech Republic, (6) Institute of Animal Physiology and Genetics, Czech Academy of Sciences, 104 00 Prague – Uhrineves, Czech Republic, (7) Department of Animal Environment and Health, Swedish University of Agricultural Sciences, P.O. Box 234, 53223 Skara, Sweden

To investigate how oxytocin, prolactin and somatostatin during nursings relate to sow maternal characteristics we asked two specific questions: 1. How do oxytocin, prolactin and somatostatin relate to the willingness/capability of the sow to use resources for milk output? and 2. Do high oxytocin and prolactin levels associate with a high incidence of positive piglet-directed behaviour? Undisturbed nursing behaviour and sow-piglet nasal contacts of 21 lactating sows were recorded on day 13 of lactation, and hormonal status during three successful nursings on day 14. Piglet and litter growth (day 8-15), sow weight loss (day 1-15) and catabolic state (measured as non-esterified fatty acids (NEFA) on day 7), and nursing frequency were used as measures of sows' body resource use, nasal contacts and massage-allowing behaviour as measures of positive piglet-directed behaviour. Non-nursing (NN) and nursing (N) levels of hormones were compared using pairwise t-tests. Based on preliminary results, the following hormonal variables were selected for further analyses: NN oxytocin, oxytocin release (area under curve during nursing-related peaks), NN prolactin, N prolactin, and mean overall somatostatin. Associations between variables were investigated with Spearman rank correlations. Oxytocin level was higher, prolactin lower and somatostatin similar during nursings compared to samples taken 15 min after nursing. Oxytocin peaked during most nursings and prolactin increased gradually after nursings. NN oxytocin correlated positively with piglet weight gain and oxytocin release during nursings with NEFA and sow weight loss. Neither oxytocin nor prolactin showed positive correlations with the measures of positive piglet-directed behaviour. Instead, NN oxytocin was negatively connected to a high allowance of massage behaviour in the sows. Our results suggest that oxytocin not only has an all-or-nothing function in triggering milk ejection, but also quantitatively enhances mobilisation of sow body reserves and thus boosts piglet growth. We found no evidence that prolactin or somatostatin have a similar effect.

Keywords:	pig, lactation, behaviour, oxytocin, prolactin, somatostatin
Species:	pig
Session, type, nr	*Free papers, Short oral* 57
For information contact	Anna Valros or email anna.valros@helsinki.fi

Crushing of piglets - a matter of maternal protectiveness and personality?

Andersen, I. L., Berg, S. and Bøe, K. E.

Animal Environment and Ethology Group, Agricultural University of Norway, Department of Agricultural Engineering, P.O.Box 5065, 1432 Aas, Norway

When sows are kept loose during farrowing, crushing and starvation appears to be the most important causes of neonatal mortality in piglets. Maternal behaviour may be a more important determinant of piglet survival than the farrowing environment per se.

The objective of this study was to investigate whether sows with a higher incidence of crushing piglets, are less protective and attentive towards their offspring and have a different social strategy, than sows that do not crush any of their piglets.

Healthy sows from different parities were video recorded from two days before farrowing until 4 days after farrowing. The sows were housed individually in farrowing pens without confinement. Twelve sows with 11 to 16 live born piglets that crushed 2 or more piglets, and 12 sows that did not crush any piglets, were selected for further video analysis, and individually subjected to several experimental tests which all put emphasis on maternal behaviour.

Before farrowing, the sows with no piglets crushed, spent less time lying ($p<0.05$), and showed more nest-building behaviour ($p<0.05$), than sows with several piglets crushed. Sows that did not crush any of their piglets responded much sooner on recorded screaming from a piglet than sows that crushed several piglets ($p<0.05$). Sows that did not crush any piglets also had a longer latency to enter a resting position when separated from the offspring ($p<0.05$), and after being reunited with the offspring, these sows had a shorter latency to nurse ($p=0.11$), and spent more time nosing their piglets ($p<0.05$), than sows that crushed several piglets. When mixed with other sows, mothers with no piglets crushed showed a different social strategy, i. e. they won a larger proportion of their fights ($p<0.05$), explored others more, but also avoided others more than sows with several piglets crushed.

In conclusion, these results suggest that sows that do not crush any piglets have a more protective mothering style and are more flexible in a social situation, than sows that crush many piglets.

Keywords:	crushing, piglets, sows, nest-building, farrowing
Species:	pig
Session, type, nr	*Free papers, Short oral* 58
For information contact	Inger Lise Andersen or email Inger-Lise.Andersen@itf.nlh.no

Does larger enriched cages have an effect on behaviour of two strains of laboratory rats?

Lidfors, L., Wichman, A., Ewaldsson, B. (1), Lindh, A.-S. (1)

Department of Animal Environment and Health, Swedish University of Agricultural Sciences, P.O.Box 234, SE-532 23 Skara, Sweden, (1) AstraZeneca R & D, Laboratory Animal Resources, SE-431 83 Molndal, Sweden

The aim was to investigate effects on behaviour in two strains of rats kept in new types of enriched group cages.

The study was conducted at AstraZeneca R&D on 7-16 weeks old male rats (Sprague Dawley n=42, Wistar n=42). They were randomly allocated to: 1) Enriched rat cage from Scanbur (SC, 4900 cm?), 2) Re-built rabbit cage (RRC, 4400 cm?), 3) Makrolon III-cage Tecniplast (MC, 800 cm?). Group size was five rats/cage in SC and RRC, and two rats/cage in MC. Cages were video recorded 3 times 24 h., once without and twice with enrichment (shelter, paper shreds, aspen sticks). Behaviour was recorded instantaneously at 10 minute intervals. Weighing was done of rats once, food 5 days and water two days per week, and adrenal glands after euthanasia. Statistics, based on cage means, used Analysis of Variance and Tukey´s test.

In SC rats performed less rearing ($p<0.001$), grooming ($p<0.001$) and manipulating nesting material ($p<0.01$), and more resting ($p<0.05$) than in MC. In RRC rats performed more standing ($p<0.001$) and play fighting ($p<0.01$), and less rearing ($p<0.001$) and grooming ($p<0.001$) than in MC. In RRC rats performed more standing ($p<0.001$) and manipulating sticks ($p<0.01$) than in SC. Water consumption was highest in MC ($p<0.001$). There were no differences between cage types in eating, drinking, manipulating litter, moving, climbing cage bars, social grooming, food consumption, weight gain of rats, and relative weight of adrenal glands. Sprague Dawley rats differed significantly from Wistar rats: higher weight gain ($p<0.001$), heavier at euthanasia ($p<0.001$), higher food consumption ($p<0.001$), higher water consumption ($p<0.001$), lower relative adrenal glad weight ($p<0.001$), and performed less grooming ($p<0.01$), movements ($p<0.05$), rearing ($p<0.05$) and more manipulating sticks ($p<0.05$).

It is concluded that there were no major differences in behaviour between the cage types, but some differences related to weight gain and activity between strains.

Keywords:	rats, enrichment, strains, behaviour, weight, food consumption, water consumption, adrenal glands
Species:	rat
Session, type, nr	*Relevance of Natural Behaviour, Short oral* 59
For information contact	Lena Lidfors or email Lena.Lidfors@hmh.slu.se

Teat choice and suckling patterns in Bos indicus calves - optimal foraging and begging

Jung, J., Jensen, P.

Dept of Animal Environment & Health, Swedish University of Agricultural Sciences, Box 234, SE-53223 Skara, Sweden

Theories of optimal foraging predict that animals forage at high-quality patches that are easy to reach, and stay longer on these patches. We investigated suckling behaviour in 18 Tanzanian Bos indicus calves where the calves were allowed to suckle the dam after hand-milking ("restricted suckling"). The foraging qualities of each teat, i.e. the foraging patches, were estimated by recording the milk yield of each udder quarter, the length and the volume of each teat, and the position of the calves in relation to the cow. In each cow-calf pair, we milked in half of the meals all four teats (treatment T4) or the two front teats only (treatment T2). All calves were allocated to both treatments. The data were analysed with ANOVA (GLM).

In T4, sucking time at the individual udder quarters was positively correlated with the quarter milk yield but negatively to volume and length of the teat. The calves preferred the teats that were closest to them. In T2 the calves increased sucking on the rear teats. The duration of sucking bouts (uninterrupted sucking at a teat) was in the beginning of the meal shorter in T4 but declined during the meal in both treatments to 3 sec per bout. All observed teat preferences occurred only in the first minutes of the meal; later the calves sucked equally on all four teats in both treatments.

We confirmed in another study that the later part of the meal consisted of non-nutritive sucking, which leaded to increased milk yield in future sucklings. This indicates that the function of sucking may switch from milk intake to begging, i.e. stimulation for future milk production. We suggest that the observed teat choice and the duration of sucking bouts in the beginning of the meal are consistent with predictions of optimal foraging theories.

Keywords:	cattle, calves, Bos indicus, Tanzania, East Africa, milk, restricted suckling, optimal foraging, begging
Species:	cattle
Session, type, nr	*Free papers, Short oral* 60
For information contact	Jens Jung or email jens.jung@hmh.slu.se

Improved method for detecting estrus behavior in dairy cows

Kerbrat, S. and Disenhaus, C.

UMR Production du Lait, ENSAR - INRA, 65 rue de Saint-Brieuc, CS 84215, 35042 Rennes cedex, France

To update knowledge about estrus behavior, dairy cows have been continuously observed using a video camera system. Behaviors were recorded within the follicular phase (second or third postpartum ovulations attested by progesterone profiles) and 2 days within luteal phase. Changes of frequency of different behaviors were tested by change-Point test (Siegel and Castellan, 1988).

First, 15 cows were used to define behaviors related to estrus. Only 8 cows have showed standing heat behavior (standing immobile when mounted by another cow). Simultaneously, they shown a significant increase of secondary sexual initiated behaviors (SSIB: resting of chin on the rump of another cow and sniffing the vulva of another cow) from 1/d the day before to 60/d ($p<0.001$). The frequency of SSIB decreased to less than 1/d the day after. Seven haven't shown standing heat behavior. However 3 of these shown a significant increase of SSIB ($p<0.01$). Therefore, estrus was defined as the period between two frequency changes of SSIB. Four cows didn't show any change in expression of any behavior.

Afterwards, the sensitivity of estrus behaviors for heat detection was tested on 44 cows in the same conditions than previously. SSIB were sensitive of the estrus day (100%). Twenty-six cows (59%) have showed standing heat behavior. Thirty-seven (84%) were detected using SSIB. These behaviors are expressed more frequently (chin resting : 29.3 per estrus, sniffing the vulva: 11.9 per estrus) than standing heat estrus behavior (5.2 per oestrus) Seven cows (16%) had silent ovulations.

In conclusion, increase of SSIB appeared to be as specific as and more sensitive than standing heat behaviour for estrus detection. It can be successfully used to improve heat detection in dairy farms.

Siegel S., Castellan N.J., 1988. Non parametric statistics for the behavioral sciences (second edition). McGraw-Hill, Inc.

Keywords:	estrous behavior, dairy cattle, free-stalls
Species:	cattle
Session, type, nr	*Free papers, Short oral* 61
For information contact	Sebastien Kerbrat or email kerbrat@epi.roazhon.inra.fr

Aggression and emotionality in two lines of a phenylethanol-amine-n-methyl-transferase (pnmt) overexpressing transgenic mouse model

Bratbo Sørensen, D., Fraas Johnsen, P., Bibby, B.M. (1), Bornstein, S. (2) and Kornerup Hansen, A.

Centre for Bioethics and Risk Assessment, The Royal Veterinary and Agricultural University of Copenhagen, Division of Laboratory Animal Science and Welfare, Ridebanevej 9, 1870 Frederiksberg C, Denmark, (1) The Royal Veterinary and Agricultural University of Copenhagen, Department of Mathematics and Physics, Thorvaldsensvej 40, 1870 Frederiksberg C, Denmark, (2) Department of Endocrinology, University of Düsseldorf, Moorenstraße 5, 40225 Düsseldorf, Germany

PNMT - phenylethanolamin-N-methyl-transferase - is the enzyme catalysing the formation of adrenaline from noradrenaline. Using microinjection technique, transgenic mice over-expressing PNMT with resultant hypersecretion of epinephrine have been developed to study the relation between the sympatho-adrenergic system and obesity.

To evaluate the influence of PNMT on aggression and emotionality in PNMT transgenic mice, single-sex male and female groups were established, consisting of either four wild types, four Tg1815 or four Tg1819, each group consisting of littermates. Moreover, single-sex mixed groups were established. Number of fights in home cages and open field behaviour was evaluated. Weights of the adrenal glands were measured.

In the open field, Tg1819 were significantly less active than wild types ($p<0.0001$) and Tg1815 ($p=0.0008$); no significant difference was found between wild types and Tg1815 ($p=0.11$). Moreover, Tg1819 showed significantly longer latency to leave the inner circle than wild types ($p<0.0001$) and Tg1815 ($p<0.05$), indicating a higher level of emotionality in Tg1819 compared to Tg1815 and wild types. Whether the groups were pure single-line transgenic mice, pure control groups or mixed groups did not influence the measured open field behaviour.

Almost no fights were observed in female groups. In male groups, Tg1815 showed a significantly higher level of fighting than Tg1819, controls and mixed male groups ($p<0.0001$). Housing transgenic lines in mixed groups with wild types seems to decrease the level of aggression in particularly Tg1815.

High levels of intra-group aggression may reduce welfare. However, housing a highly aggressive line of transgenic PNMT mice with wild types seems to reduce aggression within groups. This study demonstrates significant differences in aggression and emotionality between the two lines of transgenic mice, emphasizing the need for phenotypic characterisation to optimise welfare.

Keywords:	transgenic, PNMT, aggression, emotionality
Species:	mouse
Session, type, nr	*Free papers, Short oral* 62
For information contact	Dorte Bratbo Sørensen or email dobj@kvl.dk

Fluctuating asymmetry and malformations as welfare indicators in aquaculture

Eriksen, M.S. and Bakken, M.

Ethology group, Agricultural University of Norway, Department of Animal Science, Box 5025, 1432 Ås, Norway

Any organism is characterized by regularity of its phenotype. A number of developmental mechanisms ensure that ontogenetic processes are kept within certain limits, and this ability to control development under given environmental conditions is called developmental stability. Yet, ontogenetic disorders often occur, and is most often measured in terms of fluctuating asymmetry (FA), denoting small, random deviations from symmetry in normally bilateral symmetrical traits. Developmental imprecision can also be measured as the frequency of phenodeviants, referring to any relatively gross departure from the adaptive, phenotypic target of development. Phenodeviants are normally quite rare, phenodeviance can however be more common under particular conditions, e.g. in commercial aquaculture. Farmed fish are inflicted with a high incidence of various morphological deformities, involving skeletal malformations, organ anomalies, scale disorientation and body line irregularities. Deformed fish show increased mortality rates, growth diminution and enhanced susceptibility to disease, malformations may consequently undermine the value of reared fish and also compromise animal welfare.

The aetiology of these syndromes and the origin of FA is not fully elucidated. However, in a wide range of teleost species, increased FA and amplified frequency of deformations are related to abnormal temperatures, oxygen depletion, pollutants, radiation, nutritional deficiencies, parasites and intensive light regimes. The high occurrence of morphological aberrations in aquaculture may thus reflect suboptimal husbandry conditions.

Farmed fish are frequently exposed to stressful events, and registrations of developmental disruptions, ranging from subtle asymmetries to severe malformations, might provide valuable information when assessing how commercial rearing systems and the ubiquitous stressors influence farmed fish. Based on a review of experimental data on fluctuating asymmetry, malformations and stress in fish, the application of FA and frequency of phenodeviants as reliable, sensitive indicators of stress and animal welfare in aquaculture will be discussed.

Keywords:	animal welfare, aquaculture, farmed fish, stress, fluctuating asymmetry, malformations
Species:	fish
Session, type, nr	*Aquaculture and Fish, Short oral* 63
For information contact	Marit Skog Eriksen or email marit-skog.eriksen@ihf.nlh.no

Group size and space availability affect behaviour and stress parameters in African catfish (Clarias gariepinus)

Almazán-Rueda, P., Schrama, J.W. and Verreth, J.A.J.

Fish Culture and Fisheries Group, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

Little is known about fish behaviour under intensive aquaculture conditions. This study assesses the effects of group size and space availability on behaviour and stress parameters in juvenile catfish.

Fish's initial weight was 29.5 g. Different group sizes were accomplished by stocking 30 or 300 fish per tank (120 l), using 4 and 2 replicates, respectively. Space availability was accomplished by using groups of 30 fish housed at either 100, 50, or 10% of the tank (4 replicates per treatment). Fish were fed twice daily at apparent satiation level. Video recordings were made. Blood cortisol, glucose and lactate as well bite wounds were measured. Additionally, growth and feed conversion ratios (FCR) were recorded.

Group size affects swimming activity. Fish spent 73% and 47% of their time swimming in group size of 300 and 30, respectively. Blood cortisol, lactate and glucose were unaffected by group size. Bite numbers were also unaffected by group size. However, final weight and FCR were significantly higher (163 vs 207 g) and lower (1.0 vs. 0.8) respectively, at the group size of 300.

Space availability affects swimming activity. Fish spent 47, 77 and 58% of their time swimming at the tank size of 10, 50 and 100% respectively. Blood cortisol levels increased (from 140 to 183 ng/ml) with decreasing tank size from 100% to 10% ($p<0.0004$). Blood glucose and lactate level were not influenced by tank size (6.5 and 2.5 mmol/l, respectively). Bite numbers decreased (from 1.8 to 0.7 bites per fish) with decreasing tank size ($p<0.002$). Final weight declined from 186.2 to 163.2 g and FCR increased from 0.8 to 1, when tank size declined from 100% to 10%.

In conclusion: both group size and space availability affect behaviour and stress parameters in catfish.

Keywords:	behaviour, stress, group size, space availability, African catfish, Clarias gariepinus
Species:	fish
Session, type, nr	*Aquaculture and Fish, Short oral* 64
For information contact	Pablo Almazan-Rueda or email pablo.almazan@alg.venv.wau.nl

Assessment of slaughter methods of turbot (Psetta maxima), eel (Anguilla anguilla) and African catfish (Clarias gariepinus) by behavioural observation and post mortem analysis

Van de Vis, J.W., Morzel, M., Lambooij, E. (1), Kloosterboer, R.J., de Zwart, M., Gerritzen, M.A.(1) and Pieterse, C.(1)

The Netherlands Institute for Fisheries Research (RIVO), P.O. Box 68, 1970 AB IJmuiden, The Netherlands, (1) Institute for Animal Science and Health (ID-Lelystad), P.O. Box 65, 8200 AB Lelystad, The Netherlands

Recently, experimental methods for humane slaughter of fish became available. Their applicability depends on the species. The objective was to assess industrial and experimental slaughter methods of turbot (Psetta maxima), eel (Anguilla anguilla, L.) and African catfish (Clarias gariepinus) with respect to behaviour and flesh quality.

Turbot. The current method, bleeding in an ice slurry, resulted in aversive reactions and a loss of responses to stimuli after 30 min. After percussion these were lost immediately and permanently. Percussion resulted in a significantly higher pH, viz. 7.5 vs. 6.9 and full rigor after 96 vs. 24-48 h for the current method. No significant differences were observed for colour and texture.

Eel. Eel slaughtered commercially (salt bath followed by evisceration) exhibited aversive reactions and responses to stimuli. These phenomena were not observed for the experimental method, i.e. application of electricity and oxygen removal. The pH was significantly higher for the latter, viz. 6.8 vs. 6.3 for the commercial one, as well as the redness of the red muscle tissue and hardness of the muscle tissue.

African catfish. The current slaughter method, live chilling followed by evisceration, was compared to injection of air under pressure in the brains during 1.5 s. Live chilling was aversive and the loss of responses to stimuli may take more than 5 min. The preliminary results showed no significant differences for pH, rigor mortis, colour and texture.

Keywords:	
Species:	fish
Session, type, nr	*Aquaculture and Fish, Short oral* 65
For information contact	Hans Van de Vis or email J.W.vandeVis@rivo.wag-ur.nl

Pain and adrenal function in fish

Broom, D.M.

Department of Clinical Veterinary Medicine, Cambridge University, Madingley Road, Cambridge CB3 0ES, UK

The aim of this paper is to compare the functioning of fish and mammals in order that fish welfare can be properly considered. Since fish are poikilothermic and their brain and body anatomy differs from that of mammals in various ways, it is often assumed that all of their life regulatory processes are also very different functionally. Evidence is presented for considerable similarity in adrenal function between fish and mammals, in particular in relation to the nature of circumstances eliciting adrenal responses and the likelihood of immunosuppression after adrenal activity.

Where pain is considered to be an aversive sensation and a feeling associated with actual or potential tissue damage, fish have a pain system which has much in common with those of birds and mammals. Fish have pain receptor cells, nociceptive neuronal pathways and specialised transmitter substances including substance P, serotonin, calcitonin, gene-related peptide, neuropeptide Y, bombesin and metenkephalin in the dorsal horn of the spinal cord. They show electrophysiological responses to cuts, bruises and electric shocks and learned avoidance of places where they have had unpleasant experiences. The functioning of the brain in relation to stimuli which are likely to be painful is similar, even if the anatomical regions are different. A comparison of the brain regions involved in these functions is presented. Opioids seem to have a similar role in the brains of fish and mammals in relation to pain. Pain is an important aspect of welfare in fish and other animals but it is only one of several aspects.

The general conclusion is that the functioning of the important coping systems which involve responses to actual or potential tissue damage, as well as the emergency physiological responses which facilitate flight, defence, or freezing, are generally similar in fish and mammals. Hence welfare assessment in fish should include measurement of the functioning of the pain and adrenal systems.

Keywords:	pain, adrenal function, welfare, fish
Species:	fish
Session, type, nr	*Aquaculture and Fish, Short oral* 66
For information contact	Don Broom or email ga207@cam.ac.uk

Pain perception in the rainbow trout

Sneddon, L.U.

Welfare Biology, Roslin Institute, Roslin, Midlothian, EH25 9PS, UK

Nociception or pain perception has been demonstrated in a number of higher vertebrates however the question of whether lower vertebrates are capable of pain perception has not been systematically studied. In this study, I addressed this question by assessing whether the rainbow trout (Oncorhynchus mykiss) was capable of pain perception. To assess whether the fish was capable of pain perception, trout were trained individually to perform a simple conditioning task. Once they had successfully performed this task for 6 consecutive trials, the fish were assigned to one of four groups: three groups had either bee venom, 1% acetic acid or saline injected into the frontal lips and a fourth group that was simply handled. The behaviour was assessed before the treatment as well as the opercular beat rate, and at intervals after the treatment. The venom and acid injected groups performed anomalous behaviours that were not observed in the saline or handled group.

These anomalous behaviours, rocking and rubbing of the affected areas, are similar to pain coping behaviours in higher vertebrates. The saline and handled control groups fed 80 minutes after the treatment whereas the venom and acid groups did not feed for a period of three hours. The opercular beat rate increased from approximately 54 beats/min to 70 beats/min in the saline injected and handled groups. However, the venom and acid injected groups showed an almost double-fold increase in opercular beat rate. The effects of bee venom and acid injection were short-term and lasted for approximately three hours. The fish were tested in the cognitive task for 3 days after the treatment and fed at each trial.

Since there were adverse behavioural and physiological responses to noxious stimulation and these chemicals are painful in higher vertebrates, it is likely that the rainbow trout is capable of pain perception. This should be considered during the treatment and handling of fish. Acknowledgements: This work was funded by BBSRC.

Keywords:	pain, fish, nociception
Species:	fish
Session, type, nr	*Aquaculture and Fish, Short oral* 67
For information contact	Lynne Sneddon or email

Well-being of reared Atlantic halibut (Hippoglossus hippoglossus L): high fish densities increase swimming activity and reduce feeding and growth rates.

Kristiansen, T.S., Fernö, A. (1), Holm, J.C. (2), Privitera, L., Bakke, S. and Fosseidengen, J-E.

Institute of Marine Research, Austevoll Aquaculture Research Station, N-5692 Storebø, Norway, (1) Institute of Fisheries and Marine Biology, University of Bergen, Thormøhlensgt. 55 N-5020 Bergen, Norway, (2) Directorate of Fisheries, P.O. Box 185, N-5804 Bergen, Norway

The Atlantic halibut has been the major "new species" candidate for aquaculture in Norway since the 1980's. However, in the fish farms growth rates in the ongrowing period were found to be lower than expected. We hypothesised that at high densities, frequent social interactions will lead to stress, less appetite and impaired well-being. In six 3m-diameter tanks halibuts weighing 2 to 10 kg were kept at low, medium, and high densities (respectively 10, 30 or 60 individuals in two parallels; density 18%, 54% and 112% bottom coverage). All fish were individually marked with TrovanTM passive implant transponder (PIT) tags, and a PIT-antenna registered fish swimming at the surface. The behaviour was observed by under water video cameras.

Growth rates were highly variable among individuals, but decreased significantly with increasing fish density. This was due to reduced appetite and food consumption in conditions of higher density. Swimming activity increased with fish density. Frequent "surface swimmers" as recorded by the PIT-antenna showed significantly lower growth rates than fish with few registrations. Surface swimming can thus be an indicator of reduced well-being. The concepts of well-being, welfare indicators and welfare of farmed fish are discussed.

Keywords:	halibut, welfare, growth, density, behaviour, fish farming
Species:	fish
Session, type, nr	*Aquaculture and Fish, Short oral* 68
For information contact	Tore Kristiansen or email tore.kristiansen@imr.no

Mating strategies by Nelore bulls under natural breeding

Paranhos da Costa, M.J.R. (1), da Costa e Silva, E.V. (2,3) and Robson Bezerra Sereno, J. (3,4)

Departamento de Zootecnia, FCAV/UNESP, 14884-900, Jaboticabal-SP, Brazil, (1) ETCO-Grupo de Estudos e Pesquisas em Etologia e Ecologia Animal, (2) Departamento de Medicina Veterinária,UFMS, Campo Grande–MS, Brazil, (3) Grupo de Estudos em Reprodução Animal no Estado de Mato Grosso do Sul - GERA-MS / CNPq, (4) Embrapa Pantanal, Corumbá-MS, Brazil

In natural conditions, it is expected that a bull is able to present different mating strategies to achieve the reproductive success. The objective of this study was to test this hypothesis, describing the sexual behaviour of Nelore bulls (Bos taurus indicus) under natural breeding in free-range conditions.

Sexual behaviour of 5 adult bulls (with previous sexual experience) was recorded during 5 consecutive days (120 hours) in two groups: LHI = two bulls and 120 cows, with natural incidence of oestrus and HHI = three bulls and 180 cows, synchronising heat in 50 of them. The frequency of complete services (CS) was recorded. It was also considered the frequency of each bull to begin or to participate in the courtship (without beginning it). The bulls' dominance order was determined within groups, considering the agonistic interactions between them. Data were analysed by Chi-squared or McNemar tests.

Two mating strategies were defined: monogamous (when only a bull mated a cow) and polygamic polyandrous (when 2 or more bulls mated a cow). The frequency of CS did not differ between dominant and subordinate (Mcnemar: 1.212; p=0.271). Therefore, dominant bulls presented higher frequency of monogamous mating than subordinates (Mcnemar: 4.858; p=0.028). In the HHI group all bulls have participated in the courtship, resulting in higher CS for dominant bull than for subordinates 1 and 2 (Chi-squared=4.332; p=0.037 and Chi-squared=9.808; p=0.02, respectively); when the dominant begun the courtship its CS was similar of that presented by the subordinate 1 (Chi-squared=1.017; p=0.313) and different of subordinate 2 (Chi-squared=8.905; p=0.003). In LHI only the dominant bull has executed CS.

Based on these results we concluded that the social structure of Nelore cattle could be characterised as groups with several males and promiscuous mating system, and that mating strategy would be dependent upon the bulls' dominance order and number of receptive females.

Supported by CECITEC-SEMADES/MS, FUFMS-UFMS e Fazenda Bodoquena SA.

Keywords:	bovine, zebu, sexual behaviour, social behaviour
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 69
For information contact	Mateus Paranhos da Costa or email mpcosta@fcav.unesp.br

Monitoring the frequency and duration of outside run visits by laying hens of different genotype

Von Borell, E. (1), Müller, J. and Mahboub, H. (1)

Institute of Agricultural Ecology at the Martin-Luther-University Halle-Wittenberg, c/o Animal Husbandry Centre Merbitz, D-06193 Nauendorf, Germany, (1) Institute of Animal Breeding and Husbandry with Veterinary Clinic, Martin-Luther-University Halle-Wittenberg, Adam-Kuckhoff-Str. 35, D-06108 Halle, Germany

Free range housing systems are generally regarded as animal friendly and enable laying hens to perform a variety of natural behaviours. However, recent studies indicate that laying hens might prefer to stay in close proximity to the farm building or do not even use the outside run at all. In order to study this problem in detail, 100 laying hens of different genotype (50 LT [brown] and 50 LSL [white], Lohmann, Cuxhaven) were individually equipped with transponders (DAISY, Diehl Ident, Roethenbach) to record the frequency of changes between inside and outside areas and the time hens spend in these areas. The poultry house provided floor space for 6 hens/m2 with access to an outside area (winter garden and grassland). Passages with built in antennas enabled individual recording of birds. Changes between functional areas were recorded continuously for two consecutive vegetation periods.

Hens spent about 50 % of the daylight time and 30 % during 24 hrs outside of the poultry house. However, individual variability was high. Some of the hens never went outside (5 % for LSL and 20 % for LT). LSL hens changed more frequently between functional areas (in average 80 changes per hen/day for LSL vs. 50 for LT, $p<0.001$, Scheffe-test). In 80% of cases, time periods in which hens were identified in the outside area were not longer than 10 min. Feather scoring indicated that the duration hens spent in the outside run positively correlated with less plumage damage ($r=0.53$ for LSL and $r=0.67$ for LT, $p< 0.01$, Spearman).

Our results suggest that it is necessary to further characterise individual birds for their motivation to gain access to an outside area. The influence of genotype, early experience, group size and specific housing design on the behaviour and health of laying hens in free range systems need to be considered accordingly.

Keywords:	laying hen, genotype, free range use, feather scoring
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 70
For information contact	Eberhard Von Borell or email BORELL@landw.uni-halle.de

Space requirements of horned and hornless goats at the feed barrier

Wechsler, B., Loretz, C. Hauser, R. and Rüsch, P.

Swiss Federal Veterinary Office, Centre for proper housing of ruminants and pigs, FAT, CH-8356 Tänikon, Switzerland

As goat keepers often consider the horns to be an important aspect of the animals' appearance, recommendations concerning the design of loose housing systems for horned goats are needed. In this study, we compared the behaviour of horned and hornless goats to investigate their space requirements at the feed barrier. In four groups of 10 females with horns and four groups of 10 females without horns, the number of feeding places (width 35 cm) was restricted stepwise, from an initial 20 to 15 and 10 feeding places. With each animal/feeding place ratio, every group was observed for four hours a day during feeding on four consecutive days.

The distance between the animals at the feed barrier was significantly influenced by the number of feeding places available (ANOVA with repeated measurements, $p<0.002$) and by the presence of horns ($p<0.05$). The average distance was markedly lower in the experimental condition with only 10 feeding places available and in the groups with horned goats, because low-ranking animals had to share a feeding place whereas high-ranking animals occupied several places. The proportion of time the animals spent feeding decreased significantly with increasing animal/feeding place ratio ($p<0.001$) and was significantly lower in groups with horned goats ($p<0.02$). The rate of aggressive interactions at the feed barrier, however, was not significantly affected by the number of feeding places available nor by the presence of horns.

It is concluded that the space requirements of horned goats at the feed barrier are markedly higher than those of hornless goats.

Keywords:	goat, behaviour, feeding, aggression, space requirements
Species:	goat
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 71
For information contact	Beat Wechsler or email Beat.Wechsler@fat.admin.ch

What does lying behaviour by group housed sows tell us about sow welfare?

Bonde, M., Cronin, G.M. (1), Barnett, J.L. (1) and Hemsworth, P.H. (2)

Danish Institute of Agricultural Sciences, Dept. of Animal Health and Welfare, P.O. Box 50, 8830 Tjele, Denmark, (1) Animal Welfare Centre, NRE, Victorian Institute of Animal Science, 600 Sneydes Road, Werribee, Vic 3030, Australia, (2) Animal Welfare Centre, University of Melbourne, Victorian Institute of Animal Science, 600 Sneydes Road, Werribee, Vic 3030, Australia

Aggression can be a major welfare problem in group-housing systems for pregnant sows. Some sows may respond to aggression by avoiding other sows altogether, and this may result in impaired welfare caused by reduced feed intake and social stress. The avoidance strategy may influence the lying location of sows when resting, in relation to others in the group. The aim of this study was to investigate the relationships between spatial location at resting and aggression, cortisol, reproductive performance and injuries of sows.

The study was conducted on a commercial farm with dry sows housed in groups of ten, and floor fed. The lying location and distance in relation to the nearest neighbour were recorded for individual sows on three consecutive weekdays 10 weeks post-service. In each of 28 pens, one "solitary" and one "social" sow were identified: animals lying away from neighbours were classed as "solitary" and animals close to neighbours as "social" sows. These were observed for one hour during feeding, focusing on feeding and agonistic behaviour. Additionally, skin lesions and salivary cortisol concentrations were measured in resting sows. Reproduction data were obtained from the subsequent farrowing.

Initial analyses indicate that the lying strategy was not associated with feeding behaviour, the occurrence of skin lesions or the cortisol concentrations. However, the "solitary" sows were involved in more agonistic interactions during feeding (16 and 10 interactions respectively, for "solitary" and "social" sows, $p<0.001$), but not particularly in more aggressions performed (7 vs 4, NS) or received (6 vs 4.5, NS). Stillbirths were higher for "solitary" sows (0.7 vs 0.3 piglets, $p<0.01$) but litter size was not affected.

Solitary lying behaviour by sows may be an avoidance response or alternatively it may reflect dominance status. The behaviour could be of potential relevance when identifying sows that do not adapt to group housing systems but further investigation of the welfare of individual sows is required.

Keywords:	animal welfare, dry sows, social behaviour, group housing systems
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 72
For information contact	Marianne Bonde or email marianne.bonde@agrsci.dk

The electrophysiological recognition of sleep behaviour in sheep

Langford, F.M., Baxter, E.M., Brash, H.M. (1) and Cockram, M.S.

Department of Veterinary Clinical Studies, Royal (Dick) School of Veterinary Studies, University of Edinburgh, Easter Bush Veterinary Centre, Easter Bush, Roslin, Midlothian, EH25 9RG, UK, (1) Department of Medical Physics, University of Edinburgh, Royal Infirmary of Edinburgh, Lauriston Place, Edinburgh, EH3 9YW, UK

In humans, sleep can be affected by stressful events and painful conditions. The reliable recognition of sleep may be useful when assessing both short and long-term effects of aversive experiences on animal welfare.

A technique using behavioural observation and non-invasive recordings of the electroencephalogram (EEG), electro-oculogram and electromyogram has been developed to recognise sleep in sheep. Results from six sheep showed that 15% (±2.4) of a 24h period was spent in non-REM sleep and 3% (±0.2) in REM sleep. Sheep slept in polyphasic bouts throughout the 24h period (mean bout frequency 27 ± 11, mean bout length 576 ± 96s). Sleep occurred on 72% of occasions that sheep adopted the characteristic sleep posture (lying down with head lowered and neck relaxed). After 71% of sleep periods, sheep raised their head on waking. After the other 29%, sheep woke up, but did not alter their head position.

In another study, sheep were exposed to a dog-bark recording that was subsequently used as an auditory arousal stimulus. When sheep were observed in a characteristic sleep posture the volume of the dog-bark was increased step-wise by 5dB at 40s intervals over an 11-minute period. EEG recordings were compared 10s before and after the penultimate stimulus that produced a behavioural response (thereby avoiding artefacts from muscle movement). Spectral analysis of EEG recordings 10s before and after the stimulus showed a significant increase in frequency (pre: 1 ± 0.2Hz, post: 21 ± 3.9Hz, paired t-test, $p < 0.05$, N=6) and a significant decrease in the percentage of Delta waves (pre: 40 ± 2.7%, post: 13 ± 1.6%, $p<0.001$, N=6). These changes are indicative of an arousal from sleep to wakefulness and provide evidence for the validity of this non-invasive technique to record sleep in sheep. FML is supported by a UFAW research training scholarship

Keywords:	electrophysiology, sheep, sleep, welfare
Species:	sheep
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 73
For information contact	Fritha Langford or email F.M.Langford@sms.ed.ac.uk

Stockperson-husbandry interactions and animal welfare in the extensive livestock industries

Tosi, M.V. and Hemsworth, P.H. (1)

Istituto di Zootecnica, Facoltà di Medicina Veterinaria, Università di Milano, Italy, (1) Animal Welfare Centre, University of Melbourne and Department of Natural Resources and Environment, Werribee, VIC, 3030, Australia

In extensive management systems livestock often receive only neutral or aversive interactions from humans, such as health treatments and husbandry practices. Research on dairy cattle, pigs and poultry has shown that the relationship between animals and the stockperson has direct effects on animal welfare and production. In the present experiment, we hypothesized that positive handling by stock people may ameliorate the acute stress response in lambs to tail docking.

16 male (7) and female (9) lambs were randomly allocated within mixed sex pairs of similar weight animals to one of the two handling treatments (positive and negative). Positive handling consisted of the handler slowly approaching and squatting near the lamb, while negative handling involved the handler quickly approaching and shouting at the lamb. Handling treatments were imposed for 2 minutes a day for 5 days a week for 5 weeks from 2 weeks of age. Lambs were tail docked with a hot iron at 7 weeks of age. The heart rate of the lambs was measured before, during and after tail docking and the behaviour of the lambs and their ewes was observed for 3 h after tail docking.

Lambs that had received negative handling had higher ($p<0.05$) maximum heart rates within 20 s of tail docking with a hot iron than lambs that had received positive handling (187.0 bpm (mean)+/- 13.5 (SEM) and 141.5 +/- 14.2). Although the positively-handled lambs had lower heart rates than the negatively-handled lambs during the 3-min period before and the 3-min period after tail docking, these differences were not statistically significant. There were no significant treatment effects on the behaviour of the lambs after tail docking.

These limited results further indicate the importance of human-animal interactions on the welfare of farm animals.

Keywords:	human-animal interactions, sheep, tail docking, acute stress response
Species:	sheep
Session, type, nr	*Behaviour and welfare assessment in farm animals, Short oral* 74
For information contact	Mariavittoria Tosi or email Paul.Hemsworth@nre.vic.gov.au

Posters

Free range, behaviour of male turkeys and its effect on the spatial variability of phosphorus in soil

Berk, J., Haneklaus, S. (1) and Schnug, E. (1)

Institute for Animal Science and Animal Behaviour, Dörnbergstr. 25/27, 29223 Celle, Germany, (1) Institute of Plant Nutrition and Soil Science, Federal Agricultural Research Center (FAL), Bundesallee 50, 38116 Braunschweig, Germany

In Germany, a free range to turkeys is only offered regularly in organic farming. The offer of an outdoor area is possibly a way to give the birds the opportunity to exercise fully appreciated aspects of animal behaviour, but can also cause environment pollution.

In this study the influence of commercial turkeys of three subsequent fattening periods (three stocking densities, two lines) using the free range and the effect of the spatial variability of phosphorus in the upper soil layer was determined. In the first period 104 turkeys (2.7 birds/m2) and in the second and third 54 or 126 turkeys (1.5 or 3.5 animals/m2) had access to 256 m2 (64 m2 roofed), respectively.

The number of animals in the outside area was video-recorded and its relationship to the soil P content was investigated.

Outside areas were frequented less with rising age and body weight and in dependence of the lines (line N 700 from 65 to 40 % and BUT Big 6 from 70 to 20 %). Turkeys preferred the roofed free-range areas near the poultry house. The results revealed that the fattening periods had a significant effect on the plant available P content which increased from on average of 96 to 151 mg/kg in the non-roofed area and from 215 to 544 mg/kg in the roofed area (3.5 birds/m2). The stocking density of 1.5 animals/m2 caused a significant increase in the roofed area from 204 to 453 mg/kg P. Geo-statistical analysis was performed to determine spatial auto-correlations. The range provides an estimate of the distance up to which P contents are spatially related. The range was<5 m in the roofed area, but 9-10 m in the non-roofed area.

The results indicate that the activity of the birds was related to the spatial distribution of phosphorus supplied by faeces. Accumulation of P was highest in the roofed free range so that a further enrichment of the non-roofed area (bushes, trees) is supposed to further promote activities in this area and thus can improve animal health and welfare.

Keywords:	free range, behaviour, phosphorus, turkey
Species:	turkey
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 01
For information contact	Jutta Berk or email Jutta.Berk@fal.de

Effect of housing system of lactating sows on piglets' behaviour

Chaloupková, H., Illmann, G. and Smazalová, Z. (1)

Ethology Group, Research Institute of Animal Production, Prague -Uhrineves,Pratelstvi 815, Czech Republic, (1) Czech Agriculture University, Prague, Czech Republic

During early ontogeny housing conditions of piglets have an important effect on the development of their social skills – learning of correct dominant and subordinate behaviour and coping with stress. The aim of this study was to test whether the housing conditions during the pre-weaning period affects agonistic behaviour and the reaction of piglets to an isolation test.

We compared piglets from a "poor" housing system – farrowing crate without straw (Type A) with piglets from an "enriched" housing system – modified farrowing crate with straw (Type B). We predicted, that Type A piglets will have (i) higher frequency of fights and different agonistic behaviour after mixing and (ii) more scream calls during a short isolation than Type B piglets. Piglets were weaned at 4 weeks post partum.

In the first part of our study the agonistic behaviour was observed during 3 hours after mixing of two unfamiliar litters from the same housing system (6 Type A litters and 6 Type B litters). The isolation test consisted of removing a single piglet for 3 min from the mother and the litter mates at the age of 3 weeks. Four Type A litters (16 piglets) and 4 litters Type (15 piglets) were observed. The preliminary low number of observed litters prevented statistical analysis and will be done later.

(i) The frequency of fights was 5.3 (mean) fights per piglet in Type A piglets and 3.3 (mean) in Type B piglets. The amount of abnormal agonistic behaviour (chasing and biting to the opponent's hindquarters) was 52% in Type A piglets and 34 % in Type B piglets. (ii) The proportion of scream calls during isolation test was 30 (mean) screams in Type A piglets and in Type B piglets 14.1.

These preliminary results indicate that the "enriched" housing system during the suckling period might decrease the number of fights after mixing and diminish the stress reaction to an isolation challenge.

Keywords:	pig, housing, lactation, environmental enrichment, agonistic behaviour, weaning
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 02
For information contact	Helena Chaloupkova or email Illmannova@vuzv.cz

Visiting periodicity of milking cows to an automatic milking system

Chiku, F., Honda, Y. (1), Uetake, K., Tanaka, T. and Hasegawa, S. (1)

School of Veterinary Medicine, Azabu University, Fuchinobe, Kanagawa, 229-8501, Japan, (1) National Institute of Livestock and Grassland Science, Inashiki, Ibaraki, 305-0901, Japan

To study on the visiting periodicity to an automatic milking system, 44 Holstein-Friesian cows in a free stall barn were videotaped on their visits to the milking system for seven days. The cows were divided into three groups based on the distribution of variance of milking and visiting intervals for each. The high, average and low periodicity groups (M-H, 13 heads; M-A, 21 heads; M-L, 10 heads and V-H, 12 heads; V-A, 24 heads; V-L, 8 heads) were determined at 25% and 75% of the distribution. ANOVA and post-hoc test were carried out among the groups on the days in lactation, parity, the number of visits, visiting interval and visiting efficiency (milking number/ visiting number). Visiting efficiency was also compared between the groups based on the setting of the number of milking lactation (S-H, 22 heads; S-L, 22 heads). The grouping was set according to cow's milk yield and the days in lactation.

On milking periodicity grouping, the days in lactation in M-H was significantly shorter than those in M-A ($p<0.05$) and M-L ($p<0.01$). The M-H visited the milking system more often than M-A and M-L (both $p<0.01$). On visiting periodicity grouping, the days in lactation in V-H was significantly shorter than those in V-A ($p<0.05$) and V-L ($p<0.01$). The visiting interval of V-H was significantly shorter than that of V-L ($p<0.05$). The V-H visited the milking system more often than V-L ($p<0.01$). Visiting efficiency of S-H was better than that of S-L ($p<0.001$).

Milking periodicity would not reflect the voluntary visits of cows since this grouping was affected by the setting of the number of milking by stockpersons. The need for concentrated feed is higher in the cows at the early stage of lactation because of their high milk yield. This might make cows come to the milking system more frequently and get the visiting periodicity higher. Further study is required on the change of cows' visiting periodicity as lactation period progresses.

Keywords:	milking cows, robotic milking, periodicity
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 03
For information contact	Fumie Chiku or email f-chiku@fc4.so-net.ne.jp

Free farmed: a united states farm certification program emphasizing animal welfare

Coe, B.L.

Farm Animal Services, 236 Mass. Ave, NE. #206, Washington, DC 20002

The Free Farmed Certificate Program (FFCP) is a voluntary, fee-based service, launched in September 2000, available to livestock producers. The program provides independent verification that care and handling of livestock and poultry on enrolled farms meets the American Humane Association's (AHA) Animal Welfare Standards. AHA Standards require that livestock have access to clean, sufficient food and water, an environment not dangerous to their health, sufficient protection from weather elements and sufficient space allowance, and other features that ensure the safety, health and comfort of the animals. Standards also require managers and stockmen to be thoroughly trained and competent in animal husbandry and welfare. Current AHA standards are available for dairy cattle, beef cattle, swine, layers, and broilers. Sheep, turkey, and goat standards are underway.

Participants must complete a Farm Manual outlining their nutrition program, housing, husbandry practices, handling systems, record keeping, animal health protocols, and emergency plans. Participants meeting all requirements are certified for a year to use the Free Farmed logo. Major non-conformance points that compromise the program's integrity must be corrected before program approval is awarded. Minor corrections must be made and documented in a timely fashion. Farm Animal Services (FAS), a non-profit organization, created by AHA, administers, certifies and monitors the FFCP program. The FAS inspection process is independently audited.

Currently, eight producer groups are marketing beef, chicken, eggs, and dairy products under the FFCP label. Six more are completing program requirements. Animal Industry Foundation's (AIF) survey (1999) found that 44% of consumers would pay 5% more for meat/poultry products labelled as "humanely raised." Humanely produced farm animal products are becoming a significant market niche in the food industry. The FFCP program enables consumers to support producers' attempts to support animal welfare, thereby providing a viable alternative model for animal agriculture in the US.

Keywords:	animal welfare, certification, production
Species:	general
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 04
For information contact	Brenda Coe or email bxc10@psu.edu

Behavioural and performance of piglets weaned at 3 and 4 weeks

Colson, V., Orgeur, P. and Lévy, F.

Physiologie de la Reproduction et des Comportements, UMR 6073, INRA/CNRS/Université F. Rabelais, 37380 Nouzilly, France

Very early weaning (at one week) of piglets is occasionally practised in France to save surplus young. This type of weaning causes behavioural, hormonal and animal production problems. A recent European Directive increased the minimum weaning age to 28 days, (weaning at 21 days is allowed in special conditions).

The study compared 3 groups of Large-White piglets weaned at different ages: 21 days (W21), 28 days (W28) and a control group nursed by the sow until 40 days (C). Position, activity and social behaviour were observed until then, in each group composed of 6 litters of 7-8 piglets. Observations occurred on 7 days (between d-1 and d+12 after weaning), for 2h/day.

W/C comparisons showed more vocalizations, oral and aggressive activities towards other piglets in weaned groups, and more litter cohesion (60% in W28 vs 25% in C; $p<0.01$), although this was less than previously reported for very early weaned piglets: "belly-nosing" was reduced by 50% in our study in both groups and vocalizations in very early weaned group were longer-lasting (until d+6). We did not observe starvation.

W21/W28 comparisons showed 2 significant differences: longer-lasting vocalizations were observed in W21 (until d+4), but aggression was twice as great in W28 at d+6 ($p<0.05$).

Growth rate did not differ from that of C after 2 days in W28, and after 8 days in W21 .

This work shows that behavioural and growth disorders exist when weaning occurs at 21, or even at 28 days, comparing to a nursed group, but these are less intense and long-lasting than in piglets weaned at 7 days.

Keywords:	piglets, weaning, behavioural disturbances, growth rate, welfare
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 05
For information contact	Violaine Colson or email colson@tours.inra.fr

Matching horses for courses: development of robust tests of equine temperament to optimise equine welfare

Creighton, E., Angharad, E. (1), McGregor, E. (1) and Stowe, S. (1)

Department of Psychology & Speech Pathology, the Manchester Metropolitan University, Manchester, M13 0JA, UK., (1) Department of Biological Sciences, Chester College, Chester, CH1 4BJ, UK

Equine welfare can be optimised by finding the right match between a horse's temperament, it' rider's personality and the management and training techniques employed. Temperament is difficult to define, but may be considered as an individual' basic stance towards continuing changes and challenges in it's environment. Attempts to measure temperament by scoring an animal known to the assessor on a set of subjective scales allows measurement of qualities not readily dissected into behavioural elements, but suffers from a lack of reliability. Attempts to infer temperament from an animal's responses to specific behavioural tests are more objective, but suffer from high individual-situation interaction and so may lack also lack reliability as well as validity. Here we combine both of these approaches in an attempt to arrive at a reliable, valid and objective set of tests of equine temperament. Inter-observer reliability tests from independent pairs of observers of 56 riding horses and ponies were used to determine a set of reliable paired-semantic-opposites scales and reliably observed frequencies or likelihood of behaviour.

Principle components analysis revealed three independent dimensions encompassing sociability, aggression, emotionality, sensitivity and fear that correlate between the two data sets. A set of reliable and discriminative behavioural tests were found by the degree of concurrence on test-retest and the range of responses observed, to novel experience, social isolation and handling tests in 36 riding horses and ponies. Comparisons of the subjective assessment of the temperament of these individuals with their observed behaviour on the objective tests permits the development of a descriptive set of behavioural responses that reflects the animals' underlying temperament.

Further testing and refinement of these tests is expected to lead to a robust set of objective tests of temperament that can be used to improve equine welfare by matching the horse to the course.

Keywords:	horse, temperament, welfare
Species:	horse
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 06
For information contact	Emma Creighton or email Emma@orrelwood.org.uk

A cognitive approach to emotions: are the responses to suddenness and novelty different?

Désiré, L., Boissy, A., Veissier, I. and Després, G.

INRA de Clermont-Ferrand Theix, URH-ACS, 63122 Saint-Genès-Champanelle, France

The root of emotions experienced by an individual is its own assessment of the situation according to various criteria such as novelty, suddenness, pleasantness, expectancies and controllability (see Veissier et al., ISAE 2002). We develop a strategy, derived from cognitive psychology (Scherer, 1987), in which animals are placed in experimental situations where the evaluation is oriented according to one criterion or a combination of criteria. We aimed at identifying behavioural and physiological responses specific to the way the criteria are assessed. The two criteria first considered are suddenness and novelty. According to studies in human, it was expected that responses to suddenness and novelty differ.

Three experiments were run on 3 months-old female lambs isolated for the individual testing. In experiment 1, lambs were confronted with a scarf lifted either suddenly or slowly. In experiment 2, lambs were confronted with an object familiar vs. unfamiliar. In Experiment 3, the two criteria were combined: lambs used to the presence of a slowly moving object were then exposed to the same object moving slowly vs. suddenly, or to a new object moving slowly vs. suddenly. Cardiac response, respiration, skin temperature and behavioural responses (feeding time, locomotion activity, latency to enter, ears posture) were measured. In experiment 1, feeding time were reduced following presentation of the scarf but with no difference between the sudden and slow presentation ($p=0.8$). Heart rate acceleration was stronger in response to sudden presentation ($p=0.05$). In experiment 2, latency to enter the room was longer with the unfamiliar object than with the familiar object ($p=0.05$) but the cardiac responses were similar ($p=0.95$).

In conclusion, as expected, emotional responses to the suddenness differ from those to novelty, leading probably to distinct emotional experience.

Keywords:	emotion, behaviour, novelty, suddenness, sheep, psychophysiological measures
Species:	sheep
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 08
For information contact	Lara Désiré or email ldesire@clermont.inra.fr

Effect of long distance road transport on serum total and free iodothyronine levels of limousine calves: correlation to temperament and body weight loss

Fazio, E., Medica, P., Cavaleri, S. (1) and Ferlazzo, A.

Department of Morphology,Biochemistry, Physiology and Animal Production - Unit of Veterinary Physiology - University of Messina, Italy, (1) Veterinary Practitioner, Messina, Italy

The transport procedure involves several potential stressors and the role of hormones not directly involved in stress adaptation is not fully understood. Nevertheless, the degree of cerebral activation is dependent on circulating levels of thyroid hormones, particularly for T3 (Tucker et al., 1984). On this basis, and by considering that genetic factors could interfere with handling stress adaptation and that hormonal activation can induce metabolic and functional modifications, serum total and free iodothyronines of calves after road transport have been evaluated, by relating their changes to temperament and body weight loss. The study was carried out on 13 Limousin calves, 13 months old, transported over a distance of 2200 Km (about 33 hours). They were distinguished in Group A: calm subjects (No.8), and Group B: aggressive subjects (No. 5), depending on a restless and aggressive attitude showed with respect to co-specifics, blood sampling and handling. On the basis of body weight decrease after transport, that was statistically significant for all 13 subjects ($p<0.001$), they were distinguished in Group I: body weight decrease of 5-8% (No. 4 subjects) and Group II: body weight decrease of 10-14% (No. 9 subjects). Blood samples were taken at 05.30 p.m., about 4 hours before loading, and at 06.30 p.m., after long distance transport. The data post-transport showed a general increase of T3, T4 and fT4 and a decrease of fT3 levels. Significant positive correlations between T3 and T4 ($p<0.05$), fT3 and fT4 ($p<0.05$) and free and total iodothyronines ($p<0.01$) after transport were showed. The results obtained could be expression of increased thyroid secretion and best utilization of fT3.Patterns of iodothyronines increased slightly post-transport, but significantly only for T4 ($p<0.02$), in "calm" subjects, while decreased in "aggressive" subjects. Then, significant lower levels of T4 ($p<0.05$) and fT4 ($p<0.001$) in "aggressive" than in calm subjects were recorded. Concerning relation to body weight, iodothyronines generally increased in all subjects after transport, except for T3 in subject with 5-8% body weight loss. Data obtained suggest that transport induces an increase of thyroid activity and a contemporaneous peripheral tissue request. However, this is more evident in “calm” calves, while aggressive” subjects are probably submitted to an increased peripheral utilization of iodothyronines.

Keywords:	iodothyronines, calves, transport
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 09
For information contact	Ester Fazio or email esterina.fazio@tin.it

Influence of sawdust distribution frequency on the motivation for dust-bathing in laying hens

Guesdon, V. and Faure, J.M.

Station de Recherches Avicoles, INRA-Centre de Tours, 37380 Nouzilly, France

In laying hens the lack of dust bathing material has been pointed out as potential source of frustration. In order to estimate the consequences of substrate deprivation on hens' welfare, motivation for dust bathing was studied in the present experiment. The principle was to test whether the supply of sawdust in hens that were previously deprived of this material would induce more dust-bathing than in hens usually bred with sawdust (rebound effect).

Four types of cages were compared.

- Standard cages S6 (6 hens/cage, 6 cages) and S5 (5 hens/cage, 6 cages).

- Enriched cages with a nest, dust-bathing box, perches and a claw-shortening : E7 (7 hens/cage, 12 cages) and E15 (15 hens/cage, 12 cages).

In standard cages birds never had access to dust-bathing material. In enriched cages sawdust was normally distributed once a week during the week preceding the tests sawdust was distributed daily in half of the enriched cages (E7d and E15d)and once week (as usual) in the other half(E7W and E15w).

Dust-bathing behaviour of four hens per cage was video-recorded and scan sampled every 2 minutes in a test cage with a deep layer of sawdust for 50 minutes per day and for 5 days.

For all treatments, the number of dust-bath taken tend to increase with the repetition of the testing procedure but the day effect is significant only for S6, S5, E15w. During the first two tests PS and MS hens showed very long latencies to dust-bath whereas hens in the four other treatments already habituated to sawdust, show short latencies even during the first test.

Rebound effect for dust bathing was shown in hens previously habituated to dust bathing material and then deprived of it. In the case when hens encounter dust bathing material for the first time, the expected rebound effect was not observed and this was due to the prevalence of neophobic reactions in hens reared without contact with sawdust.

This experiment should be repeated with longer tests so that the deprived animals can habituate to the situation and the presence sawdust.

Keywords:	hens, dust-bathing, motivation, rebound effect
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 10
For information contact	Vanessa Guesdon or email guesdon@tours.inra.fr

The Pig Mobile: a simple environmental enrichment device for growing pigs in barren pens

Guy, J.H., Whitehead, N. and Cussins, R.A.

Department of Agriculture, University of Newcastle, Newcastle upon Tyne, NE1 7RU, UK

Growing pigs are often reared in barren buildings, where thermal and physical requirements may be met, but there is little opportunity for exploration or oral manipulation. The Pig Mobile is a simple environmental enrichment device, designed to offer pigs in fully-slatted pens the opportunity for oral manipulation and exploration, without impinging on the management of the housing system.

The aim of this study was to investigate the effect of the Pig Mobile, on the behaviour of pigs reared in a fully-slatted building. The Pig Mobile is an iron cylinder, fixed to the floor, with two horizontal bars on top forming a cross. The cross rotates freely in a horizontal plane with 4 rubber dog toys suspended by chains 0.5 m above the floor. A total of 152 pigs were used, male and female (average weight 43kg), allocated to either barren (control) pens (space per pig 0.58 m2, 2 nipple drinkers) or enriched pens (as for control plus a Pig Mobile and two plastic balls on the floor) in groups of 19. They were fed ad libitum and behaviour recorded for a period of 3 weeks, using both scan (group) and focal (individual) sampling. Each pen was recorded for a total of 5 hours, between the hours of 14.00 and 17.00 h.

Pigs in enriched pens spent proportionately 0.16 of observation time engaged with the Pig Mobile and plastic balls. They spent a significantly lower proportion of observation time lying (0.33 vs. 0.57, $p<0.001$) and engaged in aggressive behaviour (0.02 vs. 0.07, $p<0.05$) compared to those in barren pens. Results from focal-pig observations confirm these findings, with more time engaged in play and exploration.

In conclusion, these results suggest that the welfare of pigs in a barren environment may have been improved by addition of the Pig Mobile and plastic balls.

Keywords:	pigs, welfare, housing systems, enrichment, behaviour
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 11
For information contact	Jonathan Guy or email j.h.guy@ncl.ac.uk

Behavioral and physiological consequences of deprivation from nightly lying in dairy cows

Hopster, H., Hermans, G.G.N., Engel, B. (1), Van der Werf, J.T.N.

Dept. Animal Sciences, Institute for Animal Science and Health, Edelhertweg 15, 8219 PH, Lelystad, The Netherlands, (1) Dept. of Quantitative Veterinary Epidemiology, Institute for Animal Science and Health, Edelhertweg 15, 8219 PH, Lelystad, The Netherlands

Housing conditions for dairy cows can result in deprivation of lying. Therefore the behavioral and physiological effects of deprivation periods with different lengths were studied.

Three groups of 10 cows were successively housed in 16 cubicles that were equipped with electronic means that identified cows and continuously recorded lying behavior. Cows were milked twice daily at 5.30 am and 5.30 pm. After one week of adaptation, cows had free access to the cubicles for one week followed by a week in which the cubicles were blocked from 11.00 pm till 5.00 am (Group1) or between 2.00 and 5.00 am (Group 3). For Group 2, cubicles were not blocked to estimate possible time effects on lying behavior. In each treatment week, morning milk (days 5-7) and blood sampled from the tail vein (day 7) just before milking were used for cortisol analysis.

Three hours of deprivation had no effect on 24-hr lying times (Depr: 765 min, Ctrl: 735 min). Cows that were deprived during 6 hrs, however, lost 106 min lying time during the first day of deprivation (Depr. 532 min, Ctrl. 638 min), but completely compensated their nightly loss from day 3 onwards. The average length of lying bouts was longer only on days with 6-hr deprivation (+ 27.9 min). No differences were found between control and deprivation weeks in milk- and plasma cortisol, in white blood cell counts and differentiation, in milk production and in somatic cell count. Behavioral observations during deprivation, however, revealed that cows deprived from lying for 6-hr seemed to enlighten their feet by shifting their bodyweight from one leg to the other, by standing with their forelegs on a heightened passageway or even by incidentally lying down on the solid concrete floor.

We conclude that cows were able to compensate for their loss of nightly lying time and that physiological signs of stress were absent. Cows, however, showed evident behavioural signs of tiredness during standing for 6 hrs but not during 3 hrs.

Keywords:	dairy cows, lying, deprivation, stress
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 12
For information contact	Hans Hopster or email h.hopster@id.wag-ur.nl

Behaviour of outdoor housed sows and piglets in single or group farrowing paddocks

Hörning, B. and Dix, K.

Department of Farm Animal Behaviour and Management, Faculty of Organic Agriculture, University of Kassel, D-37213 Witzenhausen, Germany

In outdoor farms both single or group farrowing paddocks are used. Aim of the study was to compare the behaviour of sows and piglets between these systems.

Two groups of 4 sows and 4 single fenced sows were observed in an outdoor farm. One farrowing hut was available for each sow. Piglets were weaned with 3 weeks. Behavioural observations took place during 4 weeks starting from day 5 ante partum. Observations were carried out 6 hours per day on 25 days, using different time periods between 5 a.m. and 5 p.m. Behavioural activities of sows (walking, standing, lying, sitting, rooting, grazing, eating, drinking, elimination, stone chewing, nest building, nursing) and piglets (nursing, active, lying) were recorded using scan sampling in 5 minute intervals. Social interactions between sows in group paddocks were recorded using continuous observation (sniffing, threat, chasing, pushing, biting). Data were evaluated with the SPSS package.

Comparison of systems: Most aggressions in group sows occurred during feeding. Enterings of sows in huts of others were seldom and mostly without aggression. Single housed sows grazed more than group sows. In contrast, stone chewing was more common in group sows. In group paddocks, cross-suckling occurred in few cases. No differences in any other behaviour were found between the systems.

Comparison of weeks: Aggressions were highest in the week around partum. In the 1st week p.p. lying increased markedly (while eating / grazing / rooting decreased) and decreased again in the second week. Nursing frequency decreased from the 1st to the 3rd week. Activity of piglets and time spent outside the hut increased from week 1 to week 3. Other behaviours of sows or piglets were less common and did not differ between weeks.

In conclusion, only few behaviours differed between group or single farrowing paddocks.

Keywords:	outdoor housing, farrowing paddocks, single or group housing, behaviour of sows and piglets
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 13
For information contact	Bernhard Hörning or email hoerning@wiz.uni-kassel.de

Infrared thermotracking as tool for assessing welfare: synergy of behavioural and physiological measurement

Houx, B., Baars, A.M. and Spruijt, B.M.

Ethology & Animal Welfare, Utrecht University, Yalelaan 17, 3584 CL Utrecht, The Netherlands

Infrared thermotracking is a new method, which combines infrared thermography and automated behaviour tracking. The rationale for developing this non-invasive tool is that animals confronted with severe environmental challenges (stressors) do not always show behavioural responses, while showing clear physiological responses. In previous studies thermotracking appeared useful in monitoring of (1) short-term stress-induced skin- and tail temperature changes (comparable to Stress Induced Hyperthermia); (2) long-term temperature changes (diurnal temperature rhythms); and (3) behavioural activity. Our poster reviews the thermotracking method as tool for assessing stress and welfare in freely moving rats.

Compared to standard-housed rats, enriched-housed rats showed more intense skin- and tail temperature responses to environmental challenges (e.g. the tail temperature decreased to a lower level after introduction into a novel environment; MWU: $N1=N2=12$, $p<.05$). An increase in the same stress-induced responses was also found in socially stressed (defeated) rats (N=8), as compared to control rats (N=8). Interestingly, the socially stressed rats did not differ from the control rats in their behavioural activity (e.g. locomotion).

In all experiments we found a considerable individual variation in the sharp increase of the tail temperature, after a stress-induced decrease. We have strong indications that the onset of this increase (and thus the intensity of the response) is related to the severity of the stressor, as perceived by the animal. As the surface temperature, especially the tail temperature, is mainly autonomously mediated, thermotracking is an additional indicator for autonomous responses.

In conclusion, the data show the potency of the integrated non-invasive tracking of behavioural and physiological measures as indicator for reduced welfare. The possibilities for using this thermotracking method for the monitoring of welfare in other species will be discussed.

Keywords:	Infrared thermotracking, welfare assessment , stress ,
Species:	rat
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 14
For information contact	Bart Houx or email b.b.houx@vet.uu.nl

The effect of sire line on behaviour of heifers in the maze and open-field tests

Kisac, P., Broucek, J., Flak, P., Uhrincat, M., Mihina, S., Hanus, A. and Marencak, S.

Research Institute of Animal Production Nitra, Slovakia

The aim of our work was to examine the effect of sire on the behaviour of heifers in a maze and an open-field tests.

56 Holstein heifers descended from 9 sires (BS-17, n=5; BS-19, n=11; BS-22, n=15; CLE-15, n=4; DIX-1,n=9; KLK-2,n=3; NEW-3, n=5; PEL-9, n=2; SAD-1, n=2) were kept in the same environmental conditions. At 15 weeks of age, the time to traverse a 6-unit maze (16.4x4.5 m) was determined. Feed mixture was as reward at the end. First day the passage was open to the left, second day to the right side. An open-field test was applied at three ages: 16 (A1), 28 (A2) weeks, and 18 months (A3). Animals were subjected to four 5-min tests on 2 consecutive days at each age. We used the 2-way variance analysis with repeated observations on the same individuals for evaluation of the measured values.

The average time of both maze test to exit the maze was 84.5±77 s. Sire significantly affected the time to complete the maze test ($F=5.35$, $p<0.01$). The animals after father PEL-9 needed the longest time to pass the maze during both days (174.3 s), the shortest time needed the heifers after father CLE-15 (31.6 s). In addition, there was a significant effect of day on the time to complete the maze test: on the second day of testing, calves needed more time to complete the test than on the first day (62.4±58.3 vs. 106.6±85.4 s, $F=11.71$, $p<0.01$). During the first minute in all four tests at the age A1 was the average number of grid crossings 8.1±4.6, at the A2 6.0±3.4, at the A3 17.1±7.6. Sire did not have a significant effect on the number of grid crossings. We found only differences between days at the age A1 ($F=55.53$, $p<0.01$), A2 ($F=11.91$, $p<0.01$) and A3 ($F=4.32$, $p<0.01$).

In conclusion, parental differences between heifers with respect to sire influenced the time to complete a maze test.

Keywords:	maze, open-field test, heifer, sire
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 15
For information contact	Peter Kisac or email kisac@vuzv.sk

Is rewarding necessary for heifers to choose familiar herd members in a Y-maze?

Koba, Y., Munksgaard, L.(1), Pedersen, L.J.(1) and Tanida, H.

Graduate School of Biosphere Science, Hiroshima University, 1-4-4, Kagamiyama, Higashi-Hiroshima, 739-8528, Japan, (1) Department of Animal Health and Welfare, Danish Institute of Agricultural Sciences, Research Centre Foulum, PO Box 39, 8830 Tjele, Denmark

Previous studies demonstrated that cattle have the ability to discriminate between their conspecifics, however it is not clear if they prefer familiar individuals. This study examined whether heifers prefer familiar herd members to unfamiliar individuals encountered simultaneously.

Sixteen Danish Friesian heifers, 8 old animals (360.6 ± 24.2 days old) and 8 young animals (190.1 ±14.1 days old) were used. Each age group was further divided into two experimental groups of 4 animals: Old 1, Old 2, Young 1 and Young 2. Animals in each group had been housed together in a pen for 3 weeks before the experiments. In experiment 1, animals from each group were allowed to approach a familiar pen mate or an unfamiliar non-pen mate tethered in each arm of a Y-maze (Old groups against Young groups). In experiment 2, two test animals were selected from each experimental group. The test animals were rewarded, when they chose the group of 3 pen mates against a group of 3 non-pen mates (Old 1 vs. Old 2, Young 1 vs. Young 2) in a Y-maze. For each test series, they had to make 10 choices.

In experiment 1, the animals did not show a preference for either the familiar or the unfamiliar individual. However, when tethered in the Y-maze, animals from the Young groups vocalised more when approached by an unfamiliar than a familiar animal ($p=0.02$), while this difference was not found for the animals in the Old groups. In experiment 2, four animals showed two consecutive sessions with 80 % or higher correct choices ($p<0.003$).

The heifers did not show preference toward their familiar herd members. In a Y-maze they did not voluntary choose their pen mates against non-pen mates encountered simultaneously, but some of the heifers learned to choose the group of pen mates if they were rewarded.

Keywords:	heifers, preference test, discrimination, Y-maze
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 16
For information contact	Yuki Koba or email yukikoba@hiroshima-u.ac.jp

Behavioural and adrenocortical responses to swimming deprivation in mink

Korhonen, H.T., Jauhiainen, L. and Niemelä, P.

MTT Agrifood Research Finland, Animal Production Research, FIN-69100 Kannus, Finland

This study assessed stress responses in mink denied access of swimming water for 2 and 4 weeks. Each group consisted of 12 standard yearling male mink weighing 2.5 kg on average. Each animal had free access to swimming water during 7 weeks before the actual experiment. Test period lasted for 6 weeks, in each of which representative 24 h urine samples were collected for analysis of cortisol-creatinine and corticosterone-creatinine ratios. Behaviour was monitored by 24 h video recordings.

Water loss from the pools correlated significantly with swimming frequency ($r=0.67$, $p<0.001$), head dipping ($r=0.35$, $p=0.07$) and time spent on the swimming jetty ($r=0.61$, $p<0.005$). Deprived access to swimming water was found to elevate both the cortisol-creatinine and the corticosterone-creatinine ratios in each group. The adrenocortical response was highest during the second week of deprivation. Swimming deprivation significantly ($p<0.05$) reduced the time spent inside the nestbox but increased ($p<0.05$) both locomotor activity and stationary behaviour. The amount of biting/scratching the cage tended to increase as a result of deprivation. The incidence of stereotypic behaviour showed only minor changes in respect of swimming deprivation. Swimming motivation was found to be low. The time spent swimming was from 0.1 to 0.9 min/24 h. The corresponding values for head dipping ranged from 4.1 to 10.4 min/24 h. The time spent on the swimming jetty (18-27 min/24 h) was found to be associated with swimming behaviour. No rebound response in behaviours such as swimming, head dipping or staying on the jetty occurred after deprivation ceased.

It would seem that some frustration may occur after access to swimming water is blocked. Further studies will be needed to provide insight into the function and welfare implications of swimming pools for farmed mink.

Keywords:	behavioural need, swimming, mink, deprivation
Species:	mink
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 17
For information contact	Hannu Korhonen or email hannu.t.korhonen@mtt.fi

Methodological considerations on pharmacological validation of a novel object test in piglets

Kranendonk, G., Fillerup, M., Korte, S.M. and Hopster, H.

Institute for Animal Science and Health (ID-Lelystad), Animal Welfare group, P.O. Box 65, 8200 AB, Lelystad, The Netherlands

The novel object test is commonly used in pigs to quantify individual characteristics related to anxiety. To validate this test for measuring fear in piglets, we administrated different dosages of an anxiolyticum to suppress fear. Behavioural measures of control and treated piglets were compared to determine behavioural indicators of fear.

Thirty-six piglets from nine litters were tested individually. Piglets were weighed and injected i.m. with either physiological saline, 0.4 or 0.8 mg diazepam / kg. The piglet was equipped with a heart rate monitor (Polar Vantage) and placed into a familiar testing arena. After five minutes, a blue bucket (novel object) was lowered from the ceiling. The piglet was left with the bucket for another five minutes. The behaviour of the piglet was recorded on video for further analysis.

No treatment-effects were found on parameters analysed, such as latency to touch the novel object, frequency of touching, frequency of approaching, or time spent near the bucket (F-test, $p>0.05$). Diazepam-treated animals had elevated heart rate and lower rMSSD-values (F-test, $p<0.05$), probably caused by a diazepam-induced decrease of parasympathetic nervous system activity. Marked differences between litters were found (F-test, $p<0.05$) for latency to touch the novel object, frequency of touching and number of posture changes.

Effects of diazepam on heart rate clearly showed that the lack of treatment effects on the behaviour of the piglets could not be attributed to the ineffectiveness of diazepam. Other factors should therefore be considered. First, the piglets possibly already lost their fear because they had been habituated to the arena twice before testing. Secondly, the anxiolyticum could have qualitatively affected the behaviour of piglets with different coping styles differently i.e. scared reactive piglets might otherwise stand still but approach the novel object when treated, while scared proactive piglet might originally explore the novel object but loose their interest when treated. And finally, litter-effects are considerably large and might therefore mask treatment-effects. These factors should be taken into account in future validation studies.

Keywords:	novel object test, swine, validation, anxiety
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 18
For information contact	Godelieve Kranendonk or email g.kranendonk@id.wag-ur.nl

Behavior of feeder pigs housed in deep-bedded 'hoop' structures

Lay Jr., D.C., Phelps, A. (1), Haussmann, M.F. (1) and Daniels, M.J. (2)

Agriculture Research Service-USDA, Livestock Behavior Research Unit, West Lafayette, IN USA, Iowa State University, (1) Dept. of Anim. Sci., (2) Dept. of Zoology, (3) Dept. of Statistics, Iowa State University, Ames IA, USA

Previous research in our laboratory has shown that, in comparison to total confinement housing of swine, swine raised in 'hoop' structures perform less aberrant behavior and more play behavior. However, behaviors such as agonistic interactions and belly nosing did occur in the housing systems, albeit at a much lower rate. Pigs housed in hoop structures are subjected to fluctuations in environmental temperatures and extremes in temperature can have deleterious effects on behavior. This study describes the effects that lower temperatures, in a variable environment, may have on the expression of behavior.

Therefore, behaviors such as agonistic encounters, belly nosing and bar-biting were quantified during four, 1-week periods from October to December, when temperatures averaged from 13.9 to -11.9 ^{o}C during the study period.

Effective temperatures for the animals were enhanced in the hoop structure by heat generated by the decomposing bedded pack (ranging from approximately -1.1 ^{o}C to 47 ^{o}C). The total number of agonistic and abnormal behaviors increased during lower temperatures ($p<.05$). Bar- biting increased from 14.5 ± .70 to 74 ± 31 incidences per hoop (120 pigs1)/15 min. 'Wall-sucking' increased ($p<.05$) from 11.5 ± 7.8 to 55.0 ± 4.2 incidences per hoop (120 pigs)/15 min. Other behaviors such as agonistic encounters and belly nosing did not increase over the study period ($p>.10$).

It is critical to remember that these differences in behaviors can not be attributed to temperature alone, as the pigs were gaining in age during the study period. Although some behaviors appear to occur at a greater rate during the later study periods, these rates are low. Thus further research to identify characteristics of those individuals performing aberrant behaviors may lead to strategies to optimize their well-being.

Keywords:	swine, housing, well-being
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 19
For information contact	Donald Lay or email layd@purdue.edu

On-farm monitoring of lameness in pregnant sows

Leeb, Ch., Leeb, B. (1) and Troxler, J. . (2)

Animal Welfare and Behaviour Group, Department of Clinical Veterinary Sciences, Bristol, BS40 5DU, UK, (1) II. Medical Clinic for Ruminants and Swine, Veterinary University Vienna, Veterinaerplatz 1, 1210 Vienna, Austria, (2) Institute for Animal Husbandry and Animal Welfare, Veterinary University Vienna, Veterinaerplatz 1, 1210 Vienna, Austria

European legislation demands group-housing for pregnant sows from 2013 onwards, therefore farmers may have to change their housing-systems. Lameness in pregnant sows is a serious health and welfare concern. Therefore it is necessary to monitor loose herds to identify the main risks of housing, management and animal oriented factors. An on-farm method is necessary to assess lameness, claw overgrowth and foot lesions.

A cross-sectional study of 55 herds including 1177 pregnant sows in group-housing systems was conducted in Austria. During single half-day visits to each herd, management data were recorded and the housing system was inspected. The integument was assessed as an indicator for the quality of the multifactorial relationship between animals and their environment (De Koning, 1985). Callosities and lesions on all four extremities were scored (Leeb et al, 2001) and length and lesions of claws and accessory digits were recorded. Lameness was scored as present or absent. Statistical analysis was based on farm level.

The mean lameness prevalence varied significantly ($p<0.001$) in the seven defined housing systems, 0.56% was found in deep litter systems with individual feeding-stalls and 21.64% in non-straw systems with electronic sow feeders. Lameness prevalence also varied within farms of the same system, showing the important influence of management and individual housing conditions. Significant positive correlations with lameness could be found in the mean prevalence of fat sows ($p<0.05$) and mean prevalence of overgrown claws ($p<0.001$). The mean prevalence of lameness was significantly lower in pens with an adequate amount of straw ($p<0.05$).

Scoring of lameness, foot lesions and calluses is an adequate tool for assessing housing and management of pregnant sows on farm. It is appropriate for comparing different housing systems and evaluating individual farms. The animal-based method is easy to apply in practise and health and welfare implications can be demonstrated to the farmer immediately.

Keywords:	lameness, pig welfare, assessment, group-housing
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 20
For information contact	Christine Leeb or email ch.leeb@gmx.at

Effect of different floor types in farrowing crates on sow welfare

Lewis, E.(1), Boyle, L., Lynch, B., Brophy, P.(1) and O' Doherty, J. (1)

Pig Husbandry Department, Moorepark Research Centre, Fermoy, Co. Cork, Ireland, (1) Department of Animal Science and Production, University College Dublin, Belfield, Dublin, Ireland

The use of fully slatted flooring in farrowing crates can have a detrimental impact on aspects of sow health and welfare. However, there are benefits associated with slatted flooring in terms of hygiene and reduced labour requirements. The objective of this study was to evaluate the effect of four types of slatted flooring on the behaviour and welfare of sows in farrowing crates.

At day 110 of gestation, 69 multiparous sows were introduced to crates furnished with 4 floors. The area under the sow had either conventional steel Tri-bar® [T] (n=20), cast iron [C] (n=16), plastic coated cast iron [P] (n=15) or an alternative steel Tri-bar® [A] (n=18). Skin lesions at 58 locations (29x2) on the body were scored 0 to 6 according to severity on days 109 and 111 and 1, 8, 15, 21 and 28 days post-partum (p.p.) to yield a total lesion score. A severe lesion score for each sow was calculated by addition of all scores greater than 2. Limb lesion scores were calculated by addition of scores of both the hind and front limbs. Sow behaviour was recorded for 9hrs on day 110 and 1 and 14 days p.p. by scan sampling at 10min intervals.

Total lesion scores did not differ between treatments ($p>0.05$). On days 8, 15 and 21 [T] sows had higher hind limb scores than sows in the other treatments ($p<0.05$). They also had higher severe scores on d15 ($p<0.05$). On d14 [T] sows were more frequently observed dog-sitting ($p<0.05$). There were no other effects of floor type on sow postural behaviour ($p>0.05$).

Damage to the skin of the hind limbs and the severity of lesions found on sows housed on T floors indicates that they had greater difficulty manoeuvring on these floors possibly because they were more slippery. This is supported by the finding that T sows were more frequently observed dog-sitting, which could reflect a reluctance to change posture from lying to standing. Hence, this floor should not be recommended for use in farrowing crates.

Keywords:	sow, welfare, farrowing crate, floors
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 21
For information contact	Eva Lewis or email lboyle@moorepark.teagasc.ie

The effect of automatic milking systems compared to tie stall system on the human-animal interaction in dairy cows

Loberg, J. and Lidfors, L.

Department of Animal Environment and Health, Swedish University of Agricultural Sciences, P.O. Box 234, SE-532 23 Skara, Sweden

The aim of the study was to investigate if there was a difference in behavioural and heart rate reactions towards human handling in dairy cows housed in automatic milking systems (AMS) or in tied up systems and between primiparous and multiparous cows.

The study was carried out on six private dairy farms, three had tied up systems with conventional milking and three had loose housing with cubicles and AMS. Twenty cows, ten primiparous and ten multiparous cows were used on each farm. Behaviour and heart rate were measured on the cows when they were moved to a test pen (10sqm), in the test pen and from the test pen. In the test pen the cow was alone for five minutes, then an unknown person entered in one corner and stood quiet, talked to the cow and approached the cow for one minute each. When approaching the cow the distance between the person and the cow was measured when the cow stepped away from the person (flight distance). Finally the person tried to move the cow in (max. 2.5 minutes) the test pen and hold her in a corner for thirty seconds.

More cows in the tied up systems accepted to be touched by a human than in the AMS ($p<0.05$, GLM). They also had a shorter flight distance ($p<0.05$). There was a negative correlation between the time each farmer reported to spend with the cows and flight distance ($p<0.05$, Spearman). Cows that were more difficult to handle when moved to the test pen also had higher heart rate ($p<0.001$, GLM). The primiparous cows walked more ($p<0.05$) and had a higher heart rate ($p<0.05$) than multiparous cows.

We conclude that cows on the tied up farms were easier to approach touch than cows on the farms with AMS.

Keywords:	human-animal interaction, cattle, heart rate, AMS
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 22
For information contact	Johan Loberg or email Johan.Loberg@hmh.slu.se

Dustbathing behaviour of caged laying hens on novel floor types

Merrill, R.J.N. and Nicol, C.J.

Division of Animal Health and Husbandry, Department of Clinical Veterinary science, Langford House, Langford, Bristol, BS40 5DU, UK

From 2012 all conventional battery cages for laying hens will be banned under European Directive 1999/74/EC. Furnished cages, which include a perch, nest area and a pecking and scratching area will not be banned and have certain welfare, hygiene and practical advantages over other systems of egg production. However, no furnished cage yet exists that allows the full expression of dustbathing behaviour. Even when a pecking and scratching area is provided in a cage, most dustbathing occurs on the wire floor as sham dustbathing. This is a potential welfare problem as sham dustbathing is not an adequate motivational substitute for real dustbathing.

The aim of this study was to determine whether novel cage floor types could stimulate a full expression of dustbathing behaviour, equivalent to that seen on litter. 144 hens were housed in pairs and allocated to pens that differed only in the floor type provided and videorecorded over three four hour sessions. Floor types were conventional wire, woodshavings litter, wire coated with string or perforated rubber.

The results of this study showed that birds housed on litter or rubber performed fewer bouts of dustbathing than those on wire and string ($F=3.130$, $df=3$, $p<0.05$). However, bouts performed by birds housed on litter were longer than those on the three other floor types ($F=4.072$, $df=3$, $p<0.05$). Overall, birds housed on litter or string showed a greater total duration of dustbathing than those housed on rubber ($F=2.872$, $df=3$, $p<0.05$). Following foot and feather condition scoring, it was found that birds housed on rubber and litter had poorer foot and feather condition than those housed on wire or string. Although dustbathing was influenced by floor type, none of the novel floors produced a full expression of dustbathing behaviour. Work is continuing to identify a floor type that can be included in furnished cages.

Keywords:	Laying hens, dustbathing, furnished cages, novel floors
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 23
For information contact	Ralph Merrill or email ralph.merrill@bristol.ac.uk

The effect of lameness treatment on daily activity levels, daily milk yield and locomotion of dairy cattle

O'Callaghan, K.A., Downham, D.Y. (1), Cripps, P.J. and Murray, R.D.

Department of Veterinary Clinical Science and Animal Husbandry, University of Liverpool, Leahurst, Chester High Road, Neston, South Wirral L64 5TE., (1) Mathematical Sciences, University of Liverpool, L69 3BX, UK

Lameness in cattle is a well-recognised financial drain on the dairy industry and results in unacceptable welfare of the affected animal. Pain and discomfort caused by lameness encourage cattle to alter their normal behaviour patterns to reduce time spent walking or standing on diseased feet, this is frequently overlooked during treatment. This fundamental change to behaviour can have serious implications for the welfare and long term survival of the lame cow. Reduced time spent eating has obvious implications for body condition and productivity, in addition reduced interaction time with herd mates can result in lowered status in the dominance hierarchy.

The study objective was to examine the effect of different lameness treatments, which alleviate pain, on locomotion, daily activity level and milk production.

Individual daily activity levels and daily milk yields of 345 dairy cattle in a single herd were examined and profiled. Pedometers fitted to each cow recorded daily activity levels. Milk yield per cow was automatically recorded daily. Lame cattle were identified by locomotion scoring according to a five point numerical rating scale. At treatment the predominant foot lesion was classified as either chronic (claw horn lesions) or acute (skin lesions). All cows were foot trimmed according to the method devised by Toussaint Raven, then randomly allocated to treatments T1=controls (no further treatment); T2=administration of a non-steroidal anti-inflammatory drug; T3=application of a foot block. Data was analysed using SAS and Minitab.

Generalised linear models were used to fit the activity data, their fit was assessed using residual plots. There were significant correlations [Pearson correlation] between daily activity levels and locomotion scores ($p<0.001$) and milk yield ($p<0.001$). The effect of treatment will be discussed relative to the lesion characteristics and site. The outcome of this work should provide a better understanding of how lesions and their treatment impact on the welfare and behaviour of lame cattle.

The authors would like to thank the RSPCA, Clayley Hall Farm staff and Merial Animal Health for financial assistance and support associated with this work.

Keywords:	dairy cattle, lameness, pain, treatment, foot block, locomotion, daily activity, milk yield, pedometer
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 24
For information contact	Karen O'Callaghan or email k.a.ocallaghan@liv.ac.uk

Prolificacy and welfare in pig: fostering and early weaning of supernumerary piglets

Orgeur, P., Colson, V., Saez, E., Le Roux, N. (1), Salaün, C. (1), Le Dividich, J. (2), Venturi, E. and Lévy, F.

Physiologie de la Reproduction et des Comportements, UMR 6073 INRA-CNRS-Université, 37380 Nouzilly, France, (1) Chambre d'Agriculture de Bretagne, E.D.E. du Finistère, Station Expérimentale de Guernevez, 29520 St-Goazec, France, (2) Unité Mixte de Recherches sur le Veau et le Porc, Station de Recherches Porcines, INRA, 35590 St-Gilles, France

Genetic improvement in prolificacy may be limited by the nursing capacities of sows. Two trials were conducted to examine (1) nursing behaviour of large litters when the number of piglets exceeded the number of functional teats and (2) the effects of fostering and early weaning of supernumerary piglets on their behaviour and performance.

(1) Nine litters of 14-17 piglets (S), raised by sows with a maximum of 16 functional teats, were compared to 8 litters of 11-12 piglets (C1), with a maximum of 15 functional teats. The first suckings, and at least 5 suckings per day, were observed during the first 15 days post partum. (2) Eighteen litters were fostered at 24-36h after birth, onto a nursing sow whose own young were weaned at 3 weeks, and weaned one week later (FW). They were compared to 18 litters nursed by their mother (C2). Mother-young behaviour and piglets' growth were examined for 3 weeks.

(1) The first colostrum ingestion was significantly delayed in S compared with C1 piglets ($p<0.05$). Greater competition at the udder in S piglets induced significantly more fighting $p<0.05$ on d7, 8, 11, 12, 14; $p<0.01$ on d9, 13), more nursing failure ($p<0.05$) and lower teat fidelity ($p<0.01$). A great heterogeneity of weight within and between litters, and higher mortality ($p<0.05$) were observed in S than in C1 piglets. (2) In FW, sows nursed the new piglets within 5h following their introduction. Changes in piglets' behaviour were observed on the day of fostering (more vocalizations and more piglets in standing position: $p<0.001$ and $p<0.01$, respectively). Growth rate was also affected ($p<0.05$). Early weaning induced more lasting behavioural perturbations (belly-nosing: $p<0.01$ from d8 to d20; body contact: $p<0.001$ from d7 to d20) and a greater decrease on growth rate ($p<0.01$ on d27), compared to C2.

Underfeeding and behavioural disturbances in large litters are contrary to welfare as defined by Farm Animal Welfare Council. Fostering and early weaning of supernumerary piglets enhance survival. In spite of a great adaptation capacity, this strategy induces behavioural disturbances. Therefore, it is recommended only in exceptional situations.

Keywords:	piglet, behaviour, fostering, weaning, welfare, growth rate
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 25
For information contact	Pierre Orgeur or email orgeur@tours.inra.fr

Provision of space and not substrate facilitates maternal behaviour in primiparous sows

Reed, B.T., Jarvis, S. (1), Lawrence, A.B. (1), Calvert, S.K. (1) and Stevenson, J.(1)

Institute of Ecology and Resource Management, University of Edinburgh, West Mains Road, Edinburgh, EH9 3JG, UK, (1) Animal Behavioural Sciences Department, Animal Biology Division, SAC-Edinburgh, West Mains Road, Edinburgh, EH9 3JG, UK

This study examined the impact of the provision of space and substrate on the performance of maternal behaviour of gilts (primiparous sows), physiological indicators of stress and the progress of parturition. At 5 days before expected farrowing, 34 catheterised gilts were placed in one of four farrowing treatments; crate without straw (C, n=8), crate with straw (CS, n=9), pen without straw (P, n=9), or pen with straw (PS, n=8). Behavioural observations and blood samples were collected during the eight hours after the birth of the first piglet (BFP).

Overall, gilts were more active in the first two hours from BFP before becoming inactive. However this temporal pattern of activity was more pronounced in the penned gilts which performed higher levels of standing/walking during the first 2 hours than the crated gilts ($F_{7,184}=2.14$, $p<0.05$). Crated gilts were observed to spend longer sitting ($F_{1,30}=6.94$, $p<0.05$) throughout. Straw provision did not alter gilt behaviour, but did alter piglet behaviour, with piglets being born into environments with no straw, spending more time at the udder ($F_{1,30}=8.68$, $p<0.01$). The provision of straw increased the length of parturition ($F_{1,33}=4.82$, $p<0.05$) but this did not have detrimental effects on piglet survival, and was not reflected in circulatory oxytocin concentrations. Plasma cortisol was unaffected by space or substrate, however plasma ACTH tended to be highest in C gilts during the second hour of parturition ($F_{1,29}=3.25$, $p=0.08$).

In conclusion it appears that the provision of space, irrespective of straw availability, facilitates the performance of maternal behaviour that we think more closely resembles that performed by free-ranging sows.

Keywords:	pig, parturition, environment, maternal behaviour, stress
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 26
For information contact	Barney Reed or email s.jarvis@ed.sac.ac.uk

Effect of environmental enrichment on the behaviour and salivary cortisol of piglets weaned at 14d of age

Rodarte, L.F., Valdez, R.(1), Romano, M.(1) and Galindo, F.

Departamento de Etología y Fauna Silvestre, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México, (1) Departamento de Fisiología, Biofísica y Neurociencias, Centro de Investigaciones Avanzadas, Instituto Politécnico Nacional, Mexico

Early weaning in piglets is an increasingly common practice, however this management procedure can relate to serious welfare problems. The aim of this study was to assess the effect of environmental enrichment on the welfare of piglets weaned at 14d of age.

A total of 112 hybrid piglets divided into four treatments were used. Control (T1), barrier (T2), ropes and tires (T3) combination of T2 and T3 and (T4). The pigs were observed for 200h using a combination of focal and scan samplings. In addition, three saliva samples were obtained from half of the piglets in order to determine salivary cortisol (RIA). According to the saliva samples, the study was divided in three time periods. The variables compared between treatments and periods were the proportion of time in maintenance behaviours (TM), the frequencies of aggression (FA), and of belly nosing (FN), as well as the reactivity latency to human presence (RL).

Average cortisol levels were also compared. Daily weight gain (DWG) was considered in the four treatments. FA, FN and RL were significantly higher in T1 ($p<0.05$). No differences were found in the average salivary cortisol levels between treatments. With respect to the comparison between periods the RL significantly decreased in all treatments ($p<0.05$). The FA decreased in T3 and T4 ($p<0.05$). A difference between cortisol levels from the second and third sampling was found in all treatments. In T1 and T2 average cortisol levels increased from the second to the third samplings, while in T3 and T4, cortisol levels decreased in the third sampling with respect to the second sampling ($p<0.05$). T4 had the higher DWG ($p<0.05$).

Environmental enrichment in early weaned piglets decreases the incidence of behaviour abnormalities and may be having a positive effect on adrenal activity of growing piglets.

Keywords:	environmental enrichment, behaviour, salivary cortisol, piglet, early weaning, human-animal interaction
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 27
For information contact	Luis Felipe Rodarte or email rodarte@servidor.unam.mx

Learning ability and fearfulness in broilers kept in barren or enriched housing

Schulze Westerath, H. (2), Knierim, U. (1) and Sachser, N.

University of Muenster, Institute of Neuro and Behavioural Biology, Badestrasse 9, D-48149 Muenster, Germany, (1) School of Veterinary Medicine Hannover, Institute of Animal Hygiene, Welfare and Behaviour of Farm Animals, Buenteweg 17 p, D-30559 Hannover, Germany, (2) current address: Swiss Federal Veterinary Office, Centre for proper housing of ruminants and pigs, FAT, CH-8356 Taenikon, Switzerland

Broilers are typically housed in barren environments that may impair the bird's adaptability to environmental change without undue fear. Learning ability and fearfulness were therefore chosen as animal welfare indicators, and the effect of environmental enrichment on them was investigated.

In each of three replicates two 9 m? littered pens were each populated with 106 mixed sex broilers. One pen was enriched with an electrical brooder, hay nets and two additionally illuminated areas with sand and loose straw, the other remained barren. Learning ability of altogether 37 "barren" and 35 "enriched" broilers was investigated six times in operant conditioning tests (triple choice situation, corrected choice mode) between day 27 and 37. At days 14, 21, 28 and 35, a tonic immobility (TI) test was carried out with altogether 55 completely test naive animals per housing condition and test day, with the duration of the TI serving as an indicator of fearfulness.

In the conditioning test, "enriched" and "barren" broilers merely differed in one session in the percentage of faultless trials (barren: 81 %, n=29; enriched: 87 %, n=31; $p<0.01$, U-Test) and in another session in the average number of errors (barren: 2.5, n=28, enriched: 2.0, n=31; $p<0,05$; U-Test). Only at day 14, "enriched" chickens showed a longer TI than "barren" birds (76 s vs. 43 s; $p<0,05$; U-Test).

The lack of consistent differences indicates that the enrichment was insufficient or unsuitable to improve welfare with respect to adaptability and fearfulness. The high growth rate of current broiler lines may have played a limiting role in this. Differences were possibly also reduced by the experimental conditions, that included for welfare reasons a lower stocking density, higher light levels and better litter quality than commercially usual, and involved a frequent presence of humans and visibility of the enriched pen for the "barren" broilers.

This work was funded by the H. Wilhelm Schaumann Foundation.

Keywords:	broiler, environmental enrichment, learning ability, tonic immobility
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 28
For information contact	Heike Schulze Westerath or email Heike.Westerath@fat.admin.ch

Effect of supplementary ultraviolet lighting on the behaviour and circulating corticosterone of Japanese quail

Smith, E.L., Greenwood, V.J., Goldsmith, A.R. and Cuthill, I.C.

Centre for Behavioural Biology, School of Biological Sciences, University of Bristol, Woodland Road, Bristol, BS8 1UG, UK

Most birds have visual sensitivity to ultraviolet (UV) wavelengths, and it appears that this sensitivity plays a part in their colour vision. Many birds have been found to use UV cues in visually mediated behaviour, such as intraspecific signalling and foraging. Artificial lighting is normally deficient in UV wavelengths, and there is some evidence to suggest that there may be welfare implications for captive birds kept under such lighting (Sherwin & Devereux, 1999; Maddocks et al, 2001). We compared the behaviour (measures of activity, aggression, and feeding) and blood plasma corticosterone levels of Japanese quail chicks (Coturnix coturnix japonica) reared in UV deficient conditions with those of chicks reared with supplementary UV. We predicted that aggression and corticosterone would be higher in UV deficient conditions. However, contrary to predictions, there was no significant measurable difference in behaviour, body mass or size between the two treatments, and the levels of plasma corticosterone in birds of both groups were so low as to be barely detectable. These results suggest that rearing in UV deficient conditions does not engender significant stress in quail.

Sherwin, C.M. and Devereux, C.L.(1999). Preliminary investigations of ultraviolet-induced markings on domestic turkey chicks and a possible role in injurious pecking. British Poultry Science, 40, 429-433

Maddocks, S.A., Cuthill, I.C., Goldsmith, A.R. and Sherwin, C.M.(2001). Behavioural and physiological effects of absence of ultraviolet wavelengths for domestic chicks. Animal Behaviour, 62, 1013-1019

Keywords:	ultraviolet, stress, welfare, corticosterone
Species:	quail
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 29
For information contact	Emma Smith or email emma.smith@bristol.ac.uk

Pros and cons of different evaluation methods for flooring systems in cowsheds

Stefanowska, J. and Metz, J.H.M. (1)

Institute of Agricultural and Environmental Engineering (IMAG), 6700 AA Wageningen, P.O. Box 43, the Netherlands, (1) Agricultural University, Farm Technology Group, 6700 AA Wageningen, P.O. Box 43, the Netherlands

Because of the concern about the welfare of farm animals, the evaluating of existing housing systems and the development of new ones should be based on the reactions of the animals themselves. We carried out, using different methods, 5 studies on floors for cows and calves because the floors are considered a main reason of leg problems and they can influence behaviour detrimentally.

The daily time budget of 12 cows kept on the grooved floor was generally not different from 12 cows kept on the slatted floor, however after switching between floors, the cows that came back to the slatted floor were more active.

In the first preference test, in which 16 cows had free access to two compartments (each with 16 cubicles and one concentrate dispenser, but different floors), it appeared that the cows reacted more to the two concentrate dispensers and extra space for lying than to the floors.

In the second preference test, in which calves were kept on two floors in a single pen, it was the spot where the milk was supplied that interacted with the calves' floor choice ($p<0.01$).

The follow-up study of the behaviour of 15 cows before and after the floor was changed revealed less aggression and less movement (both $p<0.001$) on the new floor, however the time related effects could not be excluded.

In last study, during direct observation on interactions between the cows and the manure scraper, cows interrupted eating to pass over the moving scraper, however the effect of the manure scraper in the lying area was difficult to estimate.

All these methods had positive, but also confusing and unexpected facets. We think that our studies gave a clearer indication of how the animals experience their surroundings and that evaluation of flooring systems by the animals themselves is very useful.

Keywords:	floor, cattle, cowshed, housing system, evaluation, methodology
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 30
For information contact	Joanna Stefanowska or email j.stefanowska@imag.wag-ur.nl

Dominance status in beef cattle: does it affect aggressivity?

Stehulová, I. and Spinka, M.

Ethology Group, Institute of Animal Production, Prátelství 815, 10400 Prague-Uhríneves, Czech Republic

The aim of our observations was to elucidate the relationship between beef cattle dominance status, its stability, and the frequency and intensity of agonistic behaviour.

We examined three hypotheses: A. High dominance status is connected with less frequent and/or involvement in agonistic behaviour; B. The more animals in a pair differ in dominance status, the less frequent/intensive will be their interactions; C. Pairs in which the direction of dominance status has changed between two years will have more frequent/intensive agonistic interactions.

The observations were performed during 1999, 2000 and 2001 (last two months before the calving season) in a herd of approx. 40 female Gasconne cattle. The number of observed dominance interactions was about 750 per season. The dominance status of each animal was calculated as DI=D/(D+S), where D=number of relationships in which the animal was dominant and S=number of relationships in which she was subordinate. Two intensities of agonistic behaviour were distinguished: but and threat.

We found some evidence for hypothesis A: In years 2000 and 2001, cows with higher dominance index were less often involved in agonistic interactions (R_s=-0.36, $p<0.001$ and R_s=-0.51, $p<0.001$). Hypothesis B was also partially supported because pairs with large differences in dominance index had somewhat less frequent interactions in 2000 and 2001 (R_s=-0.16, $p<0.001$ and R_s=-0.25, $p<0.001$) and had lower percentage of buts in their interactions (R_s=-0.47, $p<0.01$) in 2001. Finally, hypothesis C was strongly supported because pairs which reverted their dominance relationships since the previous season displayed much higher percentage of buts than those that were unchanged (82% vs. 50%, Student t-test, $p<0.01$ in 2000; 92% vs. 50%, $p<0.0001$ in 2001).

We conclude that cows which are low in hierarchy, close in status to their opponent, and which experienced a change in dominance relationship with their opponent, are inclined to more frequent and/or more intensive involvement in agonistic interactions.

Keywords:	beef cattle, social behaviour, hierarchy
Species:	cattle
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 31
For information contact	Ilona Stehulová or email Ilona.stehulova@atlas.cz

Evidence for maternal selective behavior recovery in goats following two years of anosmia

Terrazas, A., Hernandez, H., Serafín, N., Jacinto, G. (1) and Poindron. P.

Instituto de Neurobiología, UNAM-UAQ, AP 1-1147, QUERETARO 76001. QRO. México, (1) Universidad Autónoma de Querétaro, México

In ewes and goats, prepartum anosmia prevents the establishment of the maternal selective bonding that normally is established through the learning of the neonate's individual odour. Although they may last for more than one lactation, the long-term effects of anosmia have never been analysed.

In the present study we tested maternal selectivity in two separated groups of 3-4 years old multiparous goats (intact and anosmic, n=10 and 8 respectively), over the first month postpartum. Anosmia had been performed two years before the study. At each test, mothers were tested separately for 5 min. with their own and an alien kid from each group. Anosmia was verified by a test of food preference: no anosmic females showed discrimination, whereas all the intact females did so. The intact mothers showed selective nursing in all the tests performed at 4hrs and every following 7 days thereafter.

At 4 hours postpartum, the anosmic mothers did not differ in the acceptance at the udder of their own vs. the alien kid. However, they were more aggressive towards the alien kid ($p=0.04$), and showed a tendency to reject it more at the udder ($p=0.09$). In all the following tests the anosmic goats showed more acceptance at the udder and longer durations of nursing for their own kid, and more aggressive behavior towards the alien kid ($p=0.05$). Although goats recently made anosmic were not studied in the present experiment, our results are at variation with previous findings concerning the effects of anosmia in goats.

We concluded that long term anosmia (> 2 years) is not associated with a permanent loss of maternal selectivity in this species, indicating that in goats visual and/or acoustic cues can compensate for the loss of olfactory information.

With support of Universidad Autónoma de Querétaro.

Keywords:	goat, maternal behaviour, selective behaviour, anosmia
Species:	goat
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 32
For information contact	Angelica Terrazas or email garciate@servidor.unam.mx

Do family group housing systems improve the welfare of farmed mink?

Vinke, C.M.(1), Baars, A. (1), Spruijt, B.M. (1)(2) and Ruis, M.

Research Institute for Animal Husbandry, P.O. Box 2176, 8203 AD Lelystad, The Netherlands, (1) Department of Animals & Society, Faculty of Veterinary Sciences, Utrecht University, Yalelaan 17, 3584 CL, Utrecht, The Netherlands, (2) Section Ethology, Department of Animal Husbandry, Wageningen University, P.O. Box 338, 6700 AH, Wageningen, The Netherlands

Farmed mink are known for having behavioural disorders due to their barren environment (e.g. Mason 1993, 1994; Vinke 2002). The objective of this pilot was to compare aspects of welfare in three housing systems, differing in cage enrichment and social structure. Incidences of behavioural disorders and post mortem criteria were studied as indicators for impaired welfare.

Twelve mink families were raised and housed in an enriched family system (e.g. 2-floors, platforms, chewing material, running wheel, water bowl) (E), and twelve families in a barren family system (N) (Mean # pups per family = 6,7 ± 0,4 SE). Seven female juveniles were housed standard in male-female pairs (P). All E-, N- and P-subjects were observed for stereotypies at the age of 26 weeks. At 28 weeks of age a post mortem control was carried on one juvenile female (randomly selected from each experimental family), for tail-biting, skin lesions, stomach ulceration and weights of liver, adrenals and pituitary.

None of the subjects showed stereotypical behaviour at the age of 26 weeks. No significant differences were found between E- and N-subjects and P-subjects for body weights, tail biting, skin penetrations, the number of stomach ulcers and the weights of liver and pituitary. An overall significant difference was found for adrenal weights (Kruskal-Wallis: Chi-squared=12.13; DF=2; N1,2,3=9,11,7; $p<.01$), whereby E- and N-subjects had higher adrenal weights than P-subjects (Mann-Whitney U Test: $U>.00$; N1,2,3=9,11,7; $p<.05$).

Mink females housed in E- and N-systems had higher adrenal weights than females in P-systems. High adrenal weights possibly indicate impaired welfare and more precise analyses will be carried out. So far, the absence of stereotyped behaviours and the higher adrenal weights suggest -without discussing the possible enriching effects of companions- that group housing of solitaire species like mink, should be considered with caution.

Keywords:	enrichment, farmed mink, housing, physiology, welfare
Species:	mink
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 33
For information contact	Claudia Vinke or email C.M.Vinke@las.vet.uu.nl

Influence of age at weaning on the behaviour of piglets raised outdoors

Wolf, F.M., Hötzel, M.J., Teixeira, D.L., Egert, R., Coimbra, P.A.D., Dinon, P.S.L. and Pinheiro Machado, L.C.

LETA - Laboratório de etologia Aplicada, Universidade Federal de Santa Catarina, Rodovia Admar Gonzaga, 1346, Itacorubi, Florianópolis, SC, Brasil

Age at weaning is known to affect the behaviour of piglets weaned in conventional confined environments. The adaptation of piglets to this stressful event has not been examined in detail in outdoor systems. The aim of this study was to compare the behaviour of piglets weaned at 3 or 4 weeks, two ages often used in outdoor systems.

The piglets used in the study were raised outdoors in a communal paddock during lactation. Groups of four piglets from different litters were weaned into 50 m2 outdoor pens at the age of approximately 21 (W3) or 31 days (W4) and offered weaning diets ad libitum. Their behaviour was recorded by direct visual observation during four consecutive days after weaning (d1-d4) and at 40 and 60 days of age. Data were analysed by repeated measures ANOVA (n=13 groups/treatment).

Compared to W4 piglets, W3 piglets showed a higher frequency of escape attempts on d1 ($p<0.05$) vocalised more during d1 and d2 ($p<0.02$) and walked longer during the d1-d4 ($p<0.01$). Oral/nasal behaviours (belly-nosing, nosing and biting) were also more frequent in W3 piglets ($p<0.03$) and increased steadily from d1 to d4. Feeding events, on the other hand, were more frequent in W4 piglets from d1 to d3 ($p<0.001$). On d3 and d4 W4 piglets spent more time interacting with penmates (playing and fighting; $p<0.001$). No important differences between treatments were observed on days 40 and 60. As found in confined environments, age at weaning affected the behaviour of piglets raised on the outdoors system.

Data indicate that weaning may be more stressful for the piglets at 3 than at 4 weeks of age, although these effects were temporary. However, if piglet welfare is to be addressed properly in outdoor systems, the short term consequences of early weaning should not be ignored.

Keywords:	weaning, piglet, outdoor system, age, behaviour
Species:	pig
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 34
For information contact	Fernando Wolf or email mjhotzel@cca.ufsc.br

The use of free range area during rearing and laying by hens of different genetic strains

Zeltner, E. and Hirt, H.

Research Institute of Organic Agriculture (FiBL), Division of Animal Husbandry and Breeding, Ackerstrasse, 5070 Frick, Switzerland

Genetic strains of laying hens differ in the use of free range area and feather pecking. This indicates the possibility of breeding for a laying hen that is better adapted to the upcoming extensive husbandry systems and can better manage to live in these. We studied free range behaviour of 3 genetic strains to see if differences found during rearing stay the same during the laying period.

In one group of 2000 hens of 3 genetic strains -ISA Brown (BR), ISA Black (BL), LSL White (WH)- we collected data during rearing and laying period. The use of the free range area, feather pecking, weight, plumage condition, injuries, fear and foraging behaviour was recorded. Additionally the endoparasitic pressure was determined by analysing the infectious stages in the excrements.

There was no difference in the use of the hen run during rearing in our descriptive study. But during laying 40.0% of BL were outside compared to 32.8% BR and 27.6% WH. The frequency of feather pecking changed from WH during rearing to BL during laying as the most frequent feather peckers (feather pecking interactions per 30 minutes per 50 hens: rearing; WH=11.35, BR=7.60, BL=4.27, laying; WH=4.15, BR=8.50, BL=9.99). A similar change was in the plumage condition. During both, rearing and laying period, BR went furthest in the free range and WH showed the least fear behaviour. The excrements of the 3 hybrids had no relevant parasitic load.

In respect to endoparasitic pressure, rearing in a free range system was no problem. We didn't find a direct link between behaviour during rearing and laying period. Each hybrid of our investigation managed best to live in free range in a different aspect. This indicates that for free range systems we need a new hybrid with a mixture of positive features from different existing lines.

Keywords:	laying hens, genetic strain, free range
Species:	chicken
Session, type, nr	*Behaviour and welfare assessment in farm animals, Poster* 35
For information contact	Esther Zeltner or email esther.zeltner@fibl.ch

Criteria for assessment of slaughter methods of eel (Anguilla anguilla) and African catfish (Clarias gariepinus)

Lambooij, E., Van de Vis, J.W. (1), Kloosterboer, R.J. (1), Morzel, M. (1), Gerritzen, M.A. and Pieterse, C.

Institute for Animal Science and Health (ID-Lelystad), P.O. Box 65, 8200 AB Lelystad, The Netherlands, (1) The Netherlands Institute for Fisheries Research (RIVO), P.O. Box 68, 1970 AB IJmuiden, The Netherlands

Ethical aspects concerning food production, such as protection of the environment and animal welfare, are gaining importance. A slaughter method is considered to be humane when unconsciousness is induced immediately prior to killing and lasts until death. When unconsciousness is not immediate, it should be applied without avoidable stress. Methods to assess unconsciousness in fish are available for evaluation of stunning procedures. However these methods have been used for fish in only a few cases.

The objective of this study was to establish criteria to evaluate the state and duration of unconsciousness in eel (Anguilla anguilla) and African catfish (Clarias gariepinus) after live chilling, electrical stunning and applying captive needle stunning (i.e. injection air under pressure in the brains). Electroencephalographic measurements (EEG), electrocardiographic measurements (ECG), observation of responses to a stimulus and changes in behaviour were performed for assessment of the stunning methods.

Based on obtained results the following criteria for induction of unconsciousness without avoidable stress in eel and African catfish could be established.

1. Electrical stunning is immediate when a general epileptiform insult is recorded on the EEG. On the ECG fibrillation and extra systolea are present. Behavioural observation reveals two phases: 1 tonic/clonic cramps followed by 2 an exhaustion phase.

2. Mechanical stunning is immediate when theta and delta waves appear on the EEG. The ECG reveals a decreased heart rate and an ischaemic configuration. With respect to behaviour clonic cramps are observed and pain responses are absent.

3. In case of live chilling a slow change in amplitude and frequency of the traces on the EEG is observed in combination with a slowly disappearing pain response. On basis of observation of behaviour and registration of the ECG it can be established whether stress may occur during the period of consciousness.

Keywords:	
Species:	fish
Session, type, nr	*Aquaculture and Fish, Poster* 36
For information contact	Bert Lambooij or email e.lambooij@id.wag-ur.nl

Do laboratory rats choose to spend time together ?

Talling, J.C., Van Driel, K.S. and Inglis, I.R.

Animal Welfare Team, Central Science Laboratory, Sand Hutton, York, YO41 1LZ, UK

Group housing for laboratory rats is generally thought of to be the ideal. However, this has been based on differences in behavioural repertoires between single and group housed animals. The aim of this study was to determine how much time rats spent together in a free choice paradigm.

Six groups of five rats, with no previous contact, and previously housed in groups of three, were placed into a large arena for seven days. The arena (165x140cm) contained six plastic bottomed, grid topped cages (53x39x27cm) evenly spaced around the edges. Rats could enter and leave the cages as they pleased. Each cage contained a hopper filled with rat chow pellets, a water bottle, an aspen block, two cardboard urinal bottles and shavings covered the base of the cage. The location of the rats within the arena was determined once every ten minutes for the first and last 24 hours that the rats were in the arena.

The rats spent significantly more time in groups of three, four and five and less time in groups of one and two than if they had randomly distributed themselves between the cages (GLM repeated measures, $F=8.19$, $df=4$, $p=0.009$). The rats tended to aggregate more during the light phase. Overall use of urinal bottles was low (one rat per observation), but tended to be higher during the light phase.

The results show that rats prefer to aggregate in groups of three and above. This supports the studies looking at time budget and hormone differences between single and group housed rats.

Keywords:	group size, rats, preference
Species:	rat
Session, type, nr	*Free papers, Poster* 37
For information contact	Ian Inglis or email j.talling@csl.gov.uk

The relationships between social dominance in female goats and response to male effect

Álvarez, L., Martin, G. (1), Galindo, F. (2) and Zarco, L. (3)

Centro de Enseñanza Práctica e Investigación en Producción y Salud Animal, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México, (1) Faculty of Agriculture (Animal Science), The University of Western Australia, (2) Department of Ethology, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México, (3) Department of Animal Reproduction, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México

In anestric goats the sudden contact with a male results in ovulation of most of the females in a group. A study was carried out to assess the influence of social rank on the time of ovulation after exposure to a male.

45 goats were observed for 96h, 48h without the male and 48h with the male (2 males were alternated every other day). Behaviour sampling was used in both periods to record all agonistic interactions. An index of success (SI) based on the ability to displace other individuals was calculated and three ranking groups were formed, low (SI=0.0-0.33), medium (SI=0.34-0.66) and high rank (SI=0.67-1). When the goats were exposed to the male, scan sampling was used to record every 5 min the position of each goat with respect to the male. An index of association (AI) with the male was calculated for each goat. The time of ovulation was determined by blood progesterone of samples taken daily during a period of 30 days after the introduction of the male. Kruskal-Wallis and Mann-Whitney were used to compare time for ovulation and index of association between ranking groups.

High and medium ranking goats ovulated before low ranking individuals ($p<0.05$; 7.4±1.1, 8.1±0.9 and 11.5±1.0). Also, the high and medium ranking groups had on average a higher index of association with the male than the low ranking goats (AI=0.05±0.02, 0.08±0.01, 0.005±0.01).

It is concluded that low ranking goats ovulate later than high-ranking individuals, possibly by the fact that they have a lower degree of contact with the male.

Keywords:	goat, social rank, social dominance, male effect
Species:	goat
Session, type, nr	*Free papers, Poster* 38
For information contact	Lorenzo Alvarez or email alorenzo@servidor.unam.mx

Behaviour and emotional reactivity of quails reared in stable or unstable groups

Arnould, C., Quekenborn, D., Mills, A.D. and Faure, J.M.

Station de Recherches Avicoles, INRA - Centre de Tours, 37380 Nouzilly, France

In commercial conditions meat poultry are reared in large group sizes and are regularly confronted with unknown individuals. The aim of this study was to determine if the regular encounter with unknown individuals has an influence on emotional reactivity in quails selected for their high (HSR) or low (LSR) social reinstatement motivation (Mills & Faure, 1991, J. Comp. Psychol., 105: 25-38).

Quails were reared in groups until 21days old. From this age 72 males were reared in pairs. The quails belonging to the unstable groups (UN) changed cagemate every 2 or 3 days (nHSR=nLSR=9 pairs) and the quails belonging to the stable groups (ST) stayed with the same cagemate (nHSR=nLSR=9 pairs). These manipulations were repeated eight times (from day 24 to day 41). The behaviour of the birds (4 pairs observed from each category) was video recorded during the half hour following the first, third, sixth and eighth manipulation. The emotional reactivity of each bird was measured at day 42 and birds were weighted at day 43.

In each line there was more aggressive pecking in the UN than in the ST groups (HSR: $p=0.02$; LSR: $p=0.07$). HSR birds jumped and paced more than LSR birds. The duration of tonic immobility were similar in the UN and the ST groups for HSR quail ($p>0.05$) but were lower in the UN than in the ST groups for LSR quail ($p<0.01$). There was no effect on the weight gain of the quails ($p>0.05$).

Even if the change of cagemate induced aggressive behaviour in each line, only the emotional reactivity in LSR birds was affected. This suggests that in this line repeated changes of cagemate may facilitate adaptation rather than induce emotional perturbation. It would be interesting to determine if aggressive behaviour is only transitory.

Keywords:	quail, emotional reactivity, tonic immobility, social instability, social reinstatement motivation
Species:	quail
Session, type, nr	*Free papers, Poster* 39
For information contact	Cecile Arnould or email arnould@tours.inra.fr

Intraspecies aggression and bite wounds in dogs

Baranyiova, E., Holub, A., Martinikova, M.(1), Necas, A. (2) and Zatloukal, J. (2)

Department of Veterinary Public Health and Forensic Medicine, Faculty of Veterinary Hygiene and Ecology, and Veterinary Research Institute, Brno, (1) student, Faculty of Veterinary Medicine, (2) Small Animal Clinic, Department of Surgery and Orthopedics, Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences, Palackeho 1-3, 612 42 Brno, Czech Republic

The epidemiology of bite wounds in dogs which resulted from intraspecies conflicts and were treated at the Small Animal Clinic, Department of Surgery and Orthopedics, University of Veterinary and Pharmaceutical Sciences, Brno was evaluated from 246 records in 1989-90 and 337 records in 1998-99. The number of bite incidences seemed to fluctuate during the year. The majority of incidences occurred in the second (n=149) and third (n=193) trimester of the year. In comparison, only 119 and 122 bite victims were treated in the first and fourth trimester, respectively. Most treated dogs belonged to the small (37.9%), and large (24.8%) breeds, followed by medium-sized (19.0%), giant (11%) and toy breeds (7.3%). A high proportion of the victims was 1 year (11.4%) and 2 years (15.6%) of age, and the proportion decreased with age down to 1% at 11 years. Also, there were indicators for a gender effect. Of the 571 cases where the dog´s sex was recorded 176 concerned a female (30.3%) and 405 (69.7%) a male. For 503 dogs the positions of the wounds were recorded. A large portion of the wounds was administered to the thorax (26.6%) and head (24.30%), i.e. the frontal body parts. More than one fourth of head wounds were in the relatively small areas around the eyes (28.7%). Fewer bites were on the limbs (17.7%), neck (17.3%) and in the abdominal regions (14.3%). These data suggest that for dogs the risk on being wounded by a conspecific differs between seasons and depend on a dog´s age, sex and body size.

Ministry of Education of the Czech Republic supported this work (project No.353/2002).

Keywords:	dog, bite, age, season of the year, body size, sex, wound position
Species:	dog
Session, type, nr	*Free papers, Poster* 40
For information contact	Eva Baranyiova or email actavet@vfu.cz

Behavioural responses in a restraint test of pigs with different backtest classifications

Bolhuis, J.E. and Schouten, W.G.P. (1)

Ethology Group, Department of Animal Sciences, Wageningen University. Marijkeweg 40, 6709 PG Wageningen, The Netherlands, (1) DLO-Institute of Agricultural and Environmental Engineering, (IMAG-DLO), P.O. Box 43, 6700 AA Wageningen, The Netherlands

A number of studies suggest that the response of piglets in a so-called Backtest, in which they are restrained for 1 min, is indicative of their coping style. However, this test is only applicable for young pigs. The current study investigated whether Backtest classification of pigs relates to their behaviour in a Restraint test that can be performed at various ages.

Eight litters of pigs were subjected to the Backtest at 10 and 17 days of age. Based on the number of escape attempts in both Backtests, pigs were classified (Hessing et al.,1993, Appl. Anim. Behav. Sci. 37:285-295) as high-resisting (HR=40), low-resisting (LR=22) or intermediate (n=12). Pigs were restrained for 1 min in a cage with adjustable size (Restraint test) at 8 (R1) and 18 weeks (R2) of age. Vocalisations and escape behaviour (duration, frequency and latency) were scored.

Pigs classified as HR and LR differed in escape behaviour in R1 (latency HR 18.3±3.0 s, LR 29.6±4.9 s, $p<0.05$; duration HR 44.7±4.6%; LR 21.7±5.1%, $p<0.01$; frequency HR 2.7± 0.3, LR 2.0±0.4, $p<0.01$), and tended to differ in vocalisation frequency (HR 26.9±3.4, LR 20.6±4.5, $p<0.10$). Scores of intermediates were in between. Subjective observation suggested that pigs did not experience R2 as a challenge. For instance, vocalisation scores decreased from 24.1±2.5 in R1 to 4.8±0.9 in R2. LR and HR pigs still differed, however, in latency to escape behaviour (HR 19.6±2.4, LR 33.5±4.7, $p<0.05$).

In conclusion, behaviour in R1 was related to Backtest classification of pigs, which indicates that the Restraint test is suitable to characterize pigs at a later age. In R2, however, only latency to escape behaviour related to Backtest classification. Possibly R2 did not elicit the intended stress response in all pigs.

Keywords:	backtest, coping style, coping strategy, restraint, pig
Species:	pig
Session, type, nr	*Free papers, Poster* 41
For information contact	Liesbeth Bolhuis or email Liesbeth.Bolhuis@etho.vh.wau.nl

Effects of feeding method from the second week to weaning on locomotor behavior of heifers

Broucek, J., Uhrincat, M., Friend, T.H. (1), Arave, C.W. (2), Mihina, S., Kisac, P., Hanus, A. and Marencak, S.

Research Institute of Animal Production, Nitra, Slovakia, (1) Texas A&M University, College Station, USA, (2) Utah State University, Logan, USA

During the milking period, the calf is exposed to several environmental factors that can affect its behavior in the open-field tests.

Fifty-eight Holstein heifers were assigned to one of three feeding treatments after having nursed their mothers for the first week: BN) bucket with nipple, n=25; DF) machine milk feeder, n=16; NC) nursing cow, n=17. After weaning at 8 weeks, all animals were kept in group pens. Heifers were subject to an open-field test in the 17th month of age (six times for 5 minutes during 3 consecutive days). During the first four tests the animals were exposed to silence. The noise of 80 dB and 4 kHz was used as stress factor during the last two tests. In the third and fourth tests there was an unknown man sitting in the arena.

We were examining the hypothesis: the locomotor behavior is affected by the feeding method and by the housing system. NC heifers had the highest total time of movement and BN heifers the lowest time. There were significant differences on the second day when the unknown person was present. On the third test, the average time of total movement among treatments BN (98 s), DF (130 s) and NC (153 s) varied ($F=5.26$; $p=0.0084$). In the fourth test, the averages were: BN 76 s, DF 111 s and NC 119 s ($F=3.36$; $p=0.0425$).

The results indicate that different feeding of calves during the milking period may have a significant impact on their locomotor behavior at later age.

Keywords:	locomotor behavior, feeding, housing, heifer
Species:	cattle
Session, type, nr	*Free papers, Poster* 42
For information contact	Jan Broucek or email broucek@vuzv.sk

Deficiency of calcium in the diet did not increase foraging activity by broilers in outdoor areas

Christensen, J.W. and Nielsen, B.L.

Danish Institute of Agricultural Sciences, Dept. of Animal Health and Welfare, Research Centre Foulum, Po Box 50, DK-8830 Tjele, Denmark

This experiment investigated whether different levels of calcium in the feed affected the use of outdoor areas by two strains of slow-growing broilers (i657 and a Labresse cross). Fowl appear able to select an appropriate and balanced diet, and the best-documented specific appetite is that for calcium. Birds that experience deficiency of calcium in their diet are likely to seek other calcium sources in their environment and to show increased foraging activity, compared to non-deprived birds.

The birds were housed as day-old in an indoor system of 2x8 groups of 111 birds (11.8 birds/m2) and fed the same starter feed. After six weeks, the groups were moved to an outdoor system of 2x8 houses (3x5 m2) with free access to outdoor grass-covered areas (9x22 m2) and fed a high or low calcium diet in a 2x2 factorial design. The outdoor areas were enriched in the middle part with two supported sloping roofs (1.2x1.2 m2) and a sandpit (1.2x2.4 m2).

In each group, number and behaviour of birds outside was recorded one day per week between sunrise and sunset (15 scans per group per day) during a six-week period until slaughter at 84 days of age.

Number of birds outside was unaffected by feed, but the proportion of birds foraging when outside was higher on the high calcium diet (p=0.04), and within strain these birds also had a higher feed consumption (p=0.01) and a larger body weight at slaughter (p=0.01). Birds on both feeding treatments showed a diurnal activity rhythm and a clumped distribution with more birds staying in the areas closest to and farthest from the house.

The deficiency of calcium in the diet did not cause increased foraging activity in the affected birds, and the deficiency merely acted as a restricting factor on feed intake and growth rate.

Keywords:	broiler, calcium deficiency, foraging activity
Species:	chicken
Session, type, nr	*Free papers, Poster* 43
For information contact	Janne Winther Christensen or email JanneWinther.Christensen@agrsci.dk

Environmental and social enrichment in laboratory mice: effects on exploration, weight gain and urine corticosterone

Dahlborn, K., Augustsson, H. and Cvek-Hopkins, K.

Unit for Comparative Physiology and Medicine, Swedish University of Agricultural Sciences, Uppsala, Sweden

Mouse welfare may be enhanced both by increased cage complexity and contact with other mice. Depending on type of enrichment used, the behaviour of the mice may be modified resulting in changes in the animal model. Hence, such effects should be characterised.

Twenty-four female C57BL/6 mice were randomly allocated to single-housing in Macrolon type I cages (8 mice) or in groups of 4 mice in Macrolon type IV cages (16 mice). Half of the cages were provided with objects and nesting material. The mice were subjected to two different behavioural tests of exploration; the Aluminium foil test (weekly during 6 weeks) and the Petri dish test (once after 6 weeks). Food and water intake, body weight, and the ratio of urine corticosterone/creatinine were measured weekly.

All mice spent equally long time in the Petri dish before leaving it. However, enriched mice were faster in re-entering the Petri dish, which was also true for group housed compared to single housed animals. There was a tendency ($p=0.07$) also for faster re-entering in the aluminium foil test when group housed mice were compared to single housed.

Single housed mice had a higher food and water intake ($p<0.01$) than group housed mice and their body weight was higher ($p<0.05$). Single housed mice had a significant lower ratio of urine corticosterone/creatinine when they were provided with environmental enrichment but no such effect was found in group housed mice.

In this study greater effects were found between single and group housed mice compared to standard and enriched housed mice. In addition, both the socially as well as the environmentally enriched mice seemed more explorative than mice from standard cages, and single housed mice in standard cages.

Keywords:	enrichment, corticosterone, mice, behaviour, welfare
Species:	mouse
Session, type, nr	*Free papers, Poster* 44
For information contact	Kristina Dahlborn or email kristina.dahlborn@djfys.slu.se

Social stress impairs induction of immunological memory in young male pigs

De Groot, J., Ruis, M., Scholten, J.W. and Boersma, W.

Institute of Animal Science and Health (ID-Lelystad), Lelystad, Wageningen University and Research Centre, P.O. Box 65, 8200 AB Lelystad, The Netherlands

Bringing unfamiliar pigs together (mixing) is common practice in intensive pig husbandry. Since pigs maintain a hierarchy based on dominance, one of the problems with mixing is that it may lead to vigorous fights. We investigated the impact of mixing on the immune response against a viral vaccine that is obligatory in pigs in the Netherlands. The vaccine protects pigs against infection with Aujeszky's disease caused by pseudorabies virus (PRV).

Pairs of related animals of the same gender were housed in separate pens from weaning. Vaccination was performed at 6 weeks of age with attenuated live PRV. Day 3 post-vaccination half of the pairs were mixed such that unrelated pairs of the same gender (3 for each gender) were created. The control pairs (3 for each gender) were left undisturbed. Cortisol-responses in saliva, urinary catecholamines, agonistic behavior, and anti-viral immune responses were analysed for effects of mixing, gender, dominance, and for interactions between these factors. Statistical analysis was performed with GLM, ANOVA and REML procedures depending on completeness and distribution of the data.

Immune measures showed main effects of dominance and gender. Dominant pigs showed higher lymphocyte proliferation responses and IFN-gamma responses than subordinate pigs. Mixing and gender interacted on many immune measures. Mixed females showed similar lymphocyte proliferation and antibody responses as controls. In contrast, mixed males showed weak responses compared to control males. At 6 weeks post vaccination pigs were challenged with pathogenic PRV. Females did not show effects of mixing following challenge, whereas mixed males showed more severe clinical effects (fever, bodyweight) as compared to control males. Agonistic behavior, salivary cortisol responses and urinary catecholamines were elevated following mixing, but were not affected by gender. Dominance only affected noradrenaline excretion. These results suggest that immunological memory formation was impaired in mixed males but not in mixed females.

This study was supported by the Dutch Ministry of Agriculture, Nature Management, and Fisheries.

Keywords:	immunity, stress, virus, gender, dominance
Species:	pig
Session, type, nr	*Free papers, Poster* 45
For information contact	Johanna De Groot or email J.deGroot@id.wag-ur.nl

Running operant conditioning equipment, or whatever, from any old PC

Decker, E.L.

Dept. of Animal Health and Welfare, Danish Institute of Agricultural Sciences, Research Center Foulum, DK-8830 Tjele, Denmark

When we started the operant conditioning program at DIAS we had a look at the market for operant conditioning equipment and found equipment suitable for intensive research on the behaviour of rats. As we wanted equipment for other animals – from mink to cows – we were forced to design our own. This poster describes the ”Research Centre Foulum” operant conditioning system. The main purpose though is to show how easy it is to design and run your own operant conditioning equipment, or indeed any kind of research equipment or prototype, using any old PC as a controlling unit.

The main component in the system is a digital switch card (f.x. Measurement Computing’s CIO-PDISO8 card) installed in the computer. Secondly, you need a program to run your equipment with. No problem, our operant conditioning program code is “open source” and is available. Finally you need to connect your bits and pieces. Easy enough, connection diagrams for different types of equipment are worked out. Your data are date- and time stamped records of all actions, in a simple text file. That means you can analyse your data any way you want.

The design of levers for large animals is described elsewhere. The actual equipment you need depends on the purpose of your study, but quite a lot of the parts for the equipment can be bought in DIY shops. In our experiments with mink, pigs and cattle we have for example used windscreen wiper motors to drive most equipment, caulking guns as paste feeders, motorcar batteries to power equipment, garage port openers to open ports or gates. Examples of different types of equipment are given.

All relevant diagrams, computer programmes, examples of equipment as well as this poster will be available on http://www.agrsci.dk/hsv/ede/

Keywords:	operant conditioning, methodology, research equipment, design guide
Species:	general
Session, type, nr	*Free papers, Poster* 46
For information contact	Erik Luc Decker or email erikl.decker@agrsci.dk

Overground enrichment - a possible alternative to nose ringing in outdoor pigs?

Edge, H.L., Bornett, H.L.I., Newton, E.J. and Edwards, S.A.

Department of Agriculture, University of Newcastle, Newcastle upon Tyne, NE1 7RU, UK

Nose-ringing of outdoor sows is often considered necessary to prevent excessive pasture damage and environmental problems, but is prejudicial to animal welfare. This experiment was designed to assess the effectiveness of overground paddock enrichment as a possible alternative to the nose-ringing. Three groups of four multiparous sows were randomly allocated to one of three treatments in a 3x3 Latin Square design with a two week period: a control group with no paddock enrichment (C), edible overground enrichment in the form of grass silage (S), and inedible overground enrichment in the form of branches and tyres (E). Behavioural observations were made three times per week over four one-hour sessions at five-minute intervals. Pasture damage was measured on a weekly basis using a quadrat on a fixed sampling pattern.

Those pigs housed in paddocks with silage enrichment spent significantly less time rooting (C=22%, S=15%, E=25% of total time, sem 0.7% of observations, $p<0.01$). Grass cover was quickly destroyed, but lasted longer in those paddocks where silage was offered as the form of enrichment (C=1%, S=21%, E=10%, sem 2.8% grass cover after 2 weeks, $p<0.05$).

The provision of an edible overground form of environmental enrichment decreased rooting behaviour and reduced paddock damage, although not to a level which might be viewed as providing a sole alternative to nose-ringing.

Financial support for this project was received from the RSPCA

Keywords:	pig, environmental enrichment, rooting behaviour, outdoor
Species:	pig
Session, type, nr	*Free papers, Poster* 47
For information contact	Sandra Edwards or email Sandra.Edwards@ncl.ac.uk

Jumping ability of Japanese wild boars

Eguchi, Y., Miyashige, T. and Ishii, T.

Department of Agro-environmental Management, National Agricultural Research Center for Western Region, Japan

Japanese wild boars cause agricultural damage as well as European wild boars. It is important to understand the behavioural characteristic of wild boars to protect from agricultural damages. In present research, jumping ability of Japanese wild boars was measured.

Preliminary experiment: Two wild boars under captive conditions ('domestic' wild boars) were used in order to evaluate a method of a measurement of jump ability. Foods were put on the other side across the bars (iron pipe).

First, the interval of the each bar was set up in 15 or 20 cm. The wild boars stopped jumping when the height of the bar became 70cm and tried to pass through the gap although they were impossible to go through physically.

When the interval of each bar was set up in less than 10 cm, one wild boar could jump over 77cm. Another one jumped over 70cm. As the height of the bar becomes higher, it stands up with only rear legs and put front legs on the top of the bar. After that, it climbed the obstacle.

Experiment: We estimated the jumping ability of wild boars under natural conditions ('wild' wild boars) from motives of getting foods, not of escape from fear. Two groups (A: 4 adults and 6 juvenile, B: 1 adult and 4 infants) and 1 adult male were lured out by feed. A square pen (4mx4m, 5cm -high) was set in the out door field. Foods were put inside the pen. It took 6 months to lead and make the wild boars accustomed to the test area. After this step, test was started. The top bar of pen was heightening gradually (from 5cm to 130cm-high). The interval of each bar was set up in less than 10 cm.

Jumping ability of 'wild' wild boars was by far surpassing 'domestic' wild boars in preliminary experiment. All 'wild' wild boars jumped without making an approach run. They could jump over the enclosure 88-110 cm high. Two adults could jump over 110 cm high One adult could jump over the height of 120cm with touching on the top bar of the pen. Even juveniles, from 15 kg (at the start of test) to 25 kg weight (at the end of test), could jump over the bar 60 cm high without touching on the top bar of the pen.

We could also observe many interest behaviours of the wild boars approaching the test area from the bush.

Keywords:	wild boar, jumping ability, agricultural damage
Species:	pig
Session, type, nr	*Free papers, Poster* 48
For information contact	Yusuke Eguchi or email eguchiy@ab.mbn.or.jp

Individual differences in response to short-term restraint stress in breeding gilts

Geverink, N.A. and Schouten, W.G.P.

Ethology Group, Department of Animal Sciences, Wageningen University, Marijkeweg 40, 6709 PG Wageningen, The Netherlands

Several recent studies in piglets and fattening pigs have demonstrated a relationship between classification as high resisting (HR) and low resisting (LR) in a so-called "backtest" and a variety of behavioural and physiological responses. The current study aimed to evaluate the effect of an acute stressor on vocalisations and heart rate of adult HR and LR gilts housed in groups or stalls.

During the suckling period gilts were subjected to the backtest. Piglets classified as LR (n=36) and HR (n=36) were selected. At 5 months of age they were housed in 12 groups of six (three HR, three LR). At 7 months of age, animals out of 6 groups were housed in individual stalls. At 10 months of age, fixation with a nosesling for 5 min was used to challenge the gilts. The number of vocalisations per minute was counted. Heart rate was measured by radiotelemetry.

No significant effects of housing or backtest x housing interaction were found. Over the whole 5 min period, HR gilts tended to vocalise more than LR gilts ($p=0.06$). During the first minute, HR gilts vocalised significantly more than LR gilts (HR 9.2 ± 1.0, LR 6.5 ± 0.7; $p<0.05$). Heart rate quickly decreased during the first min of restraint and thereafter remained fairly constant. Estimated heart rate after 5 min of nosesling (derived from a fitted exponential decay model per animal) was significantly lower in HR gilts compared to LR gilts (HR 79.12 ± 3.11 bpm, LR 87.68 ± 3.25 bpm; $p<0.05$).

In conclusion, this study showed that also at an adult age, HR and LR gilts differ in their response to an acute stressor. This supports the idea that the backtest relates to individual characteristics, that play an important role in the regulation of behavioural and physiological responses to challenges.

Keywords:	pig, backtest, housing, vocalisations, heart rate
Species:	pig
Session, type, nr	*Free papers, Poster* 49
For information contact	Nicoline Geverink or email nicoline.geverink@etho.vh.wau.nl

Who initiates maternal behaviour, a cow or a calf ?

Kohari, D., Sato, S. and Sugawara, K.

Graduate School of Agricultural Science, Tohoku University, Naruko,Miyagi989-6711, Japan

It is well known that maternal behaviour affects physically and psychologically offspring's growth. In animal husbandry, much maternal behaviour would be productive especially in grazing. We investigated the cow-calf interaction to clarify the initiative of maternal behaviour.

13 cow-calf pairs of Japanese Black were observed individually for 8 h at about 1 month after births using the focal animal sampling method. Maternal grooming (MG) and nursing were investigated as maternal behaviour. Contact and approach behaviours and vocalization during 5 min (IB5) and just (IB) before maternal behaviour were investigated as the initiative behaviour of maternal behaviour (IB) in a pair of cow and her calf.

24 and 37 MGs followed IBs of cows and calves, respectively. In each pair, MGs preceded by IBs of calves tended to be more than those by cows' IBs (Wilcoxon signed-rank test: $Z=-1.77$, $N=13$, $p=0.08$). However the mean duration of MG was positively correlated with the number of IB5s of a cow in a pair ($r=0.66$, $p<0.05$). 4 and 25 nursings followed IBs of cows and calves, respectively. Nursings preceded by IBs of calves were significantly more than those by cows' IBs (Wilcoxon signed-rank test: $Z=-2.80$, $N=13$, $p<0.01$). The mean duration of nursing was positively correlated with the number of IB5s of a calf ($r=0.79$, $p<0.001$) and with the number of IB5s of a cow ($r=0.68$, $p<0.01$) in a pair. IB5s of cow were a few.

It is suggested that IB of a calf might be a main trigger of maternal behaviour and the number of IB5s of a cow might be a main lasting factor of maternal behaviour.

Keywords:	maternal behaviour, initiative, maternal grooming, nursing
Species:	cattle
Session, type, nr	*Free papers, Poster* 50
For information contact	Daisuke Kohari or email kohari@bios.tohoku.ac.jp

The effects of light colour and illuminance on the behaviour and fear responses of broilers

Perkins, G.Y. (1), Kristensen, H.K. (1), Prescott, N.B. (1) and Wathes, C.M. (1)

Institute of Ecology and Resource Management, University of Edinburgh, West Mains Road, Edinburgh, EH9 3JG, UK, (1) Silsoe Research Institute, Wrest Park, Silsoe, Bedfordshire, MK45 4HS, UK

In the UK, some companies catch their broilers under blue light in the belief that the birds are more docile, easier to catch and endure fewer injuries which results in improved welfare and less carcass damage.

Experiment 1 assessed the open-field behaviour of 54 seven-week old broilers under three light colours (white, red and blue) at two illuminances (5 and 20 lux). Nine birds were tested individually and once only with two companion birds in each light treatment. Thirty minutes into the test, a novel device in the centre of the arena was activated to emit a sound and rotate.

The birds emerged sooner from a darkened acclimatisation box into the arena under white (at both 20 and 5 lux) and bright red light than dim red or blue light at either illuminance (392, 309, 296, 714, 801 and 704s respectively - ANOVA; $F(2,40)=4.80$; $p=0.01$; sed=133.9). The birds lay for longer in the blue treatments than the red or white and walked for longer in the red treatments (ANOVA; $F(40,2880)=1.73$; $p<0.01$). The duration of freezing when the device was activated was shorter in the blue (4.6s) than the white (19.6s) or red (19.8s) light (ANOVA; $F(2,40)=4.55$; $p=0.02$; sed=5.81).

Experiment 2 assessed the responses of 48 seven-week old broilers to an approaching human in the same six light treatments. Eight birds were tested individually and once only with two companion birds in each light treatment. The birds stood up sooner in blue than red or white light. No strong avoidance responses were seen in blue compared with the white (16 instances) and red (5 instances) light (Chi-squared test; Chi-squared=19.2; $p<0.01$).

These results not only illustrate the complexity of the underlying mechanisms of fear but also provide some evidence to support the hypothesis that blue light reduces fear levels in broilers.

Keywords:	fear, welfare, broiler, light
Species:	chicken
Session, type, nr	*Free papers, Poster* 51
For information contact	Helle Kristensen or email neville.prescott@BBSRC.ac.uk

Effect of early handling on the behaviour of young horses

Lansade, L., Bertrand, M., Boivin, X. (1), Bouissou, M-F.

Laboratoire du Comportement animal, INRA-UMR6073, F-37380 Nouzilly, France, (1) URH-ACS, INRA Theix, F-63122, Saint-Genès-Champanelle, France

Horses are presently mainly used for sport and leisure activities, therefore animals that are easy to handle and not fearful are valued. Early handling of new-born foals has recently become fashionable in horse breeding, and is believed to have long lasting effects on the manageability of adults. However this has not been confirmed by scientific experiments.

Short and long term effects of handling during two periods of foal development (birth and weaning), were studied.

In a first experiment, 13 Welsh foals were handled from birth for 14 days, 13 were controls not handled. Two days, 3, 6, and 12 months after the end of handling they were submitted to various behavioural tests to measure their manageability and various aspects of reactivity. The results showed that neonatal handling had only a short term effect on manageability and fear reactions. Furthermore there was no generalization to unknown frightening stimuli. These effects are similar to habituation, and cannot be interpreted in terms of “imprinting” as it has been suggested.

In a second experiment, 16 Anglo-Arab foals were handled for 12 days either immediately following weaning (S0) or 21 days later (S21), 8 were non-handled controls (C). During handling sessions S0 were easier to handle than S21 (e.g.: time to fit a halter, sum of rank: 135.5[114.5;154.5] vs 195[175;308], $p<0.01$). During tests conducted two days and three, seven and ten months after the end of handling period, S0 did not differ from S21 but both were easier to handle and less reactive than controls (e.g.: time to pick up feet at 10 months S0: 39.5[35;49], S21: 49[42;51], C: 61[53;120]; heart rate after a surprise effect: S0: 69.8bpm [64.3;87.5]; S21: 88.4bpm [80.4;103.4]; C: 97bpm [80.8;126.3]; $p<0.05$).

The period following weaning can therefore be considered as an “optimal period” for handling horses, as suggested for other species (cattle, goats). Furthermore, in contrast to the first experiment, the effects persist at least ten months.

Keywords:	horse, handling, neonatal period, weaning, emotional reactivity, manageability
Species:	horse
Session, type, nr	*Free papers, Poster* 52
For information contact	Léa Lansade or email lansade@tours.inra.fr

Twin recognition and phenotype matching among artificially reared lambs

Ligout, S. and Porter, R.H.

Laboratoire de Comportement, INRA/CNRS/ Université F. Rabelais de Tours, UMR 6073 PRC, 37380 Nouzilly, France

Phenotypic similarity among close kin may provide a basis for recognizing previously unencountered individuals. Through a process of indirect familiarity or phenotype-matching, individual animals may be discriminated because of their resemblance to known genetic kin, or to oneself. The aim of the present study was to determine whether such a mechanism plays a role in social recognition among lambs.

24 Pairs of Prealpes du Sud twin lambs were separated between 5 to 9 hours after birth and housed in groups of 6 artificially fed animals. Each pen contained unrelated individuals and the twins of the lambs housed in one pen where housed together in another one. At 3 weeks of age, lambs participated in a “distress test” (i.e. they were paired during 5 min with an unfamiliar partner in a 1m2 square testing pen).

When paired with their unfamiliar twin, lambs bleated less than those paired with an unfamiliar unrelated lamb (Unfamiliar twin: 44(31.5-54), Unfamiliar unrelated: 58(47.5-65.5); Mann-Whitney U-test: n=12/12, U=36, $p<0.05$) which is evidence that the twins were recognized. A reduction in bleating was also found when lambs were paired with the unfamiliar twin of one of their pen mates (Unfamiliar twin of a pen mate: 29.5(10-47), Unfamiliar unrelated: 63(31-73.5); n=22/22, U=115.5, $p<0.01$).

The discrimination between an unfamiliar twin vs. an unfamiliar unrelated lamb could be either based on early learning of twin phenotypic traits (template) before separation shortly after birth or on a process of self-matching (comparing with self cues). Furthermore lambs’ discrimination of unfamiliar relatives of pen mates indicates that cues used in phenotype matching can be learned from unrelated individuals.

Keywords:	lambs, individual recognition, phenotype matching
Species:	sheep
Session, type, nr	*Free papers, Poster* 53
For information contact	Séverine Ligout or email ligout@tours.inra.fr

Environmental enrichment as a tool for the reduction of acute stress in laboratory mice

Meijer, M.K., Kramer, K. (1), Remie, R. (2), Spruijt, B.M. (3), van Zutphen, L.F.M. ..and Baumans, V. (4)

Dept. of Laboratory Animal Science, Utrecht University, PO box 80166, 3508 TD Utrecht, the Netherlands, (1) Dept. of Safety and Environmental Affairs, Free University, Van der Boechorststraat 1, 1081 BT Amsterdam, the Netherlands, (2) Solvay Pharmaceuticals B.V., C.J. van Houtenlaan 36, 1381 CP Weesp, the Netherlands, (3) Dept. of Animals & Society, Animal Welfare Centre, Utrecht University, Yalelaan 17, 3584 CL, Utrecht, the Netherlands, (4) Veterinary Resourses, Karolinska Institute, 17177 Stockholm, Sweden

Laboratory animals are frequently subjected to routine procedures like injections or blood sampling. We investigated the effect of cage enrichment, social housing and handling on the stress response caused by such procedures. Female animals of two mouse inbred strains (BALB/C and C57BL/6) were housed under minimal (cage with sawdust bedding and handled only when necessary) or maximal (enriched cage and handled daily) conditions. Initially all mice were housed in groups of three, but the animals of the minimal groups were housed individually halfway the experiment. In each group of three, one mouse was implanted with a radio-telemetry transmitter for measuring heart rate, body temperature and activity. These animals were subjected to restraint or i.p. injections once a week. One of the other two, non-implanted mice was also subjected to these procedures. Urine was collected for corticosterone analysis. At the end of the experiment, all mice were killed and blood, adrenals and thymuses were collected. Behavioural observations showed that minimal housed BALB/c mice reacted more anxious to restraint and injections than maximal housed BALB/c mice. To a lesser extent, C57BL/6 mice showed the same effect. Preliminary telemetry results show an overall housing effect: heart rates of the minimal groups were increased when compared to the maximal groups. Moreover, increased heart rates were seen after a procedure when compared to the pre-procedural period or the same period in the weekend, when the animals were not disturbed. The results seem to be similar for both strains.

Acknowledgements: The authors would like to thank C.J.W.M. Brandt and A.S. van der Sar for performing the transmitter implantations.

Keywords:	mice, stress, routine procedures, environmental enrichment, radio-telemetry
Species:	mouse
Session, type, nr	*Free papers, Poster* 54
For information contact	Margot Meijer or email m.k.meijer@las.vet.uu.nl

Changes of the utilization of automatic milking machine after the transfer cows to automatic milking system

Morita, S., Komiya, M., Izumi, K. Oikawa, K. and Hosiba, S.

Faculty of Dairy Science, Rakuno Gakuen University, Ebetsu, Hokkaido 069-8501, Japan

Following the installation period of automatic milking system (AMS), farmers spent a lot of time training cows. An easy and efficient training program would reduce the time required. A program where some cows were trained first so that they can transfer this 'knowledge' to other cows (using social learning) was tested. To establish this program, the familiarising process of the first group of cows to the milking robot needed to be clarified first. Nineteen cows were transferred from tie-stall to free-stall housing with AMS, and the responses of the cows to the training program and their behavioural changes towards the use of the milking robot were assessed over 90 days. There was no relationship between behaviours such as stepping and kicking during milking in the tie-stall period and the level of assistance from the manager needed during milking in the training period. It was suggested that docile cows should not be chosen for the training group. The number of cows fetched daily decreased sharply from the day of transfer (38 occasions, all cows twice) to day 13 after the transfer (7 occasions) and continued to decrease until day 90 (2 occasions). The average number of daily milkings was the lowest in the period of 1-10 days (3.0) compared to any other period (3.3 milkings/day; $p<0.05$). The milkings occurred frequently in the period of 4:00-7:00 and 16:00-19:00 (over 20%), and less in 0:00-3:00 and 20:00-23:00 (under 10%). About one month was needed for the bi-phasic pattern to disappear. It was concluded that two weeks was necessary for learning how to utilise the milking robot and two more weeks was needed for the cow to change their milking pattern over time when 19 cows were transferred.

Keywords:	cow, automatic milking system, utilization of milking robot, response during training
Species:	cattle
Session, type, nr	*Free papers, Poster* 55
For information contact	Morita Shigeru or email smorita@rakuno.ac.jp

Behavioural assessment of pain in cats following onychectomy and tenectomy

Newberry, R.C.C., Cloutier, S., Cambridge, A. J. (1) and Tobias, K.M. (2)

Center for the Study of Animal Well-being, College of Veterinary Medicine, Washington State University, Pullman WA 99164-6520, USA, (1) Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Washington State University, Pullman WA 99164-7060, USA, (2) Present address: Veterinary Surgical Specialists, Tustin, CA 99708, USA, (3) Present address: Department of Small Animal Clinical Sciences, University of Tennessee, Knoxville, TN, 37901-1071, USA

We hypothesised that the relative degree of post-surgical pain in cats undergoing onychectomy (declawing), digital flexor tenectomy, or a sham procedure could be detected using behavioural indicators. We predicted that onychectomy would produce more behavioural signs of post-surgical pain than flexor tenectomy. Cats presented at the hospital for onychectomy were recruited to the study. Cats were randomly assigned to three groups: Control (sham surgery, n=5), Tenectomy (n=6), and Onychectomy (n=6). All surgeries were performed under anaesthesia by the same surgeon. The forepaws of all cats were then bandaged. Analgesic was administered to all cats pre-operatively and to any cat subjectively assessed to be experiencing pain post-operatively. At –1, 0.5, 1.5, 3.5, 7.5, 11.5, 23.5 and 35.5 hours after surgery, we made a 30-min videotape of each cat. The 1-0 frequencies of groom body, groom with forepaw(s), groom bandages, shake forepaw(s), wipe forepaw(s), stand/sit, lie on sternum, and lie on side were assessed from the videotapes.

In the hour following surgery, Tenectomy cats groomed their bandages more than Onychectomy or Control cats (mixed model repeated measures ANOVA on ranked data: treatment x time, $F=1.84$, $DF=14,98$, $p=0.04$; Tukey comparisons: p;0<04). Control cats rested in sternal recumbency more than Tenectomy cats (treatment, $F=4.06$, $DF=2,14$, $p=0.04$; Tukey comparison: $p=0.03$). No other treatment differences were detected. Cats from all treatments showed higher levels of forepaw wiping and shaking, and resting in lateral recumbency, after, than before, surgery (time, $F=2.77$, $DF=7,98$, $p<0.01$).

The application of bandages probably accounts for the increased forepaw shaking and wiping after surgery. Remote observation of undisturbed cats following surgery revealed scant evidence for treatment differences in behaviour. Since a surgeon blind to the treatments subjectively differentiated between control and surgically-treated cats during clinical evaluation of the cats, future behavioural assessments of pain should focus on behaviour occurring during direct interaction with cats.

Keywords:	cat, pain, behaviour
Species:	cat
Session, type, nr	*Free papers, Poster* 56
For information contact	Ruth Newberry or email rnewberry@wsu.edu

Odour from horse chestnuts (Equus caballus) on toys increases playing time in Beagles

Meers, L., Christiaens, I. and Ödberg, F. O.

Department of Animal Nutrition, Genetics, Production and Ethology, Ghent University, Heidestraat 19, B-9820 Merelbeke, Belgium

It is anecdotally known that dogs are extremely attracted by hoof trimmings and by chestnuts from horses. This study investigated the effect of adding chestnut odour to toys on play duration.

Twelve Beagles (6 females, 6 males) were individually housed during the experiment. Spatial constraints resulted in 6 animals (3 females, 3 males) housed in 1.5mx1.5mx1.75m cages and 6 in identical ones with access to an outside playground. Each dog received a cotton-filled jeans bag (15cm long). For 3 dogs a 15cm plastic tube replaced it after they had destroyed their bag. For practical reasons toys for the first group were hanged 35 cm above the ground, while they laid chained on the floor for the second one. The experiment lasted 3 consecutive weeks. Dogs got the unscented toy during the first and the third week. Horse chestnuts were introduced in the bags (or the tubes were rubbed daily) during the second week. All animals were observed one hour daily and randomly between 7 and 18h from Monday till Friday each week. Toy contact was defined as biting or touching with the nose or the paw. Each minute during which contact was made was tallied for each dog. After normality and variance control, data were analysed with a Friedman repeated measures ANOVA followed by a Newman-Keuls post-hoc (treatment comparisons) and with a Student t-test (group comparison).

Minutes with toy contact were significantly ($p=0.003$) more frequent during period 2 (average=12.75; SD=9.56) than periods 1 (4.42; 6.33) and 3 (4.58; 4.30). There was no significant difference ($p=0.42$) between the housing/toy presentation groups.

Scenting toys with chestnut increases play duration, at least on a short-term base. Further work should investigate long-term effects and whether other scents are equally efficient.

Keywords:	enrichment, dogs, odours, chestnuts, housing
Species:	dog
Session, type, nr	*Free papers, Poster* 57
For information contact	Frank Ödberg or email frank.odberg@rug.ac.be

Relationships between measures of beef cattle temperament and some blood parameters

Petherick, C., Doogan, V. (1), Swain, A. (1), Venus, B. (1), Holroyd, R. and Quinn, P. (2)

Cooperative Research Centre for Cattle and Beef Quality, Dept Primary Industries, Agency for Food and Fibre Sciences, PO Box 6014, Rockhampton, Qld 4702, Australia, (1) Animal Research Institute, Yeerongpilly, Qld 4105, Australia, (2) Brigalow Research Station, Theodore, Qld 4719, Australia

A 'fear of humans test' was conducted on 196 Bos indicus crossbred weaner steers (mean liveweight 162 kg) in an open arena with a stimulus person sitting outside the arena.

Seven zone boundaries were marked on the floor of the arena at 1m intervals from the person. The animals were individually tested and their position in the arena recorded for a 3-minute period. From this test the following measures were determined: where on average the animal was in the arena, as a distance (m) from the person (zone average); the total number of times zone boundaries were crossed in the arena (movement); and the closest (m)that the animal approached the stimulus person (closest approach). The flight speeds (the time taken to cover 2.65m on release from the weighing crate and converted to m/s) of the steers were also recorded. Blood samples were taken and assayed for: white blood cell count (WBC); red blood cell count (RBC); haemoglobin; pack cell volume (PCV); creatine phosphokinase (CPK); non-esterified fatty acids (NEFA), L-lactate, glucose and cortisol. Relationships between the parameters were explored using correlations with the $p<0.001$ level of significance ($r=0.234$) as n and the number of correlations being screened were so large.

Flight speed was positively correlated with movement ($r=0.269$) and L-lactate ($r=0.400$). Movement was negatively correlated with zone average ($r=-0.333$), and closest approach ($r=-0.640$), but positively with WBC ($r=0.278$) and L-lactate ($r=0.586$). Closest approach was positively correlated with zone average ($r=0.649$) and negatively with L-lactate ($r=-0.318$). These results suggest that the 'fear of humans test' and flight speed may measure different aspects of cattle temperament, although flighty animals moved around more in the arena. It also appears that flighty cattle may have experienced a greater stress response than the more docile animals.

Keywords:	beef cattle, temperament, physiology, fear
Species:	cattle
Session, type, nr	*Free papers, Poster* 58
For information contact	Carol Petherick or email carol.petherick@dpi.qld.gov.au

Behaviour toward man during the pre-mating period and temperament affect on reproduction in farmed mink

Rekilä, T., Korhonen, H.T. and Jauhiainen, L.(1)

MTT Agrifood Research Finland, (1) Animal Production Research, Fur Animals, FIN-69100 Kannus, Finland, Data and Information Services, FIN-31600 Jokioinen, Finland

The present study examined the effects of temperament and pre-mating behaviour on reproductive performance in farmed female mink (Mustela vison).

Temperament was measured by using a stick test and pre-mating behaviour by a walking test. The experimental animals comprised 100 confident and 100 fearful scanblack female mink. In each temperament group, 58% of female mink were primiparous and 42% multiparous. The length and timing of mating periods and the length of the gestation period were similar in all groups.

Pooled data showed that the length of the gestation period correlated negatively with litter size ($r=-0.17$, $p=0.03$). The whelping proportions for confident and fearful primiparous female mink were 81% and 74% ($p=0.37$), respectively, and for multiparous vixens 83% and 81% ($p=0.78$), respectively. A significant correlation between kit losses and litter size was found only in primiparous and multiparous confident females ($r=0.35$, $p=0.02$; $r=0.32$, $p=0.07$). Postnatal kit mortality was higher in primiparous confident than fearful females (0.9 vs. 0.5 cub/female, $p<0.05$). Pre-mating body weights were significantly higher ($p<0.001$) in primiparous than in multiparous females. Significant correlations between pre-mating body weight and reproductive success were not found. During walking tests, fearful animals, irrespective of age, remained inside the nestbox more frequently than did confident ones. Stationary behaviour outside the cage (lying, sitting, standing etc.) was more common in confident than in fearful animals ($p<0.001$). Significant differences in locomotor activity or stereotypies were not found between the groups. In multiparous fearful females, the whelping result declined significantly with the increasing incidence of stereotypies ($r=-0.37$, $p=0.04$). In primiparous fearful female mink, the relationship was the reverse ($r=0.37$; $p=0.01$).

It can be concluded that confident female minks reproduce better than fearful ones.

Keywords:	farmbred mink, personality trait, temperament-related behaviour, reproductive success, domestication
Species:	mink
Session, type, nr	*Free papers, Poster* 59
For information contact	Teppo Rekilä or email teppo.rekila@mtt.fi

Aggressive interactions between breeding does are related to degree of familiarity

Ruis, M.A.W. and Coenen, E.

Research Institute for Animal Husbandry, Runderweg 6, 8219 PK, Lelystad, The Netherlands

In commercial rabbit production, housing conditions for rabbit does are far from preferable from a welfare point of view. Most striking is that breeding does are housed individually, while their wild counterparts normally live in groups. Much effort should therefore be put in the development of a group-housing system for breeding does. The objective of the current experiment was to investigate the effect of pair-housing of breeding White New Zealand does on aggressiveness and overall performance. Former research has shown that when breeding does are kept in pairs, much aggression occurs, especially when the animals are close to giving birth (Reichel, 1995; DGS Magazin).

In order to test whether this aggressiveness is related to the degree of familiarity of pair-members, 5 pairs of littermates (LP) and 5 pairs of non-littermates (NP) were formed at 13 weeks of age. At 16 weeks of age they were inseminated, and subsequently observed during pregnancy and lactation period of the first litter. Familiarity had an important effect on aggression. In three cages of the NP treatment, animals either died or had to be removed due to high aggression. Removal took place to avoid unnecessary suffering.

Does of NP pairs showed the highest frequency of external wounds, caused by fighting (Mann-Whitney: U=7.5; N1=5, N2=5; p=0.1; scored one week after giving birth). Reproduction performance was not affected by familiarity, as litter size (ANOVA: $F_{1,8}=1.44$; p=0.27) and numbers of stillborn young (ANOVA: $F_{1,8}=1.80$; p=0.22) did not differ. Degree of familiarity did also not affect body growth (body weight at 16 weeks: ANOVA: $F_{1,8}=0.56$; p=0.47).

It was concluded that the degree of familiarity did not have consequences for reproduction performance and initial body growth of young breeding does. However, very important, aggression prevailed when two unfamiliar does were kept together in breeding units, leading to serious loss of animals. From a welfare and economic perspective, it may therefore be advised for commercial purposes to house familiar animals together. This option should be further investigated with a larger sample size.

Keywords:	rabbits, housing, aggression, familiarity
Species:	rabbit
Session, type, nr	*Free papers, Poster* 60
For information contact	Marko Ruis or email m.a.w.ruis@pv.agro.nl

Daily home ranges and distances between those were stable in cattle

Sato, S., Sugiyama, M.(1), Tsuboi, Y. (1), Yasue, T. (2) and Suyama, T.

Nasu-Centre, National Institute of Livestock and Grassland Science, Nishinasuno 329-2793, Japan, (1) Land Ecology, Graduate School of Agricultural Science, Tohoku University, Naruko 989-6711, Japan, (2) Animal Science, Faculty of Agriculture, Ibaraki University, Ami 300-0393, Japan

Daily home range (DHR) is one of behavioural characteristics of cattle left uninvestigated. However, it is very important for considering the strategy of land use in cattle and for a stockperson to discover effectively the free-ranging cattle.

Cows were located every 2 h for 6 months from May to October by GPS in a grazing land (G land) of 256 ha containing an artificial pasture of 15.2 ha and an agro-forest of about 1,000 ha available (AF land). Each 2 cows from 15 and 21 grazing beef suckler cows of Japanese Black and Japanese Shorthorn (JS), respectively, were attached of GPSs individually in the G land in 2000. Two and 5 cows from 27 and 37 JSs were attached of GPSs in the AF land in 2000 and 2001, respectively. The individual DHR was calculated every day using the minimum convex polygon method and the distance to its center from one of the previous day (DDHR) was also calculated when a cow was located over 10 times/day. DHRs and DDHRs were averaged a month and analysed by ANOVA.

Mean sizes per month of DHRs from May to October were 7.2, 9.0, 10.2, 11.5, 10.5, and 10.0 ha in the G land (mean: 9.7 ha) and 15.1, 21.6, 13.5, 12.3, 9.6, and 7.6 ha in 2000 (mean: 13.3 ha) and 21.5a, 13.4b, 12.0b, 15.0ab, 12.1b, 10.9b ha ($F_{5,24}=4.794$; significant differences among different characters) in 2001 (mean: 14.2 ha) in the AF land, respectively. Mean DDHRs per month from May to October were 146, 242, 304, 206, 285, and 252 m in the G land (mean: 239 m) and 440, 693, 559, 569, 331, and 278 m in 2000 (mean: 478 m) and 440bc, 451bc, 531a, 517ab, 394bc, and 340c m ($F_{5,24}=6.101$) in 2001 (mean: 445 m) in the AF land, respectively.

It is suggested that cattle graze with DHR of 10~14 ha and only move to the adjoining place even in rich vegetation and that cattle change the strategy of land use with smaller DHR and shorter DDHR in poor vegetation.

Keywords:	home range, distance, cow, GPS
Species:	cattle
Session, type, nr	*Free papers, Poster* 61
For information contact	Shusuke Sato or email shusato@affrc.go.jp

Can Individual vibratory pagers be used to leading cows to concentrate feeding stations efficiently?

Seo, T., Takahashi, S., Ohtani, M. and Kashiwamura, F.

Department of Animal Production, Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido, 080-8555, Japan

One problem encountered with automatically dispensed concentrates in feeding stations for cattle is that many cattle may visit the feeding station simultaneously. A novel solution to this problem is to use vibrating pagers attached to collars to inform cattle of individual feeding times.

In the present study, 6 dry Holstein cows with pagers were put into a group pen containing a feeding station. Training: First, each cow was kept for about 30 minutes in an area fenced off in front of the feeding station only in the morning and evening, respectively. A computer activated the pager for 40 seconds at 4 times every morning and evening, with 240 g of concentrate delivered at the feeding station after each call. When cows had learned that concentrates were available if they visited the feeding station after being called, concentrates were not delivered until cows were at the feeding station. After training was completed, each cow was called from the group 4 times per day at 6-hour intervals, in a specified order. A delivery of 480 g of concentrate was made only when the cow visited the feeding station following the call.

Cows learned to visit the feeding station in response to calls at a mean of 2.7 days after start of training. A total of 350 calls were made to the group, and cows fed in response to 78.6% of calls. In 0.6% of calls, cows could not feed due to interference by pen mates. In the remaining 19.6% of the calls, cows did not move to the station.

We conclude that vibrating pagers may be successfully used to systematize feeding of cows at feeding stations like automatically milk-fed calves (Seo et al., 2001), but further research with a larger number of herds is needed.

Keywords:	cattle, learning, feeding station
Species:	cattle
Session, type, nr	*Free papers, Poster* 62
For information contact	Tetsuya Seo or email seo@obihiro.ac.jp

Effects of hand-touch for foal on behavior against human through and after suckling period

Takita, N., Hata, H., Kondo, S. and Okubo, M.

Graduate school of Agriculture, Hokkaido University, Sapporo 060－8589, Japan

Hand-touching (stroking, rubbing and touching)newborn foals is suggested to have certain effects on horse behavior towards humans following weaning, though ethological studies thus far have not provided consistent results.

In this study, 12 foals of Hokkaido native horses (born in May) were allocated to 1 of 4 treatments (3 horse per treatment) and their behavior towards human was observed at body size measuring (BSM) each month through their suckling period and at open field test following weaning. The treatments were; hand-touch during 10 minutes a day for 0-1 week of age after birth (G1),for 2-3 weeks after birth (G2),for 4-5 weeks after birth (G3),and no hand-touch treatment (G4). In BSM which was done once a month from May to November, Moving frequency of foal's ears and legs were recorded, in which each foal was hold by a human during measurement. In open field test (10.5?12m pen), exploratory behavior towards the human standing in the center of the pen was recorded during 15 min.

The moving frequency of an ear and legs of foals in BSM at May was the highest in G4 (16 and 5) then decreased gradually, while the behavior in G1 was almost stable throughout the suckling period (4.9 and 2.8). Foals in G2 and G3 showed higher activity in May compared to G1, but was similar afterward. The behavioral response toward BSM was similar between treatments by November. In the open-field, G4 foals seldom approached to the human, while the foals in other groups approached the human frequently. The difference between G1, G2 and G3 were not significant.

Keywords:	foal, hand-touch, behavior against human, suckling period, weaning, open-field test
Species:	horse
Session, type, nr	*Free papers, Poster* 63
For information contact	Nana Takita or email takita@amin.agr.hokudai.ac.jp

A computer-control operant conditioning system for visual discrimination tests with dogs

Tanaka, T., Saito, M. and Uetake, K.

School of Veterinary Medicine, Azabu University, Sagamihara, Kanagawa 229-8501, Japan

We developed a versatile operant conditioning system for dogs to study their high cognitive ability, which has rarely been investigated until now. The system was modelled on the standard operant conditioning apparatus used in other small experimental species. The operant chamber (120 x 120 x 90 cm) had three display windows (24 x 24 cm), two response holes (5 x 5 cm) with infrared sensors, and the food bowl connected with a pellet dispenser, on the front wall. Dog's responses were detected when they stuck their muzzle into the response hole. Two personal computers (SONY, VAIO PCV-J10 and VAIO PCV-R52) were included in the system for gathering data and operating test paradigms (application software: DKH Inc., a custom-made item), respectively. Discriminative stimuli were projected on the display windows from the outside with a multimedia projector (EPSON, ELP-7250). To prove the utility of the system, two female Shiba dogs (Botan, 3.0 years old; Satsuki, 3.5 years old) were tested using an alternative discrimination training. In the tests, pictures of circle, square and triangle were used as conditioned discriminative stimuli.

Dogs rapidly developed a "learning set" to the alternative discrimination paradigm that the experimenter required, and responded correctly to the presented stimuli. Botan achieved the criterion after 3, 7, and 3 sessions for circle, square, and triangle, respectively. Satsuki achieved the criterion in the third session for circle.

In conclusion, the system seemed usable for operant conditioning testing of dogs. Other paradigms such as matching-to-sample remain to be tested, as well as it's utility in a wider variety of learning paradigms.

Keywords:	dog, discrimination learning, visual stimulus
Species:	dog
Session, type, nr	*Free papers, Poster* 64
For information contact	Toshio Tanake or email tanakat@azabu-u.ac.jp

LH and testosterone response of experienced and inexperienced rams to the presence of estrous ewes during the non-breeding season

Ungerfeld, R., Silva, L., Carbajal, B. and Laca, M.

Departamento de Fisiología, Facultad de Veterinaria, Lasplaces 1550, Montevideo 11600, Uruguay

The aim of this experiment was to compare the LH and testosterone response to the presence of oestrus ewes in experienced and inexperienced rams during the non-breeding season.

Eight adults experienced (AR; 4-6 years; 74.3 ± 2.2 kg) and 8 young inexperienced (YR; 1-1.5 years; 44.2 ± 1.3 kg; mean ± SEM) Corriedale rams were used in the experiment. Rams remained isolated from ewes (sight, sound, smell) by a minimum distance of 1 km for 30 days. On Day 0, rams came in contact with 120 ewes treated for coming into oestrus gradually from Day 0 to 5, assuring exposure to a substantial amount of oestrus ewes each day. Blood samples from rams were obtained on Days -12 and -6, and twice daily from Day -2 to Day 5. LH and testosterone concentrations were measured by RIA.

LH and testosterone concentrations increased significantly after the introduction of the estrous ewes (ANOVA for repeated measures; $p<0.01$). LH concentrations increased from 0.9 ± 0.3 µg/L (pooled data from isolated period; mean ± SEM) to a maximum concentration of 2.3 ± 0.7 µg/L, and from 1.3 ± 0.6 µg/L to 4.3 ± 2.2 µg/L in AR and YR respectively. Testosterone increased from 11.7 ±1.4 pmol/L to a maximum of 32.2 ± 4.9 pmol/L and from 10.6 ± 2.8 pmol/L to 25.9 ± 13.2 pmol/L in AR and YR respectively. There were no differences in hormone levels or interactions with time between AR and YR.

We conclude that similar responses were observed in both AR and in YR, with important increases in both LH and testosterone levels during the first days that followed the introduction of oestrus ewes.

Keywords:	ewe effect, rams, LH, testosterone, estrous, ewe, stimulus
Species:	sheep
Session, type, nr	*Free papers, Poster* 65
For information contact	Rodolfo Ungerfeld or email piub@internet.com.uy

Replacing stimulus animals by scent-filled cups in the rat social discrimination test?

Van den Bos, R., Van der Horst, K.J., Baars, A.M. and Spruijt, B.M.

Animal Welfare Centre, Veterinary Faculty, Utrecht University, Yalelaan 17, NL-3584 CL Utrecht, the Netherlands

The rat social discrimination test measures social memory using in general juvenile rats as stimulus animal. Rats (rattus norvegicus) are offered a juvenile to investigate (5 min: learning trial) and after a specified interval the same and a novel juvenile to investigate again (5 min: retrieval trial). When more sniffing is shown towards the new than the previously presented juvenile in the retrieval trial social memory for the latter juvenile is said to be present. This test is mainly based on scents from the juvenile rat. We decided to modify the test in order to reduce the number of animals used, to enhance the scope of the test and improve the validity of the test. Firstly, the stimulus animals were replaced by the scent of juveniles in the form of cups filled with saw dust taken from cages of juvenile rats. It turned out that using these scents similar results as in the original test were obtained: rats (>10 weeks of age, used two times at most) directed more sniffing towards the new scent than towards the previously presented scent in the retrieval trial after an inter-trial interval of 3 minutes (n=9 rats) but not after an inter-trial interval of 120 minutes (n=9 rats). Furthermore, for male (n=10; n=8) and female (n=13; n=8) scents the same results were found as for juvenile scents. Secondly, in the learning trial rats were also given two cups (one scent-filled and one filled with plain saw dust) to discriminate allowing more precisely to delineate motivational, discriminatory and memory components in the test. Overall our data show that it is possible to replace stimulus animals by scent-filled cups in the social discrimination test.

Keywords:	rats, social memory, refinement
Species:	rat
Session, type, nr	*Free papers, Poster* 66
For information contact	Ruud Van den Bos or email R.vandenbos@las.vet.uu.nl

Individual behavioural and immunological differences in pigs

Van Erp-van der Kooij, E., Kuijpers, A.H., Van Eerdenburg, F.J.C.M., De Vries-Reilingh, G. (1), Parmentier, H.K. (1), Timmerman, H.M. and Tielen, M.J.M. (2)

Pig Health Unit, Department of Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, Yalelaan 7, PO Box 80151, 3508 TD Utrecht, the Netherlands, (1) Adaptation Physiology Group, Department of Animal Sciences, Marijkeweg 40, PO Box 338, 6700 AH Wageningen, the Netherlands, (2) the Netherlands Feed Industry Association (Nevedi), Heer Bokelweg 157b, PO Box 1732, 3000 BS Rotterdam, the Netherlands

Previous experiments have shown that pigs with a different approach to stress, displayed in an active or reactive behavioural coping response, also showed different physiological, endocrine and immunological responses. This raises the question if there is a 'best coping strategy' with respect to the immune system.

In the present study a backtest at 3, 10 and 17 days of age was used to record the behavioural coping strategy of 173 fattening pigs, housed in conventional farrowing and fattening pens, in groups of 10 pigs per pen. In the backtest, a piglet is put on its back and escape attempts are recorded during 1 minute. Animals were weaned at 4 weeks, and at 9 weeks half of the pigs were mixed. All pens contained active and reactive piglets. The cell-mediated immune reactivity was measured in all animals by conducting a phytohaemagglutinine (PHA) skin test after weaning and at 9 weeks. At 10 weeks 149 animals were immunized with keyhole lympet haemocyanin (KLH) and subsequent blood samples were taken to measure humoral immune responses. A repeated measurements model (PROC MIXED, SAS) was used to determine effects of mixing and coping behaviour on immune responses.

Active responders in the backtest at day 3 tended to have overall lower KLH titers ($p<0.10$) then reactive animals. Animals that were mixed at 9 weeks showed higher KLH titers at day 7 ($p<0.01$) and day 14 ($p<0.05$) after immunization. Active responders in the backtest at day 10 tended to have better cell-mediated immune responses after weaning ($p<0.10$). A weak interaction ($p<0.10$) was found between mixing and backtest response at day 3 for the PHA test. Results from the PHA test at weaning and at 9 weeks were positively correlated ($r=0.39$, $p<0.0001$, $N=159$), and PHA test results were negatively correlated with KLH-titers (based on Area Under the Curve) ($r=-0.27$, $p<0.005$, $N=132$).

We concluded that there were weak relations between backtest behaviour and cell-mediated and humoral immune reactivity, but no optimal behavioural strategy was found. Mixing of pigs influenced immune responses, and humoral and cell-mediated immune responses were negatively correlated.

Keywords:	pigs, individual behavioural characteristics, backtest, humoral and cell-mediated immunity
Species:	pig
Session, type, nr	*Free papers, Poster* 67
For information contact	Lenny van Erp-van der Kooij or email l.vanerp@vet.uu.nl

Distribution of fattening pigs in a two-level choice pen: can future welfare regulations be met by providing existing pens with a second floor?

Vermeij, I., Vermeer, H.M., Hoofs, A.I.J., Enting, J., Ruesink, E.W. (1) and Hopster, H. (2)

Research Institute for Animal Husbandry, Runderweg 6, 8219 PK, Lelystad, The Netherlands., (1) Dept. of Animal Sciences, Institute for animal Science and Health (ID-Lelystad), Edelhertweg 15, 8219 PH, Lelystad, The Netherlands

Future Dutch pig welfare regulations require increased space allowance (1 m2/pig) as well as 60% solid floor area in existing fattening pig houses. Some farmers comply with this by adding a second floor to a pig pen. A pilot study was carried out to observe whether pigs use the extra area provided in these two level pens.

During two rounds, four pens with 19 pigs each were observed. Pens had a second floor (5.3 m2) fixed approximately 1 m above the ground floor (14.5 m2). The use and the accessibility of the second floor were observed through 15-min scan sampling during three 24-hrs observations in two different growing periods: 60–85 kg and 85–110 kg. Based on the number of pigs present on each of the two different floors the distribution of pigs was expressed as average space (m2) used per pig. To get an idea of the pigs' individual use of the second floor, four 24hr observations were analysed through continuous focal sampling. In the first round the use of the second floor increased, as the pigs grew older, resulting in a proportional distribution of pigs over both the ground (from 0.94 to 1.06 m2 /pig) and the second floor (from 1.76 to 0.96 m2 /pig) at the end of the fattening period. During the second round, pigs started to use the second floor at a lower live weight. No indications were found that pigs slipped or fell from the ramp. At the level of the individual pig, some pigs seem to consistently use the second floor for lying while others only paid short visits to the second floor or did not use the second floor at all. No signs were found that the design of the pen resulted in more leg problems.

With respect to the behaviour of pigs we speculate that providing existing fattening pens with a second floor may be a suitable option for meeting increased space allowance requirements.

Keywords:	pigs, space allowance, two-level pen
Species:	pig
Session, type, nr	*Free papers, Poster* 68
For information contact	Herman Vermeer or email I.Vermeij@pv.agro.nl

Horses differ in learning performances using two different learning tests

Visser, E.K. (2), van Reenen, C.G., Schilder, M.B.H. (1), Barneveld, A. (2) and Blokhuis, H.J.

Division of Animal Sciences, Institute for Animal Science and Health, PO Box 65, NL-8200 AB, Lelystad, The Netherlands, (1) Department of Animals and Society, Faculty of Veterinary Medicine, Utrecht University, Yalelaan 17, NL-3584 CZ Utrecht, The Netherlands, (2) Department of Equine Sciences, Faculty of Veterinary Medicine, Utrecht University, PO Box 80.163, NL-3508 TD Utrecht, The Netherlands

The individual learning performance of a horse can be regarded as an aspect of personality which could be of importance to breeding, selecting and training of young horses.

Thirty-nine young horses of the Dutch Warmblood were tested in two learning tests, i.e. the avoidance learning test and the reward learning test as yearlings. Both tests were repeated with a one day interval and the same procedure was executed when the horses were two years of age. Besides learning performances, behavioural variables (e.g. pawing, snorting and neighing, putatively related to emotionality) and heart rate variables (e.g. mean heart rate and heart rate variability) were measured during the tests.

There was no simple relationships between measures of heart rate, behavioural responses putatively related to emotionality and learning performances. Horses showed consistent individual differences in learning performances within years and for the avoidance learning test also between years. There was no significant correlation between learning performances in the avoidance learning test and the reward learning test.

It is concluded that consistent differences in learning in horses can be assessed. Furthermore, this study shows that the lack of correlations between learning performances in either test suggests that one horse performs better with avoidance learning and another horse performs better with reward learning. It is suggested that these differences may be relevant to design optimal individual training programmes and methods.

Keywords:	horse, personality, learning performances, consistency
Species:	horse
Session, type, nr	*Free papers, Poster* 69
For information contact	Kathalijne Visser or email e.k.visser@id.wag-ur.nl

The role of endogenous CRH in stress responses in calves

Yayou, K., Nakamura, M. and Sato, Y.

National Agricultural Research Center for Hokkaido Region, Sapporo 062-8555, Japan

To determine the central roles of endogenous CRH in calves, we investigated whether intracerebroventricular infusions of CRH antagonist, alpha-Helical CRF [9-41] (anti-CRH) could suppress the stress responses in calves.

Three calves were each assigned two stress contexts with three drug treatments using randomized blocks design. They were infused intracerebroventricularly with 0.5 ml of artificial cerebrospinal fluid for the vehicle control or with 20 or 100 nmol of anti-CRH into the third ventricle for 30 min before each contexts started. The psychological stress context was the isolation that 1 of 3 calves was left in the habituated cage for 1 hour while 2 were taken outside. The physical and psychological stress context was the pain that the auricles of the calves were pinched by a paper clip for 1 hour. Observations were conducted over a period of 120 min after the start of infusion.

The isolation induced significant rise in the plasma cortisol concentration (CORT) and the number of tongue playing from the values before the stressor application in vehicle control ($p<0.05$). The numbers of rubbing and stretching the neck also tended to increase ($p<0.08$). 100 nmol of anti-CRH tended to suppress the increase in CORT ($p<0.09$). 20 nmol of anti-CRH tended to suppress the increase in the numbers of tongue playing, rubbing and stretching the neck ($p<0.09$).

The pain induced a rise in CORT from the values before the stressor application in vehicle control ($p<0.09$), which was significantly suppressed by 100 nmol of anti-CRH ($p<0.05$). The rectal temperature significantly increased after the stressor application ($p<0.05$), which tended to be suppressed by 20 nmol ($p<0.1$) and 100 nmol ($p<0.06$) of anti-CRH. The behavioral indicators did not change by the pain.

These results indicate the possibility that the endogenous CRH might modulate endocrine and behavioral responses to stresses in calves.

Keywords:	CRH, calf, stress, CRH antagonist
Species:	cattle
Session, type, nr	*Free papers, Poster* 70
For information contact	Ken-ichi Yayou or email ken318@affrc.go.jp

Behavioral problems reported in dogs and cats brought to the Universidad Nacional Autónoma de México (UNAM) Veterinary Hospital

Edwards, P.C., Tejeda, P.A., and De Juan, G.L.(1)

Departamento de Etología y Fauna Silvestre, Facultad de Medicina Veterinaria y Zootecnia, (UNAM), (1) Hospital de Pequeñas Especies, Facultad de Medicina Veterinaria y Zootecnia, (UNAM), Mexico

The objective of this study was to determine the incidence of behavioural problems in dogs and cats, as perceived by their owners, that were treated at the UNAM veterinary hospital. The animals were brought to the hospital for other reasons than their behaviour. During January and February 2001, 111 pet owners were asked to fill in a species specific questionnaire of 29 questions.

83.8% of the owners reported behaviours that they considered problematic. 88.3% of these complaints concerned dogs and 11.7% concerned cats. 71% of the owners were willing to start a treatment, 6.6% were unsure about it and 23.1% had no intentions to treat the problem behaviour. Every cat that was brought to the hospital was considered to have problem behaviour, and 84.6% of the owners were willing to start a treatment.

The most frequent problem behaviours in dogs were: behaviours related to separation anxiety (68%), aggression toward other dogs (37%), aggression toward people, fear of, for example, fireworks and thunder, and inappropriate elimination. Other problem behaviours were self mutilation, feeding disorders, reproductive problems, convulsion, predatory behaviour, running away, digging, hypersomnia, hyperactivity and excessive barking.

In cats, the most frequent problem behaviours seem to be scratching and destructive behaviour (40%). Other problems, were: meowing excessive in the owners' absence, and demanding a lot of attention, diverse fears, biting when caressed, and aggression toward other cats.

In conclusion, it seems that the majority of cats and dogs that are brought to the UNAM veterinary hospital, for other than behavioural problems, behave in a way that is considered problematic by their owners. Aggression and separation anxiety seem to underlie the most frequent occurring problem behaviours in dogs.

Keywords:	clinical ethology, anxiety separation, aggression
Species:	dog cat
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 71
For information contact	Claudia Edwards Patiño or email atp@servidor.unam.mx

Rats' ability to recognise humans in a laboratory setting: limited exposure is enough

Van Driel, K.S., Talling, J.C., Inglis I.R., Gomm, M.K. and Robson, M.

Animal Welfare Team, Central Science Laboratory, Sand Hutton, York, YO41 1LZ, UK

A relationship, however subtle, between an animal and a person is influenced by previous exposure to and experience with that person. Davis et al (Psychon. B. Rev., 4, 1997, 118-120) showed that a single ten-minute handling session is enough for rats to consistently tell the difference between familiar and unfamiliar humans. However, in a commercial situation the actual handling of the animals is often confined to transferring animals between cages during husbandry procedures. Whether this relatively short contact provides rats with enough cues to recognise their caretaker as predicted, was tested in an open field test.

A rat was placed in the middle of a 50 x 120cm stainless steel table with the familiar caretaker and a stranger sitting quietly at opposite ends. Time spent in proximity (<30 cm) and number of visits to each person was measured for five minutes, using 67 adult rats of three inbred strains. The minimum overall contact duration with the designated caretaker was approximately two minutes over nine weeks; total non-contact exposure at least 18 hours. For the trial, caretaker and stranger were matched only for gender, and respectively wore their blue work clothes, or a blue lab coat over their normal clothes.

As predicted, rats spent significantly more time in proximity to the familiar person (GLM repeated measures, $F=14.2$, $df=1$, $p=0.000$), and visited the familiar person more often (GLM repeated measures, $F=18.7$, $df=1$, $p=0.000$). The results are generalised across strains, although not shown to the same degree.

These results support earlier findings and show that a relationship between humans and rats can be formed and identified on the basis of predominantly non-physical exposure. As most experiments involve at least some degree of human-animal interactions this may be a source of variability between trials.

This project was supported by the Pfizer/LASA Animal Welfare Research Fund.

Keywords:	rat, familiarity, human-animal relationship
Species:	rat
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 72
For information contact	Matt Gomm or email k.vandriel@csl.gov.uk

Does the flicker frequency of fluorescent lighting affect the welfare of captive birds?

Greenwood, V.J., Smith, E.L., Goldsmith, A.R., Cuthill, I.C., Crisp, L., Walter-Swan, M. and Bennett, A.T.D.

School of Biological Sciences, University of Bristol, Bristol, BS8 1UG, UK

It is common practice for captive birds to be kept under fluorescent lighting, which typically flickers at either 100 Hz (UK) or 120 Hz (USA). Such lighting was developed for human vision and it is thought that birds may differ from humans in their ability to perceive the flicker of light. Humans cannot perceive the flicker of 100 Hz lighting, but there is evidence to suggest that birds can. 100 Hz fluorescent lighting has been linked to eyestrain, headaches and migraine in humans, even though this rate of flicker is above human perceptual critical flicker fusion frequency. As bird sensitivity to flicker may be higher than that of humans, keeping birds under 100 Hz lighting is potentially detrimental to their welfare.

We studied the preferences of European starlings (Sturnus vulgaris) for high frequency (HF), greater than 30000 Hz, which would have an imperceptible flicker to all animals, vs. low frequency (LF), 100 Hz, fluorescent lighting. We also exposed starlings to either HF or LF light for two weeks, and studied their behaviour and plasma corticosterone levels. The birds were housed outside under natural lighting conditions prior to the experiments so that they had no previous experience of either HF or LF lighting.

Although groups of starlings showed a significant preference for HF lighting over LF lighting, when forced to live in one condition for two weeks there were no differences in behaviour or plasma corticosterone levels between the two treatments. These results suggest that although the birds may prefer HF to LF conditions when given a choice, the frequency of the lighting may not be a major factor for the welfare of captive wild-caught birds.

We would like to thank BBSRC and UFAW for funding.

Keywords:	flicker frequency, light environment, Sturnus vulgaris, avian vision
Species:	starling
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 73
For information contact	Verity Greenwood or email V.Greenwood@bristol.ac.uk

Stress assessment by dogs' behavior and urinary catecholamine concentrations under animal-assisted activity

Horii, T., Uetake, K. and Tanaka, T.

School of Veterinary Medicine, Azabu University, Sagamihara, Kanagawa 229-8501, Japan

Stress states of dogs under an animal-assisted activity (AAA) in a nursing home were assessed by observing the dogs' behavior and urinary catecholamine concentrations.

Six dogs (two males and four females) aged 1.5-5.3 years were used. Urine was gathered when dogs were resting in the home (T1), after exercises for 30-60 minutes (T2), on the previous day of AAA (T3), in the morning of AAA (T4) and just after AAA (T5). Activity time during the dog was in front of elderly people with a volunteer, contacting time with elderly people during the dog was petted by elderly people or played with a ball and restricted time of movement and posture (RT) were measured. Effects of the length of these times and the body size of the dogs on their behavior such as yawning, panting, snout lick, paw-lifting, sniffing, and posture related to refusal (PR) were analysed by MANOVA. Effects of each timing (T1-T5) of urine gathering, the body size and sex of the dogs, the month (September-November) of urine gathering on catecholamine concentrations were analysed by ANOVA and the Tukey test.

The observed number of PR was significantly more when RT was more than 2 minutes compared to other shorter RT times (all $p<0.05$). RT effects on the total duration of PR tended to be in the same direction ($p=0.066$). Small dogs (BW: 3.6-5.0 kg) showed significantly more PR than large dogs (BW: 16.4-28.0 kg) ($p<0.05$). Large dogs showed significantly more and longer panting than small dogs (both $p<0.05$). The mean adrenaline concentration in T5 was significantly higher than in T1, T3, T4 (all $p<0.05$). Adrenaline concentrations of small dogs were significantly higher than those of large dogs ($p<0.05$).

These results suggest that dogs experienced some degree of psychological stress during AAA. Body size determined some of the variation in the dogs' behavior and urinary catecholamine concentrations during AAA.

Keywords:	dog, stress, animal-assisted activity
Species:	dog
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 74
For information contact	Takayuki Horii or email tanakat@azabu-u.ac.jp

Owner-dog matching procedures and their effect on dog re-homing success at rescue shelters

Ledger, R.A.

'Brunel University, DFAW, Runnymede Campus, TW20 0JZ, Egham, UK

In 2000, the RSPCA re-homed in excess of 29,000 dogs in the UK. Approximately one in nine of these dogs were later returned to rescue shelters, over two thirds of new owners citing that it was because their new dog had a behaviour problem. Mis-match has implications for the welfare of both dogs and their owners.

New procedures that aim to reduce the number of dogs returned to RSPCA animal centres were developed and piloted at seven RSPCA dog re-homing centres across the UK. These procedures consisted of seven dog temperament tests to predict the behaviour dogs would display in their new homes (Ledger, 1998), assessments of the needs and expectations of prospective dog owners; a process for matching assessed dogs with compatible owners. The experiment was a controlled repeated measures design. Centres were allocated to either a Control (N=7) or a Treatment group (N=7), ensuring that there was no significant difference in return rates between the two groups. The Treatment centres implemented the new procedures for between 3 and 5 months. The Control centres received no such instruction and continued with their pre-existing procedures.

Return rates at the Treatment centres reduced significantly by 27% compared with the previous year (Wilcoxon: $p<0.05$). Return rates at Control centres increased non-significantly by 44% compared with the previous year. The response of dogs to behaviour tests prior to re-homing corresponded significantly with their temperament in their new homes.

In conclusion, theories regarding owner-dog compatibility are supported by the results of this study, that is matching dog temperament characteristics with owners' expectations of their new dogs' behaviour is associated with fewer failed owner-dog relationships.

This study was supported by a research grant from the RSPCA.

Keywords:	domestic dog, owner-dog matching, rescue shelters, temperament
Species:	dog
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 75
For information contact	Rebecca Ledger or email rebecca.ledger@brunel.ac.uk

Case report – effect of therapeutic riding by handicapped persons on the behaviour of Kiso horses

Okamoto, K., Matui, K. and Takeda, K.

Faculty of Agriculture, Shinshu University, 8304 Minami-minowa, Kami-ina, Nagano 399-4598, Japan

Few studies have examined the stress placed on horses used for therapeutic riding (TR). We studied the behaviour of horses after TR, and compared it with their behaviour after grazing on a non-therapeutic riding day (non-TR).

Two Kiso horses (10- and 11-years-old), which are the native horse of Japan, were used. The horses usually grazed in a pasture from 0900 to 1530, except when used for TR. These horses have been used for riding for about 5 years, and for TR once in the past. On the study day, eleven handicapped persons (from 4- to 20-years-old) rode the horses from 1030 to 1430 in a sand-covered arena (23?19 m). Each horse carried roughly 9 riders during TR (15 min/person). The behaviour of each horse in the stable at night after TR, and on a non-TR day, was observed from 1600 to 0830 the next morning. The posture, behaviour, and circling by each horse were recorded at one-minute intervals. The hardness of their faeces was also measured.

The horses spent more time standing after TR (84.5%) than after non-TR (72.2%), and spent 1.3 times longer feeding, although the amount of feed consumed was the same. Recumbency decreased from 27.5% (non-TR) to 14.6% (TR). The faeces after TR (0.29 kg/cm2) were softer than after non-TR (0.9 kg/cm2). Circling increased from 43 times (non-TR) to 60 times (TR). Urination was twice as frequent after TR than after non-TR, although the time spent drinking increased only slightly.

These results show that therapeutic riding may cause distress for the horses used. This study examined a small number of horses. Therefore, we are now trying to collect data on a larger number of horses to clarify the effect of TR on the behaviour of the horses used.

Keywords:	horse, stress, welfare
Species:	horse
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 76
For information contact	Keiko Okamoto or email a01a102@agrfs1.shinshu-u.ac.jp

Effects of repeated social isolation on immunological, behavioural and endocrine responses in piglets

Tuchscherer, M., Puppe, B., Kanitz, E. and Tuchscherer, A. (1)

FB Verhaltensphysiologie, (1) FB Genetik und Biometrie, FBN Dummerstorf, 18196 Dummerstorf, Germany

Animals isolated from the dam during the early neonatal period may exhibit profound alterations in their subsequent ontogenetic development.

Therefore, the aim of the present study was to investigate the immunological, behavioural and endocrine consequences of a 2-h daily social isolation from day 3 to day 11 of age in piglets (German Landrace, 9 litters, n=90) compared to untreated controls (9 litters, n=89). Blood samples were taken from piglets at the age of 2 days (before isolation) and 12 days (after isolation) to determine the levels of total protein, IgG, ACTH and cortisol and the in vitro lymphocyte activation by different mitogens. Open field behaviour (e.g. locomotion, exploration, vocalization) of all piglets were observed before (day 2) and during (day 5 and 10) the isolation period. Additionally, an immune challenge with lipopolysaccharide (LPS) was used to characterise possible effects of isolation on disease susceptibility. Isolated and control piglets received an intraperitoneal injection of LPS (100 mg/kg body weight) and were behaviourally observed for the subsequent 3 h to monitor signs of sickness. Blood samples were taken before LPS injection as well as 1 and 3 h after the LPS challenge to analyse stress hormones and the proinflammatory cytokine TNF-alpha.

Social isolation resulted in significantly increased basal plasma ACTH and cortisol levels after and a decreased open field activity during the isolation period. Furthermore, isolation had an immunosuppressive effect on lymphocyte proliferation in response to concanavalin A and to pokeweed mitogen, whereas total protein and IgG concentrations were not altered. Although all piglets showed physiological and behavioural responses on LPS challenge, there was no significant effect of isolation on the parameters analysed.

The results indicate that neonatal piglets repeatedly isolated from their litter show increased stress hormone levels following isolation and a reduced immune response.

Keywords:	social isolation, stress, pig, open field, immunity
Species:	pig
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 77
For information contact	Tuchscherer Margret or email

Dogs' behavior in two different Italian shelters: environmental influence on behavior

Valsecchi, P., Mondelli, F. (1), Montanari, S. and Prato Previde, E. (1)

Dipartimento di Biologia Evolutiva e Funzionale, Università degli Studi di Parma, 43100 Parma, Italy, (1) Istituto di Psicologia, Università degli Studi di Milano, 20100 Milano, Italy

In Italy, the number of dogs housed into shelters is very high. Living in a shelter may be stressful to dogs, especially when the environment provides little contact with humans and stimulation in general, and the dogs' behavior could be negatively influenced.

The purpose of this study was to evaluate dogs' behavior in two different shelters, in order to estimate the influence of different environments. In both shelters, dogs are kept in groups in outdoor adjacent boxes and are fed once a day. In Parma, dogs are never walked out of their box, whereas, in Reggio Emilia, dogs are walked to a grass area and thus interact with people, once a day.

Dogs were observed inside their home cage, when being outdoors, during interactions with a familiar person, an unfamiliar person and other dogs, during walks on the leash, play and training sessions and when responding to acoustic and visual stimuli.

Dogs from different shelters behaved alike in their home environment, but differed in their interaction with humans, play behavior and obedience. Dogs from Reggio Emilia tended to be more confident towards an unfamiliar person ($p=0.051$), were more playful ($p=0.038$) and more prone to learn basic commands ($p=0.013$) than those from Parma.

Contact with people and the possibility to exit the box seem to positively influence dogs' confidence towards people, dogs' listening, understanding and learning capacity and dogs' playfulness.

Considering that dogs are social animals and thus need to interact with people and other dogs and that they also need to stretch, run and explore, we might conclude that the welfare of dogs housed into shelter could be improved by providing human contact and avoiding to kept them in their box all day long.

Keywords:	dogs, behaviour, shelters
Species:	dog
Session, type, nr	*Integration of research on human welfare and animal welfare, Poster* 78
For information contact	Paola Valsecchi or email valsecchi@biol.unipr.it

Effects of social and physical environment on the welfare of juvenile farmed silver foxes

Ahola, L. and Mononen, J.

Institute of Applied Biotechnology, University of Kuopio, P.O.Box 1627, FIN-70211 Kuopio, Finland

In a series of four experiments, effects of social and physical environment on the welfare of farmed silver fox cubs were clarified. Cubs were housed either singly, in pairs, in quartets or in family groups consisting of a vixen and five or four of her cubs either in large enclosures or in a cage environment. In the cage environment, space allocation for the cubs varied between 0.6 and 1.2 m2 per individual. The enclosures were either 50 or 112 m2 each.

The cubs weaned straight into single living expressed more stereotypic behaviour than the cubs in pairs or in quartets. This indicates that social contacts are important to young cubs. On the other hand, in group housed foxes aggressiveness and incidence of bite wounds as well as tendency to avoid each other increased in later autumn. This evidence that group housing of foxes during and after the dispersion time (September-October) may not be beneficial for the foxes. Furthermore, the results show that especially male silver fox cubs may lack adaptations for living with their mother in the same family group after the onset of dispersal time. The amount of space had only minor effects on the cubs. However, in large enclosures the foxes were suffering from short-term stress when faced with human proximity.

The results obtained show that, in rich food environment, the quality (e.g. social organization) rather than the quantity of the living space is more crucial factor for the welfare of the silver foxes. In large enclosures, however, the foxes became at least to some extent feral as a consequence of the lack of close daily contacts between the foxes and their caretakers.

Keywords:	fox, social environment, physical environment, welfare
Species:	fox
Session, type, nr	*Relevance of Natural Behaviour, Poster* 79
For information contact	Leena Ahola or email Leena.Ahola@uku.fi

Could "physical fitness" be part of the animal welfare concept?

Augustsson, H., Cvek-Hopkins, K., Essén-Gustavsson, B., Spangenberg, E. and Dahlborn, K.

Unit for Comparative Physiology and Medicine, Department of Large Animal Clinical Sciences, Swedish University of Agricultural Sciences, P.O.Box 7018, SE-750 07 Uppsala, Sweden

Although rats may travel several kilometres a day in the wild, laboratory rats are commonly kept in small cages, fed ad libitum with restricted opportunities to physical activity. This lead to animals being passive and overweight. In a previous study investigating human-animal interactions in pen-housed rats (Augustsson et al), we found no effect on anticipatory reactions to handling and restraint compared to standard housed rats but a lower body weight. The aim of this study was to investigate if and how pen-housing affect locomotor activity and physical fitness of the rats.

Male Sprague-Dawley rats were randomised into two groups. Sixteen rats were kept individually in standard Macrolon type III cages (ST-rats) and sixteen rats were kept in enriched pens, each 210 x 150 cm, with 8 rats in each (PH-rats). After 3 weeks home cage behaviour was video recorded for 24 h. Locomotor activity and frequency of eating and drinking were recorded using instantaneous sampling. Physical fitness was measured using an inclined plane and muscle glycogen content and enzyme activity was analysed in samples from m. triceps brachii.

The PH-rats showed a more diverse locomotor activity pattern than ST-rats and were significantly more active. The food and water intake was similar but ST-rats gained 15-20% more body weight than PH-rats ($p<0,05$). The PH rats showed greater resistance to fatigue ($p<0,01$) measured by total maintenance time at previously specified angles in the inclined plane test. Maintenance time was positively correlated to higher levels of muscle glycogen content and citrate synthase activity (marker for oxidative capacity).

When rats were allowed to increase their physical activity their body weight gain decreased and the physical fitness was improved. We suggest that there is a connection between physical fitness and animal health that ought to be considered in the welfare concept.

Augustsson et al "Human-animal interactions and animal welfare in conventionally and pen-housed rats". Laboratory Animals, In Press.

Keywords:	rats, housing, activity, muscle
Species:	rat
Session, type, nr	*Relevance of Natural Behaviour, Poster* 80
For information contact	Hanna Augustsson or email Hanna.Augustsson@kirmed.slu.se

How do laboratory dogs of different breeds utilise an enriched housing?

Ejvegård, S., Lidfors, L. and Björklund, L. (1)

Department of Animal Environment and Health, Swedish University of Agricultural Sciences, P.O.Box 234, SE-532 23 Skara, Sweden, (1) AstraZeneca R & D Mölndal, Laboratory Animal Resources, SE-431 83 Mölndal, Sweden

This study investigated the effects of breed and time of day on behaviour, use of space and salivary cortisol levels of dogs. The study was conducted at AstraZeneca R&D on 24 male dogs 1-7 years old (Beagles n=12, Labradors n=9, cross-breed Labrador/Harrier n=3). Dogs of equal breed were housed pair-wise in pens (~11 m_) with shelves, wood shavings and toys. During working hours, all pairs had free access to an outdoor pen (~10 m2).

Direct behavioural observations (DO) were done during 3 bouts (7-9, 10-12 and 14-16) of 30 min. per day, for 3 days, per pair. Once per pair, behaviour was recorded on video (VR) for 24 h. Behaviour was recorded on focal dogs with intervals of 1 min. 0-1 sampling (DO), and 5 min. instantaneous sampling (VR). Activity was measured by a pedometer. Salivary samples were taken every second hour, between 7-17, and analysed for cortisol by radio immunoassay (Coat-A-Count, DPC). Statistics used Linear Mixed Effect Model.

Beagles performed more exploring ($p<0.001$, DO, VR), standing on hind-legs ($p<0.01$, DO, VR), urinating ($p<0.01$, DO) and standing at outdoor ($p<0.01$, VR) than Labradors. Labradors performed more interactions with toys ($p<0.01$, DO), standing ($p<0.05$, DO), lying ($p<0.01$, VR) and sitting ($p<0.001$, VR). No significant breed differences were found in activity or salivary cortisol levels. There were effects of time of day with peak values at 15 h. in activity ($p<0.001$) and salivary cortisol ($p<0.05$). During the 7-9 observation period dogs performed significantly more moving, standing, sitting, jumping onto shelf, standing on hind-legs and exploring. During the 10-12 observation period dogs spent more time outdoors and standing at outdoor. Lying was more common during the 14-16 observation.

It is concluded that Beagles and Labradors differ in some behaviours and use of space, but not in general activity or salivary cortisol levels.

Keywords:	dogs, Beagle, Labrador, enrichment, behaviour, activity, cortisol
Species:	dog
Session, type, nr	*Relevance of natural behaviour, Poster* 81
For information contact	Sara Ejvegård or email Lena.Lidfors@hmh.slu.se

Reward duration – a matter of concern in relation to the construction of demand curves

Hansen, S.W. and Jensen, M.B.

Danish Institute of Agricultural Science, Dept. of Animal Health and Welfare, Research Centre Foulum, PO Box 50, DK-8830-Tjele, Denmark

Measures of demand elasticity are one way to assess animal resource requirements, but there are still a number of experimental parameters that need to be carefully controlled in order to generate valid data.

For measuring elasticity of demand, the price paid and the amount of a resource used must co-vary. This means that the reward duration/size must be fixed but at the same times it must be sufficiently long/large to be meaningful to the animal. In this paper data will be presented showing that 1 min of assess to a nest box for a mink is less important than 20 or 60 min of assess to a nest box, and that 1 gram of food is less important than 2 grams of food.

Arguments for or against mink's need of swimming water have been raised. In this paper, we will also present demand curves for swimming water and a running wheel at a reward duration of 1 and 2 min, respectively. Mink do not differentiate between 1 and 2 min of access to swimming water, but they prefer 2 min of access to a running wheel. Mink seems to give higher priority to a running wheel rather than a swimming basin, indicating that the wish for occupation is more important than a "specific need" to swim. For construction of demand curves the reward duration seems to be of significant importance.

Keywords:	operant conditioning, reward size, mink
Species:	mink
Session, type, nr	*Relevance of Natural Behaviour, Poster* 82
For information contact	Steffen Hansen or email Steffenw.hansen@agrsci.dk

Parental behaviour of group-housed farmed silver foxes in semi-natural environment

Pyykönen, T., Ahola, L., Mononen, J., Mohaibes, M. and Kasanen, S.

Institute of Applied Biotechnology, University of Kuopio, P.O.Box 1627m Fin-70211 Kuopio, Finland

In dense populations, wild foxes live in small groups usually comprising of a male and one to four related females. Typically only the dominant female breeds, whereas the subdominant females abstain from reproduction and may act as helpers. Also communal breeding by two females has been reported in nature. Furthermore, the male may take part to cub care. We studied whether the natural reproduction strategies also occur in farmed silver foxes when housed in groups in semi-natural environment.

A total of 14 groups of two juvenile vixens (sisters) and a juvenile male were farmed in ground floor enclosures (50-225 m2) during four breeding seasons. There were two or three nest boxes in each enclosure. Behaviour of the foxes was observed daily through the breeding season. The nest boxes were inspected from two weeks before expected delivery onwards.

In two groups neither of the two vixens delivered, and in one group one of the vixens delivered but the cubs were killed in the age of four weeks. In two groups both vixens delivered but the cubs were lost a day after the deliveries. In two enclosures both vixens delivered, but only one litter survived, and in four enclosures only one female delivered and also weaned cubs. In these six cases the non-producing vixens acted as helpers. In three groups both vixens delivered and nursed mixed litters together. Most males participated in rearing the cubs. Forty-three percent of vixens reproduced successfully and mean litter size at weaning per breeding female was 2.3±2.8 cubs.

The reproduction strategies observed in the present descriptive study indicate that farming silver foxes for about 100 generations has not suppressed the effect of social environment on reproduction. These social mechanisms may operate under normal farming conditions where vixens are housed singly but in high densities.

Keywords:	silver fox, parental behaviour, reproductive performance, semi-natural environment
Species:	fox
Session, type, nr	*Relevance of Natural Behaviour, Poster* 83
For information contact	Teija Pyykönen or email teija.pyykonen@messi.uku.fi

The behaviour of foals before and after weaning in groups

Muhonen, S., Lönn, M. and Rundgren, M.

Dept. of Animal Nutrition and Management, Swedish University of Agricultural Sciences, P.O. Box 7024, SE-750 07, Uppsala, Sweden

The aim was to compare the behaviour of foals kept in groups before and after stepwise removal of their mares, a method suggested to decrease weaning stress.

Two groups of Standard bred foals (12 and 11, respectively, 5 months old, colts and fillies mixed), were kept with their mares on pasture (3 - 4 hectares). The horses had also free access to silage and the foals were fed concentrate in a creep feeding area. Every or every second day 2 - 3 mares were removed. Observations were performed daily in two hour-shifts from the day before the first removal until the day after the last removal of mares. The two groups were observed for 28 and 26 hours, respectively. Vocalisation and nursing frequencies were recorded continuously. Other behaviours were recorded every second minute. Means for periods of 14 minutes were calculated and analysed by the GLM procedure, the Statistical Analysis System.

The day before any mares were removed, the foals spent in % of observations: feeding 59.4 (including 2.8% suckling; frequency 1.1 times per hour and foal), other active behaviours 25.4, and resting 15.1. The day after all the mares had been removed, these figures were 59.2, 18.8 and 21.9, respectively. During days when mares were removed, the foals without mothers were vocalising significantly more than during the other days ($p<0.001$), and also more than the foals with mothers ($p<0.001$). Vocalisations were often performed in connection with running (Pearson correlation 0.6, $p<0.001$). The foals without mothers spent significantly less time resting more than 5 m from another foal ($p<0.001$), and also less time in lateral recumbency ($p<0.05$). The unchanged time budget indicates a fast recovery after weaning. However, the weaned foals suckled on each other (average frequency 0.4 times per hour and foal). The significance of this behaviour needs further investigation.

Keywords:	foals, weaning, group, behaviour
Species:	horse
Session, type, nr	*Relevance of Natural Behaviour, Poster* 84
For information contact	Margareta Rundgren or email a8sarmuh@ulmo.stud.slu.se

Difference of grazing behavior and distribution of horses and cattle on woodland pasture

Shingu, Y., Kondo, S., Hata, H. and Okubo, M.

Hokkaido University, 'Kita-ku Kita 9 Nishi 9, 060-8589, Sapporo, Japan

In Japan, horses and/or cattle have been sometime grazed on woodland. Between these two animals, effects of grazing on woodland would be different because of their behavioral differences of grazing on developed grassland. From the viewpoint of the sustainable utilization of woodland, we observed behavioral differences of grazing horses and cattle on woodland pasture.

A group of 12 Hokkaido native horses and a group of 5 Hereford cows were kept on two separated paddocks in woodland for 12 days in autumn, respectively. They grazed leaves of bamboo grass as the undergrowth of each paddock (1.1 ha/horse and 0.96 ha/cattle). On Days 3 and 8, the time budget of grazing, the moving distance and the daily staying area were recorded in three focal animals for each group during 24 hr. On Days 2, 6 and 11, the number of bites and the staying time in every feeding stations (FS) were recorded in three focal animals for each group through 9 sets of 10 min-observations at morning and evening, respectively. FS was defined as the area accessible to a grazing animal without moving its forefeet.

The activities of grazing in each FS for both species were not differed essentially. Horses and cattle stayed in each FS at 16.6 to 14.6 sec, and took 5.4 to 4.1 bites per FS, respectively. On the other hand, there were statistical differences on the time budget of grazing and the moving distance between them. The time budget of grazing and the moving distance per day were larger for horses (697.4 min and 5.8 km) than for cattle (484.4 min and 1.4 km). Differences were both significant ($p<0.05$). Consequently, horses had been using larger area of woodland than cattle, as the daily staying area of 2.5 and 0.7 ha, respectively ($p<0.05$).

Keywords:	cattle, horse, grazing behavior, feeding patch distribution, woodland pasture
Species:	cattle horse
Session, type, nr	*Relevance of Natural Behaviour, Poster* 85
For information contact	Yuko Shingu or email shing@anim.agr.hokudai.ac.jp

Reduction of peeling damage to shade tree in a free barn caused by rubbing of cattle

Takeda, K., Sakaguchi, M. and Matsui, K.

Faculty of Agriculture, Shinshu University, 8304 Minami-minowa, Kami-ina, Nagano 399-4598, Japan

The present study was carried out to investigate if the installation of thin wooden logs in the pasture at the University farm would reduce the damage caused to shade trees by excessive rubbing of horned cattle.

In a preliminary study twenty-four Japanese black cattle were housed together for 17 hours per day in an open yard (28.5a) with shade trees (17 red pines and 4 chestnut oaks), and grazed at pasture (1 ha) for 7 hours during daytime in the absence of trees. The climate is moderate with daytime temperatures around 25ü[C. To minimize the peeling damage without preventing cattle to rub in the yard, we installed 28 thin logs inside the fence surrounding the pasture. Cattle were observed 6 and 5 hours in the pasture and the yard, respectively, for 5 fine days in summer. After installing the logs, we observed the cattle for 4 hours each in the pasture and the yard for 2 days. Rubbing of all cattle was recorded continuously, distinguishing the body parts and objects rubbed.

More rubbing was observed in the yard than in the pasture (Wilcoxon: $Z=-2.02$; $N=5$; $p<0.05$), and cattle rubbed oaks more than pines in the yard ($Z=1.75$; $N=5$; $p=0.08$). Most rubbing was done with the forehead (28%) and least with the horns (3%). Most rubbing with horns was preceded by rubbing other parts. Half of the rubbing was done on shade trees in the yard. After installing logs, the cattle increased rubbing by 2.5 times in the pasture. Moreover, the frequency of rubbing (times/animal/hour) in the yard decreased from 4.9 to 4.0 ($p>0.05$).

The results show that providing objects for rubbing in the pasture may reduce peeling damage to shade trees without obstructing rubbing and its motivation by cattle in the yard.

Keywords:	cattle, grooming, shade tree, trigger rubbing
Species:	cattle
Session, type, nr	*Relevance of Natural Behaviour, Poster* 86
For information contact	Ken-ichi Takeda or email ktakeda@gipmc.shinshu-u.ac.jp

Does the pre-orbital gland opening signal hunger of red deer calves?

Vichova, J., Bartos, L. and Lancingerova, J.

Ethology Group, Research Institute of Animal production, Pratelstvi 815, 104 00 Prague 10 - Uhrineves, Czech Republic

In 1976 Wölfel published a paper describing that a pre-orbital opening is a signal to a red deer mother that her calf is hungry and stated that the mother stops suckling once the calf's pre-orbitals are closed and argued that closing the gland is a signal of receiving physiological amount of milk (Wölfel, H. 1976 Z. d. Kölner ZOO 19: 16). We tested the hypothesis that the pre-orbital opening signals hunger, while the gland is closed when the calf is satiated.

For this we observed behaviour of 8 calves bottle-reared over the period of 6 months and recorded pre-orbital opening in two periods, before they were offered the meal and after they ate it. Satiation of the calf was estimated (not begging for more food after the meal - satiated, begging - not satiated).

Repeated measurement model with weighted least squares (PROC CADMOD, SAS) revealed that pre-orbital opening was dependent on satiety and period (Interaction pre-orbital opened x Satiety x Before meal/After meal, Chi-squared=134.58, $p<0.001$). When not satiated (Percentage calculated of all cases n=6232), percent of opened increased and percent of closed decreased from before meal (pre-orbital opened =2.46%, pre-orbital closed =1.16%) to after meal (pre-orbital opened =3.00%, pre-orbital closed =0.72%, Chi-squared=9.50, $p<0.01$). In contrast, when satiated, percent of pre-orbital opened decreased and pre-orbital closed increased from before meal (pre-orbital opened =20.56%, pre-orbital closed =10.33%) to after meal (pre-orbital opened =13.16%, pre-orbital closed =24.05%, Chi-squared=409.22, $p<0.001$).

Pre-orbital opening tended to be associated with feeding and achieving satiety. Nevertheless, pre-orbital opening was not present always, when the calves were hungry and did not vanish during the feeding in all cases. It suggested that pre-orbital opening may reflect excitement of the calves, rather than signalling the stage of satiety.

Keywords:	pre-orbital gland, red deer, calf
Species:	red deer
Session, type, nr	*Relevance of Natural Behaviour, Poster* 87
For information contact	Jitka Vichova or email vichova@vuzv.cz

Workshops

Biologist-friendly statistics workshop

Garner, J.P.

Department of Animal Science, University of California, One Shields Avenue, Davis, CA 95616, USA.

Within the last few years the statistical methods reported in pure and applied ethology journals have become increasingly sophisticated. However this increase in sophistication has not been accompanied by an increase in the rigor or validity of statistical analysis in published papers. For instance, a recent issue (Vol 62: Issue 1) of Animal Behaviour picked at random contains 22 papers. Of these, 3 fail to report analyses in sufficient detail to assess their validity (i.e. confidence intervals, degrees of freedom, or standard errors are omitted); whilst a further 11 contain statistical mistakes that are evident with nothing more than a cursory glance at the results tables or graphs.

A large part of this problem is that statistics is rarely taught to biologists in a readily digestible form - the implications of equations whilst apparent to statisticians are often not apparent to biologists. Similarly, the implications of biology or experimental design are rarely apparent to statisticians, so even when statisticians are consulted inappropriate advice is often given. Finally, most sophisticated statistics software assumes that the user is extremely statistically literate - as statistics is more of an art than a science, a computer can rarely tell the user whether the analysis is appropriate given the experiment (this is particularly problematic for repeated measures ANOVA, which many statistics programs default to analysing incorrectly).

However, the common statistical errors in most ethological papers boil down to a handful of basic concepts that can be easily and briefly explained in words and pictures. The purpose of this workshop is to discuss the pitfalls inherent in analysing ethological data, from a conceptual, equation-free point of view. We will take a user-friendly cook-book approach, discussing the classic errors to watch out for in one's own research, whilst refereeing papers, and whilst assessing published work. Listed below are the seven common mistakes, with typical examples. For brevity the following list contains a lot of jargon, please do not be put-off.

1. Non-homogeneity of variance, normality of error, and transformation:
    - · Lack of suitable transformation.
    - · Failure to assess the success of a chosen transformation.
    - · Assuming that normally distributed error reflects a valid analysis.
    - · Floor and ceiling effects.
2. Non-independence:
    - · Ignoring sources of non-independence, such as sex or strain.
    - · The many flavours of pseudoreplication.
3. Inappropriate choice of analysis:
    - · Unnecessary use of non-parametric tests.
    - · Inappropriate use of Chi-squared.
    - · Drawing conclusions from non-significant results without performing power tests.

- · Removal of covariance by residual techniques, rather than partialling.
- · Use of ANOVA with unbalanced designs.
- · Confounded designs.

4. Inappropriate model design and incorrect F-ratio calculation ('linearity', 'hierarchy', 'marginality'):

- · GLIM, GLM, ANOVA or logistic regression model designs that do not reflect the experimental design, including...
- · ...treating continuous X variables as categorical when the null hypothesis requires the variable to be tested as continuous.
- · Reporting p-values for variables marginal to an interaction when Type III sums of squares are used.

5. Inappropriate or incorrect use of repeated measures ANOVA (these are all special cases of inappropriate model design, but repeated measures ANOVA errors are so common they deserve their own category!) :

- · Using repeated measures ANOVA when the 'subject' is not a random effect.
- · Incorrect calculation of the F-ratio in repeated measures ANOVA when the 'subject' is a random effect, including...
- · ...using the residual SS to calculate the error term (a case of pseudoreplication)...
- · ...and reporting p-values for variables marginal to their error term in repeated measures ANOVA when Type III sums of squares are used.

6. Multiplicity:

- · Hypothesis-free fishing expeditions...
- · ...Stepwise regression...
- · ...and other dubious manifestations of multiple comparisons.
- · Treating continuous X variables as categorical.

7. Lies, damn lies, and statistics:

- · Reporting arithmetic- rather than least-squares- means.
- · Failing to report confidence intervals, effect sizes with standard errors, or degrees of freedom...
- · ...and failing to discuss the real-world impact of p-values with large error degrees of freedom.
- · Incorrectly interpreting the population to which the statistical results pertain.
- · Drawing conclusions from non-significant results without performing power tests.
- · Using internally valid analyses that do not actually test the hypothesis investigated.

I'll pick one or two papers that illustrate all of these mistakes and shall send them to participants ahead of time. We'll run the workshop as a discussion of the papers more than anything else, starting with a brief talk from me at the start.

I would expect people attending the workshop to be people who analyse experiments or review papers - i.e. it'll be suitable for everyone at the conference!

Keywords:	statistics, biology, recent developments
Species:	general
Session, type, nr	*Workshops, Workshop* 01
For information contact	Joop De Bree or email jpgarner@ucdavis.edu

Towards a consensus view on the future of non-confinement farrowing systems

Day, J.E.L.

ADAS Terrington, Terrington-St-Clement, King's Lynn, Norfolk PE34 4PW UK

Background

For some time the agricultural research community has been active in gathering information about the welfare and productivity of sows and litters housed in free-farrowing systems. However, scientists often appear to be in disagreement about the future of such systems, and consequently there is much concern in the agricultural sector that research may result in legislation which could outlaw the use of farrowing crates.

Aim of the workshop

The aim of the proposed workshop is to discuss the future of pig farrowing systems. Interested research groups will be invited to present the main findings of their research and speculate on how they view future of pig farrowing systems developing. Particular emphasis will be placed upon delineating the areas of agreement, and highlighting the areas in which there is disagreement.

Format

It is proposed to run the workshop jointly with the British Society of Animal Science (BSAS).

Keywords:	future, pig, farrowing system
Species:	pig
Session, type, nr	*Workshops, Workshop* 02
For information contact	Jon Day or email Jon.Day@adas.co.uk

Feather pecking in laying hens: new insights?

Rodenburg, T.B., Van Hierden, Y.M. (1), Buitenhuis, A.J. (2) and Riedstra, B. (3), Koene, P., Korte, S.M. (1), Van der Poel, J.J. (2), Groothuis, T.G.G. (3) and Blokhuis, H.J. (1)

Ethology Group, Wageningen University, P.O. Box 338, 6700 AH Wageningen, The Netherlands, (1) Division of Animal Sciences, ID-Lelystad, (2) Animal Breeding and Genetics Group, Wageningen University, (3) Department of Animal Behaviour, University of Groningen

Background

The problem of feather pecking in laying hens has received much attention from applied ethologists over the years, yet an unambiguous solution remains to be found. In Europe, cages will be banned in the near future. In large groups feather pecking is less controllable and may spread more easily through the flock. In the Netherlands a research program on feather pecking in laying hens started in 1999. A multidisciplinary approach was chosen for this program, integrating physiological, ethological, ontogenetic and genetic aspects of feather pecking.

Aim of the workshop

The aim of the proposed workshop is to discuss current approaches to solve the problem of feather pecking and to indicate promising approaches for future research. To meet this aim, four propositions, based on data, will be presented and discussed:

1. Gentle feather pecking in young birds is not a predictor of severe feather pecking in adult laying hens.
2. High feather peckers have a pro-active coping strategy and low feather peckers have a reactive coping strategy.
3. Feather pecking is social exploration.
4. Implementation of molecular genetics in selection strategies is a viable way to relieve the FP problem in practice.

You are all invited to contribute to the workshop by bringing data that support or oppose one of the propositions! We look forward to a stimulating discussion!

Keywords:	feather pecking, laying hen, genetics, ethology, physiology, ontogeny
Species:	chicken
Session, type, nr	*Workshops, Workshop* 03
For information contact	Bas Rodenburg or email bas.rodenburg@etho.vh.wau.nl

Consequences of grazing for the welfare and health of dairy cows

Hopster, H.

Dept. Animal Sciences, Institute for Animal Science and Health, Edelhertweg 15, 8219 PH, Lelystad, The Netherlands

At least in the Netherlands, and possibly also in other European countries, the importance of grazing for the health en well-being of dairy cows is subject to intense public concern and debate; for example, should zero-grazing systems be discouraged. We think that a scientific review on aspects of grazing / zero-grazing relevant for the welfare of the dairy cow will contribute to a meaningful public discussion.

In this workshop participants from different European countries will give short (10 min) presentations addressing at least the following three points:

1) How many dairy farms apply grazing in your country, what is the dominant housing type and what are the developments for the future?
2) Is grazing a public issue in your country? Do the dairy industry and/or retail organisations stimulate grazing and if yes, in what way?
3) Is there any national legislation that compels farmers to graze their cows on pasture. If yes, for how many days and for what time per day?

The results of the workshop will be used as input for a scientific publication on the significance of grazing for dairy cow health and welfare.

Keywords:	zero-grazing, health, welfare, grazing, future
Species:	cattle
Session, type, nr	*Workshops, Workshop* 04
For information contact	Hans Hopster or email h.hopster@id.dlo.nl

Workshop on scientific advice and decision-making processes: the Animal Needs Index as a tool

De Jonge, F.H.

Animal Welfare Centre, Faculty of Veterinary Medicine, University of Utrecht, Yalelaan 17, NL-3584CL, Utrecht, the Netherlands

Advice from applied ethologists is often asked in order to give a scientific underpinning to decision-making processes on animal welfare. However, there are several reasons why such advice may fall short. For instance: 1) Scientific argumentation on animal welfare may be too complicated to be useful in more politically oriented argumentation. 2) Discussions tend to focus on detailed aspects of welfare regulations, while its relative contribution to the entire welfare problematic of the species under question, remains obscure for most discussants. 3) Pressure groups capitalize on the scientific controversies that may, but equally often may not be relevant to the underlying political issue. 4) The scientific knowledge that is generated by applied ethologists, does not allow cross-species comparisons: the welfare violations due to, for instance race-horsing as opposed to intensive poultry farming, cannot be estimated relative to each other.

The Animal Needs Index is a tool that aims to translate complex ethological knowledge in an index that can be more easily valued by laymen. It has therefore the potential to increase the impact of applied ethologists in decision-making processes. It is also a tool that may be used for cross-species comparisons. However, such a tool can only be effectively applied, if it is broadly adopted by the scientific community, and if there exists consensus about its use.

In the present workshop, we want to address the role of the scientific community in decision-making processes. More in particular, we want to discuss the potential benefits and pitfalls of the Animal Needs Index in this respect. The following questions will be addressed: 1) What should be the role of the applied ethologists in decision-making processes: should we strive for scientific statements based on consensus or should we encourage the freedom of the scientific debate in all forums equally. Should the ISAE play a special role in this respect? 2) What are the benefits and pitfalls of the Animal Needs Index as a tool in decision-making processes. 3) Could we develop procedures for a further development of the Animal Needs Index a) so that we can guarantee that it is based on consensus by the scientific community b) so that newly developed scientific concepts can be incorporated in the index at a regular basis.

Keywords:	welfare assessment, Animal Needs Index, decision-making, applied ethologist
Species:	general
Session, type, nr	*Workshops, Workshop* 05
For information contact	Francien De Jonge or email F.H.deJonge@vet.uu.nl

Pros and cons of different animal-directed methods to evaluate housing systems for farm animals

Stefanowska, J.

Institute for Agricultural Engineering, 6700 AA Wageningen, P. O. Box 43, The Netherlands

Background

The growing public interest in the conditions under which farm animals are kept is accompanied by mounting criticism because the welfare of livestock in current housing systems cannot be ensured. People are therefore looking for different and new methods for evaluating the existing housing systems.

Aim

The aim is to involve the animals themselves in such evaluations. Because the animals do not speak in our language we must look for indirect methods based on animal behaviour and we must be very careful about interpretation. The possible methods include comparative studies under different conditions, preference tests, "follow-up" studies in which conditions can be changed, and direct observations on interactions between the animals and specific elements of their environment. One promising method is to look to what extent the animals can behave naturally under the conditions under which they are kept.

I would like to stimulate discussion related to following points:

1. Comparison of different methods: pro and cons
2. Exchange of experiences related to applying the above-mentioned methods to farm animals
3. Danger of personifying the expected results (e.g. the animals choose the floor that we humans think is "better")
4. Refinement of methods.

Keywords:	ask the animal, preference test, behavioural indicator
Species:	general
Session, type, nr	*Workshops, Workshop* 06
For information contact	Joanna Stefanowska or email j.stefanowska@imag.wag-ur.nl

Participants

Adagun, T.
1 *, Saheeto International Limited, 20 Gambari Street Epetedo, LAGOS ISLAND, Nigeria, Phone: 00234126 32937, Fax: 00234126 37437 Email address: saheetointl@yahoo.com.*

Adarkwah, S.
2 *Education, University of cape Coast, Ghana, Valco Hall, Rm E8 Cape Coast, CAPE COAST, Ghana, Phone: 0023351 35943, Fax: 0023342 36235 Email address: sammytugaus@yahoo.com.*

Adejuyigbe Sunday,
3 *Research, Cocoa Research Institute of Nigeria, No 15 Idi Ayure, Ijebu Ode, Road, P.O. Box 12490, IBADAN, Nigeria, Phone: 002342 231 8400, Fax: 002342 231 1670 Email address: easyway2001@onebox.com.*

Adelu, A.
4 *Research and Development, Sunny Ventures Nigeria Limited, P.O. Box 1206, Dugbe, IBADAN, Nigeria, Phone: 002342 2414328, Fax: 002342 2414328 Email address: sunnelux@yahoo.com.*

Agabi Chidi Bright,
5 *Research, National Horticulture Research Institute, Idi-ishin Jericho Reservation Area, P.O.Box 12490, IBADAN, Nigeria, Phone: 002342 241 3835, Fax: 002342 231 8677 Email address: nathort@yahoo.com.*

Agergaard, N.A.
6 *Dept. of Animal Health and Welfare, Danish Institute of Agricultural Science, P.O. Box 50, TJELE, Denmark, Phone: 4589991502, Fax: 4589991500 Email address: Niels.Agergaard@agrsci.dk.*

Ahmed, R.
7 *Social Welfare, B-11/372 Indus Mehran Housing Society, Malir Karachi No.37, KARACHI, Pakistan, Phone: 009221 4503493, Fax: 009221 2418954 Email address: lotustrust@yahoo.com.*

Ahola, L.
8 *Institute of Applied Biotechnology, University of Kuopio, P.O. Box 1627, KUOPIO, Finland, Phone: 0035817 163 144, Fax: 0035817 163 148 Email address: leena.ahola@uku.fi.*

Akanji, M.
9 *Care and Production, Betalise Farms Limited, 6 Koya Street, Challenge, IBADAN, Nigeria, Phone: 002342 2312846, Fax: 002341 8017204032 Email address: betalise_group@yahoo.com.*

Albentosa, M.
10 *Biological Science, University of Lincoln, Caythorpe Court, Caythorpe, LINCOLNSHIRE, United Kingdom, Phone: 00441400 275674, Fax: 00441400 275686 Email address: malbentosa@dmu.ac.uk.*

Almazan-Ruada, P.
11 *Fish Culture and Fisheries Group, Wageningen University, Marijkeweg 38-40, WAGENINGEN, The Netherlands, Phone: 0317 484942, Fax: 0317 483937 Email address: pablo.almazan@alg.venv.wau.nl.*

Alvarez, L.
12 *Centro de Enseñanza Práctica, Universidad Nacional Autónoma de Mexico, Cruz Blanca 486, Tlalpan, Topilejo, MEXICO CITY, Mexico, Phone: 5258480515, Fax: 5258480514 Email address: alorenzo@servidor.unam.mx.*

Andenaes, H.A.
13 *, Hegdehaugsveien 36c, OSLO, Norway, Phone: 004790 853500, Fax: Email address: hilde@andenaes.com.*

Andersen, I.L.A.
14 *Agricultural Engineering, Agricultural University of Norway, P.O. Boox 5065, AAS, Norway, Phone: 4764948710, Fax: 4764948810 Email address: Inger-Lise.Andersen@itf.nlh.no.*

Arnould, C.
15 *Station de Recherches Avicoles, INRA, Unite de Gestion, NOUZILLY, France, Phone: 00332 47 42 76 97, Fax: 00332 47 42 77 78 Email address: arnould@tours.inra.fr.*

Atembe, A.
16 *Live Stock, Cirecdep, Kumba Meme, SOUTH WEST PROVINCE, Cameroon, Phone: 00237751 2929, Fax: 00237335 4256 Email address: cirecdep@yahoo.com.*

Augustsson, H.
17 *Unit for Comparative Physiology/Medicine, Swedish University of Agri. Sciences, P.O. Box 7018, UPPSALA, Sweden, Phone: 0046018 671000, Fax: 0046018 673509 Email address: hanna.augustsson@kirmed.slu.se.*

Awosanya, N.
18 *Biology, Ahmadu Bello University, 25 Liwe Street Ikorodu, LAGOS, Nigeria, Phone:, Fax: 2342875262 Email address: jibowl@yahoo.com.*

Bakken, M.B.
19 *Department of Animal Science, Agricultural University of Norway, P.O. Box 5025, ÅS, Norway, Phone: 4764948003, Fax: 4764947960 Email address: morten.bakken@ihf.nlh.no.*

Baranyiova, E.
20 *Vet. Public Health and Forensic Medicine, Uni.of Veterinary and Pharmaceutical Sc., Palackeho 1-3, BRNO, Czech Republic, Phone: 0042541 562505, Fax: 0042541 211151 Email address: actavet@vfu.cz.*

Baumans, V.
21 *Veterinary Resources, Karolinska Institute, , STOCKHOLM, Sweden, Phone: 00468 7286786, Fax: 00468 339247 Email address: vera.baumans@admin.ki.se.*

Beerda, B.
22 *Dier en Omgeving, Dierenwelzijn, ID Lelystad, Edelhertweg 15, LELYSTAD, The Netherlands, Phone: 0320-238189, Fax: 0320-238094 Email address: b.beerda@id.wag-ur.nl.*

Berk, J.
23 *Federal Agricultural Research Center, Institute for Animal Science, Dörnbergstr. 25/27, CELLE, Germany, Phone: 00495141 38417, Fax: 00495141 381849 Email address: Jutta.Berk@fal.de.*

Bestman, M.W.P.
24 *Animal Husbandry, Louis Bolk Institute, Hoofdstraat 24, DRIEBERGEN, The Netherlands, Phone: 0343-523863, Fax: 0343-*

515611 Email address: m.bestman@louisbolk.nl.

Blokhuis, H.J.
25 Divisie Dier & Omgeving, ID-Lelystad, P.O. Box 65, LELYSTAD, The Netherlands, Phone: 03 20 23 81 95, Fax: 03 20 23 80 94 Email address: h.j.blokhuis@id.dlo.nl.

Bøe, K.
26 Department of Agricultural Engineering, Agricultural University of Norway, P.O. Box 5065, AAS, Norway, Phone: 4764948700, Fax: 4764948810 Email address: knut.boe@itf.nlh.no.

Bokkers, E.A.M.
27 Ethologiy Group, Dep. of Animal Sciences, Wageningen University, PO Box 338, WAGENINGEN, The Netherlands, Phone: 0317 48 31 20, Fax: 0317 48 50 06 Email address: eddie.bokkers@etho.vh.wau.nl.

Bolhuis, J.E.
28 Ethology Group, Wageningen University, Marijkeweg 40, WAGENINGEN, The Netherlands, Phone: 317483926, Fax: 317485006 Email address: Liesbeth.Bolhuis@etho.vh.wau.nl.

Bonde, K.
29 Department of Animal Health and Welfare, Danish Institute of Agricultural Science, P.O. Box 50, TJELE, Denmark, Phone: 4589991347, Fax: 4589991500 Email address: Marianne.Bonde@agrsci.dk.

Borell, H. von
30 Animal Husbandry and Livestock Ecology, Animal Breeding an Husbandry, Adam-Kuckhoff-Str.35, HALLE/S, Germany, Phone: 0049345 5522332, Fax: 0049345 5527106 Email address: BORELL@landw.uni-halle.de.

Bos, R. van den
31 Animal Society/Ethology and Welfare Grou, Utrecht University, Yalelaan 17, UTRECHT, The Netherlands, Phone: 030-2532573, Fax: 030-2539227 Email address: R.vandenbos@las.vet.uu.nl.

Bouissou, M.F.
32 Physiologie de la Reproduction, INRA, Centre de Recherches de Tours, NOUZILLY, France, Phone: 00332 47427971, Fax: 00332 47427743 Email address: bouissou@tours.inra.fr.

Bouwma, I.M.
33 , Alterra, Droevedaalsesteeg 3, WAGENINGEN, The Netherlands, Phone: 0317 477985, Fax: 0317 424812 Email address: i.m.bouwma@alterra.wag-ur.nl.

Bowell, A.
34 Animal Behaviour Department, Scottish Agricultural College, Bush Estate, EDINBURGH, United Kingdom, Phone: 0044131 5353210, Fax: Email address: V.Bowell@ed.sac.ac.uk.

Boyle, L.B.
35 Pig Production, Teagasc, Moorepark Research Centre, CO.CORK, Ireland, Phone: 00353025 42389, Fax: 00353025 42340 Email address: Lboyle@Moorepark.Teagasc.ie.

Bracke, M.B.M.
36 Animal Sciences, ID-Lelystad, P.O. Box 65, LELYSTAD, The Netherlands, Phone: 0320 238 205, Fax: 0320 238 094 Email address: m.b.m.bracke@id.wag-ur.nl.

Breuer, K.
37 Department of Agriculture, University of Newcastle, King George VI Building, NEWCASTLE PON TYNE, United Kingdom, Phone: 0044 1733 252320, Fax: 0044 1733 252240 Email address: kate.breuer@yahoo.com.

Brink, S. van de
38 DPW, Ministerie van LNV, Bezuidenhoutseweg 73, DEN HAAG, The Netherlands, Phone: 070 3784295, Fax: 070 3786161 Email address: S.van.den.brink@DL.agro.nl.

Broom, M.
39 Clinical Veterinary Medicine, Cambridge University, Madingley Road, CAMBRIDGE, United Kingdom, Phone: 0044 122 3337697, Fax: 0044 122 3337610 Email address: ga207@cam.ac.uk.

Broucek, J.J.
40 Ethology of Farm Animal, Research Institute of Animal Production, Nitra Hlohovska 2 VUZV, NITRA, Slovak Republic, Phone: 0042 1376 546280, Fax: 0042 1376546 483 Email address: broucek@vuzv.sk.

Bukasa, G.
41 Department of Agriculture, 69 AV Mutombo katshi- c/ Gombe, KIN 1, Congo, Phone: 00242982 18450, Fax: 00242001 775 255 6482 Email address: depteducation@yahoo.fr.

Canali, E.
42 Medicina Veterinaria, Instituto di Zotecnica, Celoria 10, MILAN, Italy, Phone: 003902 50318027, Fax: 003902 50318030 Email address: elisabetta.canali@unimi.it.

Cassoret-Bedoucha, M.
43 , 1221 Dorcas Terrace, KINSTON, NOTH CAROLINA, United States of America, Phone: 001252 523 2118, Fax: 001252 520 9319 Email address: marine@icomnet.com.

Chaloupkova, H.Ch.
44 Ethology, Research Inst. of Animal Prod. Prague, Pratelstvi 815, PRAGUE, UHRINEVES, Czech Republic, Phone: 004202 67009657, Fax: 004202 67710779 Email address: chaloupkova.helena@vuzv.cz.

Chandroo, P.
45 Ontario Veterinary College, University of Guelph, University of Guelph, GUELPH, Canada, Phone: 001 151 982 44120, Fax: Email address: kchandro@uoguelph.ca.

Chiku, F.C.
46 Animal Science, Azabu University, 1-17-71 Fuchinobe, SAGAMIHARA, Japan, Phone: 008142 7547111, Fax: 008142 7533395 Email address: f-chiku@fc4.so-net.ne.jp.

Christensen, J.W.C.
47 Department of Animal Health and Welfare, Danish Institute of Agricultural Science, Research Centre Foulum, P.O. Box 50, TJELE, Denmark, Phone: 4589991330, Fax: 4589991500 Email address: JanneWinther.Christensen@agrsci.dk.

Christiansen, S.B.
48 University, Department: Bioethics, The Royal Veterinary and Agricultural, Groennegaardsvej 8, FREDERIKSBERG COPENHAGEN, Denmark, Phone: 00453528 3075, Fax: 00453528 3022 Email address: sbc@kvl.dk.

Cloutier, S.

49 *Deptartment of VCAPP, Washington State University, P.O. Box 646520, PULLMAN, United States of America, Phone: 15093352956, Fax: 15093354650 Email address: scloutie@vetmed.wsu.edu.*

Coattrieux, M.C.
50 *Sciences Animals, ISAB, Rue P. Waguet, BP 30313, BEAUVAIS CEDEX, France, Phone: 00333 44067606, Fax: 00333 44062526 Email address: marina.coattrieux@isab.fr.*

Cockram, M.S.
51 *Veterinary Clinical Studies, University of Edinburgh, Easter Bush Veterinary Centre, Roslin, MIDLOTHIAN, United Kingdom, Phone: 0044 131650 6272, Fax: 0044 131650 6588 Email address: M.S.Cockram@ed.ac.uk.*

Coe, B.
52 *, Farm Animal Services & Penn State Univ., P.O. Box 11162, STATE COLLEGE, PA, United States of America, Phone: 001814 4668701, Fax: 001814 4662710 Email address: bcoe@psu.edu.*

Coenen, E.
53 *, Research Institute for Animal Husbandry, P.O. Box 2176, LELYSTAD, The Netherlands, Phone: 555066558, Fax: 555064858 Email address: E.Coenen@pv.agro.nl.*

Colson, V.
54 *Physiology of Reproduction, INRA-CNRS-University F. Rabelais, PRC, NOUZILLY, France, Phone: 0033 247427 974, Fax: 0033 247427 743 Email address: colson@tours.inra.fr.*

Conte, S.
55 *Department of Animal Science, University of California davis, 1 Shields Ave., DAVIS, CALIFORNIA, United States of America, Phone: 15307527689, Fax: 15307527817 Email address: fsconte@ucdavis.edu.*

Cooper, J.
56 *Biological Science, University of Lincoln, Caythorpe Court, Caythorpe, LINCOLNSHIRE, United Kingdom, Phone: 00441400 275678, Fax: 00441400 275686 Email address: jjcooper@dmu.ac.uk.*

Cooper, M.
57 *Animal Welfare and Veterinary Health, Moulton College, Moulton College, West Street, NORTHAMPTON, United Kingdom, Phone:, Fax: Email address: mercc@moulton.ac.uk.*

Creighton, E.
58 *Psychology & Speech Pathology, Manchester Metropolitan University, Elizabeth Gaskell Campus, MANCHESTER, United Kingdom, Phone: 0044161 8604608, Fax: 0044161 2472558 Email address: Emma@orrelwood.org.uk.*

Croney, C.
59 *Animal Science, Oregon State University, 112 Withycombe Hall, CORVALLIS, OR, United States of America, Phone: 001541 7537621, Fax: 001541 7374174 Email address: candace.croney@orst.edu.*

Cvek-Hopkins, K.
60 *Unit for Comparative Physiology and Med., Swedish University of Agri. Sciences, P.O. Box 7018, UPPSALA, Sweden, Phone: 0046018 671000, Fax: 0046018 673509 Email address: katarina.cvek@kirmed.slu.se.*

Dahlborn, K.
61 *Unit for Comparative Physiology and Med., Swedish University of Agri. Sciences, P.O. Box 7018, UPPSALA, Sweden, Phone: 0046018 671000, Fax: 0046018 673509 Email address: kristina.dahlborn@djfys.slu.se.*

Damm, B.I.D.
62 *Dept. of Animal Science and Animal Healt, The Royal Veterinary and Agri.University, Groennegaardsvej 8, FREDERIKSBERG C, Denmark, Phone: 004535 282828, Fax: 004535 283022 Email address: bid@kvl.dk.*

Dankyi, P.D.
63 *Electricals, NVTI, P.O. Box 0970, TAKORADI, Ghana, Phone: 0023331 26940, Fax: Email address: pdankyi@yahoo.com.*

Day, E.L.
64 *Pig Research Unit, ADAS, ADAS Terrington, Terrington St. Clement, King's Lynn, NORFOLK, United Kingdom, Phone: 00441553 828621, Fax: 00441553 827229 Email address: jon.day@adas.co.uk.*

Decker, E.L.
66 *Animal Health and Welfare, Danish Institute of Agricultural Science, Research Centre Foulum, TJELE, Denmark, Phone: 4589991380, Fax: 4589991500 Email address: erikl.decker@agrsci.dk.*

Désiré, L.D.
67 *URH-ACS, INRA, Centre de Rechoche de Clermont, Ferraud Thiex, SAINT-GENES CHAMPANELLE, France, Phone:, Fax: Email address: ldesire@clermont.inra.fr.*

Dierendonck, M.C. van
68 *, University of Iceland, P/a Tolnegenweg 39, STROE, The Netherlands, Phone: 034 42 40 15 02, Fax: 034 24 75 65 6 Email address: m.dierendonck@planet.nl.*

Dixon, J.P.
69 *Clinical Veterinary Science, University of Bristol, 74 Melrose Avenue, CARDIFF, United Kingdom, Phone: 00440117 9289647, Fax: Email address: Greg.Dixon@bristol.ac.uk.*

Docking, C.M.
70 *Departement of Agriculture, ADAS/ University of Newcastle, Adas Terrington, Terrington St. Clement, NORFOLK, United Kingdom, Phone: 00441553 828621, Fax: 00441553 827229 Email address: caroline.docking@adas.co.uk.*

Driel, K.S. van
71 *Animal Welfare Team, Central Science Laboratory, Sant Hutton, YORK, United Kingdom, Phone: 004401904 462409, Fax: 004401904 462111 Email address: k.vandriel@csl.gov.uk.*

Dudink, S.
72 *Dier/Maatschappij/Ethologie en Welzijn, University Utrecht, Yalelaan 17, UTRECHT, The Netherlands, Phone: 030-2535359, Fax: Email address: s.dudink@las.vet.uu.nl.*

Dwamena, E.D.
73 *School of Agriculture, University of Cape Coast, P.O. Box 1217, ACCRA, Ghana, Phone:, Fax: Email address: edakus@yahoo.com.*

Dwyer, M.
74 *Animal Behavioural Science, Scottish Agricultural College, Kings Building, West Mains Road, EDINBURGH, United Kingdom, Phone: 0044131 5353228, Fax: 0044131*

5353121 Email address: c.dwyer@ed.sac.ac.uk.

Dybkjaer, L.

75 Dept. of Animal Health and Welfare, Danish Institute of Agricultural Science, P.O. Box 50, TJELE, Denmark, Phone: 4589991306, Fax: 4589991500 Email address: Lise.Dybkjaer@agrsci.dk.

Eckstein, A.

76 Biology, Warren Wilson College, P.O. Box 9000, WWC 6013, ASHEVILLE, NC, United States of America, Phone: 001828-771-3777, Fax: Email address: eckstein@warren-wilson.edu.

Edwards, P.

77 Etologia, Fauna Silvestre y Animales, Universidad Nacional Autonoma de Mexico, Edificio a-6 103, MEXICO CITY, Mexico, Phone: 5255933607, Fax: Email address: cedwardsp@yahoo.com.mx.

Edwards, S.A..

78 Agriclture, University of Newcastle, King George VI Building, NEWCASTLE UPON TYNE, United Kingdom, Phone:, Fax: Email address: sandra.edwards@ncl.ac.uk.

Eguchi, Y.

79 Agro-environmental Management, National Agricultural research Centre, Kawai, Yoshinaga 60, SHIMANE. ODA, Japan, Phone: 0081854 820144, Fax: 0081854 822280 Email address: eguchiy@naro.affrc.go.jp.

Ejvegard, S.

80 Dept. of Animal Environment and Health, Swedish Uni. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167000, Fax: Email address: saralottakristin@hotmail.com.

Ekkel, E.D.

81 Ethology9, Wageningen University, Marijkeweg 40, WAGENINGEN, The Netherlands, Phone: 0317 483968, Fax: 0317 485006 Email address: dinand.ekkel@etho.vh.wau.nl.

Elliker, K.R.

82 Clinical Veterinary Medicine, University of Cambridge, Madingley Road, CAMBRIDGE, United Kingdom, Phone:, Fax: Email address: kre20@cam.ac.uk.

Elusanmi, A.E.

83 Systems Admin. Department, Kolmon Farm NIG.LTD., P.O. Box 17206, LAGOS, Nigeria, Phone: 00234039 7213291, Fax: Email address: kolmonenterprises@hotvoice.com.

Erhard, H.

84 Animal Ecology, Macaulay Institute, Craigiebuckler, ABERDEEN, United Kingdom, Phone:, Fax: Email address: h.erhard@macaulay.ac.uk.

Eric, T.

85 Head Office, Dozzy Group Ltd, P.O. Box 4174, Ikeja, LAGOS, Nigeria, Phone: 002341 4728116, Fax: 002341 2663294 Email address: dozzygroup@37.com.

Eriksen, M.S.E.

86 Department of Animal Science, Agricultural University of Norway, P.O. Box 5025, ÅS, Norway, Phone: 4764948008, Fax: 4764947960 Email address: marit-skog.eriksen@ihf.nlh.no.

Erp-van der Kooij, E. van

87 Farm Animal Health, Pig Health Unit, Utrecht University, Yalelaan 7, UTRECHT, The Netherlands, Phone: 030-2531086, Fax: 030-2521887 Email address: l.vanerp@vet.uu.nl.

Fazio, E.

88 Dept.di Morfologia,Biochimica,Fisiologia, Universita Degli Studi di Messina, Polo universitario Dell'Annunziata, MESSINA, Italy, Phone: 003990 3501126, Fax: 003990 356195 Email address: estherina.fazio@tin.it.

Fernö, A.

89 Dept. of Fisheries and Haring Biology, University of Bergen, P.O. Box 7800, BERGEN, Norway, Phone: 4755584400, Fax: 4755584450 Email address: anders.ferno@ifm.uib.no.

Fisker, B.N.F.

90 Depart. for Nutrition and Reproduction, The National Committee for Pig Prod., Axeltorv 3, COPENHAGE, Denmark, Phone: 00453373 2667, Fax: 00453314 2517 Email address: bnf@danskeslagterier.dk.

Forkman, A.

91 Animal Science and Animal Health, Danish Royal Vet. Agricult. Univ., Grønnegårdsvej 8, FREDERIKSBERG C, Denmark, Phone: 4535283581, Fax: 4535283022 Email address: bjf@kvl.dk.

Francois, S.C.G.

92 Animal Science, Wageningen University, Marijkeweg 40, WAGENINGEN, The Netherlands, Phone: 0317-418293, Fax: 0317-483962 Email address: bien_f@hotmail.com.

Freire, R.

93 Animal Sciences, Purdue University, West Lafayette, WEST LAFAYETTE, United States of America, Phone: 001765 4161241, Fax: 001765 4911993 Email address: Freire@Purdue.edu.

Fuhrer, K.F.

94 Institut fur Tierzucht und Tierverhalten, FAL, Doernbergstr. 25/27, CELLE, Germany, Phone: 004905141 384634, Fax: Email address: Katja.Fuhrer@fal.de.

Galindo, A.

95 Etologia y Fauna Silvestre, Universidad Nacional Autonoma de Mexico, Circuito Exterior, Ciudad Universitaria, MEXICO D.F., Mexico, Phone:, Fax: Email address: galindof@servidor.unam.mx.

Geverink, N.A.

96 Animal husbandry,Ethology Group, Wageningen University, Marijkeweg 40, WAGENINGEN, The Netherlands, Phone: 0317 483926, Fax: 0317 485006 Email address: nicoline.geverink@etho.vh.wau.nl.

Gilbert, L.

97 Neurobiology, The Babraham Institute, Babraham, CAMBRIDGE, United Kingdom, Phone: 00441223 496532, Fax: 00441223 496485 Email address: colin.gilbert@bbsrc.ac.uk.

Gomm, K.

98 Animal Welfare Team, Central Science Laboratory, Sant Hutton, YORK, United Kingdom, Phone: 004401904 462143, Fax: 004401904 462111 Email address: m.gomm@csl.gov.uk.

Goodwin, D.

99 *New College, University of Southampton, The Avenue, SOUTHAMPTON, United Kingdom, Phone:, Fax: Email address: dg1@soton.ac.uk.*

Greenwood, J.

100 *School of Biological Sciences, University of Bristol, Woodland Road, BRISTOL, United Kingdom, Phone:, Fax: Email address: V.Greenwood@bristol.ac.uk.*

Groot, J. de

101 *D en O, ID-Lelystad, Postbus 65, LELYSTAD, The Netherlands, Phone: 0320-238201, Fax: 0320-238094 Email address: J.deGroot@id.wag-ur.nl.*

Guesdon, V

102 *Staticen de Recherches Avicoles, INRA, Centre de Recherche de Tours, NOUZILLY, France, Phone:, Fax: 00332 47427778 Email address: guesdon@tours.inra.fr.*

Gunnarsson, S.

103 *Animal Environment & Health, Swedish Univ. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 0046511 67216, Fax: 0046511 67204 Email address: leena.ahola@uku.fi.*

Guy, J.H.

104 *Agriculture, University of Newcastle upon Tyne, King george VI Building, NEWCASTLE UPON TYNE, United Kingdom, Phone: 0044191 2226901, Fax: 0044191 2227811 Email address: j.h.guy@ncl.ac.uk.*

Gyasi, V.K.G.

105 *Agriculture, Knust Kumasi, C/o Efiessil, Shaba19b, Knust, Kumasi, KUMASI, Ghana, Phone: 2332461056, Fax: 2335126643 Email address: lebesgues@yahoo.com.*

Hänninen, S.

106 *Institute of Applied Biotechnology, University of Kuopio, P.O. Box. 1627, KUOPIO, Finland, Phone: 0035817 163137, Fax: 0035817 163148 Email address: sari.kasanen@uku.fi.*

Hansen, S.W.H.

107 *Animal Health and Welfare, Danish Institute of Agricultural Science, P.O. Box 50, TJELE, Denmark, Phone: 4589991327, Fax: 4589991500 Email address: steffenw.hansen@agrsci.dk.*

Harst, J.E. van der

108 *Animals and Society, Utrecht University, Yalelaan 17, UTRECHT, The Netherlands, Phone: 030-2535359, Fax: 030-2539227 Email address: j.e.vanderharst@las.vet.uu.nl.*

Hartnell, J.

109 *Environment Group, Silsoe Research Institute, Wrest Park, Silsoe, BEDFORD, United Kingdom, Phone:, Fax: Email address: sally.hartnell@bbsrc.ac.uk.*

Hanninen, T.

110 *Clinical Veterinary Science, University of Helsinki, Hameentie 57, HELSINKI, Finland, Phone: 003589 19149514, Fax: 003589 19149670 Email address: Laura.Hanninen@helsinki.fi.*

Hazekamp, A.A.H.

111 *, Dutch Society for protection of animals, Postbus 85980, DEN HAAG, The Netherlands, Phone: 070-3142766, Fax: 070-3142777 Email address: anja.hazekamp@dierenbescherming.nl.*

Herrmann, H.J.

112 *Agricultural Technology, Deutsche landwirtschafts-Gesellschaft, Max-Eyth-Weg 1, GROSS UMSTADT, Germany, Phone: 004906078 963530, Fax: 004906078 963590 Email address: h-j.herrmann@dlg-frankfurt.de.*

Hierden, Y.M. van

113 *Animal Sciences, ID-Lelystad, Edelhertweg 15, LELYSTAD, The Netherlands, Phone: 0320 238 171, Fax: 0320 238 094 Email address: y.vanhierden@id.wag-ur.nl.*

Hillmann, E.

114 *Physiology & Animal Husbandry, Swiss Federal Institute of Techn. Zurich, Schorenstrasse 16, SCHERZENBACH, Switzerland, Phone: 004152 3683383, Fax: 004152 3651190 Email address: edna.hillmann@fat.admin.ch.*

Holm, L.H.O.

115 *Research Centre Foulum, Danish Institute of Agricultural Science, Blichers Allé, P.O. Box 50, TJELE, Denmark, Phone: 4589991330, Fax: 4589991500 Email address: louiseholm@agrsci.dk.*

Hopster, H.

116 *Animal Sciences, ID-Lelystad, P.O. Box 65, LELYSTAD, The Netherlands, Phone: 032 0238206, Fax: 032 0238094 Email address: h.hopster@id.wag-ur.nl.*

Hörning, B.

117 *Farm animal Behaviour and Management, University of Kassel, Nordbahnhofstr. 1a, WITZENHAUSEN, Germany, Phone:, Fax: Email address: hoerning@wiz.uni-kassel.de.*

Hovland, A.L.H.

118 *Department of Animal Science, Agricultural University of Norway, P.O. Box 5025, AAS, Norway, Phone: 4764948008, Fax: 4764947960 Email address: anne.hovland@ihf.nlh.no.*

Hermans, G.

119 *, , , , Nederland, Phone:, Fax: Email address: Geerdina.Hermans@97.Student.WAU.nl.*

Horii, T.H.

120 *Animal Science, School of Vet.Medicine, Azabu University, 1-17-71 Futinobe, SAGAMIHARA, Japan, Phone: 008142 7547111, Fax: 008142 7533395 Email address: ma0214@azabu-u.ac.jp.*

Houx, B.B.

121 *Ethology & Animal Welfare, Utrecht University, Yalelaan 17, UTRECHT, The Netherlands, Phone: 030-2534868, Fax: 030-2532610 Email address: b.b.Houx@vet.uu.nl.*

Illmann, G.

122 *Ethology group, Resaerch Institute of Animal Production, Pratelstvi 815, PRAGUE, Czech Republic, Phone:, Fax: Email address: Illmannova@vuzv.cz.*

Inglis, I.R.

123 *Animal Welfare Team, Central Science laboratory, Sand Hutton, YORK, United Kingdom, Phone:, Fax: Email address: i.inglis@csl.gov.uk.*

Jansen, J.

124 *, , , , Nederland, Phone:, Fax: Email address: Jarno.Jansen@97.Student.WAU.nl.*

Jarvis, S.

125 *Animal Behaviour Science, Scottish Agricultural College, Bush Estate, PENICUIK, United Kingdom, Phone: 0044131 5353214, Fax:*

0044131 5353121 Email address: s.jarvis@ed.sac.ac.uk.

Jensen, M.B.J.

126 Department of Animal Health and Welfare, Danish Inst.of Animal Health and Welfare, P.O. Box 50, TJELE, Denmark, Phone: 004589 99 13 25, Fax: 004589 99 15 00 Email address: MargitBak.Jensen@agrsci.dk.

Jensen, P.

127 Ept. of Animal Environment and Health, Swedish University of Agri. Sciences, P.O. Box 234, SKARA, Sweden, Phone: 0046511 67219, Fax: 0046511 67204 Email address: per.jensen@hmh.slu.se.

Jong, I.C. de

128 Animal Sciences, ID-Lelystad, P.O. Box 65, LELYSTAD, The Netherlands, Phone: 0320 238192, Fax: 0320 238094 Email address: i.c.dejong@id.wag-ur.nl.

Jonge, F.H. de

129 Ethology and Welfare, University of Utrecht, Yalelaan 17, UTRECHT, The Netherlands, Phone: 030-2535534, Fax: Email address: F.H.deJonge@vet.uu.nl.

Jung, J.

130 Animal Environment and Health, Swedish Uni. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167000, Fax: 4651167204 Email address: jens.jung@hmh.slu.se.

Keeling, L.J.

131 Dept. of Animal Enviroment and Health, Swedish Univer. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167220, Fax: 4651167204 Email address: linda.keling@hmh.slu.se.

Keiko, K.O.

132 Faculty of Agricuture, Shinshu University, 8304, MINAMI-MINOWA, NAGANO, Japan, Phone: 81265771424, Fax: 81265771424 Email address: a01a102@agrfs1.shinshu-u.ac.jp.

Kemps, H.A.

133 , Marine Information and Research Group, 39 Lynn Street, TRIGG, W.A., Australia, Phone: 00618 92 43 45 67, Fax: 00618 92 03 52 34 Email address: HAKEMPS@MIRGAUSTRALIA.COM.AU.

Ken-ichi, K.T.

134 Faculty of Agriculture, Shinshu University, 8304, MINAMI-MINOWA, NAGANO, Japan, Phone: 81265771427, Fax: 81265771427 Email address: ktakeda@gipmc.shinshu-u.ac.jp.

Kerbrat, S.K.

135 Milk Production, Institut Nat. de Recherch Agronomique, 65 rue de Saint-Brieuc, RENNES CEDEX, France, Phone: 0033223 485625, Fax: 0033223 485080 Email address: kerbrat@epi.roazhon.inra.fr.

King, A.

136 Animal Research Issues, Humane Society of the United States, 2100 L St. NW, WASHINGTON DC, United States of America, Phone: 001301 258 3046, Fax: 001301 258 7760 Email address: lesley.king@linacre.ox.ac.uk.

Kisac, P.

137 , Research Institute of Animal Production, Hlohovská 2, NITRA, Slovak Republic, Phone: 00421 376546483, Fax: 00421 376546483 Email address: kisac@vuzv.sk.

Kjaer, B.

138 Animal Health and Welfare, Danish Intitute of Agricultural Sciences, Blichers Alle, TJELE, Denmark, Phone: 4589991900, Fax: 4589991500 Email address: j.kjaer@agrsci.dk.

Knierim, U.

139 Institute of Animal Hygiene, School of Veterinary Medicine, Buenteweg 17p, HANNOVER, Germany, Phone:, Fax: Email address: ute.knierim@tiho-hannover.de.

Koba, Y.K.

140 Graduate School of Biosphere Science, Hiroshmima University, 1-4-4, Kagamiyama, HIGASHI-HIROSHIMA, Japan, Phone: 0081824 247974, Fax: 0081824 247974 Email address: yukikoba@hiroshima-u.ac.jp.

Kobelt, J.

141 Animal Welfare Centre, University of Melbourne, C/o 600 Sneydes Rd, Werribee, MELBOURNE, Australia, Phone: 00613 97420423, Fax: 00613 97420400 Email address: amandakobelt@hotmail.com.

Kobina Tetteh, N.A.K.T.

142 Community Development, Ghalibro, Teshie Tui Bloo, ACCRA, Ghana, Phone: 0023321 716932, Fax: 0023321 7010765 Email address: shakesnak@yahoo.co.uk.

Koene, P.

143 Animal Sciences, Wageningen University, P.O. Box 338, WAGENINGEN, The Netherlands, Phone: 03 17 48 28 96, Fax: 03 17 48 50 06 Email address: paul.koene@etho.vh.wau.nl.

Kohari, D.

144 Graduate school of Agri. Science, Tohoku University, Kawatabi 232-3, NARUKO, MIYAGI, Japan, Phone: 0081229 847378, Fax: 0081229 847378 Email address: kohari@bios.tohoku.ac.jp.

Kondo, S.

145 Graduate School of Agriculture, Hokkaido University, Kita 9 Nishi 9, Kita-ku, SAPPORO, Japan, Phone: 008111 7062545, Fax: 008111 7062550 Email address: skon@anim.agr.hokudai.ac.jp.

Kooij, M.Y. van der

146 ALW, NWO, Laan van Nieuw Oost Indië 300, DEN HAAG, The Netherlands, Phone: 070-3440866, Fax: 070-3351005 Email address: kooij@nwo.nl.

Korhonen, T.

147 Animal Production Resaerch, MTT Agrifood Research Finland, Turkistie 8, KANNUS, Finland, Phone: 003586 87435422, Fax: 003586 87435431 Email address: hannu.t.korhonen@mtt.fi.

Kosebinu, O.P.

148 Environment, Landmark International Organisation, Plot 4 Folayemi Street, Ilupeju, LAGOS, Nigeria, Phone: 002341 4961029, Fax: 002341 4971015 Email address: lmio_hesd@yahoo.com.

Kranendonk, G.

149 Animal Sciences, ID-Lelystad, Edelhertweg 15, LELYSTAD, The Netherlands, Phone: 0320 238 191, Fax: 0320 238 094 Email address: g.kranendonk@id.wag-ur.nl.

Kristensen, H.H.K.

150 *Dept. Animal Science and Animal Health, Royal Veterinary and Agri. University, Groenegaardsvej 8, FREDERIKSBERG C., Denmark, Phone: 4535283069, Fax: 4535283022 Email address: hek@kvl.dk.*

Kristiansen, S.

151 *Aquaculture, Institute of Marine Research, Austevoll Aquaculture Research Station, STOREBØ, Norway, Phone: 4756182244, Fax: Email address: torek@imr.no.*

Krohn, C.C.K.

152 *Animal Health and Welfare, DIAS, P.O. Box 50, TJELE, Denmark, Phone: 4589991327, Fax: 4589991500 Email address: CC.KROHN@AGRSCI.DK.*

Laakkonen, M.

153 *Institute of Applies Biotechnology, University of Kuopio, P.O. Box 1627, , Finland, Phone: 0035817 163130, Fax: 0035817 163148 Email address: laakkone@hytti.uku.fi.*

Ladewig, J.L.

154 *Ethology, Royal Veterinary and Agri. University, Groennegaardsvej 8, FREDERIKSBERG C, Denmark, Phone: 004535 283031, Fax: 004535 283022 Email address: jal@kvl.dk.*

Lambooij, E.

155 *Infecteous Diseases and chain Quality, Institute for Animal Science and Health, P.O. Box 65, LELYSTAD, The Netherlands, Phone: 0320 238970, Fax: 0320 238050 Email address: e.lambooij@id.wag-ur.nl.*

Langford, M.

156 *Veterinary Clinical Studies, University of Edinburgh, Easter Bush Veterinary Centre, EDINBURGH, United Kingdom, Phone:, Fax: Email address: f.m.langford@sms.ed.ac.uk.*

Lansade, L.

157 *Physiology of Reproduction, INRA-CNRS-University F. Rabelais, PRC, NOUZILLY, France, Phone:, Fax: Email address: lansade@tours.inra.fr.*

Latham, R.

158 *Zoology, Oxford University, Department of Zoology, South Parks Road, OXFORD, United Kingdom, Phone: 004401865 271214, Fax: 004401865 281253 Email address: naomi.latham@zoo.ox.ac.uk.*

Lawrence, B.

159 *Animal Behaviour Science, Scottish Agricultural College, Animal Biology Division, Kings Building, West Mains Road, EDIN BURGH, United Kingdom, Phone: 0044131 5353217, Fax: 0044131 5353121 Email address: a.lawrence@ed.sac.ac.uk.*

Lay, C.

160 *Animal Science Department, U.S. Department of Agriculture, Room 216 Poultry Building, WEST LAFAYETTE, United States of America, Phone: 001765 4967750, Fax: 001765 4971993 Email address: layd@purdue.edu.*

Ledger, A.

161 *Design, Brunel University, Egham, SURREY, United Kingdom, Phone: 00441784 431341, Fax: 00441784 472879 Email address: rebecca.ledger@brunel.ac.uk.*

Leeb, Ch.

162 *Clinical Veterinary Science, Bristol University, Langford House, Langford, BRISTOL, United Kingdom, Phone:, Fax: Email address: ch.leeb@gmx.at.*

Leeuw, J.A. de

163 *ID TNO Animal Nutrition, ID-Lelystad, Edelhertweg 15, LELYSTAD, The Netherlands, Phone: 0320 237 289, Fax: 0320 237 320 Email address: j.deleeuw@idtno.nl.*

Lerner, H.

164 *Department of Health and Society, University of Linköping, Linköping University, LINKÖPING, Sweden, Phone: 4613285771, Fax: Email address: henle@ihs.liu.se.*

Lervik, S.L.

165 *, Norwegian Poultry Association, Rosenkrantzgt. 26, SARPSBORG, Norway, Phone: 4795079209, Fax: 4764943370 Email address: lervik@c2i.net.*

Lewis, E.L.

166 *Pig Production, Teagasc, Moorepark Research Centre, CO. CORK, Ireland, Phone: 00353025-42389, Fax: 00353025-42340 Email address: elewis@moorepark.teagasc.ie.*

Lidfors, M.

167 *Dept. of Animal Environment and Health, Swedish Univ. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167215, Fax: 4651167204 Email address: Lena.Lidfors@hmh.slu.se.*

Ligout, S.

168 *Physiology of Reproduction, INRA-CNRS-University F. Rabelais, PRC, NOUZILLY, France, Phone:, Fax: Email address: ligout@tours.inra.fr.*

Lindqvist, C.L.

169 *Dept. of Animal Environment and Health, Swedish Uni. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167248, Fax: 4651167204 Email address: christina.lindqvist@hmh.slu.se.*

Loberg, J.

170 *Animal Environment and Health, Swedish Uni. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167215, Fax: 4651167204 Email address: johan.loberg@hmh.slu.se.*

Loberg, J.

171 *Animal Environment and Health, Swedish Uni. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167215, Fax: 4651167204 Email address: jenny.loberg@hmh.slu.se.*

Lönn, M.L.

172 *Dept. of Animal Nutrition and Management, Swedish Uni. of Agricultural Sciences, Fnysinge Gård, Altuna, FJARDHUNDRA, Sweden, Phone: 46017196130, Fax: 46 Email address: reijo.soininen@swipnet.se.*

Loo, P.L.P. van

173 *Laboratory Animal Science, Utrecht University, Yalelaan 2, UTRECHT, The Netherlands, Phone: 030 2533818, Fax: 030 2537997 Email address: p.l.p.vanloo@vet.uu.nl.*

Made, D. van der

175 *, , , , Nederland, Phone:, Fax: Email address: Denise.vanderMade@2K.Student.WAU.nl.*

Mafuana, M.K.

176 *Department of Agriculture, 69 AV Mutombo katshi- c/ Gombe, KIN 1, Congo, Phone:*

00242982 18450, Fax: 00242001 775 255 6482 Email address: depteducation@yahoo.fr.

Malmkvist, J.M.
177 Department of Animal Health and Welfare, Danish Institute of Agricultural Science, P.O. Box 50, TJELE, Denmark, Phone: 4589991314, Fax: 4589991500 Email address: jens.malmkvist@agrsci.dk.

Marchant Forde, M.
178 School of Agriculture, De Montfort University, Caythorpe Court, GRANTHAM, LINCS, United Kingdom, Phone: 00441765 7432308, Fax: Email address: rforde@dmu.ac.uk.

Marchant Forde, N.
179 Livestock Behavior Research Unit, USDA-ARS, Purdue University, WEST LAFAYETTE, United States of America, Phone: 001765 4946358, Fax: 001765 4961993 Email address: marchant@purdue.edu.

Martinikova, M.
180 , University of Veterinary, Palackeho 1-3, BRNO, Czech Republic, Phone: 004205 41562505, Fax: Email address: actavet@vfu.cz.

McIntyre, J.
181 Department of Agriculture, University of Newcastle, King George VI Building, NEWCASTLE PON TYNE, United Kingdom, Phone:, Fax: Email address: jayne.mcintyre@ncl.ac.uk.

McMullen, P.
182 Anatomy and Physiology, Atlantic Veterinary College, 36 Doc Blanchard Crrs., CHARLOTTETOWN, PE, Canada, Phone: 001907 5695106, Fax: 001907 5660837 Email address: Lmcmullen@upei.ca.

Meijer, M.K.
183 Laboratory Animal Science, Utrecht University, Yalelaan 2, UTRECHT, The Netherlands, Phone: 030 2533818, Fax: 030 2537997 Email address: m.k.meijer@las.vet.uu.nl.

Meijerink, L.
184 , , , , Nederland, Phone:, Fax: Email address: l_meijerink@hotmail.com.

Mejdell, M.
185 Norwegian Council on Animal Ethics, VESO, Arnemoveien 6, TYNSET, Norway, Phone: 4762482026, Fax: 4762482326 Email address: cmejdell@online.no.

Merks, J.W.M.
186 , IPG Institute for Pig Genetics B.V., Postbus 43, BEUNINGEN, The Netherlands, Phone: 024-6779999, Fax: 024-6779800 Email address: Jan _Merks@ipg.nl.

Merrill, J.N.
187 Clinical veterinary Science, University of Bristol, Langford House, Langford, BRISTOL, United Kingdom, Phone:, Fax: Email address: ralph.merrill@bristol.ac.uk.

Mheen, H.W. van der
188 Pig Division, Research Intstitute for Animal Husbandry, Runderweg 6, LELYSTAD, The Netherlands, Phone: 0320 293577, Fax: 0320 241584 Email address: h.w.van.der.mheen@pv.agro.nl.

Mkparu, S.H.
189 Agricultural Biology, University of Ibadan, P.O. Box 20674, University Post Office Box, IBADAN, Nigeria, Phone: 002342 711795, Fax: 002342 2414091 Email address: pejubabs@yahoo.com.

Moe, R.O.M.
190 Large Animal Science, Norwegian School of Vet. Sciences, Lilleåsen 12, BILLINGSTAD, Norway, Phone: 4766981042, Fax: Email address: randi.o.moe@online.no.

Mollema, E.
191 Quantitative veterinary epidemiology, ID-Lelystad, Edelhertweg 15, LELYSTAD, The Netherlands, Phone: 0320 238 397, Fax: 0320 238 961 Email address: e.mollema@id.wag-ur.nl.

Mononen, J.O.
192 Institute of Applied Biotechnology, University of Kuopio, P.O. Box 1627, KUOPIO, Finland, Phone: 0035817 163127, Fax: 0035817 163148 Email address: Jaakko.Mononen@uku.fi.

Moons, Ch.
193 Ethlogy, Ghent University, Heidestraat 19, MERELBEKE, Belgium, Phone: 00329 2647809, Fax: 00329 2647849 Email address: christel.moons@rug.ac.be.

Morita, S.M.
194 Dairy Science, Rakuno Gakuen University, Bunkyodai-midorimachi, EBETSU, Japan, Phone: 008111 3884756, Fax: 008111 3875848 Email address: smorita@rakuno.ac.jp.

Mossberg, M.
195 Animal Health and Welfare Division, Swedish Ministry of Agri. Food and Fish., Fredsgatan 8, STOCKHOLM, Sweden, Phone: 00468 4051226, Fax: 00468 4054970 Email address: ingrid.mossberg@agricultural.ministry.se.

Muhonen, S.P.
196 Animal Nutrition and Management, Swedish University of Agri. Science, P.O. Box 7024, UPPSALA, Sweden, Phone: 004618 403285, Fax: Email address: a8sarmuh@ulmo.stud.slu.se.

Murphey, M.
197 Psychology, University of California, One Shields Avenue, DAVIS, CALIFORNIA, United States of America, Phone: 001530-752-1855, Fax: 001530-752-2087 Email address: rmmurphey@ucdavis.edu.

Murphey, R.M.
198 , One Shields Avenue 95616-8686 Davis, CALIFORNIA, United States of America, Phone: 001530 7521855, Fax: 001530 7522087 Email address: rmmurphey@ucdavis.edu.

Newberry, R.
199 VCAPP, Washington State university, P.O. Box 646520, PULLMAN, United States of America, Phone: 15093352957, Fax: 15093354650 Email address: rnewberry@wsu.edu.

Nielsen, L.
200 Department of Animal Health and Welfare, Danish Institute of Agriculture Sciences, P.O. Box 50, TJELE, Denmark, Phone: 4589991373, Fax: 4589991500 Email address: birte.nielsen@agrsci.dk.

Nielsen, P.P.
201 , Howitzvej 73, 1.tv., FREDERIKSBERG, Denmark, Phone: 00453819 2071, Fax: Email address: peetz@dsr.kvl.dk.

Noldus, L.P.J.J.
202 , Noldus Information Technology B.V., Costerweg 5, WAGENINGEN, The

Netherlands, Phone: 0317 497677, Fax: 0317 424496 Email address: info@noldus.nl.

O'Callaghan, A.
203 Vet.Clinical Studies / Animal Husbrandry, University of Liverpool, Chester High Road, Neston, WIRRAL, United Kingdom, Phone:, Fax: Email address: k.a.ocallaghan@liverpool.ac.uk.

O'Connell, N.E.
204 Pig Unit, Agri. Research Inst.of Northern Ireland, Large Park, Hillsborough, Co Down, HILLSBOROUGH, United Kingdom, Phone: 0044028 92682484, Fax: 0044028 92689594 Email address: niamh.o'connell@dardni.gov.uk.

Ödberg, F.O.
205 Animal Nutrition, Ghent University, Heidestraat 19, MERELBEKE, Belgium, Phone: 00329 2647804, Fax: 00329 2647849 Email address: frank.odberg@rug.ac.be.

Ogundare, M.
206 Livestock Dept., Rubbyson Ogundare & Sons, P.O. Box 1698, Sabo-Yaba, LAGOS, Nigeria, Phone: 002341 823977, Fax: Email address: ogundare2002@lycos.com.

Orgeur, P.
207 Physiology of Reproduction, INRA-CNRS-University of Tours, PRC, NOUZILLY, France, Phone: 003302 47427978, Fax: 003302 47427743 Email address: orgeur@tours.inra.fr.

Ogunleye, O.L.
208 Farm Management, Mowab Farm Nig Enterprises, No3 Alhaji Hassan Street, Iso Pako Nla Alekuwodo Area, OSHOGBO, Nigeria, Phone: 23435243356, Fax: 23435243205 Email address: mowabfarms@yahoo.com.

Ogunrinde, B.
209 Research, Cocoa Research Institute of Nigeria, No 15 Idi Ayure, Ijebu Ode, Road, P.O.Box 12490, IBADAN, Nigeria, Phone: 002342 231 8400, Fax: 002342 231 1670 Email address: easyway2001@onebox.com.

Olagoke, O.N.
210 Argic. Department, University of Ibadan, 7 Afolabi Adesola J.P. Felele Express, IBADAN, Nigeria, Phone: 002342 2319013, Fax: 002342 3150350 Email address: university_edu_consultancy@yahoo.com.

Olatunde, S.
211 Research, National Horticulture Research Institute, Idi-ishin Jericho Reservation Area, P.O. Box 12490, IBADAN, Nigeria, Phone: 002342 241 3835, Fax: 002342 231 8677 Email address: nathort@yahoo.com.

Olubunmi, N.I.L.
212 Agriculture, Harlem International Limited, 412 rd A Close Block6 Flat1, Gowon estate ALimosho Nigeria, LAGOG, Nigeria, Phone:, Fax: 23412885290 Email address: harlem@searchmalta.com.

Oosterga-Land, J.A.
213 Veehouderij, CAH Dronten, Buitenhofstraat 37, KAMPEN, The Netherlands, Phone: 038-3327900, Fax: Email address: ooj@cah.nl.

Paranhos da Costa, M.J.R.
214 Departamento de Zootecnia, Universidade Estadual Paulista, Via de Acesso, Dr. Paulo Donato Castellane, km 5, JABOTICABAL-SP, Brazil, Phone: 005516 32092678, Fax: 005516 32024275 Email address: mpcosta@fcav.unesp.br.

Pedersen, L.J.P.
215 Department of Animal Health and Welfare, Research Centre Foulum, P.O. Box 50, TJELE, Denmark, Phone: 4589991364, Fax: 4589991500 Email address: lene.JuulPedersen@agrsci.dk.

Petherick, J.C.
216 Department Primary Industries, Cnr Yeppon Rd & Bruce Highway, P.O. Box 6014, CQMC, ROCKHAMPTON, Australia, Phone: 61749360331, Fax: 61749360390 Email address: carol.petherick@dpi.qld.gov.au.

Pickup, H.E.
217 Animal Behaviour Group, SAC, Sir Stephen Watson Building, Bush Estate, PENICUIK, United Kingdom, Phone:, Fax: Email address: h.pickup@ed.sac.ac.uk.

Pinto, A.A.P.
218 Clinical Veterinary Medicine, Cambridge University, Madingley Road, CAMBRIDGE, United Kingdom, Phone: 00441223 339865, Fax: 00441223 330886 Email address: aap28@cam.ac.uk.

Poku, P.D.B.
219 Students Affairs, University of Cape Coast, #242 Casford Hall, UCC, CAPE COAST, Ghana, Phone: 23324663610, Fax: 2334233124 Email address: bispopo1@hotmail.com.

Pritchard, D.G.
220 Animal Welfare Veterinary Division, DEFRA, 1a Page Street, LONDEN, United Kingdom, Phone: 0044020 79046199, Fax: 0044020 79046464 Email address: david.g.pritchard@defra.gsi.gov.uk.

Pyykönen, T.A.
221 Institute of Applied Biotechnology, University of Kuopio, P.O. Box 1627, KUOPIO, Finland, Phone: 0035817 163 144, Fax: 0035817 163 148 Email address: teija.pyykonen@messi.uku.fi.

Rasmussen, D.K.R.
222 Cen.for Proper Housing of ruminants/pigs, Swiss Federal Veterinary Office, , TÄNIKON, Switzerland, Phone: 004152 3683381, Fax: 004152 3651190 Email address: Dorthe.Rasmussen@fat.admin.ch.

Reed, B.
223 Animal Biology Division, SAC, Bush Estate, Penicuik, MIDLOTHIAN, United Kingdom, Phone: 00440131 5353214, Fax: 00440131 5353121 Email address: s.jarvis@ed.sac.ac.uk.

Reenen, C.G. van
224 Division Animal Sciences, ID-Lelystad, P.O. Box 65, LELYSTAD, The Netherlands, Phone: 0320-238203, Fax: 0320-238094 Email address: c.g.vanreenen@id.wag-ur.nl.

Reiter, K.
225 Applied Ethology, University of Hohenheim, Garbenstrasse 17, STUTTGART, Germany, Phone:, Fax: 49711459 Email address: reiter@uni-hohenheim.de.

Rekilä, T.
226 Animal Production Research, MTT Agrifood Research Finland, Turkistie 8, KANNUS, Finland, Phone:, Fax: Email address: teppo.rekila@mtt.fi.

Riedstra, B.J.
227 *Zoological Laboratory, Animal Behaviour, University of Groningen, Kerklaan 30, GRONINGEN, The Netherlands, Phone: 050 3632064, Fax: Email address: B.Riedstra@biol.rug.nl.*

Rodarte, F.
228 *Etologia y Fauna Silvestre, Universidad Nacional Autonoma de Mexico, Circuito Exterior, Ciudad Universitaria, MEXICO D.F., Mexico, Phone:, Fax: Email address: rodarte@servidor.unam.mx.*

Rodenburg, T.B.
229 *Ethology, Animal Science, Wageningen University, Marijkeweg 40, WAGENINGEN, The Netherlands, Phone: 0317-483942, Fax: 03174-85006 Email address: bas.rodenburg@etho.vh.wau.nl.*

Ruis-Heutinck, L.F.M.
230 *, Research Institute for Animal Husbandry, P.O. Box 2176, LELYSTAD, The Netherlands, Phone: 0320-293422, Fax: 0320-241584 Email address: l.f.m.ruis-heutinck@pv.agro.nl.*

Ruis, M.A.W.
231 *, Research Institute for Animal Husbandry, P.O. Box 2176, LELYSTAD, The Netherlands, Phone: 0320-293550, Fax: 0320-241584 Email address: m.a.w.ruis@pv.agro.nl.*

Rundgren, T.M.K.
232 *Animal Nutrition and Management, Swedish University of Agri. Science, P.O. Box 7024, UPPSALA, Sweden, Phone: 004618 672057, Fax: 004618 672995 Email address: Margareta.Rundgren@huv.slu.se.*

Rutherford, K.
233 *Welfare Biology Group, Roslin Institute, Roslin, Midlothian, ROSLIN, MIDLOTHIAN, United Kingdom, Phone:, Fax: Email address: kenneth.ruherford@bbsrc.ac.uk.*

Sall, M.
234 *Animal Breeding, Youth Agri. Development Organisation, 16 Old Railway Line Brookfields, FREETOWN, Sierra Leone, Phone: 0023230 201326, Fax: 0023222 224439 Email address: youth_agric_dev_org@yahoo.com.*

Sandilands, V.
235 *Avian Science Research Centre, Scottish Agricultural College, Temple Mount Cottage, SAC Auchincruive, AYR, United Kingdom, Phone: 00441292 525421, Fax: 00441292 525098 Email address: V.Sandilands@au.sac.ac.uk.*

Sato, S.
236 *Grazing Animal Production, Nat.Inst. of Livestock/Grassland Science, 7876-Senbonmatsu, NASU, TOCHIGI, Japan, Phone: 0081287 377807, Fax: 0081287 377807 Email address: shusato@affrc.go.jp.*

Schneider, O.
237 *, , , , The Netherlands, Phone:, Fax: .*

Schouten, W.G.P.
238 *TMD, IMAG-DLO, Mansholtlaan 10-12, WAGENINGEN, The Netherlands, Phone: 0317-476416, Fax: Email address: W.G.P.schouten@imag.dlo.nl.*

Schulze Westerath, H.
239 *Centre for Proper housing Ruminants/Pigs, Swiss Federal veterinary Office, FAT, TAENIKON, Switzerland, Phone: 004152 3683343, Fax: 004152 3651190 Email address: Heike.Westerath@fat.admin.ch.*

Schwencke, H.P.
240 *Special Veterinary, Norwegian Meat Research Centre, Postbox 396 Okern, OSLO, Norway, Phone: 0047915 47911, Fax: 4722220016 Email address: hans.schwencke@fagkjott.no.*

Segner, H.
241 *Centre for Fish and Welfare Health, University of Bern, Laenggass-Strasse 122, BERN, Switzerland, Phone: 41316312441, Fax: 41316312611 Email address: helmut.segner@itpa.unibe.ch.*

Seo, T.S.
242 *Animal Production, Obihiro University, Inada-cho, OBIHIRO, HOKKAIDO, Japan, Phone: 81155495425, Fax: 81155495425 Email address: seo@obihiro.ac.jp.*

Sesay, B.
243 *Animal Breeding, Youth Agri. Development Organisation, 16 Old Railway Line Brookfields, FREETOWN, Sierra Leone, Phone: 0023276 636874, Fax: 0023222 224439 Email address: youth_agric_dev_org@yahoo.com.*

Sheppard, C.
244 *Animal and Poultry Science, University of Guelph, Gordon Street, GUELPH. ON, Canada, Phone: 001519 8244120, Fax: Email address: ksheppar@uoguelph.ca.*

Sherwin, M.
245 *Dept. of Clinical Veterinary Science, University of Bristol, Langford House, BRISTOL, United Kingdom, Phone: 0044117 9289486, Fax: Email address: chris.sherwin@bristol.ac.uk.*

Shields, J.
246 *Animal Science, University of California, Davis, 2324 Regis Dr., DAVIS,CA, United States of America, Phone: 001530 7523643, Fax: 001530 7520175 Email address: sshields@ucdavis.edu.*

Shingu, Y.
247 *Graduate School of Agriculture, Hokkaido University, Kita 9 Nishi 9, Kita-ku, SAPPORO, Japan, Phone: 008111 7062545, Fax: 008111 7062550 Email address: shing@anim.agr.hokudai.ac.jp.*

Smith, L.
248 *School of Biological Sciences, University of Bristol, Woodland Road, BRISTOL, United Kingdom, Phone: 0044771 423 484, Fax: Email address: emma.smith@bristol.ac.uk.*

Sneddon, U.
249 *Welfare Biology, Roslin Institute, Roslin, ROSLIN, United Kingdom, Phone: 0044131 5274252, Fax: 0044131 4400434 Email address: lynne.sneddon@bbsrc.ac.uk.*

Somuah, W.S.
250 *, Asembinti Ventures, Lapaz, Accra, ACCRA, Ghana, Phone: 0023321 237858, Fax: 0023321 237858 Email address: asembinti@yahoo.co.uk.*

Sørensen, D.B.S.
251 *Dept.of Lab. Animal Science and Welfare, The Royal University, Ridebanevej 9, FREDERIKSBERG C, Denmark, Phone: 4535282724, Fax: 4535283134 Email address: dobj@kvl.dk.*

Spangenberg, E.
252 *Unit for Comparative Physiology and Med., Swedish University of Agri. Sciences, P.O. Box*

7018, UPPSALA, Sweden, Phone: 0046018 671000, Fax: 0046018 673509 Email address: elin.spangenberg@kirmed.slu.se.

Spinka, M.

253 Ethology Group, Research Institute of Animal Production, Pratelstvi 815, PRAGUE-UHRINEVES, Czech Republic, Phone: 00422 67009596, Fax: 00422 67710779 Email address: spinka@vuzv.cz.

Spoolder, H.A.M.

254 , Research Institute for Animal Husbandry, Runderweg 6, LELYSTAD, The Netherlands, Phone: 0320-293532, Fax: 0320-241584 Email address: h.a.m.spoolder@pv.agro.nl.

Spruijt, B.M.

255 Animal Society/Ethology and Welfare Grou, Utrecht University, Yalelaan 17, UTRECHT, The Netherlands, Phone: 030-2532574, Fax: 030-2539227 Email address: b.m.spruijt@vet.uu.nl.

Stauffacher, M.

256 Institute of Animal Sciences, ETH Zurich, Schorenstrasse 16, SCHWERZENBACH, Switzerland, Phone: 00411 6557351, Fax: 00411 6557201 Email address: markus.stauffacher@inw.agrl.ethz.ch.

Stefanowska, J.

257 Livestock Prod. and Environmental Engi., IMAG, Wageningen, Mansholtlaan 10-12, WAGENINGEN, The Netherlands, Phone: 03174-76450, Fax: 03174-25670 Email address: j.stefanowska@imag.wag-ur.nl.

Stehulova, I.

258 Ethology, Research Institute of Animal Production, Pratelstvi 815, PRAGUE-UHRINEVES, Czech Republic, Phone: 004202 67711747, Fax: 004202 67710779 Email address: Ilona.Stehulova@atlas.cz.

Steiger, F.

259 Division of Animal Housing and Welfare, Institute of Animal Genetics, Bremgartenstrasse 109a, BERN, Switzerland, Phone: 004131 6312327, Fax: 004131 6312640 Email address: andreas.steiger@itz.unibe.ch.

Stephen, M.

260 Design, Brunel University, Runnymede Campus, Egham, SURREY, United Kingdom, Phone: 00441784 431341, Fax: 00441784 472879 Email address: jacqueline.stephen@brunel.ac.uk.

Stephen, S.H.

261 School of Agriculture, University of Cape Coast, UCC, Casely Hayford Hall r203, CAPE COAST, Ghana, Phone: 0023342 31399, Fax: 0023342 33416 Email address: howkobby@yahoo.com.

Stricklin, W.R.

262 Animal and Avian Sciences, University of Maryland, Room 1415, Animal Science Center, COLLEGE PARK, United States of America, Phone: 001301 4051374, Fax: 001301 3149059 Email address: ws31@umail.umd.edu.

Stuijvenberg, A. van

263 , , , , Nederland, Phone:, Fax: Email address: annemarie.v.stuijvenberg@denkwerk.nl.

Takita, N.

264 Graduate School of Agriculture, Hokkaido University, Kita 9 Nishi 9, Kita-ku, SAPPORO, Japan, Phone: 008111 7062545, Fax: 008111 7062550 Email address: takita@anim.agr.hokudai.ac.jp.

Tanaka, T.T.

265 Animal Science and Biotechnology, Azabu University, Fuchinobe 1-17-71, SAGAMIHARA, Japan, Phone: 008142 754 7111, Fax: 008142 769 1692 Email address: tanakat@azabu-u.ac.jp.

Tanida, H.T.

266 Graduate School of Biosphere Science, Hiroshmima University, 1-4-4, Kagamiyama, HIGASHI-HIROSHIMA, Japan, Phone: 0081824 247974, Fax: 0081824 247974 Email address: htanida@hiroshima-u.ac.jp.

Terrazas, A.

267 Neurobiologia Conductual y Cognitiva, Instituto de Neurobiologia, Km.15 carretera san Luis Potosí-Qro., Juriquilla, QUERÉTARO, Mexico, Phone:, Fax: Email address: garciate@servidor.unam.mx.

Toates, F.

268 , , , , The Netherlands, Phone:, Fax: .

Tolo, E.T.O.

269 Slaughter/Animal Welfare, Norwegian Meat Research Centre, P.O. Box 396, Oekern, OSLO, Norway, Phone: 4722092287, Fax: 4722220016 Email address: elisiv.tolo@fagkjott.no.

Tosi, M.V.T.

270 Universita di Milano, Istituto di Zootecnica, Via Celoria 10, MILANO, Italy, Phone:, Fax: Email address: mariavittoria.tosi@unimi.it.

Trei, G.T.

271 Farm Animal Behaviour and Management, University of Kessel, Nordbahnhofstrasse 1a, WITZENHAUSEN, Germany, Phone: 00495542 981643, Fax: 00495542 981588 Email address: gtrei@wiz.uni-kassel.de.

Tuchscherer, M.

272 Behavioural Physiology, Res. Inst.for the Biology of Farm Animal, Wilhelm-Stahl-Allee 2, DUMMERSTORF, Germany, Phone:, Fax: Email address: mtuchsch@fbn-dummerstorf.de.

Tuyttens, A.M.

273 DvL, Agricultural Research Centre, Van Gansberghelaan 115, MERELBEKE, Belgium, Phone: 003209 2722752, Fax: 003209 2722801 Email address: frank.tuyttens@clo.fgov.be.

Ungerfeld, R.U.

274 Departemento de Fisiologia, Facultad de Veterinaria, Lasplaces 1550, MONTEVIDEO, Uruquay, Phone: 005982 6286955, Fax: 005982 6280130 Email address: piub@internet.com.uy.

Vaal, A. de

275 , Tuinstraat 39, AMSTERDAM, The Netherlands, Phone: 020-6237450, Fax: 020-623 7450 Email address: arie@geography.net.

Väisänen, J.V.

276 Dept. of Animal Environment and Health, Swedish University of Agri. Sciences, P.O. Box 234, SKARA, Sweden, Phone: 4651167212, Fax: 4651167204 Email address: johanna.vaisanen@hmh.slu.se.

Valros, A.V.

277 Dep. of Clinical Veterinary Sciences, University of Helsinki, P.O. Box 57, HELSINKI, Finland, Phone:, Fax: Email address: avalros@mappi.helsinki.fi.

Valsecchi, P.
278 *Dip. di Biologia Evolutiva e Funzionale, Universita di Parma, Viale delle Scienze 11/a, PARMA, Italy, Phone: 00390521 905671, Fax: 00390521 905657 Email address: valsecchi@biol.unipr.it.*

Vandenberg, M.
279 *Animal and Poultry Science, University of Guelph, Gordon Street, GUELPH. ON, Canada, Phone: 001519 8244120, Fax: Email address: cvandenb@uoguelph.ca.*

Veissier, I.V.
280 *VRH, INRA, VRH-ACS; INRA-THEIX, SAINT GENES CHAMPANELLE, France, Phone: 00334 73624098, Fax: 00334 73624118 Email address: veissier@clermont.inra.fr.*

Velarde, A.
281 *Meat Technology Centre, Inst.for Food and Agricultural Research, Granja Camps i Armet, MONELLS (GIRONA), Spain, Phone: 34972630052, Fax: 34972630373 Email address: Antonio.Velarde@irta.es.*

Vermeer, H.M.
282 *Pigs, Research Institute Animal Husbandry, P.O. Box 2176, LELYSTAD, The Netherlands, Phone: 0320 293378, Fax: 0320 241584 Email address: h.m.vermeer@pv.agro.nl.*

Verreth, J.A.J.
283 *, Leerstoelgroep Visteelt & Visserij, Marijkeweg 40, WAGENINGEN, The Netherlands, Phone:, Fax: .*

Vichová, J.V.
284 *Ethology Group, Research Institute of Animal Prod.Prague, P átelství 815, PRAGUE, Czech Republic, Phone: 00422 67009657, Fax: 00422 67710779 Email address: vichova@vuzv.cz.*

Vinke, C.M.
285 *Department of Animal & Society, Utrecht University, Yalelaan 17, UTRECHT, The Netherlands, Phone: 030-2534373, Fax: 030-2539227 Email address: c.m.vinke@las.vet.uu.nl.*

Vis, J.W. van de
286 *Seafood Technology, The Netherlands Institute for Fisheries, Haringkade 1, IJMUIDEN, The Netherlands, Phone: 0255 564613, Fax: 0255 564644 Email address: hans@rivo.dlo.nl.*

Visser, E.K.
287 *Division of Animal Science, ID-Lelystad, Edelhertweg 15, LELYSTAD, The Netherlands, Phone: 0320-238200, Fax: Email address: e.k.visser@id.dlo.nl.*

Waiblinger, S.W.
288 *Inst. of Animal Husbandry/Animal Welfare, University of Veterinary Medicine, Veterinaerplatz 1, VIENNA, Austria, Phone: 00431 250774905, Fax: 00431 250774990 Email address: Susanne.Waiblinger@vu-wien.ac.at.*

Wechsler, B.
289 *Centre for proper housing, Swiss Federal Veterinary Office, FAT, TAENIKON, Switzerland, Phone: 41523683131, Fax: 41523651190 Email address: Beat.wechsler@fat.admin.ch.*

Weerd, H. van de
290 *Agriclture, Universty of Newcastle, P/a Adas Terrington, St Clement, Kins Lynn, NORFOLK, United Kingdom, Phone:, Fax: Email address: heleen.vandeweerd@adas.co.uk.*

Weereld, L. van
291 *DPW, Ministerie van LNV, Bezuidenhoutseweg 73, DEN HAAG, The Netherlands, Phone: 070 3784216, Fax: 070 3786161 Email address: l.e.e.van.weereld@dl.agro.nl.*

Weghe, S.
292 *, KTBL, Braken Weg 2, BADBERGEN, Germany, Phone: 00495433 902400, Fax: 00495433 902402 Email address: s.vdweghe@t-online.de.*

Whitmore, G.M.
293 *Animal Welfare Veterinary Division, DEFRA, 1a Page Street, LONDON, United Kingdom, Phone:, Fax: Email address: geraldine.whitmore@defra.gsi.gov.uk.*

Winckler, Ch.
294 *University of Goettingen, Research Centre for Animal Production, Drivertrasse 22, VECHTA, Germany, Phone: 00494441 15237, Fax: 00494441 15469 Email address: christoph.winckler@agr.uni-goettingen.de.*

Wolf, F.M.W.
295 *Departamento de Zootecnia, Universidade Federal de Santa Catharina, Rua Joao Henrique Goncalves, 300, FLORIANOPOLIS, Brazil, Phone: 005548 2320657, Fax: Email address: nando@hoteloceano.com.br.*

Wolffgramm, J.
296 *Sektion Suchtforschung, Univ.klinik fuer Pschiatrie and Psychoth, Eberhard Karls Universitaet Tuebingen, Osianderstrasse 22, TUEBINGEN, Germany, Phone:, Fax: .*

Yayou, K.Y.
297 *Livestock and Grassland Science, National Agricultural Research Centre, 1, Hitsujigaoka, Sappro, SAPPRO, Japan, Phone: 008111 8579284, Fax: 008111 8579307 Email address: ken318@affrc.go.jp.*

Yngvesson, J.
298 *Animal Environment and Health, Swedish Univ. of Agricultural Sciences, P.O. Box 234, SKARA, Sweden, Phone: 0046511 67000, Fax: 0046511 67204 Email address: jenny.yngvesson@hmh.slu.se.*

Zanella, J.
299 *Animal Science, Animal Behavior and Welfare Group, 1230 F Anthony Hall, Michigan State University, EAST LANSING, MI, United States of America, Phone: 001517 4324134, Fax: 001517 3531699 Email address: zanella@msu.esu.*

Zeltner, E.
300 *Animal Husbandry and Breeding, Research Inst. for Organic Agricultture, Ackerstrasse, FRICK, Switzerland, Phone: 00416 28 65 72 77, Fax: 00416 28 65 72 73 Email address: esther.zeltner@fibl.ch.*

Zimmerman, P.H.
301 *Clinical Veterinary Science, University of Bristol, Langford House, Langford, BRISTOL, United Kingdom, Phone:, Fax: Email address: p.h.zimmerman@bristol.ac.uk.*

Author index

Species index

Keyword index

Detailed contents

SHORT ORALS

WORKSHOPS