

PROCEEDINGS OF THE 38TH
INTERNATIONAL CONGRESS
OF THE ISAE



Laura Hänninen & Anna Valros (editors)

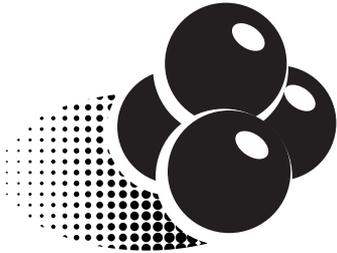
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SERVING BIOTECHNOLOGY

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CREDITS

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MTT, Agrifood Research Finland

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IN ADDITION TO THE SCIENTIFIC ORGANIZING COMMITTEE
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WE ALSO THANK FOLLOWING PERSONS FOR HELP

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Congreszon, Finland

**THE ORGANIZERS GRATEFULLY
THANK THE FOLLOWING
CONGRESS SPONSORS:**

Ministry of Agriculture and Forestry, Finland
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Noldus Information Technology

Pfizer Animal Health

Schering-Plough Animal Health

The Finnish Society for the Protection of Animals (SEY)

Algol Oy, Pharmaceutical Division

Animalia – Federation for the Protection of Animals

LOCAL MAP

A Conference venue: Porthania building,
Yliopistonkatu 3

B Sokos Hotel Helsinki,
Kluuvikatu 8

C Cumulus Hotel Kaisanimit,
Kaisaniemenkatu 7

D Hotel Helka,
Pohjoinen Rautatiekatu 23

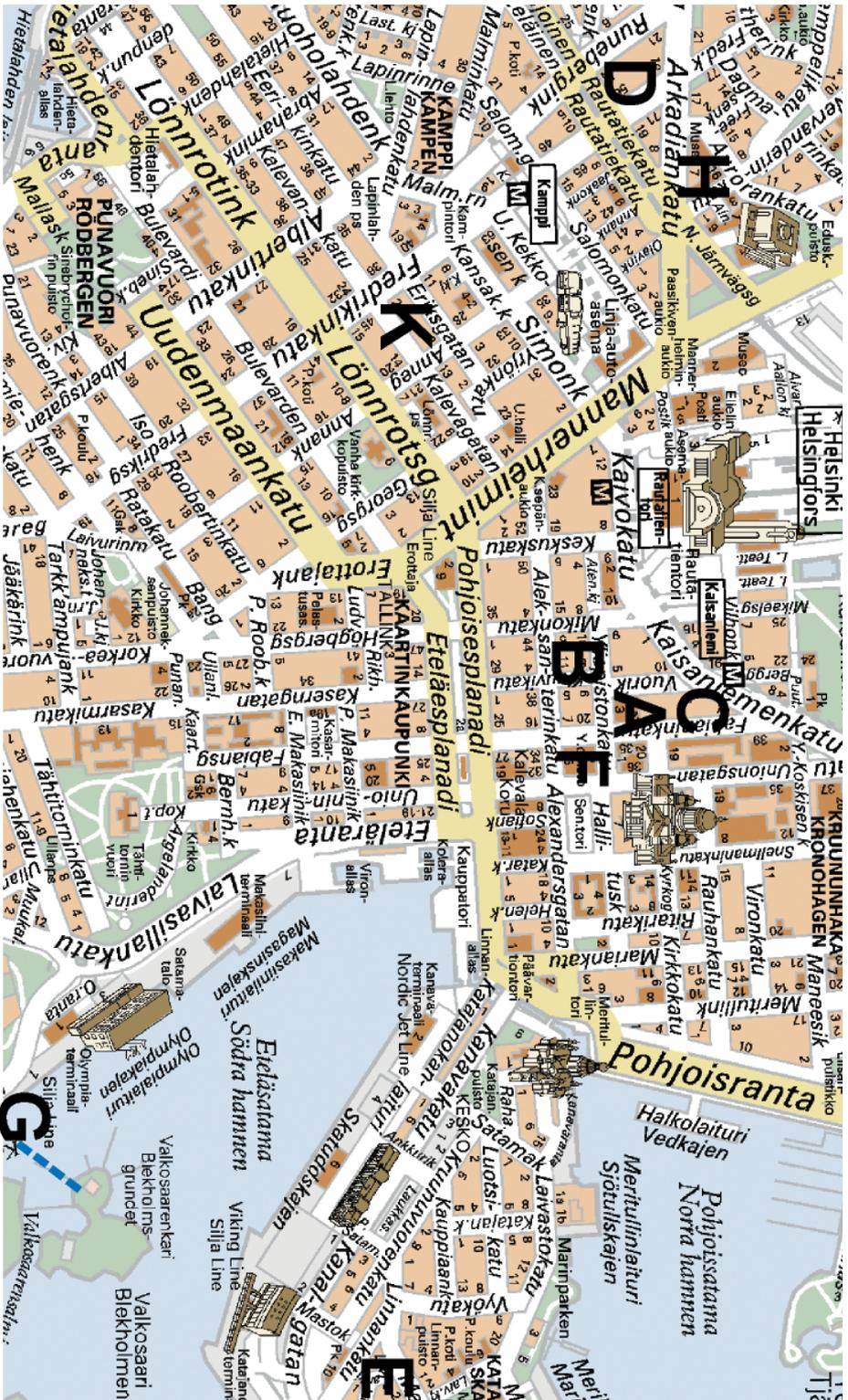
E Eurohostel,
Linnankatu 9

F Welcome Reception;
Mainbuilding of the University of Helsinki,
Unioninkatu 33

G Congres Banquet: Ferry to Valkosaari-island
(after the boat terminal "Olympia")

H Farewell Reception: Finnish Museum of Natural
History, *Pohjoinen Rautatiekatu 13*

K Farewell party pub: Restaurant Helmi,
Eerikinkatu 14



INFORMATION ABOUT POSTER SESSIONS

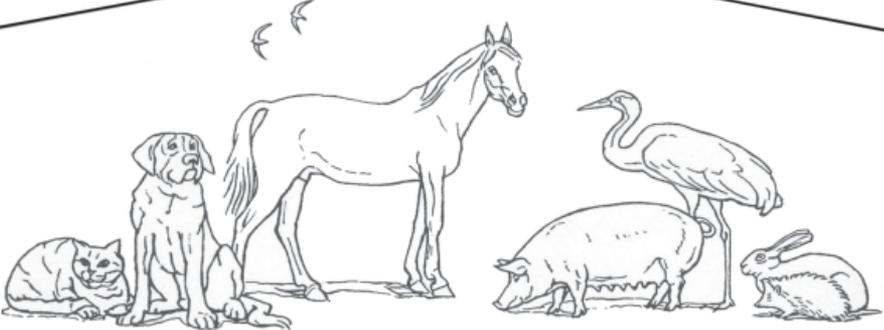
We are piloting a new way to increase the attention of poster presentations by dividing posters into sessions of 5-15 posters around similar subjects. Each poster session will be introduced and summarised at the end of one oral session by the chairman of that session. Posters in the same session will be positioned close together in the exhibition area. Authors are asked to stand by their posters especially during the coffee break/start of lunch break that follows and participants with special interest in these posters are encouraged to visit them at this time. However, to avoid crowding at the posters, poster authors are also welcome to stand by their posters at other poster sessions, thus allowing participants to visit posters during all breaks.

As this is a new system, aimed at increasing the communication value of posters, we hope you are flexible and try to help us make the system work! Posters will further be divided into two main groups (1 and 2): the first group is available Wednesday to Thursday and the second Friday to Saturday

SCIENTIFIC PROGRAM

Tuesday, August 3

- 9:00 – 17:00 ISAE Council meeting and Training of Animal welfare – workshop (invited participants only)
15:00 – 18:00 Registration and installation of posters (group I)
18:00 – 20:00 Welcome reception at the Main building of University of Helsinki



Työtä eläinten hyväksi vuodesta 1901
Working for the welfare of animals since 1901

SUOMEN ELÄINSUOJELUYHDISTYS
FINNISH SOCIETY FOR THE PROTECTION OF ANIMALS

Kotkankatu 9 00510 Helsinki +358 9 8771200 sey@sey.fi www.sey.fi

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Wednesday, August 4 Room: PI

- 8:00 – 9:00** **Registration and installation of posters (group I)**
9:00 – 9:30 **Opening of congress**
9:30 – 10:30 **Wood-Gush memorial lecture:** Jensen, P. Domestication - from behaviour to genes and back again p. 31
- 10:30 – 11:00** **Coffee/tea**
11:00 – 12:45 **Feeding and foraging behaviour**
11:00 – 11:45 **Plenary:** Nielsen, B. Feeding behaviour – more than meets the mouth p. 34
11:45 – 12:00 Rasmussen, D.K. Effects of the animal-feeding place ratio on the behaviour of fattening pigs fed by means of sensor controlled liquid feeding p. 41
12:00 – 12:15 Dybkjaer, L. Eating and drinking activity of newly weaned piglets – effects of mixing and adding zinc to the feed p.42
12:15 – 12:30 Bokkers, E. Walking for food in broilers with different body weights and motivations p.43
- 12:45 – 14:00** **Lunch**
14:00 – 15:35 **Feeding and foraging behaviour II**
14:00 – 14:15 Hörning, B. Effects of enforced behavioural desynchronization via reduced access to the feed troughs on the behaviour of dairy cows p. 48
14:15 – 14:30 Sandilands, V. Alternative methods for limiting broiler breeder growth rate during rearing p. 49
14:30 – 14:45 Harlander-Matauschek, A. The effects of genotype, feed structure and feeding regime on crop filling and feather eating in laying hens p. 50
14:45 – 15:00 Lundberg, A. The function of socially facilitated feeding p. 51
15:00 – 15:15 Lindqvist, C. A comparison of contrafreeloading in layer and broiler chicks p. 52
15:15 – 15:30 Trudelle-Schwarz, R.M. Contrafreeloading in grizzly bears p. 53
- 15:30 – 15:35** **Introduction to poster session: Feeding and foraging behaviour I**
15:35 – 16:10 **Authors of the following posters are asked to stand by their posters during the coffee break**
- Seo, T. Milk-feeding behaviours of group-housed calves with a walk-through automatic feeding station p. 148
Khalili, H. Water intake and drinking behaviour of dairy cows offered grass silage p. 149
Cook, J.E. Can sheep optimise their route to food? p. 150
Hessel, E.F. Feed level controlled mash feeder versus conventional tube mash feeder: which feeder do piglets prefer? p. 151
Bizeray, D. Effect of butyric acid supplementation on post-weaning behaviour in piglets p. 152
Ernst, K. A complex feeding system aimed to induce successful behavioural coping p. 153
Redgate, S.E. A preliminary study to investigate the effect of diet on the behaviour of weanling horses p. 154

Wednesday, August 4 Room: PII

Registration and installation of posters (group I)	8:00 – 9:00
Opening of congress	9:00 – 9:30
Coffee/tea	10:30 – 11:00
Behaviour, health and production I	11:00 – 12:45
Plenary PI	11:00 – 11:45
Keppler, C. Influence of breed and stocking density on feather-pecking in pullets reared with natural daylight p. 44	11:45 – 12:00
Sumita, S. The effect of illuminance on ovine spatial acuity p. 45	12:00 – 12:15
Kristensen, H.H. How to control activity in broiler chickens p.46	12:15 – 12:30
Sorensen, D.B. Social and emotional behaviour of the α -1,3-galactosyl transferase knock out mice and its possible relation to impaired vision p. 47	12:30 – 12:45
Lunch	12:45 – 14:00
Behaviour, health and production II	14:00 – 15:35
Kranendonk, G. Effects of increased maternal plasma cortisol levels during gestation on piglet postnatal behaviour and physiology p. 54	14:00 – 14:15
Terrazas, A. Goat-kid mutual recognition in the first day after birth are affected by maternal undernutrition in pregnancy p. 55	14:15 – 14:30
Roussel, S. Differential effects of various stressors during pregnancy on reactivity of ewes and their lambs p. 56	14:30 – 14:45
Lensink, B.J. Enhancement of learning in suckler calves after weaning: motivational or cognitive control? p. 57	14:45 – 15:00
Haley, D. A new way to wean minimises the behavioural response of cattle over traditional weaning methods p. 58	15:00 – 15:15
Orihuela, A. Effect of restricted suckling or temporal weaning on some physiological and behavioural stress parameters in Zebu cattle p.59	15:15 – 15:30
Introduction to poster session: Behaviour, health and production I	15:30 – 15:35
Authors of the following posters are asked to stand by their posters during the coffee break:	15:35 – 16:10
Kostal, L. Sexual and aggressive behaviour in broiler breeder males: Relation to morphological and physiological traits p. 155	
Paranhos da Costa, M.J.R. Genetic and environmental factors related to the calf vigor and maternal ability of Nelore cattle p. 156	
Spinka, M. Response of dairy calves to the early separation from their mothers: Effects of calves' age and visual/auditory contact p. 157	
Hernandez-Verduzco, C. Effect of restricted suckling on some physiological and behavioural stress measures in dual purpose cattle p. 158	
Ilukha, V. Maternal infanticide is more common in farmed silver foxes (<i>Vulpes vulpes</i>) than blue foxes (<i>Alopex lagopus</i>) p. 159	
Llamas Moya, S. Effect of surgical castration on the welfare of 5-day-old piglets p. 160	
Chapinal, N. Behaviour of pregnant sows kept in two different group housing systems p. 161	
Jongman, E.C. Welfare implications of a novel device for the collection of pregnant mare urine p. 162	
Baskina, S. Age and gender differences in Orlov foal behaviour p.163	

Wednesday, August 4 Room: PI

- 15:35 – 16:10 Posters and coffee/tea**
- 16:10 – 17:40 Free I: "Measures of emotion and stress"**
- 16:10 – 16:25 Langford, F.M. Effects of movement from grazing to novel indoor penning on sleep in sheep p. 60
- 16:25 – 16:40 Langbein, J. Heart rate variability a non-invasive tool to evaluate psychological stress in farm animals p. 61
- 16:40 – 16:55 Hagen, K. Heart rate variability in dairy cows p. 62
- 16:55 – 17:10 Moe, R.O. Anticipatory behaviour and emotional expressions in farmed silver foxes (*Vulpes vulpes*) – a new approach to animal welfare p. 63
- 17:10 – 17:25 Sandem, A.I. Percentage of eye white and behaviour in cows exposed to frustrating and rewarding stimuli p. 64
- 17:25 – 17:40 Boissy, A. Does the discrepancy from expectation or the uncontrollability of an appetitive event induce emotional responses in lambs? p. 65
- 18:00 – 21:00 Parallel workshops**
- **Workshop 1: Lameness - behavioural indications and measures**
 - **Workshop 2: Welfare of Fur Animals**
 - **Workshop 3: Behavioural ontogeny - effects of prenatal and early postnatal stress**
 - **Workshop 4: Do-it-yourself or test kits? A critical look at standard behaviour tests**
 - **Workshop 5: From research to practice**
 - **Workshop 6: Transport of animals: animal welfare research issues**
 - **Workshop 7: The interface between social science and animal science**



FINNISH FUR SALES

Wednesday, August 4 Room: PII

Posters and coffee/tea

15:35 – 16:10

Behaviour, health and production III

16:10 – 17:40

Muller, C. The relationship of social behaviour, cortisol levels and production in dairy cattle herds p. 66

16:10 – 16:25

Mounier, L. The false benefit of mixing fattening bulls to form groups of homogeneous weight p. 67

16:25 – 16:40

Väisänen, J. Genetic control of sociality and adaptability in association to early growth in young fowl p. 68

16:40 – 16:55

Alvarez, L., Social rank and its effect on estrual and ovu-latory response to "Male effect" in the Australian cashmere goat p. 69

16:55 – 17:10

Keeling, L. Who tailbites and who doesn't in groups of fattening pigs p. 70

17:10 – 17:25

Galina, C.S. Sexual behaviour of zebu cattle following estrous induction with CIDR applied to the whole group or in several subgroups p. 71

17:25 – 17:40

Parallel workshops

18:00 – 21:00

· **Workshop 1: Lameness - behavioural indications and measures**

· **Workshop 2: Welfare of Fur Animals**

· **Workshop 3: Behavioural ontogeny - effects of prenatal and early postnatal stress**

· **Workshop 4: Do-it-yourself or test kits? A critical look at standard behaviour tests**

· **Workshop 5: From research to practice**

· **Workshop 6: Transport of animals: animal welfare research issues**

· **Workshop 7: The interface between social science and animal science**



Thursday, August 5 Room: PI

- 8:30 – 10:05 Feeding and foraging behaviour III**
8:30 – 9:15 Plenary: Rutter, S.M. Diet preferences in free-ranging ruminants: current theory and future application p. 35
9:15 – 9:30 Von Keyserlink, M.A.G. Sensitive measures of feeding behaviour in dairy cattle p. 72
9:30 – 9:45 Botheras, N. Time budgets of Australian dairy cows on pasture p. 73
9:45 – 10:00 Jensen, M.B. Milk feeding behaviour in dairy calves p. 74

10:00 – 10:05 Introduction to poster session: Feeding and foraging behaviour II
10:05 – 10:40 Authors of the following posters are asked to stand by their posters during the coffee break:

- Martiskainen, P. Effect of grazing on the behaviour and welfare of dairy bull calves p. 164
Kuhne, F. Diurnal and seasonal rhythms of selected behaviour in Arabian horses kept on pasture throughout the year p. 165
Perera, W. Foraging behaviour of free-ranging native ponies used in conservation grazing p. 166
Kawai, M. Biting and chewing behaviour of grazing light breed horses on different pasture-conditions p. 167

- 10:05 – 10:40 Posters and coffee/tea**
10:40 – 11:55 Feeding and foraging behaviour IV
10:40 – 10:55 Haupt, K. Roughage craving in horses p. 78
10:55 – 11:10 Kress, S. Yearling horse ingestive behaviour and social interaction in three concentrate feeding systems p. 79
11:10 – 11:25 Goodwin, D. Flavour preferences in concentrate diets for stabled horses p. 80
11:25 – 11:40 Spoolder, H.W. Straw or silage provision influences feeding behaviour of pregnant sows in dynamic groups p. 81

11:55 - Installation of posters (group 2)
12:30 - Excursions

- Excursion 1: Equine Research centre & Torronsuo national park
- Excursion 2: Dairy farm & Aulanko forest park
- Excursion 3: University dairy research farm & Fiskars craft, design and arts centre
- Excursion 4: Wild boar farm and the town of Porvoo
- Excursion 5: Fur farm and the town of Porvoo

Thursday, August 5 Room: PII

Behaviour, health and production IV

8:30 – 10:05

Plenary PI

8:30 – 9:15

Raabymagle, P. The effect of box size on the lying behaviour of horses p. 75

9:15 – 9:30

Kennedy, M. The effect of stallion and mare behaviour on conception in intensively-managed breeding p. 76

9:30 – 9:45

Minero, M. Behavioural and physiological responses of hospitalised horses p. 77

9:45 – 10:00

Introduction to poster session: Behaviour, health and production II

10:00 – 10:05

Authors of the following posters are asked to stand by their posters during the coffee break:

10:05 – 10:40

Wredle, E. The use of auditory signals to call individual cows from pasture in an automatic milking system p. 168

Speroni, M. Behaviour of cows milked with an automatic milking system or a milking parlour p. 169

Hautala, M. Measuring the health of cow's legs during automatic milking p. 170

Borderas, T.F. Effect of lameness on dairy cows' frequency of visits to an automatic milking system (AMS) p. 171

Heutinck, L.F.M. Effect of automatic milking and grazing on behaviour of dairy cattle p. 172

da Rosa, M.S., Subclinical mastitis induces few changes in the behaviour of dairy cows during milking p. 173

Weary, D. Reduced feeding behaviour can identify cows at risk for metritis p. 174

Negussie, E. Breeding for increased resistance to mastitis in Nordic dairy cattle: bivariate vs univariate mode p. 175I

Ivanov, I.D. Shearing effect on welfare and milk yield at machine milking of dairy sheep with different temperament p. 176

Posters and coffee/tea

10.05-10.40

Behaviour, health and production V

10.40-11.55

Neuffer, I. Behaviour of dairy cows milked in two automatic milking systems p. 82

10:40 – 10:55

Zubrigg, K. Injuries of dairy cattle: A retrospective analysis of data from Ontario tie stall farms p. 83

10:55 – 11:10

Herskin, M. Acute stress and hypalgesia in dairy cows p. 84

11:10 – 11:25

Arnold, A. Assessment of tape recorded milking shed noise as an aversive stimulus for dairy heifers using a Y maze choice test p. 85

11:25 – 11:40

Muller, R. Long-term consistency of home pen activity and separation stress in individual dairy cows p. 86

11:40 – 11:55

Installation of posters (group 2)

11:55 -

Excursions

12:30 -

Excursion 1: Equine Research centre & Torrnsuo national park

· Excursion 2: Dairy farm & Aulanko forest park

· Excursion 3: University dairy research farm & Fiskars craft, design and arts centre

· Excursion 4: Wild boar farm and the town of Porvoo

· Excursion 5: Fur farm and the town of Porvoo

Friday, August 6 Room: PI

- 8:00 – 8:30** **Installation of posters (group 2)**
- 8:30 – 10:05** **Behaviour, health and production VI**
- 8:30 – 9:15 **Plenary:** Broom, D. Behaviour and health: effects of behaviour and welfare during transport and disease p. 36
- 9:15 – 9:30 Pedersen, L.J. Early piglet mortality in loose-housed sows related to sow and piglet behaviour p. 87
- 9:30 – 9:45 Wulbers-Mindermann, M. Maternal behaviour around parturition in gilts kept indoors in single pens or outdoors in farrowing huts p. 88
- 9:45 – 10:00 Vermeer, H.M. Farrowing accommodation for organic pigs p. 89
- 10:00 – 10:05** **Introduction to poster session: Behaviour, health and production III**
- 10:05 – 10:40** **Authors of the following posters are asked to stand by their posters during the coffee break:**
- Hockenhuil, J. An epidemiological study of the causes of reduced longevity and poor welfare in riding horses and ponies p. 177
- Gunnarsson, S. Animal welfare in free range cattle – an inventory study of farms in the western of Sweden p. 178
- Canali, E. Dairy cow gait as an on-farm indicator of lameness p. 179
- Chida, Y. Evaluation of the effect of hoof trimming on gait of dairy cows using image analyses p. 180
- Mäki-Tanila, A. Possibilities to select for leg soundness in pigs p. 181
- Venäläinen, E. Effects of stocking density and dietary CA/AVP-ratio on leg health in broiler chicken p. 182
- Djukic, M. The effect of weight load on the legs for locomotor activity and resting behaviour in fast and slow growing chickens p. 183
- 10:05-10:40** **Posters and coffee/tea**
- 10:40-12:15** **Behaviour, health and production VII**
- 10:40 – 10:55 Rodenburg, T.B. Behavioural activity of fast and slow growing broilers p. 93
- 10:55 – 11:10 Koene, P. Behaviour genetics of feather pecking in laying hens p. 94
- 11:10 – 11:25 Dixon, L. Feather pecking and its relation to dustbathing in different chicken strains p. 95
- 11:25 – 11:40 Morris, H.J. An epidemiological study of feather pecking in turkeys p.96
- 11:40 – 11:55 Merrill, R.J.N. Laying hens show a preference for AstroTurf over conventional wire as a dustbathing substrate in furnished cages p. 97
- 11:55 – 12:10 Struelens, E. Perch height preference of laying hens in furnished cages: influence of cage height p. 98

ANIMALIA



Friday, August 6 Room: PII

Installation of posters (group 2)

Free II: "Human-animal 1"

Plenary PI

Andersson, M. Handling pigs at unloading variation between transporters p. 90	8:00 – 8:30
Rushen, J. Do cows preferentially learn to associate a handling treatment with a person or place p. 91	8:30 – 10:05
Baranyiova, E. Interactions of dogs and children in Czech households p. 92	8:30 – 9:15
	9:15 – 9:30
	9:30 – 9:45
	9:45 – 10:00

Introduction to poster session:

Free I: "Methodology"

Authors of the following posters are asked to stand by their posters during the coffee break:

Dippel, S. On-farm assessment of lying behaviour in dairy cattle p. 184	10:00 – 10:05
Ng, M. Developing a methodology for measuring behavioural development in dairy calves p. 185	10:05 – 10:40
Creighton, E. Validation of salivary cortisol as an indicator of stress in horses (<i>Equus caballus</i>) p. 186	
Hiby, E.F. Behavioural and physiological indicators of diminished welfare in the dog p. 187	
Beausoleil, N.J. Lateral biases expressed by sheep in a Y maze and implications for analyses of preference tests p. 188	
Jauhainen, L. Behaviour patterns can be divided into two components with different ranges p. 189	
Genever, E. Does feeder order in pigs tell us about social position? p. 190	
Uetake, K. Temperament assessments of lactating cows in three context and their applicability as management traits p. 191	
De Rosa, G. The qualitative assessment of horse temperament p. 192	

Posters and coffee/tea

Free III: "Human-animal 2"

Heleski, C.R. Attitudes toward farm animal welfare – a comparison of U.S. animal science and veterinary college faculty p. 99	10:05 – 10:40
Schmied, C. Behavioural reactions of dairy cows to stroking at different regions p. 100	10:40 – 10:55
Tallet, C. Hand feeding and gentling: How do they contribute to the development of lambs' affinity for their stockperson? p. 101	10:55 – 11:10
Matthews, L.R. Influence of timing and type of handling on cattle reactions to humans p. 102	11:10 – 11:25
Normando, S. Effects of an enhanced human interaction program on the behaviour of dogs in long term rescue shelters p. 103	11:25 – 11:40
Rooney, N.J. Selection of breeds and individual dogs for specialist search work p. 104	11:40 – 11:55
	11:55 – 12:10



Friday, August 6 Room: PI

12:10 – 12:15 Introduction to poster session: Behaviour, health and production IV

12:15 – 12:45 Authors of the following posters are asked to stand by their posters:

Berk, J. Usage frequency of a veranda as a new alternative housing system for male turkeys and effects on animal health and performance p. 193

Valkonen, E. Perch design effects on hens' perching behaviour p. 194

Cheng, H.W. Infrared beak treatment vs. hot-blade beak trimming effects on laying hen well-being p. 195

Chaplin, S.J. The effect of housing conditions on activity and lying behaviour of horses p. 196

Tuomisto, L. Behaviour of beef bulls in a pen and in a forest paddock in summer p. 197

12:15 – 14:00 Posters and lunch

14:00 – 16:05 Environmental enrichment I

14:00 – 14:45 Plenary: Lidfors, L. The importance of environmental enrichment to satisfy behavioural needs p. 37

14:45 – 15:00 Zeltner, E. How should a hen run be structured so that it is used evenly by laying hens? p. 105

15:00 – 15:15 Albentosa, M.J. Cage height and stocking density preferences in group housed hens in furnished cages p. 106

15:15 – 15:30 Studnitz, M. Rooting materials for pigs – a choice between eighteen materials p. 107

15:30 – 15:45 Koistinen, T. Blue foxes' (*Alopex lagopus*) motivation for access to a sand floor measured by using operant conditioning p. 108

15:45 – 16:00 van der Harst, J.E., Tools to measure and improve welfare of laboratory rats: Reward-related behaviour and environmental enrichment p. 109

Friday, August 6 Room: PII

Introduction to poster session:

Free II: "Human animal"

12:10 – 12:15

Authors of the following posters are asked to stand by their posters:

12:15 – 12:45

- Brinkmann, J. Where can avoidance distance be recorded on-farm in dairy cattle? p. 198
 Panama Arias, J.L. Relationships between personality traits and attitudes of milkers and their behaviour during milking p. 199
 Takeda, K. Selection of actively affiliative individuals in a Japanese black cattle herd p. 200
 Boivin, X. Generalisation process from a familiar stockperson to an unfamiliar one in artificially reared lambs p. 201
 Koba, Y. Ability of ponies to discriminate among colors and among similarly dressed people p. 202
 Stefanini, C. Rate of successful adoptions in problem behaviour dogs subjected to an assisted adoption program p. 203
 Inutake, J. Behavioural and physiological stress responses of dogs in animal-assisted activity at an animal shelter p. 204
 Alonso, M.A. Differences in red-legged partridges (*Alectoris rufa*) behaviour depending on the pairing method p. 205
 Pérez, J.A. Behaviour of hand-reared and wild red-legged partridge (*Alectoris rufa*) used in repopulations p. 206
 Schmid, R. The influence of the breeding-method on the behaviour of adult African grey parrots p. 207

12:15 – 14:00 Posters and lunch

Free IV: "Prenatal and juvenile"

Plenary, P1

14:00 – 14:45

- Nordgreen, J. Effects of pre-hatch exposure to corticosterone on filial imprinting in the domestic chick p. 110 14:45 – 15:00
 Janczak, A. Effects of pre-hatch exposure to corticosterone on competition capacity, fear and morphology in chicks p. 111 15:00 – 15:15
 Thodberg, K. A comparison of two different methods to test bonding between sow and piglets p. 112 15:15 – 15:30
 Illmann, G. What is the function of sow nursing vocalization during the first 24 h post partum period? p. 113 15:30 – 15:45
 Poletto, R. Differential expression of genes in frontal cortex of pigs following weaning and social isolation: Implications for neural underpinnings of welfare. p. 114 15:45 – 16:00

Friday, August 6 Room: PI

16:00 – 16:05 Introduction to poster session: Environmental enrichment I

16:05 – 16:40 Authors of the following posters are asked to stand by their posters during the coffee break:

Korhonen, H. Behavioural and adrenocortical responses to digging deprivation in blue foxes p. 208

Vinke, C.M. Play behaviour of juvenile farmed mink in the presence and absence of swimming water p. 209

Winckler, C. Outdoor range use of individual laying hens p. 210

Benda, I. First results on the acceptance of showering as an alternative to bathing in Pekin ducks p. 211

Bulheller, M.A. Effects of different types of water provision on the behaviour and cleanliness of the plumage of Muscovy ducks (*Cairina moschata*) p. 212

Reiter, K. Effect of water bath on behaviour and feathering in ducks p. 213

Bracke, M.B.M. A systematic approach to supporting practical decision making regarding environmental enrichment for pigs p. 214

Dudink, S. Anticipation to reward: A tool to improve welfare in husbandry pigs p. 215

Wells, D.L. Aromatherapy as enrichment for kennelled dogs p. 216

16:05 – 16:40 Posters and coffee/tea

16:40 – 18:00 AGM

19:30 - Congress Banquet

Friday, August 6 Room: PII

Introduction to poster session: Free III: "Prenatal and juvenile" 16:00 – 16:05
Authors of the following posters are asked to stand by their posters 16:05 – 16:40
during the coffee break:

Duvaux-Ponter, C. ACTH injections do not simulate exactly physiological responses to repeated transport in pregnant goats p. 217

Pokorná, Z. How does allosucking affect the step mothers' litter in pigs? p. 218

Jung, J. Post-parturition behaviour in Mexican Creole goats and sheep p. 219

Tsourgiannis, C.A. Post-weaning biting, sucking and chewing behaviour of piglets weaned at 3, 4 or 5 weeks of age p. 220

Leite, D. The effects of weaning age on post-mixing aggressive behaviour of piglets p. 221

de Jong, I.C. The relationship between chick characteristics and broiler welfare and growth p. 222

16:05 – 16:40 Posters and coffee/tea
16:40 – 18:00 AGM
19:30 - Congress Banquet



Animal Health

Saturday, August 7 Room: PI

9:15 – 10:05 Free V

9:15 – 10:00 **Plenary:** Andersen, I.L. The significance of Theories in behavioural ecology for solving problems in applied ethology – possibilities and limitations p. 38

10:00 – 10:05 **Introduction to poster session: Free IV: Mixed**

10:05 – 10:40 **Authors of the following posters are asked to stand by their posters during the coffee break:**

Siegford, J.M. Integration of animal welfare into the veterinary curriculum: the development of an online course in animal welfare p. 223

Reed, B. Improving laboratory animal welfare – reports of the joint working groups on refinement (JWGR) p. 224

Andersson, A. Wild boar infanticide in connection with farrowing in an enclosure p. 225

Tanida, H. Behaviour of wild boars and raccoon dogs on Kamagari Island of the inland sea of Japan p. 226

Gebhardt-Henrich, S.G. Severe hydrocephalus in a colony of golden hamsters with little behavioural modification p. 227

Niel, L. Rats show aversion to a gradually increasing concentration of carbon dioxide p. 228

Kauppinen, R. Thermoregulation behaviour of cold-housed dairy bulls p. 229

Tucker, C.B. Correlates of social success in dairy cattle p. 230

Cloutier, S. The role of gonadal steroids in cannibalism in laying hens p. 231

10:05 – 10:40 **Posters and coffee/tea**

10:40 – 12:15 **Free VI: “Learning & coping”**

10:40 – 10:55 Christensen, J.W. Do horses generalise their response to novel stimuli? p. 115

10:55 – 11:10 Barone, A. Experiences of sheep during learning p. 116

11:10 – 11:25 Lee, C. Development of a maze test to assess cognitive function and learning ability of sheep p. 117

11:25 – 11:40 McLeman, M.A. Bimodal and unimodal discrimination of individual conspecifics by juvenile domestic pigs p. 118

11:40 – 11:55 Souza, A.S. Can acute stress impair the ability of weaned piglets to recognize a familiar conspecific p. 119

11:55 – 12:10 Telezhenko, E. Preferences of dairy cows for walking and standing on different floors p. 120

12:10 – 12:15 **Poster session: Free V: “Learning, temperament and emotions”**

12:15 – 12:45 **Authors of the following posters are asked to stand by their posters:**

Siebert, K. Stability of visual discrimination learning of dwarf goats under changing housing conditions p. 232

Abe, N. The relationship between hair whorl position and behavioural and physiological characteristics in beef cattle p. 233

Ito, S. The relationship between behavioural characteristics and physiological responses to isolation stress in Holstein heifer p. 234

Eager, R.A. Repeatability, diurnal variation and temperament: Factors affecting the use of heart rate variability in horses p. 235

Tanaka, T. Changes of reaction latency and stress levels with the progress of verbal commands learning in dogs p. 236

Fukuzawa, M. The effect of signal context in obedience in the domestic dog (*Canis familiaris*) p. 237

24 12:15 – 14:00 **Posters and lunch**

Saturday, August 7 Room: PII

Environmental enrichment II	10:40 – 12:15
Jensen, A.B. Effect of electrical brooders on chickens' feather pecking activity p. 121	10:40 – 10:55
Mench, J. Effects of perches and feeding platforms on lameness in broiler chicken p. 122	10:55 – 11:10
Cooper, J.J. Cage height and stocking density effects on comfort behaviour in laying hens in furnished cages p. 123	11:10 – 11:25
Zonderland, J.J. Environmental enrichment to prevent tail biting p. 124	11:25 – 11:40
O'Connell, N.E. Influence of individual predisposition, maternal experience and lactation environment on the responses of pigs to weaning at two different ages p. 125	11:40 – 11:55

Poster session: Environmental enrichment II 12:10 – 12:15

Authors of the following posters are asked to stand by their posters: 12:15 – 12:45

Mastjugina, I. The role of social environment in forming of species and sexual attachment in djungarian hamsters (<i>Phodopus sungorus</i>) p. 238
Spruijt, B.M. A simple enriched cage for laboratory rats reduces aggression, enhances activity and influences behaviour on the elevated plus maze p. 239
Brocklebank, S. Environmental enrichment for mice p. 240
Olsson, I.A.S. Behavioural activity of laboratory mice in standard and furnished cages with a running wheel p. 241

Posters and lunch

12:15 – 14:00 25

Saturday, August 7 Room: PI

14:00 – 15:35 Free VII: “Housing”

- 14:00 – 14:15 Valsecchi, P. Communal piglet area in a conventional pig farm: evaluation of pre- and post-weaning behaviour of piglets p. 126
- 14:15 – 14:30 Hillmann, E. Vocal and lying behaviour of fattening pigs at low temperatures p.127
- 14:30 – 14:45 Schulze Westerath, H. Optimizing the inclination of the lying area in cubicles for fattening bulls p. 128
- 14:45 – 15:00 Marques, J.M. Effect of preweaning and postweaning housing on laboratory mouse behaviour p. 129
- 15:00 – 15:15 Forkman, B. Hens in tents – a welfare friendly system p. 130
- 15:15 – 15:30 Håkansson, J. Behavioural variation between captive populations of red junglefowl (*Gallus gallus*) p. 131

15:30 – 15:35 Introduction to poster session: Free VI: “Housing”

15:35 – 16:10 Authors of the following posters are asked to stand by their posters during the coffee break:

- Morita, S. Lying position of cows in stalls in free-stall housing p. 242
- Fregonesi, J.A. Effect of freestall availability on dairy cattle behaviour p. 243
- Gygax, L. Optimal size of cubicles for fattening bulls p. 244
- Malmkvist, J. Effect of noise intensity on aggression toward intruder in group-housed slaughter pigs p. 245
- Takeuchi, M. Comparison of standing up activity of dairy cows in three types of housing system p. 246
- Arnould, C. Use of pen space by broiler chickens reared in commercial conditions: Identification of lying areas p. 247
- Teixiera, D.L. Dairy cows' choice of water trough based on its dimensions p. 248

15:35 – 16:10 Posters and coffee/tea

16:10 – 17:25 Behaviour, health and production VIII

- 16:10 – 16:25 Neveux, S. Changes in weight distribution to detect hoof pain in dairy cows p. 137
- 16:25 – 16:40 Flower, F.C. Hoof pathologies and gait characteristics in dairy cattle p. 138
- 16:40 – 16:55 Keil, N.M. Effect of outdoor exercise on the incidence of hock lesions in tied dairy cows p. 139
- 16:55 – 17:10 Partanen, K. Factors affecting gait scores of fattening pigs p. 140
- 17:10 – 17:25 Karlen, G. A. Incidences of sow lameness in two gestation housing systems p. 141

17:25 – 18:00 Presentation of ISAE 2005 and Closing of congress

18:30 - Farewell reception and party

Saturday, August 7 Room: PII

Environmental enrichment III	14:00 – 15:35
Sherwin, C.M. $E^2 = 3R + 2Q$: Calculating species-appropriate environmental enrichment p. 132	14:00 – 14:15
Hauzenberger, A.R. Environmental enrichment shifts circadian rhythms in golden hamsters p. 133	14:15 – 14:30
Pedersen, V. Pet toys as enrichment for farmed foxes: Effects on behaviour and physiology p. 134	14:30 – 14:45
Van der Mheen, H.W. Effects of environmental enrichment and limiting access to pasture p. 135	14:45 – 15:00
Chaloupková, H. Does housing conditions affect play behaviour of piglets during pre-weaning period? p. 136	15:00 – 15:15
Gifford, A.K. Assessing object recognition memory in pigs (<i>Sus scrofa</i>) based on novelty preference p. 137	15:15 – 15:30
Introduction to poster session: Environmental enrichment III	15:30 – 15:35
Authors of the following posters are asked to stand by their posters during the coffee break:	15:35 – 16:10
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Ishiwata, T. Effects of an environmental enrichment with a drum on the behavioural, physiological and productive parameters of beef cattle p. 250	
Norring, M. Familiarity of bedding material affects cubicle preference in dairy cows p. 251	
Loberg, J.M. Preference for indoor or outdoor exercise during winter in tied dairy cows p. 252	
Struelens, E. Sows prefer to lie on a prototype lying mattress rather than on concrete p. 253	
Maletinska, J. Piglet growth around weaning in two different housing environments p. 254	
Ruis, M.A.W. Effect of an outdoor run and natural light on welfare of fast growing broilers p. 255	
Heikkilä, M. Development of perching behaviour in chicks p. 256	
Pajor, E. Motivation for group housing in gestating sows p. 257	
Posters and coffee/tea	15:35 – 16:10
Environmental enrichment IV	16:10 – 17:25
Kanaan, V.T. The effect of co-mingling litters on piglets' social behaviour, performance and behavioural tests p. 142	16:10 – 16:25
Boyle, L.A. Effect of environmental enrichment on the behaviour of sows housed in groups with free-access stalls p. 143	16:25 – 16:40
Lexer, D. Effects of group size and group composition on behaviour and performance of weaner pigs p. 144	16:40 – 16:55
Raussi, S. Is repeated regrouping stressful for heifers? p. 143	16:55 – 17:10
	17:10 – 17:25
Presentation of ISAE 2005 and Closing of congress	17:25 – 18:00
Farewell reception and party	18:30 -



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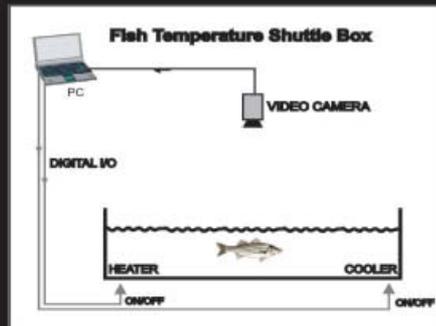
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ABSTRACTS OF WOOD-GUSH MEMORIAL AND PLENARIES

DOMESTICATION – FROM BEHAVIOUR TO GENES AND BACK

P. Jensen

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Onset of animal domestication is commonly believed to date about 15000 years back, but for some species, the process started much earlier than this (Clutton-Brock, 1999; Giuffra et al., 2000). From an evolutionary perspective, three processes are central to domestication. Firstly, there is a relaxation of certain natural selection factors, such as predation and starvation. Secondly, there is an intensified selection for traits preferred by humans. Thirdly, there is a correlated response, where traits, which are not specifically selected for, change as an adaptation to the new selection environment. This may also cause side-effects which are negative for animal welfare (Rauw et al., 1998).

Domestication tends to create phenotypes characterised by specific morphological, physiological and behavioural traits (Price, 1997). These may invade a population in few generations, and it has been suggested that, sometimes, only a small number of genes are involved in this rapid evolution (Stricklin, 2001). In dissecting the pathway from behavioural expression to the responsible genes, and back from genes via mechanisms to phenotype, domestication should be a favourite model system of any evolutionary biologist.

Chickens are excellent model animals in order to study domestication. All poultry breeds are domesticated genotypes of the red jungle fowl, *Gallus gallus* (Yamashita et al., 1994). Production levels of modern poultry have increased dramatically. A laying hen grows to about double the size of jungle fowl, and lays manyfold more eggs, of which each is more than double the size of those of jungle fowls (Schütz et al., 2002). Some correlated side-effects, both in health and behaviour, have been reported as a result of this (Rauw et al., 1998, Braastad and Katle, 1989). In semi-natural enclosures, layers were less active, showed less intense social behaviour, had a modified and less intense antipredatory behaviour, and were less inclined to explore unknown food sources (Schütz et al., 2001; Schütz and Jensen, 2001). This fits well with the resource allocation theory (Beilharz et al., 1993).

To move from behaviour phenotype to genes, we performed QTL-analysis (QTL= Quantitative Trait Loci) of different traits (Weller, 2001). We crossed one jungle fowl with four White Leghorn females and intercrossed the F1 to obtain more than 1000 F2-animals. From 751 F2-individuals, we obtained a full data matrix containing more than 100 DNA-markers (mostly microsatellites), data on growth, egg production and feed consumption, and behavioural data from an array of different tests, designed mainly to test reactions in different fear related situations.

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We located a number of QTL associated with growth and egg production. Surprisingly, a few QTL explained a large proportion of the growth variation – four QTL explained 50% of the variation in adult body weight of females and 80% of that of males (Kerje et al., 2003). The two most important growth QTL were situated on chromosome 1 (Growth1 and Growth2). Growth1 was also related to egg production (mean egg size). Both Growth1 and Growth2 were also related to different aspects of behaviour. In a genome-wide scan, QTL for tonic immobility duration and induction were located on growth1 and growth2. Regression analysis of these two QTL on various behavioural variables showed significant effects on other fear-related behaviour as well, such as latency to approach a novel object, activity in an open field and corticosterone reaction in an open field (Schütz et al, 2004).

These findings provide a possible mechanism for evolutionary trade-offs. Pleiotropic gene effects, i.e. genes simultaneously affecting production and behaviour, may be important mechanisms for optimal resource allocation. The findings also lend support to the idea that whole phenotypes can change rapidly with a modified selection pressure as a result of the action of a limited set of genes.

Of course, localisation of a QTL is only a first step towards finding the actual genes involved in the trade-off. Expression analysis, using DNA-microarrays is one way to go from gene back to behaviour. Another, more straightforward is to utilise the genome DNA-sequence, and since March 2004, the chicken genome sequence is available. One identified gene, PMEL17, strongly affected the risk of being exposed to feather pecking in our cross. The gene affects melanisation of the plumage, and this opens new ideas for how abnormal social behaviour may develop (Keeling et al, 2004).

The primary means for an animal's adaptation to a specific environment is by its behaviour. If artificial selection affects the behavioural repertoire available for such adaptation, this will have profound importance for its welfare. Modern genomics paired with evolutionary analysis of behaviour may offer a route for understanding the relation between behaviour and production and predicting possible side-effects of breeding programs.

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FEEDING BEHAVIOUR – MORE THAN MEETS THE MOUTH

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One of the easiest ways to get an animal to do something is through feeding. Feeding behaviour is the effort of an animal to fulfil one of its most basic needs. It links the disciplines of nutrition and ethology, and covers a broad spectrum of behavioural studies from intricate measures of bite size in rats to binocular observations of foraging in wild ungulates. We sometimes find it difficult to distinguish between exploratory and foraging behaviour, as the latter traditionally comprises both appetitive and consummatory phases. Different species display fascinating temporal patterns in their feeding behaviour from animals managing without food for extended periods to animals that need to eat every few hours. Feeding behaviour also contains such diverse aspects as rumination, coprophagy, and contra-free loading; there are changes over time due to the experience, maturity and size of the animal, as well as seasonal changes.

The study of feeding behaviour has given rise to a vast body of literature. Some are concerned with the concepts of hunger and satiety, whereas others deal with feeding behaviour in much broader terms, such as daily food intake. Short-term feeding behaviour lies in this overlap. Short-term feeding behaviour encompasses the `what to eat` and the `when to eat`, and spans from bite and mouthful over feeder visit to meals and daily food intake. The intricate correlations and dependencies between the various measures of short-term feeding behaviour in the way in which an animal obtain its daily food intake will be discussed. This will demonstrate how feeding behaviour is a very important tool in understanding the relative importance of food intake, social constraint and behavioural synchrony of a group. Examples will be given of how ethologists and nutritionists can utilise the otherwise hidden information, that studies of feeding behaviour can reveal.

DIET PREFERENCE IN FREE-RANGING RUMINANTS: CURRENT THEORY AND FUTURE APPLICATION

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This paper reviews the current theory and potential practical applications of diet preference research. Although much of this work has focussed on grass and clover as a model system, it has wider theoretical implications and potential for practical exploitation. It is of particular relevance with the recent increased interest in maintaining and enhancing biodiversity, both in agricultural systems and semi-natural habitats.

One of the most consistent findings of previous research is that sheep and cattle both eat mixed diets, showing a partial preference of approximately 70% for clover. There is a diurnal pattern to preference, with a stronger preference for clover in the morning, with the proportion of grass in the diet increasing towards the evening. Research has also shown that sheep and dairy cattle achieve higher intakes from grass and clover when these are offered as separate monocultures compared with animals grazing a traditional mixed sward. The initial findings were from studies where the animals had free choice, but similar results have been achieved in dairy cows being allocated to clover between morning and afternoon milking and grass for the remainder of the day.

These benefits, which have been attributed to a lower selection cost, have the potential to be exploited on-farm, to increase intake and production. Our increasing understanding of the factors influencing diet selection raises the possibility of developing grazing management practices to maintain and possibly enhance biodiversity

Various theories have been proposed to account for the fact ruminants eat mixed diets. Although some, such as spatial memory and visual discrimination have been discounted, others, such as perceived predation risk and evolutionary pressure to maintain rumen function appear to be more valid. However, further research is still needed to explore and validate hypotheses related to these theories.

BEHAVIOUR AND HEALTH: EFFECTS OF BEHAVIOUR AND WELFARE DURING TRANSPORT AND DISEASE

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The relationships among the concepts of welfare, health and pathology and the consequences for disease of particular behaviours are key issues in our understanding of animals and their welfare. Health is defined as an animal's state as regards its attempts to cope with pathology, where pathology is a detrimental derangement of molecules, cells, tissues, and functions that occur in living organisms in response to injurious agents or deprivations. Pathology can be classified into genetic abnormalities; physical, thermal, and chemical injuries; infections and infestations; metabolic abnormalities; and nutritional disorders.

Health is a part of welfare. When an animal's health is poor, so is its welfare, but poor welfare does not always imply poor health. Some measures of poor welfare classified as pathology will therefore also be indicators of poor health, including body damage and symptoms of infectious, metabolic, and nutritional disease. Other measures of poor welfare, while not being signs of poor health at the time, indicate a risk of poor health in the future. They include immunosuppression and the occurrence of injurious abnormal behaviours. The connection between physiological coping mechanisms, immune function, and susceptibility to infectious disease, as well as other routes by which poor welfare results in increased disease are illustrated well by data from studies of the transportation of farm animals. Behaviour and physiological responses during loading can indicate poor welfare. Elevated adrenal activity can result in immunosuppression and increased disease incidence during or after transport. Behaviour during transport indicates that lateral vehicle movements, sudden braking and, in some-species, movements causing motion sickness lead to poor welfare and may increase later disease. Mixing of animals, rough treatment and response to these can substantially increase later disease.

There are also other ways in which behaviour plays an important role in disease transmission and these will be reviewed.

THE IMPORTANCE OF ENVIRONMENTAL ENRICHMENT TO SATISFY BEHAVIOURAL NEEDS

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The purpose with the presentation is to analyse, discuss and give some examples of the importance of defining the behavioural needs of a species before applying environmental enrichment. Behavioural needs are behaviours that individual animals of a species in captivity show a strong motivation to perform, and which may lead to frustration, stress, health problems and/or abnormal behaviours when they are hindered. A basic knowledge of the natural behaviour of the species with special attention given to the adaptation range in different behavioural programs, and differences between age classes, sex and breeds should be the basis when defining behavioural needs.

Environmental enrichment is the adding of characteristics in the environment or changes in their way of presentation that increase the complexity of the environment for an animal kept in captivity, and which results in positive effects on behaviour and other aspects of biological function (Newberry, 1994). An enriched environment gives the animal challenges to which it is evolutionary adapted in an environment that gives it possibilities to react in an adaptive way. Hence, cages and pens for animals in captivity has to be large enough to allow retreat from stressors, foraging, exploration, play and any other basic behaviours of the species.

Behavioural tests of preference and of the strength of the preference may be used to test the animals' motivation for an environmental enrichment. In this respect also the behavioural need being satisfied may be tested. However, the use of the environmental enrichment in the animals' home environment has to be analysed, as well as if the enrichment leads to any negative or positive consequences to the animals' health. Examples are given from animal species in captivity, eg. rabbits, cattle and mink.

THE SIGNIFICANCE OF THEORIES IN BEHAVIOURAL ECOLOGY FOR SOLVING PROBLEMS IN APPLIED ETHOLOGY – POSSIBILITIES AND LIMITATIONS

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The aim of this presentation is to provide a discussion about the significance of using a theoretical framework from behavioural ecology in solving problems in applied ethology. What can we learn from behavioural ecology? To answer this question, a discussion about the experimental approach in behavioural ecology and the effects of domestication and constraints set by the artificial environment are discussed.

The theoretical approach in behavioural ecology involves costs and benefits of a behavioural pattern to an individual of a particular species. The main tool for helping us to analyse decisions in terms of their costs and benefits is optimality modelling. An optimality model seeks to predict which trade-off between cost and benefits will give the maximum net benefit to the individual.

The study of function of the behaviour leads to discussions of fitness or reproductive success, natural selection and evolution based on studies in a natural setting. This is in great contrast to applied ethology, which involves the study of animals in man-made, often barren and restrictive environments where man controls the breeding. The domestic animals are not free to behave, select mating partner, choose group mates or decide what kind of and how much food they are going to eat. To some researchers this has placed domestic animals in a category outside the limits of legitimate areas of investigation.

There is little evidence that domestication has resulted in loss of behaviours from the species repertoire, that basic structure of the motor pattern has been changed or that addition of new behaviours has occurred. In nearly all cases, behavioural differences between wild and domestic stocks are quantitative in character and best explained by differences in response thresholds (differences in frequencies of behavioural components). The characteristic perceptual capabilities of most species remain highly stable under domestication. Furthermore, some rodent experiments suggest that the ability to behave optimal (with respect to the current environmental conditions) in a stable environment may still be present for domestic species.

38 Except for animals kept on pasture, groups of domestic animals are most commonly kept in a closed space where there is no option to leave. Individuals in these groups are not

able to choose their flock mates, nor can they manipulate the group size, and resources in the environment are often limited and defensible. However, the fact that they live in an artificial environment is not in itself an argument against using domestic species as model animals for basic research questions, as long as we are aware of the effects domestication and the environment. It is possible to make a similar framework and economical models as the ones used in behavioural ecology that includes assumptions fitted to the domestic species and the artificial environment.

ABSTRACTS OF ORAL PRESENTATIONS

EFFECTS OF THE ANIMAL-FEEDING PLACE RATIO ON THE BEHAVIOUR OF FATTENING PIGS FED BY MEANS OF SENSOR CONTROLLED LIQUID FEEDING

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Sensor feeding is a liquid feeding system for fattening pigs. The aim of the present study was to quantify the effect of the animal-feeding place ratio on behaviour and performance of the animals. The study was carried out with 18 groups of 40 pigs (25-100 kg). Three different animal-feeding place ratios were investigated, 4:1, 7:1 and 13:1 (9, 6 and 3 feeding places per group). Each animal-feeding place ratio was tested with six groups of animals.

The behaviour in the feeding area (duration of feeding bouts, duration of waiting bouts, aggression, displacements involving an aggressive interaction, displacement not involving an aggressive interaction) was observed by means of video recording for 12 focal pigs per group at an age of 14 and 17 weeks. Four lightweight, four middleweight and four heavyweight pigs were selected as focal animals. Daily weight gain was calculated for all animals. Data were analysed with mixed effect models.

With increasing animal-feeding place ratio, the duration of feeding per visit at the trough was significantly reduced ($p < 0,05$) and the duration of waiting was increased ($p < 0,001$). The animal-feeding place ratio had no significant effect on the frequency of aggressive displacements at the feeding trough. On the other hand, the fatteners were more frequently pushed away from the trough not involving aggressive interactions, as the animal-feeding place ratio increased ($p < 0,001$). Besides animal-feeding place ratio, age and the weight class of the focal pigs had significant effects on the behaviour. Weight gain was lower as animal-feeding place ratio increased ($p < 0,001$), and this effect was more pronounced in lightweight focal animals ($p < 0,001$).

In conclusion, the animal-feeding place ratio has a distinct influence on the behaviour and performance of fattening pigs fed by a sensor feeding. A wide animal-feeding place ratio has a negative effect in particular on lightweight pigs, probably the subordinate group members.

**EATING AND DRINKING ACTIVITY OF NEWLY WEANED PIGLETS
– EFFECTS OF MIXING AND ADDING ZINC TO THE FEED****L. Dybkjær*, A.P. Jacobsen, F.A. Tøgersen**

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Although mixing of piglets is a well-known stressor, it is a common weaning procedure in intensive pig production. After weaning piglets usually do not eat for a period of time. This fasting causes reduced growth and an increased risk of diarrhoea. Addition of high levels of zinc to the feed has positive effects on the health and performance of piglets after weaning. However, little is known about the effects of mixing and zinc oxide on the eating and drinking behaviour of individual piglets during the first days after weaning.

The effects of mixing 2×4 littermates and/or adding zinc oxide (2500 ppm) to the feed were studied in a 2×2 factorial experiment including 123 piglets weaned at 27±2 days. Individual eating and drinking behaviour during the first 48 hours after weaning was recorded and analysed by mixed linear models as total time spent eating and drinking per piglet per day.

Neither mixing nor addition of zinc oxide affected the total eating or drinking time. The first day after weaning the piglets spent less time eating as compared to the second day (20±5 vs. 98±10 min/24 hrs, respectively, $P<0.0001$). Time spent eating was positively associated with time spent drinking ($P<0.0001$) and negatively associated with growth rate in the nursing period ($P=0.001$). Contrary, time spent drinking was positively associated with growth rate in the nursing period ($P=0.003$). Females spent more time eating than males (61±8 vs. 44±7 min/24 hrs, respectively, $P=0.002$), whereas the sex of the piglet did not affect drinking time.

In conclusion, individual eating and drinking activity after weaning are strongly associated. The total daily eating and drinking time was not affected by the external factors, but was affected by day as well as individual characteristics such as growth rate and gender.

WALKING FOR FOOD IN BROILERS WITH DIFFERENT BODY WEIGHTS AND MOTIVATIONS

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Since both motivation and body weight can have an influence on behavioural activity in broilers, it is relevant to make a distinction between these two for the assessment of broiler welfare. The aim of this study was to measure the effects of motivation and body weight on the maximum distance broilers would walk for a food reward in an operant runway.

In the operant runway, the distance between feeder and response key increased with 5 cm after each reward. The maximum distance was the distance between response key and feeder after a bird stopped working for food. Motivation was manipulated in two ways: by feed deprivation length before testing (17 vs. 22.5 h) and by food access length during testing (5 vs. 15 s). To study the impact of body weight, a high and a low body weight group was used. Effect of body weight on maximum distance was analysed with an analysis of variance with age, feed deprivation and food access length as repeated measures.

Over treatments, birds achieved a maximum distance of 153.7 cm. Birds with a low body weight achieved a higher maximum distance than birds with a high body weight ($F_{1,17}=5.85$, $p<0.05$) in both treatments. Birds of both body weight groups achieved a higher maximum distance after 22.5 h than after 17 h feed deprivation before testing ($F_{1,17}=7.10$, $p<0.05$). Birds achieved a higher maximum distance with 5 s than with 15 s food access ($F_{1,17}=62.92$, $p<0.001$) and this effect was stronger in the low than in the high body weight birds ($F_{1,17}=20.79$, $p<0.001$). In this study is shown that broilers are motivated to walk long distances for food when they are hungry. A high body weight can be considered as a physical constraint for broilers to be active and it limits the expression of normal behaviour.

INFLUENCE OF BREED AND STOCKING DENSITY ON FEATHER-PECKING IN PULLETS REARED WITH NATURAL DAYLIGHT***C. Keppler¹, K. Lange², D.W. Fölsch¹, U. Knierim¹**

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This study aimed to determine the effect of breed and stocking density on feather-pecking in non beak-trimmed laying hen chicks in pens with daylight.

Two breeds ('A', 'B') and two stocking densities (7 and 10 animals/sqm: '7', '10') were tested in three replications with 160 and 230 animals per group. Three focus animals per pen were directly and continuously observed for 5 minutes 7 times from week 2 to 10 of life, and severe feather-pecks noted. Ten animals per pen were feather-scored 9 times during the rearing period. Univariate analyses of variance were applied, means are reported.

Severe feather-pecks ranged from 0 to 11 pecks per animal in 5 minutes, with most pecks occurring during week 5 to 10, and a significant influence of breed and stocking density (A7: 0.83; A10: 4.14; B7: 0.05; B10: 0.28; breed: $p < 0.05$; stocking density: $p < 0.1$; $n=3$). Higher severe pecking activity resulted in more feather damage and injuries, mainly at the tail. From week 4 to 8, breed A and higher stocking density groups had significantly more animals with small featherless areas (e.g. week 5: A7: 30%; A10: 70%; B7: 0%; B10: 0%; breed: $p < 0.001$; stocking density: $p < 0.05$; $n=3$). Injury rates were only affected by breed (week 5: A7: 10%; A10: 20%; B7: 0%; B10: 0%; breed: $p < 0.05$; stocking density: n.s.; $n=3$), but higher stocking density groups had more cannibalism (A7: 0.2%; A10: 1.9%; B7: 0.6%; B10: 1.3%; breed: n.s.; stocking density $p < 0.05$).

Already in the early development, feather loss, injury and cannibalism can occur due to feather-pecking. Selection of breeds with a low disposition for feather-pecking is possible and recommendable, especially for more natural rearing systems with daylight and birds with intact beaks. Lower stocking densities can also contribute to a reduction of feather-pecking and cannibalism in the rearing period and possibly later on.

THE EFFECT OF ILLUMINANCE ON OVINE SPATIAL ACUITY**S. Sumita^{1, 2*}, C. J. C. Phillips³, N. B. Prescott², D. M. Broom¹,
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The effect of illuminance on spatial acuity was investigated in six 10 months-old British Friesland x Texel ewes, to provide baseline information for the design of housing and transport facilities. Test ewes were trained to discriminate a square-wave vertical grating versus a uniform grey screen at a distance of 2 m, in a Y-maze illuminated with fluorescent white light at 200 lux. The illuminance in the Y-maze (measured at the average ewe's eye level) was then set to approximately 6, 12, 25, 50, 100 and 200 lux. The light treatments were arranged in a 6 x 6 Latin Square and each animal was subjected to 3 daily sessions of 14 trials each. Prior to the sessions, the ewes were conditioned for a period of 30 minutes in the assigned illuminance.

Positions of the visual stimuli for each trial were alternated according to a Gellerman series. The animals were rewarded with palatable food for a correct choice of stimulus. Spatial acuity in each illuminance was determined by progressively decreasing the width of the grating, to a point where the ewes were unable to discriminate between the stimuli. A criterion for successful discrimination was set at ≥ 11 correct choices ($\geq 78.6\%$) out of 14 trials ($\chi^2 = 4.57$, $P < 0.05$, 1df), in 3 consecutive sessions or 3 out of 5 sessions.

The relationship between the ewes' spatial acuity and illuminance was exponential. Mean spatial acuity increased rapidly from 6.91 ± 0.16 cycles deg^{-1} at 6 lux to 10.50 ± 0.18 cycles deg^{-1} at 50 lux, and thereafter ascended gradually to 13.12 cycles deg^{-1} at 200 lux, perhaps indicative of the transition from scotopic to photopic vision. A study is being undertaken to determine the relationship of illuminance and spatial acuity in humans, in order to facilitate comparative analyses with the present data.

HOW TO CONTROL ACTIVITY IN BROILER CHICKENS?

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Controlling broiler activity may improve welfare by reducing lameness, decreasing injuries during catching and synchronising behaviour within the flock. Obtaining control includes being able to increase or decrease activity at will and may hence provide an inexpensive tool to improve broiler welfare. Despite much attention, no method has so far been able to continuously control activity in broilers successfully at production level.

We combined two approaches to this problem during three experiments. Firstly, we applied temporal step-wise variations in light intensity of two-hour durations between 5 and 100 lux to small groups of broilers. Activity was recorded via overhead cameras on a group level. Secondly, by modelling the dynamic relationship between the light intensity and the activity of the groups mathematically, we predicted that only one main process was involved in transferring the light changes into activity. Although the nature of this process has yet to be identified, the dynamic relationship between the light and activity provided information on how fast the broilers responded to the light changes.

Temporal step-wise variations in light intensity significantly affected the mean activity level of broilers in all three experiments where broilers were more active in 100 lux than in 5 lux (ANOVA, $F(1,19)=29.90$ $P<0.0001$). The broilers responded significantly faster to a step-up than a step-down in light intensity (repeated measures analysis, $F(1,90)=5.84$, $P=0.0177$). Activity decreased significantly with age (ANOVA, $F(2,19)=41.26$, $P<0.0001$) but not with experience of the step-wise light changes (ANOVA, $F(1,5)=1.53$, $P=0.271$).

The results suggest that a combination of temporal step-wise variations in light intensity and the dynamic data-based modelling technique could provide additional information on ethological mechanisms controlling broiler activity. Indeed, this combination could act as a basis for controlling broiler activity at production level by means of light, which could improve the welfare of broiler chickens in the future.

SOCIAL AND EMOTIONAL BEHAVIOUR OF THE α -1,3 GALACTOSYL TRANSFERASE KNOCK OUT MICE AND ITS POSSIBLE RELATION TO IMPAIRED VISION

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The α -1,3galactosyl transferase knock out mouse (α 1,3GT KO) is depleted from expression of the α -galactosyl epitop on cell membranes, which makes it a valuable model in the research area of xenotransplantation. One side effect of this genetic modification is the development of cortical cataract. Being nocturnal animals, mice may have the need for a greater sensitivity to light than diurnal animals and the impairment of vision may induce e.g. lack of ability to recognise visual signals from conspecifics. On the other hand, mice find high light intensities aversive and it is possible, that the genetically modified (GM) animals may be less sensitive to the aversive high light intensity often used in laboratory animal housing facilities.

All mice were tested in a light:dark exploration test and all males in a social interaction test with young DBA2 males as opponents. The sensitivity to light was assessed using a modified light:dark exploration test, performed once in bright light and once in dim light. Histopathology was performed to evaluate the degree of cataract.

All α 1,3GT KO developed severe subcapsular cataract and had significantly lower body-weight than controls (t-test; $p = 0.01$). α 1,3GT KO mice performed more attacks (Wilcoxon-test; $p < 0.05$), the duration of attacks were longer ($p < 0.05$) and more mounting behaviour was shown ($p < 0.05$) than in controls. In the standard light:dark exploration test, females had a significantly higher number of transitions (Wilcoxon; $p < 0.01$) than males. In the modified light:dark test, α 1,3GT KO mice spent significantly more time in the open area when it was dark compared to lit (Wilcoxon, $p < 0.01$). No difference in time spent in the open area under different light-conditions was found in controls and no differences between α 1,3GT KO and controls were found. In conclusion, α 1,3GT KO mice are more aggressive than wildtypes and their behaviour is influenced by lighting conditions.

EFFECTS OF ENFORCED BEHAVIOURAL DESYNCHRONIZATION VIA REDUCED ACCES TO THE FEEDING THROUGHGS ON THE BEHAVIOUR OF DAIRY COWS

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Overcrowding in dairy houses prevents cows from synchronizing their feeding behaviour. This study aimed to investigate possible welfare implications of enforced behavioural desynchronization.

Six groups of each 8 HF cows were allowed to feed for 5 hours a day divided into 4 periods. Each group had 9 feeding gates with electronic individual identification. Three groups were allowed to feed together ('All'), while in the other three groups only two cows could feed together ('Two'). This was replicated in a cross over design (n=6; each trial 17.5 days). The 4.5 days before and 10.5 days between the trials were regarded as 'Control'. Food intake per meal was determined over a weighing facility. Social behaviour was continuously behaviour sampled twice a week for 10 minutes per group each in the morning and afternoon.

Feed intake and duration per day did not differ between treatments. The number of total gate registrations per cow and day was higher in 'Two'-cows than in 'All'-cows (117.9 vs. 78.2; p=0.001, paired t-test; 'Control': 64.3). The percentage of registrations without feed intake (e.g. due to no feeding allowance) was higher in 'Two'-cows than in 'All'-cows (64.8 vs. 41.5%; p=0.021, 'Control': 15.5%). 'Two'-cows showed more replacements than 'All'-cows (1.89 vs. 0.59 times/cow/hour; p=0.019), typically near the gates.

Cows of both treatments were able to maintain their daily feed intake. However, the higher number of gate registrations indicates a higher restlessness or a higher motivation to get access to food. The highest registration rate in 'Two'-cows suggests that they had difficulties in predicting their allowed feeding periods, but may also have been caused by an attempt to behave synchronously. Increased replacements in these cows may reflect frustration. A higher restlessness and more agonistic interactions indicate impaired cow welfare, but it remains unclear to which extent this is causally linked to behavioural desynchronisation.

ALTERNATIVE METHODS FOR LIMITING BROILER BREEDER GROWTH RATE DURING REARING

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There is evidence that limitation of broiler breeder growth rates by chronic food restriction causes stress. We investigated the effects of ad libitum access to qualitatively-restricted diets on weight gain and behavioural and physiological indices of stress.

One-week-old female broiler breeder chicks were allocated among six treatments (four pens per treatment, 12 chicks per pen, n=288). Amounts of calcium propionate (CaP, an appetite suppressant) and/or oat hulls (OH, a dietary diluent) added to a basal diet were maintained or gradually increased over three periods (1-6, 6-12, and 12-20 weeks). Inclusion levels were 5-10% CaP and 30-40% OH. Treatments were: T1 (quantitatively restricted-fed control), T2 (increase CaP), T3 (low protein, increase CaP), T4 (increase CaP, maintain OH), T5 (maintain CaP, increase OH), T6 (increase CaP and OH). Chicks were weighed weekly. Times spent in different behaviours, white blood cell frequencies (WBCs), and plasma corticosterone levels (PCs) were determined in each period.

At 20 weeks, T2-T6 had limited growth to within 109-116% of the recommended body weight. T1 birds spent more time object pecking ($34\% \pm 5$ SE) than birds on other treatments (0-1%) ($P < 0.001$), while birds on T4-T6 (oat hull treatments, where there was also most food spillage) spent more time in litter-directed behaviour (26-27%) than birds on T1 and T2 (14-15%, $P < 0.05$, all by repeated measures ANOVA). Overall, WBCs increased with age ($P < 0.05$, by two-way ANOVA). Birds on T5 had higher mean PCs (3.15 ng/ml ± 0.49 SE) than all other treatments (1.60-1.95 ng/ml; $P < 0.05$, by two-way ANOVA).

The qualitative food restriction treatments tested here limited broiler breeder growth rates to near the desired level. There was some behavioural, but no physiological, evidence that they improved bird welfare compared with the quantitative restriction control. Of the qualitative treatments, T4 appeared to be most beneficial and T5 to be least beneficial.

THE EFFECT OF GENOTYP, FEED STRUCTURE AND FEEDING REGIME ON CROP FILLING AND FEATHER EATING IN LAYING HENS

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Pelleted feed and feed restriction are known to stimulate feather pecking in laying hens. The effect of these measures on feather pecking has mainly been discussed under the aspect of reduced time spent feeding, which may result in increased pecking of other objects. The interrelationship between feather pecking and feather eating has also not been elucidated. In the present study we hypothesized that feather eating is elicited by feeding conditions, which lead to inappropriate filling of the crop and disturbed gut motility. The eating of feathers as indigestible material may reflect the bird's attempt to avoid digestive problems under such conditions.

24 adult laying hens each of a high (HFP) and a low feather pecking line (LFP) were used. The lines were selected for pecking at a feather bundle. They were assigned to a randomised 2x2 – factorial design: Factor A feed structure (pellets vs. mash); factor B feeding regime (ad lib. vs. restricted). The pellets were made of the same diet as the mash. Restriction was adjusted to 90 % of the ad libitum consumption. 10 feathers were fixed to plastic dishes and offered to the hens every morning. Feed consumption was recorded daily. The number of feathers pulled out of the holder and the number of feathers eaten were counted three times a day. Crop size was scored by palpation at the same time. Crop size increased in both lines from the morning to the evening, and HFP had slightly larger crop size than LFP. Feather pulling and feather eating were also higher in HFP than in LFP ($p < .05$ resp. $.03$).

In contrast to our expectations, feed structure and feeding regime had no significant effect on crop size, feather pulling and feather eating.

THE FUNCTION OF SOCIALLY FACILITATED FEEDING

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Hypotheses of the function of social facilitation include local resource competition, learning about new food and increasing group synchronisation. To distinguish among these hypotheses, information about the proximate causal factors involved is required. In a series of four experiments we studied social facilitation and feeding in hens. Factors investigated were (1) pecking intensity and food consumed by the stimulus bird by altering the food deprivation time between 1, 6, 12 and 24 hours, (2) feeding motivation of the test bird by depriving the test bird for 0, 1, 6 or 12 hours, (3) whether food was novel in combination with differences in familiarity and rank of the stimulus bird and (4) the novelty of food and whether stimulus bird were feeding. None of the different deprivation treatments in experiments 1 and 2 affected social facilitation and no effects of rank or familiarity of the stimulus bird was found. In experiment 3, testing novel food, test birds ate more of novel than familiar food ($P=0.004$). But in experiment 4, test birds ate more familiar than novel food ($P=0.015$) and in addition test birds ate more when stimulus birds were feeding compared to standing ($P=0.034$), implying social facilitation. In conclusion, social facilitation was only found in one experiment and the hypothesis that social facilitation is caused by local resource competition or that the function is to learn about new food resources can not be fully supported. Since social facilitation was not always found, not even in the basic experimental setup designed to trigger social facilitation, we also propose that social facilitation is not as clear a phenomenon as is often proposed.

A COMPARISON OF CONTRAFRELOADING IN LAYER AND BROILER CHICKS

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Contrafreeloading (CFL) is the behaviour where an animal chooses to work for food even when identical food can be obtained without any effort. In earlier studies, White Leghorn layers that are selected mainly for larger eggs and high egg numbers showed a lower degree of CFL compared with their wild ancestor, the red jungle fowl. Previous studies have suggested that the difference in CFL between White Leghorn layers and jungle fowl may be a side-effect of selection for increased production traits in the Leghorn strain. In this experiment we studied to what extent broilers chicks (Cobb/Ross), which are highly selected for fast growth, perform CFL. We compared the level of CFL with a layer strain (Calder Ranger), which grows considerably slower. We hypothesized that broilers should have a lower degree of CFL compared to the layer strain, as an energy-saving response to the demands of rapid growth.

Ten pairs of each breed were allowed a choice of feeding, during 48 h, between freely available food and food mixed with wood shavings. Behavioural observations were made twice each day. Broilers showed less CFL ($p=0.049$), were more inactive ($p<0.001$) and performed less active behaviours ($p=0.01$) than layers.

According to resource allocation theory, energy demanding behaviours may be expected to decrease in frequency when selection pressure for production traits increases. By reducing frequency of behaviours such as CFL and other behaviour requiring much energy, the selected animal might reallocate resources to production traits. Our results support previous findings that the degree of CFL in domestic fowl may indicate possible side effects of selection for increased production traits.

CONTRAFRELOADING IN GRIZZLY BEARS

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Contrafreeloading occurs when animals choose food that requires effort to exploit when identical food is freely available. An apparent contradiction to the basic tenets of optimal foraging theory, contrafreeloading may be a form of exploration where animals seek information about alternative food sources by sampling. If contrafreeloading serves as a means to gain information about uncertain food patches, it should be evident in a species like the grizzly bear (*Ursus arctos horribilis*), whose survival is dependent upon the ability to exploit variable food patches. To investigate contrafreeloading in grizzlies, we conducted foraging choice tests with four captive adult bears (2 males, 2 females) under two levels of feed restriction (restricted, ad libitum). Each bear was presented with five foraging choices simultaneously: free apples, apples in ice block, free salmon, salmon in ice block, and plain ice block. Each bear was observed continuously for 1-h/trial, with one trial/day and three trials/food restriction level. Two measures of contrafreeloading were considered: weight of earned food consumed and time spent working for earned food. Two bears were successful in obtaining and consuming earned food from ice blocks (1 male, 1 female). Contrary to the assumption that contrafreeloading will not occur under restricted food conditions, all bears manipulated ice blocks containing food during both ad libitum and food restricted trials. There was an overall effect of food choice (mixed model repeated measures ANOVA: $F=36.09$, $P<0.0001$). Bears spent significantly more time interacting with ice blocks containing salmon or apples than plain ice (post hoc means comparison: $t\geq 3.4$, $P<0.01$), indicating that they attempted to exploit the food resource within the ice blocks even though they were not always successful. These results support our hypothesis that bears will contrafreeload as a means to gain information about uncertain food sources.

EFFECTS OF INCREASED MATERNAL PLASMA CORTISOL LEVELS DURING GESTATION ON POSTNATAL PIGLET BEHAVIOUR AND PHYSIOLOGY

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Data from rodents and non-human primates have shown that increased maternal corticosteroid concentrations during gestation may affect growth, behaviour, physiology and health of the offspring. We induced increased plasma cortisol levels in sows during gestation by twice daily oral administration of cortisol to investigate during which period of gestation this treatment influenced growth and behaviour of piglets postnatally.

Gestation was divided into three periods of equal length (P1, P2 and P3) and second-parity sows were assigned to four treatment groups. Control sows (C, n=11) received a placebo throughout gestation. P1, P2 and P3 sows (n=10) received 60 mg of cortisol during P1, P2 and P3 respectively, and a placebo during the other periods.

At birth, litter characteristics were collected and piglets were weighed at 10 and 17 days and at weaning. At the age of three and four weeks, four piglets per litter were subjected to an open field test (OFT) and a novel object test (NOT) respectively.

Data were analysed using generalised linear models.

Gestation length (114.9 ± 0.57 days) and litter size (13.5 ± 0.15 piglets) did not differ between treatment groups. At birth, P1-piglets (1501 ± 39.1 g) and P3-piglets (1521 ± 40.1 g) weighed less ($p < 0.05$) than C-piglets (1652 ± 41.0 g). This weight difference was absent at 17 days and at weaning. At slaughter however, P2- and P3-pigs had increased backfat thickness compared to C-pigs ($p < 0.05$), indicating long-term effects of elevated maternal cortisol concentrations during gestation.

In the OFT, P1-piglets vocalised more ($p < 0.05$), and P3-piglets spent more time walking and running ($p < 0.05$) compared to C-piglets. In the NOT, P2-piglets had a shorter latency to touch the NO ($p < 0.05$), although the number of interactions with the NO did not differ. These preliminary results indicate that increased cortisol concentrations during gestation in sows affect both short- and long-term behavioural and physiological characteristics of piglets.

GOAT-KID MUTUAL RECOGNITION IN THE FIRST DAY AFTER BIRTH ARE AFFECTED BY MATERNAL UNDERNUTRITION IN PREGNANCY

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This study was conducted to determine the effects of the maternal undernutrition in pregnancy on the mother-young relationship in goats during, the first day after birth. Seventy days after mating two groups were formed. One group was fed according to their nutritional requirements (n=10, C) and the other group was fed only with the 70% to their nutritional requirements of protein and energy until the end of pregnancy (n=15, U). Mothers were tested in their selective behaviour at 4 hours after birth, and in their ability of distal recognition between their own and alien kids at 8 hours after birth. While kids were tested in their ability to recognize their mother at 12 or 24 hours after birth.

Mothers and kids from the U group weigh less than the C groups (mothers: 37.31 ± 1.39 vs. 41.44 ± 1.87 ; kids: 2.11 ± 0.13 vs. 2.91 ± 0.20 , t test, $P < 0.05$). The undernutrition did not affect the maternal selective behaviour, however the distal recognition of the kid was affected, in the U group mothers did not show any indications to discriminate between the own or alien kid, (37 ± 13 vs. 36 ± 13 sec. U Mann Whitney test, $P > 0.05$), while mothers of C group were able to recognize their own kids, they stay longer time near to the own kid than to the alien kid (C group: 102 ± 24 vs. 25 ± 10 sec. U Mann Whitney test, $P = 0.03$). Kids from U group at 12 hours were no able to recognize their mother, while those from C group did so. However at 24 hours all the kids in both groups were able to recognize their mother in this test.

We conclude that maternal undernutrition in the last third of pregnancy impairs mutual mother-young recognition on the first day of parturition. In addition to its adverse consequences on body condition and milk production, undernutrition in late pregnancy can impair mother-young bonding and, as a consequence, increase kid mortality. Supported by UAQ and CONCyTEQ.

DIFFERENTIAL EFFECTS OF VARIOUS STRESSORS DURING PREGNANCY ON REACTIVITY OF EWES AND THEIR LAMBS

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The aim of this experiment was to study the effects of various stressors repeatedly applied on ewes during pregnancy on their subsequent reactivity towards humans after lambing and the emotional reactivity of their lambs. During the last third of pregnancy, ewes were subjected to either 10 sessions of transport in isolation twice a week for 1 hour (TRAN, n=20), or 10 sessions of isolation twice a week for 1 hour (ISOL, n=20), or no disturbance (CON, n=19). Blood cortisol concentrations were measured during the 1st, 5th and 9th sessions. The behavioural responses of the ewes to humans were studied 1 month after lambing. At 3-month of age, the offspring was exposed to various fear tests: novel arena and object presented suddenly. The treatment effects were analysed by the MIXED model procedure of SAS®.

TRAN ewes had a higher response than ISOL ewes during the 1st and 9th sessions of stress (P=0.026). One month after lambing, TRAN ewes were more reluctant to approach a human than ISOL ewes (P=0.037). The minimum flight distance was smaller for ISOL ewes compared to TRAN and CON ewes (P=0.037). Regarding the reactivity of lambs to novelty, TRAN lambs jumped less often than CON lambs when exposed to a novel arena (P=0.038). CON lambs spent more time further from an object presented suddenly than TRAN and ISOL lambs (P=0.047).

In conclusion, transport in isolation is more stressful than isolation alone and had a greater effect on the subsequent reactivity of ewes to humans. The effects of prenatal stress on lamb's responsiveness to novelty may vary according to the prenatal stressor. Such differential effects may be explained by two complementary mechanisms: the amount of cortisol crossing the placenta and the modification of reactivity of the ewes.

ENHANCEMENT OF LEARNING IN SUCKLER CALVES AFTER WEANING: MOTIVATIONAL OR COGNITIVE CONTROL?

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In suckler calves, performances in learning tasks are improved for a short period after weaning. We investigated if this improvement is due to motivation for the rewards or to learning abilities, and especially if a cognitive control is used (assessed in a reverse task). Among 40 Aubrac calves, 20 were weaned from their dams at eight months, 20 were weaned one month later. From the day after the last weaning, animals were exposed to a T-maze. For half of the animals of each treatment one arm led to a social or a food reward. Three sessions were conducted: on Session 1, trials were conducted until the animal did not take the unrewarded arm on three consecutive trials; the learning performance was assessed through the total time in the T-maze. On Session 2, the motivation for the reward was assessed through the time spent in the T-maze on the first 3 trials when the animal reached the reward. On Session 3, the same procedure as for Session 1 was used, however the rewarded arm was reversed.

Calves weaned for one day vs. one month did not differ in their capacities to learn the initial task (Session 1: total time 189.1 ± 49.1 vs. 258.3 ± 75.7 s, $U=0.15$, $P=0.87$) or in their motivation for the rewards (Session 2: time in maze to reach reward: 192.6 ± 50.8 vs. 137.2 ± 41.8 s, $F_{14,25}=2.20$, $P=0.15$). Calves weaned for one day learned the reversed route faster than the other calves (Session 3: 326.4 ± 56.1 vs. 511.2 ± 84.3 s, $F_{14,25}=4.71$, $P=0.04$). Hence the better learning performances of calves that have just been weaned cannot be accounted for by a higher motivation for the rewards but rather by a better cognitive control of their behaviour.

A NEW WAY TO WEAN MINIMISES THE BEHAVIOURAL RESPONSE OF CATTLE OVER TRADITIONAL WEANING METHODS

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Several experiments were conducted to explore a novel method of weaning beef cattle, which appears to reduce the behavioural signs of distress caused by the traditional weaning method, abrupt separation. The new two-stage method uses an anti-sucking device to prevent nursing (stage 1), effectively weaning animals prior to physical separation of the cow and calf (stage 2).

We compared the behaviour of pairs weaned by preventing nursing for 8d (n=6), 4d (n=6) or 0d (traditionally weaned controls, n=6). Cows and calves (mean age=204d) showed a negligible response when nursing was prevented. Two-stage animals subsequently walked and vocalized less following separation and spent more time eating and lying, compared to controls. The responses of 8d and 4d animals were similar. Vocalization frequency of two-stage calves was 1.9/h versus 56.0/h for controls ($P<0.05$; PROC GENMOD, SAS). Two-stage calves spent more time eating over four days following separation (62.0 additional min/d, $P<0.05$). Effects on the behaviour of two-stage cows were quite similar to their calves.

In a second study we found two-stage cows and their calves stayed closer together than nursing controls, on days immediately after nursing was prevented. After separation, calves that had not been suckled for 14d (n=58) and 3d (n=58) calves behaved similarly, but different than controls; results similar to the previous study. Calves weaned in two stages have also had higher growth rates than controls up to seven weeks after separation.

In other trials we observed that two-stage weaning was more effective at reducing the overt behavioural signs of distress than providing separated pairs fence-line contact. Also, we found the behavioural benefits of the two-stage method apply to calves weaned as young as six weeks of age. The advantage of the two-stage method may be due to its closer mimicry of the natural weaning process.

EFFECT OF RESTRICTED SUCKLING OR TEMPORAL WEANING ON SOME PHYSIOLOGICAL AND BEHAVIOURAL STRESS PARAMETERS IN ZEBU CATTLE

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Twenty Brahman (*Bos indicus*) cow-calf pairs were assigned to one of two groups to investigate the effects of restricted suckling (RS) on some physiological and behavioural stress parameters compared to temporal weaning (TW). Calves in the RS group were limited to suckle their dams once daily for 30 min during days 30-33, while calves in the TW group were removed from their dams during days 59-62 postpartum. All parameters were recorded 24, 48 and 72 h after the beginning of the two treatments, respectively.

In TW calves, higher ($P<0.05$) cortisol concentration and number of steps were recorded in the 1st samples and 1st and 2nd observations, respectively. No difference was found in body temperature between treatments. However, respiration and heart rates differed in the 1st and 2nd observations, respectively. In general, a decrease ($P<0.05$) in these three parameters was observed over time. In cows, no differences were found in cortisol concentration or body temperature between treatments or with time. Heart and respiratory rates were lower ($P<0.05$) in the TW treatment only 24 h after beginning of treatment.

It was concluded that (a) RS resulted in less behavioural and physiological indices of distress compared to TW in calves, although in general, differences were found only in some variables and mainly during the 1st day following start of the treatment, and (b), cows were less affected than their young, regardless of the treatment applied.

EFFECTS OF MOVEMENT FROM GRAZING TO NOVEL INDOOR PENNING ON SLEEP IN SHEEP

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In humans, sleep can be disturbed by novelty and aversive experiences. This experiment investigated whether the quantity, quality and pattern of sleep in sheep was affected by movement from grazing to novel penning. Simultaneous, non-invasive 24-h electroencephalogram, electro-oculogram and electromyogram recordings were made from 10 pairs of control (remained at pasture) and treatment (moved to penning) ewes, (1) while both were at pasture, (2) immediately after treatment sheep were moved and (3) 7 days post-movement. Light/dark periods and availability of hay and concentrates were similar at both sites. The data were analysed using repeated measures mixed model analyses of covariance, with the baseline recording at pasture as the covariate. During the first 24 hours post-movement, there was no treatment effect on the percentage time asleep ($8.8 \pm 0.9\%$), but the percentage time spent by treatment sheep in REM sleep ($2.3 \pm 0.2\%$) was greater than controls ($1.5 \pm 0.2\%$) ($P < 0.05$). There was no significant difference in the duration of REM sleep bouts, but there was a tendency for more REM sleep bouts in treatment sheep (10 ± 1.9) than controls (7 ± 2.1) ($P < 0.06$). The sleep latency was shorter in treatment sheep (138 ± 24.5 minutes) than controls (280 ± 34.9 minutes) ($P < 0.05$). Other than more sleep bouts during the late afternoon/evening, compared with sheep at pasture (where most sleep was in the middle of the night) there were no significant treatment effects on sleep 7 days post-movement. Treatment sheep lay down more than controls ($P < 0.01$) and spent less time eating ($P < 0.01$), but there was no treatment effect on the duration, bout length, or frequency of rumination. Behaviour was influenced by factors, such as change in diet, however, there were subtle treatment effects on sleep that were consistent with a psychological effect followed by adaptation.

A HEART RATE VARIABILITY A NON-INVASIVE TOOL TO EVALUATE PSYCHOLOGICAL STRESS IN FARM ANIMALS

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Modifications of heart rate are broadly accepted as a valid index of stress, as they correlate with excitation changes in the autonomic nervous system. Heart rate (HR) reflects the combined effects of parasympathetic and sympathetic nervous activity on the heart. However, until now, almost any fluctuation of HR in farm animals in reaction to a stressor has been discussed predominantly in relation to changes of the sympathetic tone, without considering parasympathetic influences. In contrast, various authors (Porges, S.W. 1995, *Neurosci. Biobehav. Rev.* 19, 225-233; Friedman, B. H. & Thayer, J. F. 1998, *J. Psychosom. Res.* 44, 133-151) have postulated that the activity of the Vagus nerve is better suited to evaluate psychological stress and stress sensitivity, especially under resting conditions. The additional feature of cardiac activity, heart rate variability (HRV), allows to evaluate separately changes of vagal nervous activity and the sympatho-vagal balance of the organism. In recent years, analysis of HRV has led to increasing evidence that changes in vagal activity, as indicated by fluctuations specific to HRV parameters, play a dominant role in the regulation of HR in reaction to psychological stress in animals. Therefore, HRV could be used as a more specific indicator of stress than simple HR, especially under resting conditions (Mohr, E. et al., 2003, *Physiol. & Behav.* 75, 251-259).

In my talk I want to give an introduction to HRV: what it is and how we can analyse and interpret HRV parameters in the time domain and frequency domain as well as non-linear parameters. Moreover I would like to present a quite robust and low-cost technology to measure HRV in free ranging animals differing in size from dwarf goats to cattle.

HEART RATE VARIABILITY IN DAIRY COWS

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Heart rate variability in dairy cows was analysed for differences due to milking system (robotic or herringbone parlour), breed (Austrian Simmental or Brown Swiss) and activity (lying, standing, feeding or being milked). Six cows (three of each breed) were chosen from each milking system.

On ten days during a three-week period in November/December 2001, heart rate was recorded as interbeat intervals (Polar telemetric system). We identified time periods of at least eight minutes duration, during which there were less than 5% measurement faults and the cow was in the same activity throughout and undisturbed. Parameters of heart rate variability in the time domain, frequency domain and non-linear domain were analysed using the custom software Multidat (E. Mohr, including software by Webber and Zbilut).

We found no differences due to the milking system and therefore pooled the systems for further analysis. Brown Swiss cows had significantly (Mann-Whitney U test, N=6, P<0.05) higher short term variability (RMSSD, HFnorm) and higher non-linear variability (%REC, %DET, Entropy, Maxline) than Simmental. With increasing activity, heart rate increased, heart rate variability (RMSSD, SDNN, LFnorm, HFnorm, %REC, %DET, Entropy, Maxline) decreased, and the sympatho-vagal balance was shifted towards a stronger sympathetic tone (lower RMSSD/SDNN and HF/LF ratios) (Friedman test, Bonferroni-corrected post-hoc tests, N=12, P<0.05).

The number of cows included in the analysis will be doubled before presentation. The results so far indicate that Simmental cows may be more vulnerable to stress than Brown Swiss. We also provide baseline values of heart rate variability in two dairy breeds during different activities.

ANTICIPATORY BEHAVIOUR AND EMOTIONAL EXPRESSIONS IN FARMED SILVER FOXES (*VULPES VULPES*) – A NEW APPROACH TO ANIMAL WELFARE

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Emotions and subjective feelings are included in recent definitions of animal welfare. However, little is known about behavioural and emotional expressions in farmed foxes that may contribute to detect emotions. Observing behaviours during anticipation of a food reward in a Pavlovian conditioning paradigm has been suggested as a useful tool to assess the state of the reward centres in the brain, and positive emotions. In contrast, anticipatory behaviour to a negative reinforcer may reflect anxiety and fear motivations. Behaviour and various emotional expressions during anticipation of a signalled reward may therefore be used as a tool to assess the emotional state and, thus, welfare in foxes.

The aims were to identify and describe emotional and behavioural expressions during anticipation. Different conditioning paradigms were aimed at creating different emotional states; positive, negative and frustration. Effects were studied by monitoring ear position and rotation, body posture, location in cage, tail posture, activity and stereotypical behaviour with video cameras during the different paradigms. Behavioural data were analysed using the SAS programme package (SAS version 6.12). Differences between paradigms were tested with Chi-square tests (χ^2).

The results demonstrated that silver foxes are sensitive to rewards and have a capacity of separating between positive and negative rewards. Pronounced differences in behaviour and emotional expressions were found between the paradigms. The foxes anticipating a positive reinforcer were more active ($p < 0,0001$), performed more stereotypical behaviour ($p < 0,0001$), and had a higher body carriage ($p < 0,01$) and more upright ears ($p < 0,0001$) compared to anticipating a negative reinforcer.

In conclusion, anticipatory behaviour should be further developed as an indicator of welfare in farmed foxes, in particular when addressing good welfare. Investigating behaviour and emotional expressions during anticipation of positive events in foxes housed in enriched environments would be one important next step in the work aiming at developing this method.

PERCENTAGE OF EYE WHITE AND BEHAVIOUR IN COWS EXPOSED TO FRUSTRATING AND REWARDING STIMULI

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To assess welfare of cattle by non-invasive techniques, more information is needed on positive and negative emotional expressions. We reported earlier that the percentage of visible white in the eyes was larger than base level in food-frustrated cows while it was lower in cows offered food as a rewarding stimulus (Sandem et al. 2002). Three further experiments investigated the generality of eye-white percentage (EWP) as a dynamic indicator of fear or frustration and satisfaction in cows.

In the first experiment, we used separation from a 4-day-old calf as the frustrating stimulus, and reunion with the calf six hours later as the rewarding stimulus. Upon separation, EWP increased moderately, accompanied by increased heart rate ($t=4.87$; $P=0.005$). After reunion, EWP was reduced markedly ($t=6.00$; $P=0.0002$).

The second experiment aimed at investigating EWP as a fear indicator in dairy cows exposed to a suddenly opened umbrella. Opening of the umbrella caused a significant increase in avoidance and EWP ($t=5.52$; $P=0.0002$) during a 30 s (avoidance) or 60 s (eye-white) observation period.

In the third experiment, we studied the behaviour and change in EWP of cows when exposed to a positive conditioned stimulus; a stockman entering the room at feeding time to give concentrate food. There was a significant increase in EWP as the stockman entered the stall ($t=2.99$, $P=0.013$), accompanied by frequent head movements in and out of the feed barrier and head shaking. Vocalisation, aggressive butts, or tongue rolling were never seen before concentrate was obtained, although these behaviours were frequent in the earlier food-deprivation test.

The present results strengthen the hypothesis that the eye-white percentage may be a general dynamic indicator of both negative and positive emotions in dairy cattle, reflecting levels of arousal and consummatory states. The exact interpretation must be done with regard to the simultaneous behaviours observed.

DOES THE DISCREPANCY FROM EXPECTATION OR THE UNCONTROLLABILITY OF AN APPETITIVE EVENT INDUCE EMOTIONAL RESPONSES IN LAMBS?

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According to psychology, emotions result from a cognitive process the individual engages to evaluate the novelty of the situation, its significance regarding his needs and his possibility to cope with. Emotions in animals could be assessed by better knowing their cognitive abilities (Désiré et al., Behav. Process. 60:165, 2002). Lambs are easily stressed by novelty. However, their abilities to evaluate the discrepancy of the situation from expectation and the uncontrollability of the situation are not clear.

In experiment 1, 40 lambs were trained to cross a corridor to access to a small versus large food reward for 11 sessions, then the amount of reward was reversed for half the lambs (3 test sessions). The data were analysed with a mixed model of ANOVA for repeated measures (SAS version 8.1). Except for the first test session, lambs that shifted to a small reward were slower to reach food (0.3 vs. 0.4 m/s, $F=2.60$, $P<0.05$) and had a lower heart rate (111 vs. 131 bpm, $F=3.65$, $P<0.01$).

In experiment 2, 24 lambs were trained to control the delivery of food by visiting a cavity with their muzzle while 12 others had never controlled (yoked) for 12 sessions. On the next 10 sessions, treatments were the same except that 12 lambs that lost the control. The same statistical analyses as previously were carried out Yoked lambs visited the cavity less frequently than their counterparts (1 vs. 15, $F=42.44$, $P<0.001$). After loosing control, lambs performed the visit, first more frequently than those controlling (20 vs. 15), then less frequently (7 vs. 14) but without any cardiac alteration.

In response to discrepancy from expectation, lambs experience a negative emotion through concomitant behavioural and cardiac responses. The inability or the loss of control of an appetitive event does not seem to trigger emotional response.

THE RELATIONSHIP OF SOCIAL BEHAVIOUR, CORTISOL LEVELS AND PRODUCTION IN DAIRY CATTLE HERDS

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Previous studies showed that short time social stress, like grouping of animals, has negative effect on production in cattle. The aim of this study was, to investigate if the undisturbed social behaviour is related to basal cortisol levels and production in dairy cattle herds.

80 dairy herds (21-55 Simmental cows) housed in cubicle loose-housing were visited once. The social behaviour of the animals was observed directly by continuous behaviour sampling for one hour in the evening. To assess the adrenocortical activity of the herds undisturbed by human action, cortisol metabolites were measured in faecal samples collected the morning following the behavioural observations. The breeding organisation provided data about milk production. Spearman correlation coefficients were calculated.

The herds differed distinctly in the number of social interactions (agonistic interactions: median: 1.82/hour/cow; range: 0.44–5.08/hour/cow), in cortisol metabolite levels (median: 77nmol, range: 30–157nmol) and in milk yield (mean±sd: 6772±1021kg). The social behaviour was correlated moderately, but significantly to milk yield and protein concentration in the milk: the more agonistic interactions were performed in a herd, the lower was the milk yield of the herd ($r_s=-0.232$; $p=0.038$) and the protein concentration in the milk ($r_s=-0.336$; $p=0.002$). No correlations were found between cortisol metabolite concentrations (CMC) and social interactions, but CMC were higher with higher yielding herds (milk kg: $r_s=0.246$; $p=0.028$; milk protein: $r_s=0.352$, $p=0.001$; milk fat: $r_s=0.303$, $p=0.006$).

The results suggest that an increased frequency of agonistic social interactions in a herd could have negative effects on production. However, a direct effect independent from a possible common basis for both in management or housing has to be confirmed in further analysis. Expected relationship with adrenocortical activity might have been obscured by the opposed relation to milk yield or other factors like health status.

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THE FALSE BENEFIT OF MIXING FATTENING BULLS TO FORM GROUPS OF HOMOGENEOUS WEIGHT

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Fattening bulls are commonly mixed after weaning to make groups of homogeneous weights in order to improve performances and produce homogeneous carcasses. We investigated if this practice disturbs animals and influences their production.

Three weeks after weaning, at the beginning of the fattening period, 64 beef bulls were allocated in 16 groups, according to a factorial design with two social conditions (mixed vs. non-mixed animals) and two weight conditions (coefficient of variation of weights within groups : 2.7% for homogeneous and 11.7% for heterogeneous groups). The behaviour of animals in groups was observed just after mixing then once a month. Animals were individually exposed to a social isolation test in a novel arena. They were weighed every 15 days. At slaughter, blood samples were collected. The observation unit was the group, except for individual testing.

Just after mixing, more agonistic interactions were observed in mixed and/or homogeneous groups (17.8 in mixed vs. 1.2 in non-mixed groups, $p < 0.01$; 11.4 in homogeneous vs. 7.6 in heterogeneous groups, $p = 0.05$). During the test of isolation, mixed animals urinated or defecated more often than non-mixed ones (0.3 vs. 0.2, $p = 0.02$). At slaughter, mixed animals had higher cortisol levels than non-mixed animals (32.1 vs. 28.1 ng/ml, $p = 0.05$). The weight gains did not differ between treatments. The initial difference in within-group variation of weights diminished during fattening (final coefficient of variation: 4% for homogeneous vs. 8% for heterogeneous groups).

In conclusion, mixing young bulls for fattening increases fighting, especially in homogeneous groups, and may make bulls more sensitive to changes in their environment. Moreover, homogeneity of weights within a group is not maintained during fattening and does not improve production. Hence, mixing bulls to homogenize weights seems detrimental to animal welfare and nonbeneficial for producers.

**GENETIC CONTROL OF SOCIALITY AND ADAPTABILITY IN
ASSOCIATION TO EARLY GROWTH IN YOUNG FOWL****J. Väisänen^{1*}, L. Andersson², S. Kerje², P. Jensen¹**¹ Department of Biology, University of Linköping, Sweden² Department of Medical Biochemistry and Microbiology, University of Uppsala, Sweden

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Sociality is considered to influence the welfare of intensively kept poultry. It is suggested that sociality and adaptation capacity interact in fowl. Comparisons between the ancestral breed, red junglefowl, and White Leghorns have shown that junglefowl chicks are more explorative in novel environments while layers tend to immobilize and stay closer to social stimuli. We aimed at studying if these differences between breeds are connected to a Quantitative Trait Locus (QTL) found earlier on chromosome 1. This QTL is associated with several production and domestication related traits in fowl, for example growth. To narrow down the size of the QTL, a backcross was produced, using F3 Leghorn/junglefowl intercross males segregating along the QTL and Leghorn females. The offspring were genotyped at five different marker positions along the QTL. The chicks' genotype at each marker position could be either heterozygous junglefowl/Leghorn or homozygous Leghorn. By comparing the genotype and growth pattern of the chicks the genome region of interest was deduced to lie close to the marker MCW106 and to have a length of approximately 19 cM. Ninety-two backcross chicks raised in one batch were tested after 3-h food deprivation in a novel L-shaped maze for 10-min. The chicks had a free choice between food and social companions at opposite ends of the test arena. The results revealed that the behavioural differences between homo- and heterozygous backcross chicks closely resembled those found earlier between identically tested Leghorn and junglefowl chicks. The heterozygous chicks behaved like junglefowl: they moved more, fed more, and spent more time away from the companions. Homozygous chicks acted more like Leghorns: they were more passive and tended to spend more time close to social companions. The results suggest that the QTL affects sociality and coping capacity in young fowl in addition to the earlier observed biological effects.

**SOCIAL RANK AND ITS EFFECT ON ESTRUAL
AND OVULATORY RESPONSE TO “MALE EFFECT”
IN THE AUSTRALIAN CASHMERE GOAT**

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In goats, sudden introduction of males results in a synchronized estrual and ovulatory response. The aim of this study was to determine the influence of social dominance of female Australian cashmere goats on their estrual and ovulatory response to this male effect.

Behaviour sampling was used five hours a day during ten consecutive days in a population of 50 Australian cashmere goats to record all agonistic interactions. An index of success (SI) was calculated based on the ability to displace other individuals and three ranking groups were formed: low, medium and high. After males introduction (day 0), scan sampling was used every 5 min, five hours daily during five days to determine the position of each goat with respect to the male and calculate an index of association (AI). Estrus occurrence was registered when females allowed to be mounted. Time of ovulation was determined by blood progesterone of samples taken on days +6 to +15. Data were analysed using Chi-square, Kruskal-Wallis and Mann-Whitney tests.

High and medium ranking goats tended to have a higher AI with the males and showed a higher incidence of estrus behaviour than low dominance ones (AI=0.031±0.004, 0.032±0.005, 0.023±0.005; 94.4, 89.5 and 53.8% respectively, P<0.05). Days to estrus, ovulation incidence and days to ovulation did not differ between ranking groups.

It is concluded that estrus detection and mating may be impaired in subordinate Australian cashmere goats compared to dominant does. This could explain the differences in conception time between animals of different social rank.

WHO TAILBITES AND WHO DOESN'T IN GROUPS OF FATTENING PIGS?

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Despite the fact that pigs can be in the same building and even the same pen, only some develop tail biting and only some are bitten. In a case control study on a commercial fattening pig farm (10 pigs/pen), we recorded the behaviour of pigs in pens with tail biting with matched neighbouring pens without tail biting (N= 9). We compared the behaviour of tail biters, tail bitten and control pigs with Wilcoxon matched paired tests.

Pigs in pens with tail biting tended to walk more ($P<0.051$) and sat significantly less ($P<0.03$) than pigs in control pens, reflecting the noticeable greater 'restlessness' in these pens. They also performed more head knocks ($P<0.04$), tended to show more avoidance ($P<0.07$) and less exploration of the pen ($P<0.07$), all in keeping with the impression that pigs in pens with tail biting focussed on each other rather than the environment. As expected, individual pigs previously identified as tail biters showed more tail biting behaviour ($P<0.008$), but they also showed more nosing behaviour ($P<0.04$). Even victims of tail biting showed more tail biting ($P<0.01$) and nosing ($P<0.07$) than control pigs in the same pen. These two categories of pigs were also more responsive to any type of social interaction than controls (tail biter, $P<0.01$; tail bitten, $P<0.02$) with tail bitten pigs showing more grunting ($P<0.02$) and tendencies to actively avoid ($P<0.08$) or simply walk away ($P<0.09$).

These preliminary results are a first step towards identifying behavioural indicators that a particular pen or a particular individual pig is at risk of developing tail biting and so alerting the farmer to take preventative action. We propose that future work should focus on activity levels and frequencies of social interactions to determine whether these levels are higher in pens even before clinical signs of tail biting are observed.

SEXUAL BEHAVIOR OF ZEBU CATTLE FOLLOWING ESTROUS INDUCTION WITH CIDR APPLIED TO THE WHOLE GROUP OR IN SEVERAL SUBGROUPS

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The effect of estrous synchronization in Zebu cattle treated as a single group or in subgroups was studied in a herd of 17 cycling Brahman cows allocated in three subgroups (n= 6, 5 and 6, respectively) and treated to display estrus in a two-day interval. Twenty five days after implant withdrawal of the last subgroup, the whole herd was treated (at the same time). Mounting activity was monitored by continuous observation during 100 h starting on the day of implant withdrawal. All cows were induced to estrus using controlled internal drug releasing device (CIDR, Upjohn) inserted in the vagina nine days plus an injection of one mg of estradiol 24 h after implant withdrawal.

The test of proportions was used to compare the number of cows displaying estrus. Onset of estrus and estrous length were compared using a "t" Student test, while a Chi squared was used to analyze mounting activity.

A trend (P=0.8) for more cows displaying estrus was observed when the herd was treated simultaneously in comparison to when subgroups were formed (64 vs 35%, respectively). Shorter periods from implant withdrawal to onset of estrus (26.6 ± 0.9 vs 141.3 ± 24.2 h; $P > 0.05$) and larger episodes of sexual activity (34.1 ± 4.5 vs 19.0 ± 6.1 h; $P > 0.05$) were registered for simultaneous and subgroups synchronization, respectively.

It was concluded that simultaneous synchronization induce a social facilitation effect, shortening the interval from implant withdrawal to estrous onset, increasing homogeneity in the response, number of animals displaying mounting activity and estrous duration.

**SENSITIVE MEASURES OF FEEDING
BEHAVIOUR IN DAIRY CATTLE****M.A.G. von Keyserlingk*, T. De Vries, D.M. Weary**

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Cattle divide their feeding time into a series of meals separated by non-feeding intervals that can be objectively defined using the frequency distribution of log intervals between visits to the feeder. The intersection point between within-meal and between-meal distributions defines the meal criterion. Over multiple studies we have found this to be approximately 27 min for lactating dairy cattle. This criterion provides an objective basis for calculations of meal frequency, meal duration, and total daily meal-time. We review evidence from several experiments showing which measures of feeding behaviour are most repeatable and sensitive to treatments differences. In general, meal based measures show poor repeatability and sensitivity, while measures of time spent eating are highly repeatable and reasonably sensitive to treatment differences. For example, in a study comparing the feeding behaviour of dairy cows at two stages of lactation we used linear regression to determine the within cow repeatability of the various measures of behaviour. Although all regression coefficients were significant ($P < 0.05$), the within cow repeatability varied considerably; it was highest for feeding time ($R^2 = 0.90$), moderate for meal duration ($R^2 = 0.75$), and lowest for meal frequency ($R^2 = 0.22$). In addition, all measures of feeding behaviour showed high between-cow variability, such that within-subject tests are normally most suitable for testing treatment effects on feeding behaviour. In summary, powerful methods of quantifying meal-based measures of feeding behaviour are available but these measures are generally less useful than simple measures of feeding time. We recommend researchers use the latter in studies designed to understand how social, biological, and environmental factors affect feeding behaviour in cattle

TIME BUDGETS OF AUSTRALIAN DAIRY COWS ON PASTURE

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In Australia, most dairy cows are grazed outdoors all year round. At milking time, the herd is brought from the pasture to the milking facility, where some cows may have to wait for an extended period of time to be milked. The amount of time cows spend off pasture may affect the time available to perform important behaviours and in turn impact on their welfare and productivity. This study aimed to describe the time budgets of Australian dairy cows on pasture.

Time budgets of 20 Friesian cows (parity 1-7) were described during peak (3-6wks) and mid (23-26wks) lactation, on a dairy farm in south-east Australia. Animals were managed as part of the normal milking herd and were milked twice daily, receiving a fresh allocation of pasture at each milking. The posture and behaviour of each animal was observed once every 10-min during six 4-h observation sessions conducted over four days.

Average time spent grazing was similar during the two stages of lactation ($41\% \pm 6.1$ in peak lactation (PL), $39\% \pm 6.2$ in mid lactation (ML), mean \pm SD), but cows ruminated more in ML ($39\% \pm 3.9$ vs $34\% \pm 4.9$) possibly due to poorer quality pasture. Cows were observed lying for $31\% \pm 6.6$ and $40\% \pm 6.5$ of the time in PL and ML, respectively. On average, cows were off pasture in PL for 195-min (range 96-311) and in ML for 101-min (range 63-156). Regression analysis indicated that in PL time spent off pasture significantly ($p < 0.05$) predicted time spent grazing and ruminating, and parity significantly predicted time off pasture. The more time cows spent off pasture, the less time spent grazing and ruminating, and the lower an animal's parity, the more time they were off pasture. In ML, although cows spent less than 2% of time in social behaviour, time off pasture was negatively related to time spent in social interactions.

MILK FEEDING BEHAVIOUR IN DAIRY CALVES

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The effect of number of calves per computer controlled milk feeder, as well as number of daily milk portions, on milk feeding behaviour in dairy calves was investigated. One-hundred-and-ninety-two dairy calves were allocated to either groups of 24 calves or groups of 12 calves with one computer controlled milk feeder per group. Within group, half of the calves were offered the daily milk allowance in either four or eight portions.

The calves in groups of 24 were more disturbed by other calves while occupying the milk feeder (50 % vs. 10 %; $P < 0.01$), they waited for longer to get access (18 vs. 4 minutes/calf/24-h; $P < 0.02$) and they occupied the feeder less time (31 vs. 36 minutes/calf/24-h; $P < 0.05$) compared to the calves in groups of 12. The higher level of competition in groups of 24 calves caused an increased rate of ingesting milk (0.4 vs. 0.3 litres/minute for calves in groups of 24 and 12, respectively; $P < 0.01$), but did not affect the milk intake. Offering the same milk allowance in four rather than eight daily portions lowered the occupancy of the feeder (30 vs. 37 minutes/calf/24-h; $P < 0.001$). This was mainly due to a lower duration of occupying the feeder just after milk ingestion (3 vs. 6 minutes/calf/24-h; $P < 0.001$), which is explained by fewer milk portions stimulating less non-nutritive sucking per day.

The increased feeding rate with 24 calves per feeder suggests that these calves were subject to a high level of competition. Fewer and larger meals lowered the occupation time and may thus lower competition other things being equal. The results illustrate the usefulness of milk feeding behaviour in the assessment of welfare and as a tool to improve the feeders.

THE EFFECT OF BOX SIZE ON THE LYING BEHAVIOR OF HORSES

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Recommendations for minimal box sizes for horses are primarily based on practical experience rather than systematic observations of the lying behavior of horses. To identify behavioral indicators that could be used for such recommendations we analyzed the lying behavior, the lying down behavior, and the getting-up behavior in a crossover study using eight horses kept in a small box (shortest side 1.5 times the height of the horse at the withers) as well as in a large box (2.5 times the height of the horse at the withers). Observations were based on video recordings made from 22.00 – 07.00 h over three consecutive nights. Prior to the observations the horses were housed in the box for a minimum of five nights. We observed the duration and frequency of sternal and lateral recumbency, as well as the behavior just prior to lying down and getting up. We found that the total time the horses spent lying was less in the small box compared to the large box. Thus the average duration of sternal recumbency in the small box was 3.67 ± 0.25 minutes as opposed to 4.01 ± 0.25 in the large box ($P \leq 0.01$), the average duration of lateral recumbency in the small box was 2.19 ± 0.25 as opposed to 2.55 ± 0.26 in the larger box ($P \leq 0.05$). In addition, prior to getting up some of the horses performed a partial rolling movement by rolling onto their back and down onto the same side after which they immediately got up. This behavior was performed both in the small and in the large box and thus could not be explained by some difficulty in getting up because of box size, as has been proposed earlier (Riemann Pedersen et al., 2004). We conclude that if recommendations on minimal box sizes are meant to contribute to the welfare of horses, detailed behavioral observations of their lying behavior are necessary.

Riemann Pedersen, G., Søndergaard, E., Ladewig, J. The influence of bedding on the time horses spend recumbent. *J. Equine Vet. Sci.* 2004, In press.

THE EFFECT OF STALLION AND MARE BEHAVIOUR ON CONCEPTION IN INTENSIVELY- MANAGED BREEDING

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Nineteen matings across three stallions were observed at a Thoroughbred stud. Mating management included the application of an upper-lip twitch, bridle and felt boots to all mares, and a bridle to stallions. Three handlers were present at each mating; one to control the stallion, another to restrain the mare, and a third to hold the mare's tail aside and assist intromission. Before mating, mares were judged to be in full oestrus through their behaviour on presentation to a stallion and veterinary examination of ovarian follicle size and cervical dilation. Lutenising hormone was administered after mating in an attempt to guarantee ovulation. Such management is typical of Thoroughbred breeding in the UK.

Ten matings were identified as resulting in conception by ultrasound scan at 16 days post-mating. Two of five matings to stallion A resulted in conception, as did three of nine to stallion B and five of five to stallion C. This suggests an effect of stallion on success of breeding.

Analysis of mare behaviour during mating identified a non-significant trend for increased clamping of the tail over the perineum where mares did not conceive ($P=0.079$, $U=4$, mean frequency = 2.2 vs. 1.0, Mann-Whitney U test) suggesting that they were not actually in full behavioural oestrus. Analysis of stallion behaviour identified a significantly greater latency to ejaculation after the final mount in matings where mares did conceive ($P<0.05$, $U=20.5$, mean and st. dev.= $18.3s \pm 2.7$ vs $16.0s \pm 2.8$, Mann-Whitney U test). There was no significant difference across stallions in latency to ejaculate after the final mount. Greater success of breeding with longer latency to ejaculate after the final mount may be due to longer stimulation of the mare's reproductive tract facilitating successful conception.

BEHAVIOURAL AND PHYSIOLOGICAL RESPONSES OF HOSPITALISED HORSES

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Horses may need to be hospitalised for many reasons. This can represent a stressful event in their lives and cause a conditioned fear response to humans. The aim of this study was to investigate which diagnostic procedures elicited higher behaviour and heart rate responses and to investigate whether the horses' reactions to an unfamiliar human changed after their hospitalisation.

We examined nine performance horses (males aged three – eight years) during their first hospitalisation at the University Clinic. Each horse was individually tested in the presence of an unfamiliar person in the box, before and after the diagnostic procedures. Reactions of the horses to the human and to the different phases of the clinical examination (entering the horse stock, examination of the mucous membranes, of the chest, of the respiratory tract and e.c.g. recording) were video-recorded continuously, simultaneously with heart rate. Mean (SD) heart rate during tests and diagnostic procedures were calculated. GLM with repeated measures, Kruskal Wallis and Wilcoxon tests were used.

The reactivity of the horses during different procedures varied ($p < 0.001$). Horses presented different heart rates during various procedures ($p = 0.001$) showing higher values when they entered the stock (64 ± 22 bpm) and during the examination of the mucous membranes (55 ± 15 bpm) than during other procedures ($p < 0.005$). The interaction with behavioural reactivity was highly significant ($p < 0.001$), more reactive horses had higher heart rates than calm horses. Horses showed higher heart rates ($p < 0.05$), spent more time with their ears back ($p < 0.05$) and had less contact with the unfamiliar human ($p = 0.05$) before the clinical examination than after it.

It can be concluded that the entry in the stock and the examination of the mucous membranes are critical moments of the clinical examination and can enhance the horses' reactivity even though this doesn't seem to affect their reactivity towards humans negatively.

ROUGHAGE CRAVING IN HORSES

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Although horses evolved to consume a high-roughage low-energy diet, most recreational and performance horses are fed a high-concentrate limited-roughage diet. To determine the effect of the different diets on the horses' behavior and motivation to consume roughage, we fed six mares a complete pelleted diet or a grass hay diet for 3 weeks with a one week transition period from one diet to the next. The horses' behavior was analyzed from 24 hr time lapse video recordings (time budgets) and from real time videos (chewing rate). The horses also were operantly conditioned to press a panel for either 100 g of hay or 100 g of pelleted feed. Using a progressive ratio technique, their motivation to consume each diet was measured weekly during the 3-week period they were fed each diet. The horse was removed from her stall and placed in a special operant conditioning stall where she could press a panel to gain access to hay or, on another day, to gain access to the pelleted diet.

The time budgets were affected by diet. The horses spent more time eating (hay=50%; pellets=10%) and less time foraging by manipulating the bedding of wood shavings (hay=1%; pellets=12%) when fed hay than when fed pellets. Their chews/day were lower when eating pellets (10,000/day) than when eating hay (40,000/day; Wilcoxon signed rank $p < 0.05$). The horses were not motivated to work for their maintenance diet (median presses for each = 1). They would press for hay when fed pellets (median = 12) and for pellets when fed hay (median = 25; $p < 0.001$ Friedmans two way ANOVA). These results indicate that horses are motivated to increase their roughage intake when fed a complete, but low roughage diet

YEARLING HORSE INGESTIVE BEHAVIOR AND SOCIAL INTERACTION IN THREE CONCENTRATE FEEDING SYSTEMS

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Domesticated yearling horses are often maintained in groups and fed concentrated grain rations at least once daily. Introduction of a limited resource and changes in management may increase the frequency of agonistic behaviors and decrease the time horses spend eating during a feeding session. The objective of this study was to compare the behaviors of group concentrate fed yearling American Quarter Horses within three management systems.

Over two consecutive years, 16 yearling horses (n = 8/year; 4 fillies, 4 geldings, full siblings between years) were observed over a 60 day trial period/year at 15:30 each day. The experimental design consisted of 3 factors (sex, feeder system, year); repeated measures on feedertype: control (tire) feeders, treatment 1 (individual tub) feeders, and treatment 2 (manger) feeders. Large tire feeders allow multiple horses per feeder, as may individual tubs, while manger feeders allow only one horse per feeding space.

The Observer Basic 4.1.126 (Noldus Information Technology, The Netherlands) was used to score behaviors and derive behavior endpoints. Statistical analyses were performed using SAS v.8.2 (SAS Institute, USA) and Statistix 7 (Analytical Software, USA). Total duration of eating during a feeding session was affected by feeder type ($p < 0.0001$) and sex ($p = 0.0295$). Horses spent the most time eating in the control feeding system (17.47 min/session), and the least time in treatment 1 (13.17 min/session). Fillies performed more than 3 times the total number of agonistic behaviors per feeding session as geldings (2.59 vs. 0.81, $p < 0.0001$). Feeder type also influenced total number of agonistic behaviors, with 1.43 times more aggressions per feeding session in manger feeders than tire feeders ($p < 0.0001$), and 1.26 times more aggressions per feeding session in individual tubs vs. tire feeders ($p < 0.0001$). There was no feeder type by sex interaction, $p = 0.2572$. Clearly, certain feeding systems increased and sex influenced agonistic interactions during feeding.

FLAVOUR PREFERENCES IN CONCENTRATE DIETS FOR STABLED HORSES.

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Our previous trials investigating effects of diet flavour in stabled horses indicated significant effects on foraging behaviour and selection.

In this series of three trials we aimed to determine relative acceptance by presenting flavour preference tests to eight horses. Horses were stabled and fed hay *ad lib* on trial data collection days plus a standard unflavoured concentrate ration at 7.30am.

In Trial I 15 flavours were separately presented at 1% in standard 100g cereal by-product meals. Quantity consumed, time to completion, partial rejection or refusal were recorded. Order of presentation determined by Latin Square design. Trial data was collected on five sampling days, separated by a minimum of one day. Horses were presented with six flavoured meals daily, minimum one hour between meals. Each flavour presented in two replicates. The most preferred 8 flavours (grams consumed and time to completion) from Trial I (Cherry, Oregano, Peppermint, Cumin, Rosemary, Fenugreek, Banana and Carrot) were presented in paired preference tests in Trial II.

In Trial II all combinations of the eight flavours were presented, in two tests per day at noon and 4pm. Presentations of the same flavour separated by at least one day. Paired presentations were of 3g in 300g cereal by-product. Presentations terminated when approx half of the total amount presented had been consumed. Flavour preferences expressed as a gram ratio from 0 (rejection) to 1 (exclusive consumption). One sample T-tests for paired flavour preferences indicated an order based on significance levels ($t=2.3-7.3$ $P<0.05-P<0.001$) of Fenugreek>Banana>Rosemary>Carrot>Cherry>Cumin>Peppermint>Oregano.

In Trial III relative consumption times of 100g mineral pellets flavoured with Fenugreek or Banana were significantly reduced in comparison with unflavoured pellets over 5 days (Wilcoxon signed ranks test: Fenugreek $Z=-1.99$ -2.2 , $P<0.05$, Banana $Z=-2.2$, $P<0.05$).

In these short term trials, flavour had significant effects on diet acceptance and consumption times.

STRAW OR SILAGE PROVISION INFLUENCES FEEDING BEHAVIOUR OF PREGNANT SOWS IN DYNAMIC GROUPS

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Aggressive interactions in dynamic groups of sows occur predominantly on introduction of new animals to the group or when fighting for access to feed. The aim of this study was reduction of aggression through provision of additional straw or silage. Three dynamic groups of 47 sows were subjected to a Latin square design involving three treatments: daily provision of 50g straw per animal in the lying area (S), daily provision of 500g per sow of grass silage in racks above the slatted floor (G) and a control group (C). Straw and silage were provided at the start of the feeder cycle (7:30h). The Latin square was replicated twice. Each group stayed within one treatment for a period of six weeks. Every week four new sows entered each dynamic group. Sows were fed individually from an automated Fit-mix feeder system, which does not protect sows during feeding. Daily feed intake did not differ between treatments, but C sows had more feeding visits to the stations (57, 45 and 49 visits per sow per day for C, G and S sows respectively; $P<0.05$). In the hours following the start of feeding, G sows spent more time near the racks (7.2, 18.0 and 7.4% for C, G and S sows respectively; $P<0.05$). S sows spent more time active in the lying area (2.9, 3.9 and 7.1% for C, G and S sows respectively; $P<0.05$). During the night C sows were more active near the feeders compared to the other two treatments (2.7, 1.0 and 0.8% for C, G and S sows respectively; $P<0.05$). No differences between treatments were found on the level of skin lesions following introduction nor at the end of each 6 week period. We concluded that the provision of roughage may result in less disturbances at the feeders and more efficient feeder use. However, in our study, silage nor straw provision reduced feeder related aggression or aggression following introduction of new sows.

BEHAVIOUR OF DAIRY COWS MILKED IN TWO AUTOMATIC MILKING SYSTEMS

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Previous studies could not answer consistently whether milking dairy cows in automatic milking systems (AMS) causes differences in behavioural and physiological parameters compared to milking in a tandem parlour.

Two different AMS models (AMS1, AMS2) were investigated and compared with auto-tandem parlours on four farms each. Data was collected continuously over three days on each farm. Movements of the hind legs (stepping, leg lifting, kicking) during milking were observed in twenty focal animals per farm based on video recordings. Simultaneously, heart rate variability (HRV) was recorded continuously in ten of the focal cows, and milk samples were analysed for milk cortisol and somatic cell count in all cows. A total of about 1600 milkings of 234 focal cows were included in the analysis. Data on behaviour and HRV were combined with data provided by the management software (e.g., milk yield, age, state of lactation, breed). Statistical analysis was done using linear and generalised linear mixed effects models.

There was a significant effect of milking system on stepping ($p < 0.05$). Stepping during milking could be observed more often on farms equipped with milking parlours than on farms with AMS. Leg lifting occurred more often in AMS2 in comparison to AMS1 and the tandem parlours ($p < 0.01$). No significant main effect of the milking system on kicking was found.

The differences between resting and milking in the observed HRV parameters increased from AMS1 to the tandem parlours and to AMS2 (interaction $p < 0.001$). No significant effect of the milking system on milk cortisol concentration was found.

In conclusion, our results suggest that different AMS models cannot be considered as equal regarding their effects on cow behaviour and HRV during milking. Viewed as absolute values, however, the significant differences between the milking systems were rather small and thus do not seem to be biologically important.

INJURIES OF DAIRY CATTLE: A RETROSPECTIVE ANALYSIS OF DATA FROM ONTARIO TIE STALL FARMS

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A cross sectional study was conducted of the lactating cows on 317 Ontario tie-stall dairy farms, to explore the levels of lameness, cleanliness and injury within herds. Several types of injuries were recorded, including hock and neck lesions and the number of cattle with broken tails. The injury variables were analyzed descriptively and for correlations with tie stall dimensions, cleanliness, other injuries, milk production, somatic cell count and culling rates.

Average herd size was 56 lactating animals. On 21% of the farms, broken tails were observed on 5% or more of the cows. A number of farms (10/317) had 20-50% of the animals affected. The percentage of cows with tail fractures was positively correlated with both dirty udders ($r=0.34$ $p<0.0001$) and dirty hindlimbs ($r=0.29$ $p<0.0001$).

The average herd size of the study farms approximates the average lactating herd size of Ontario dairy farms. Coccygeal fractures in cattle housed in tie stalls generally result from the tail being stepped on or through forceful manipulation of the tail by stockpeople during handling. Depending on the location of the break, affected cows may show signs ranging from pain and discomfort to neurologic deficits, such as decreased tail movement or flaccidity of the anus and vulva. (McDuffee, Ducharme and Ward, JAVMA. 202(7) 1126-8, 1993). The presence of these deficits could cause a dirty tail and may explain the positive correlation between broken tails and dirty udders and hindlimbs. Alternatively, broken tails and dirty cows may both be associated with poor stockmanship.

The occurrence of several cows in a herd with the same types of injuries depicts a problem. Understanding the causes of the injuries is the first step to improving husbandry, cattle housing and ultimately productivity.

ACUTE STRESS AND HYPOALGESIA IN DAIRY COWS

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Changes in nociception are a component of the fundamental and integrated behavioural and physiological responses toward stressful situations and reduction of nociceptive thresholds after acute stress has been found in many animal species. However, in cattle, there are conflicting results on the existence of stress induced changes in nociception.

Effects of acute stressors on behavioural, adrenocortical and nociceptive responses were examined in 24 dairy cows kept in tie-stalls, using 15 minutes of: social isolation in novel surroundings (ISOL), fixation by the head in the home stall (FIX), and provision of novel neighbors/stall (NEIGH) as acute stressors as well as a control treatment (CON). Each cow was exposed to all treatments in a balanced order with 24h between treatments.

Exposure to ISOL or FIX led to increased plasma concentration of cortisol ($P < 0.001$), whereas NEIGH or CON did not. The duration of rumination was decreased for all treatments ($P < 0.001$). A gradual increase in pulling the rope from CON to NEIGH to FIX ($P < 0.001$) was found, and exposure to NEIGH led to increased exploration ($P < 0.001$), aggression ($P < 0.10$) and self-grooming ($P < 0.10$) compared with CON. All treatments led to signs of hypoalgesia as indicated by longer latencies to respond ($P = 0.01$) or increased non-responding ($P = 0.06$) toward nociceptive laser stimulation. ISOL, however, had stronger effects than FIX or NEIGH.

The results suggest that nociceptive changes are part of responses toward acute stress in dairy cows. The nociceptive changes, however, were not direct reflections of the adrenocortical or behavioural responses. Quantification of nociceptive changes, therefore add further information and can increase the understanding of responses toward specific stressors in dairy cows.

ASSESSMENT OF TAPE RECORDED MILKING SHED NOISE AS AN AVERSIVE STIMULUS FOR DAIRY HEIFERS, USING A Y MAZE CHOICE TEST

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In the milking shed environment, dairy cattle are exposed to unavoidable noise from a variety of sources. Characteristics of this noise, such as its intensity, unpredictability and (initially) novelty, suggest that it is likely to be fear-provoking for dairy cows. In order to determine the relative aversiveness of tape-recorded milking shed noise (consisting of a normal array of milking-related sounds), 16 dairy heifers were repeatedly exposed to the presence and absence of noise in a Y maze apparatus over 11 trials, four of which involved a choice between the two options. Heart rate, restlessness and ease of entry measurements were recorded for every trial and compared between noise and quiet exposure using analysis of variance. Across all enforced (non-choice) trials, heart rate was found to be significantly higher ($p < 0.004$), and animals were more restless ($p < 0.002$) during noise trials than during quiet trials. In addition, subjects stopped more often ($p < 0.017$) and required more handler intervention ($p < 0.006$) during noise trials compared to during quiet trials, and the proportion of animals that stopped at least once was greater for noise (60%) than for quiet (42%) trials. Analysis of choice behaviour was carried out using Cochran's Test for repeated observations to compare the proportion of animals making quiet choices across all choice trials. No overall difference was found ($p = 0.594$), however pairwise comparisons showed significant changes ($p < 0.01$) in the proportion of heifers making quiet choices from choice 1 (35.25%; end of day 1) to choice 2 (68.75%; start of day 2) and to choice 3 (68.75%; end of day 2). These results are indicative of an increasing preference for the quiet side of the maze as the experiment progressed. This preference, combined with findings of higher heart rate, increased restlessness and reduced ease of handling highlight noise as a mildly aversive stimulus for dairy heifers which is likely to be avoided if opportunity allows.

LONG-TERM CONSISTENCY OF HOME PEN ACTIVITY AND SEPARATION STRESS IN INDIVIDUAL DAIRY COWS

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The concept of personality implies some degree of intra-individual consistency over time such as for the behavioural activity in the home pen and the coping reaction towards stressful situations. In this study, we investigated the long-term intra-individual consistency of (a) the activity in the home pen, and (b) the reaction towards a social separation in dairy cows.

In 32 Holstein Friesian dairy cows behavioural activity in loose-housing barns was automatically recorded in 1-min intervals for 10 days, and the frequencies of high activity (f_{HA}) and low activity bouts (f_{LB}) were computed (Müller & Schrader, Appl. Anim. Behav. Sci. 83:247, 2003). During a 20-min separation test, behaviour was video recorded and analysed for duration of exploration (d_{EX}) and immobility (d_{IM}), frequency of locomotion (f_{LO}) and vocalisation (f_{VO}). Saliva samples were taken at -20, 0, 20, 40, 80 min for the analysis of cortisol concentrations (CORT). For each cow, four repetitions (R_{1-4}) of the home pen activity recording and of the separation test were performed during two lactations. An interval between R_{1-3} was 6 weeks each and 31 or 32 weeks between $R_{3,4}$ respectively.

The animals did show a significant intra-individual consistency between R_{1-4} in their home pen activity (f_{HA} : $r_s=0.50$ to 0.87^{***} ; f_{LB} : $r_s=0.44^*$ to 0.53^* ; Spearman correlation; *: $p\leq 0.05$; **: $p\leq 0.01$; ***: $p\leq 0.001$). Likewise, the behavioural and adrenocortical reactions towards the social separation were significantly correlated between repetitions (d_{EX} : $r_s=0.57^{***}$ to 0.82^{***} ; d_{IM} : $r_s=0.54^{**}$ to 0.85^{***} ; f_{LO} : $r_s=0.59^*$ to 0.85^{***} ; f_{VO} : $r_s=0.52^*$ to 0.59^{***} ; CORT: $r_s=0.33$ to 0.57^* ; Spearman correlation) although d_{EX} , d_{IM} , and f_{LO} decreased among repetitions (d_{EX} : $X^2=13.3^{**}$; d_{IM} : $X^2=9.8^*$; f_{LO} : $X^2=30.7^{***}$; Friedman test).

The results suggest that the home pen activity as well as the reactivity towards a stressful situation are consistent and form individual characteristic traits. Individual characteristic traits should be considered in animal welfare research.

EARLY PIGLET MORTALITY IN LOOSE-HOUSED SOWS RELATED TO SOW AND PIGLET BEHAVIOUR AND TO THE PROGRESS OF PARTURITION

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The aim was to identify characteristics of sow behaviour and parturition related to piglet mortality in loose-housed farrowing sows. Graphical models were used to model the relationships between perinatal behaviour, periparturient individual conditions (time of day of parturition, rectal temperature 1-3 days postpartum) and causes of piglet mortality. Data from 152 farrowings (three herds) were used. Modelling was based on the correlation between variables within herd and farrowing batch.

The number of total born piglets was positively correlated to the number of stillborn, crushed and starved piglets and affected most behavioural variables. For example, the inter-birth-interval decreased by 9 % per extra piglet. Relationships between specific death causes and behavioural variables were therefore corrected to the same litter size. The correlation between the log of std.dev. in the inter-birth-interval and the number of stillborn piglets was 0.16. The correlation between still born piglets and percent piglets suckling during the first 8 hours after start of parturition was -0.17, indicating that complications leading to stillbirth also influence postnatal piglet vitality. The number of piglets dying of starvation was 0.2 higher when parturition started in the morning compared to in the evening, suggesting that a negative influence of management procedures may exist. Sows that crushed 5 % of their piglets had around three 15 minute periods in lateral recumbency without postural changes during the last 4h before start of parturition whereas the curve levelled off at a mortality around 10 % for sows with 8 or more observations without postural changes. This does not support previous suggestions that low activity close to parturition is a maternal behavioural strategy beneficial for piglet survival.

In conclusion, the results showed that the total number of piglets born not only affects the survival chances of the piglets, but also affects sow maternal behaviour.

MATERNAL BEHAVIOUR AROUND PARTURITION IN GILTS KEPT INDOORS IN SINGLE PENS OR OUTDOORS IN FARROWING HUTS***M. Wülbers-Mindermann¹, C. Berg¹, G. Illmann², B. Algers¹**

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Keeping sows outdoors in farrowing huts allows sows to perform most of their maternal behavioural repertoire compared to sows kept indoors in farrowing pens. The aim of this paper was to study whether a "better" housing system affects maternal behaviour during the critical period of piglets survival (birth to 48 h post partum). During the critical period sows should have a minimum of posture changes, giving their piglets maximum access to the udder for sufficient supply of colostrum.

We collected data from 15 gilts kept indoors in conventional single pens and 13 gilts kept outdoors in farrowing huts. Gilts were video taped and analysed during 3 periods: parturition, end of parturition up to 12 h post partum (PP12), and 13 h until 48 h post partum (PP13-48). Gilts behaviour was recorded in 5 min intervals (=12 observations / h): lying down (side and belly), posture changes (=while lying down: briefly getting up or rolling to another lying position within a 5 min interval) and PAU= piglets being active on udder (>50 % of the litter). The Mann-Whitney rank sum test was used to analyse differences between housing systems.

During parturition gilts indoors were changing posture less frequent (1.0 vs. 2.0 / h, $P < 0.05$) with no difference in lying, but PAU was more frequent in indoor than outdoor piglets (11 vs. 9 / h, $P < 0.01$). During PP12 no difference was found in posture changes, lying and PAU. During PP13-48 no differences were found in posture change and PAU but there were less lying in indoor gilts compared to outdoor gilts (11.0 vs. 12.0 / h, $P < 0.001$). In conclusion, behavioural differences between housing systems were found with outdoor gilts having more posture changes and their piglets being less active on the udder during parturition and outdoor gilts were lying more during PP13-48.

FARROWING ACCOMMODATION FOR ORGANIC PIGS

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Newborn piglets in organic farrowing pens have a lower survival rate than in conventional farrowing pens. This difference is mainly caused by housing the sow loose compared to crated and by climatic effects of the outdoor temperature. Organic lactating sows should have at least 7.5 m² indoor area with straw and a 2.5 m² outdoor run.

The aim of the project was to increase piglet survival in order to improve animal welfare as well as the profitability of organic farms.

In the experiment we compared survival and behaviour in 3 pen types: type 1 with outdoor run, type 2 with an indoor run and a higher proportion of solid floor and type 3 without run. Data was analysed with Analysis of Variance using parity and liveborn piglets as covariables. Results of 131 litters in total showed 9.6^a, 10.8^b and 9.4^a (p=0.05) weaned piglets per litter for pen type 1, 2 and 3. Fouling scores indicating dunging behaviour in the indoor lying area showed 13^a, 21^b and 19^b (p=0.04) for pen types 1, 2 and 3. We found a tendency that litters with high survival rates used the separate piglet nest sooner for lying than the litters with low survival rates. Climatic conditions seemed to be crucial for the vitality and survival of the newborn piglets.

The better climatic conditions combined with the higher proportion of solid floor resulted in a higher survival rate of the piglets. These results are currently used in a second experiment focussing on extra heating around farrowing and solid floor proportion in a new farrowing accommodation.

HANDLING PIGS AT UNLOADING – VARIATION BETWEEN TRANSPORTERS

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This study concerns the unloading of pigs at the slaughter plant in Helsingborg, Sweden. Handling at unloading has been argued to be one of the most stressful situations occurring in the life of farm animals. The major aim with this study was to see if there is a possibility to observe differences in the behaviour of transporters in the way they handle the animals and further to evaluate to what extent physical contact is used to push the animals forward during unloading. The study includes a questionnaire to the transporters (65 % response, n=11) as well as direct observations at the slaughter plant. The behaviour of the transporters and the unloaded pigs was observed from the moment the back door of the truck was opened until the first pig had reached a certain line, about 10 meters into the unloaded area. The frequency of physical contact while unloading was recorded as well as the pigs response. From the questionnaire it was found that all transporters overestimated their own time of unloading. It took them about 10 minutes to unload compared to about 30 minutes as their own estimate. The following statistical results are drawn from 32 observations of unloadings divided on 6 different transporters. Results showed that one of the transporters used more physical contact than the other transporters when handling the animals ($p<0.05$). Observations of the same transporter showed that his pigs showed more of unwanted behaviours (behaviours except moving in the right direction, $p<0.05$). One of the transporters used less physical contact than the others ($p<0.05$). The study showed that it is possible to study effects of different handling methods during unloading pigs. Furthermore, this study at the slaughter plant in Helsingborg has made the transporters more consciuos about their own behaviour at unloading.

DO COWS PREFERENTIALLY LEARN TO ASSOCIATE A HANDLING TREATMENT WITH A PERSON OR A PLACE?

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Cattle associate the quality of handling with the people handling them, becoming frightened of rough handlers, but they also associate aversive handling with the place it occurs, which reduces their fear of people. Do cows preferentially associate handling treatments with people or places? Cows (24) were tested in a Y-maze with a person standing in each arm. For 8 cows, the same person always stood in each arm (PLACE+PERSON). The cow was handled aversively or gently depending on which arm it chose. For 16 cows, the two people repeatedly switched places and the cow was handled aversively or gently depending on either the person it chose (PERSON n=8), irrespective of which arm the person was in, or the arm it chose (PLACE n=8), irrespective of which person was there. After 8 forced-choices the cows had 12 free-choices. All cows in the PLACE+PERSON and PLACE groups achieved the success criterion (10/12 gentle treatments; binomial $p < 0.02$), with no difference between the groups in frequency of correct choices (repeated measures GLM $p > 0.10$). No cows in the PERSON group achieved the criterion. It seems easier for cows to associate a handling treatment with a place than with a person. We examined the effect of previous handling in different places. Cows were either not handled (control) or were repeatedly handled gently by one person and aversively by another person in each of two locations until they approached the gentle handler more closely than the aversive handler. The cows were tested in the Y maze in the same manner as the PERSON treatment of exp1. 14/15 previously-handled cows but only 5/14 control cows achieved the success criterion ($p < .05$). Cows preferentially associate handling with places rather than people but handling in many places increases the chance they will associate the handling with the handler.

INTERACTIONS OF DOGS AND CHILDREN IN CZECH HOUSEHOLDS

E. Baranyiova

Interactions of children with dogs differ from those of adults; even physical contacts of children with dogs are closer and more frequent. To elucidate possible differences in behaviours of dogs we analyzed responses to a questionnaire of dog owners living with or without children.

Data for 112 dogs were collected in households with children and 193 in households without children. From 162 questions concerning behaviour of dogs only 14 differed between the two groups. Respondents with children reported that their dogs perceive their moods whereas only 93.8% of those without children said so. Significantly more dogs in households with children had water available (99.1/93.8%, chi-square 4.924, DF=1, $p<0.05$), were considered exclusively as companions (81.3/70.5%, chi-square = 4.330, DF=1, $p<0.05$), defended items and family members (76.8/68.9%, chi-square = 4.090, DF=1, $p<0.05$), always obedient (75.9/63.2%, chi-square = 5.226, DF=1, $p<0.05$), vocalized more (35.7/22.3%, chi-square = 6.458, DF=1, $p<0.05$), were not housebroken (19.6/11.4%, chi-square = 3.902, DF=1, $p<0.05$). Dogs in households with children were less frequently walked (51.8/70.5%, chi-square = 10.684, DF=1, $p<0.01$), considered stubborn (30.4/46.1%, chi-square = 7.312, DF=1, $p<0.05$), played tug-of-war (27.7/39.9%, chi-square = 4.626, DF=1, $p<0.05$), had professional training (8.0/17.1%, chi-square = 4.902, DF=1, $p<0.05$), were pushy (10.7 – 17.1%, chi-square = 10.100, DF=1, $p<0.01$), roamed (6.3/14.5%, chi-square = 4.757, DF=1, $p<0.05$).

The presence of children affects the lives of dogs in Czech households. Physical skills of children are reflected in tug-of-war type games which are preferred less frequently. Dogs in households with children are viewed more positively. They communicate with people acoustically more frequently and approach people actively (come on command). Less frequently they are perceived as stubborn or pushy. The human-animal bond is closer in households with children. This has life-long and later consequences for children who tend to preserve a more positive attitude to animals later in life.

BEHAVIOURAL ACTIVITY OF FAST AND SLOW GROWING BROILERS

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Conventional, fast growing broilers show low activity levels, especially at the end of the growing period. In alternative systems, birds have the opportunity to show a wider range of behaviours. For these systems a type of bird should be selected that makes use of the facilities offered. The aim of this study was to study behavioural activity and walking ability of fast and slow growing broilers.

An experiment was conducted with 12 pens of 390 birds each: six pens of fast growing broilers (Cobb 500) and six pens of slow growing broilers (Hubbard 1957). Birds were grown to a slaughter weight of 2.150 gram; 42 days for fast growing broilers and 56 days for slow growing broilers. All birds had access to perches. Two pens per type of broiler had access to a covered outdoor run from 3 weeks of age. Behaviour was observed weekly using scan sampling. Furthermore, the number of birds using the outdoor run, if available, was recorded. The gait was assessed at 37 and 51 days for fast and slow growing birds respectively. Data were analysed using ANOVA to study the effects of type of broiler and housing system and their interaction.

Fast growing broilers rested on the floor more frequently than slow growing broilers (67% vs. 47%; $P < 0.01$), whereas slow growing broilers rested more on the perches (18% vs. 4%; $P < 0.01$). Slow growing broilers also made more use of the outdoor run than fast growing broilers at 4 and 5 weeks of age (28% vs. 21%; $P < 0.05$). Slow growing birds had a better gait than fast growing birds (87% vs. 57% good / slightly trembling gait; $P < 0.05$). Slow growing broilers made better use of the facilities offered and had a better walking ability than fast growing broilers.

BEHAVIOUR GENETICS OF FEATHER PECKING IN LAYING HENS**P. Koene¹, A.J. Buitenhuis², J.J. van der Poel², T.B. Rodenburg¹**

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Feather pecking is a major welfare- and economic problem in laying hens. It is characterised by pecking at- and pulling out of feathers of conspecifics. If behavioural characteristics related with feather pecking, and preferably measurable at young age, could be identified, this would provide us with a predictor of feather pecking. The objective of this project was to measure the behavioural predictors and genetic determinants of feather pecking of laying hens.

A high (HFP) and a low (LFP) feather pecking line were reciprocally crossed to create an F1 generation (n=120). From this F1 an F2 generation was created (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 and 29 weeks of age and to a social feather-pecking test (groups of 5, 30 min) at 6 and 30 weeks of age. Heritabilities and genetic and phenotypic correlations between feather pecking, social test and open-field behaviour were calculated.

The heritability of pecking was 0.10 at week 6 and 0.24 at week 30. Positive genetic and phenotypic correlations between open-field response and pecking behaviour within the same age were found. Between ages, a strong negative genetic correlation was found between the open-field response at young age and pecking behaviour at adult age ($R = -0.65$). The high open-field activity of a layer chick at young age correlates with low feather pecking as an adult. These results are in line with the QTLs we found on GGA2 for open-field behaviour and feather pecking within 18-24 cM of each other. The possible involvement of the same genes in both behaviours at different ages and the above genetic correlation support the use of open-field behaviour at a young age as a predictor of adult feather pecking.

FEATHER PECKING AND ITS RELATION TO DUSTBATHING IN DIFFERENT CHICKEN STRAINS

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Feather pecking is a serious welfare problem in fowl species. The removal of feathers is painful for the birds and may stimulate cannibalism. As well, it may cause a monetary loss for the producer because the birds may need to eat more to compensate for heat loss and some may need to be culled. Despite all the research done on this topic, no agreement has been made as to why feather pecking occurs. One well known theory is that feather pecking is mis-directed dustbathing from lack of proper pecking experience early in the chick's life.

To more closely test this theory, 300 one-day old chicks were raised on either wire floor or peat moss, a preferred dustbathing substrate. After two weeks of the initial treatment, half the birds from each room were switched to the opposite treatment, where they remained for weeks three and four, and the effects of early experience were examined. This was done with White Leghorn and ISA Brown chicks separately. The data were analyzed using a GLM Procedure and testing at an alpha = 0.05 level with the SAS program. The White Leghorns showed no significant difference in feather pecking between treatments in week one, $p = 0.334$, but did show treatment effects in weeks two, three, and four, $p = <0.0001$, 0.0026, and 0.0015 respectively, with the highest levels of feather pecking occurring in the wire floor treatment. Similarly, the ISA Brown chicks showed no feather pecking difference in week one, $p = 0.0757$, but did show significance in weeks two, three, and four, $p = 0.0406$, 0.0005, and 0.0136 respectively, also with higher feather pecking levels in the wire floor treatment. These results could support the theory that feather pecking is dustbathing gone wrong. However, it is hard to distinguish between this behaviour and foraging, as they have a number of components in common and peat moss can be used for either by the birds.

AN EPIDEMIOLOGICAL STUDY OF FEATHER PECKING IN TURKEYS

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Feather pecking is both a welfare and an economic issue. The aim of this study was to compare the environmental management and husbandry of turkey farms in the UK and the effect of these factors on feather pecking. Longitudinal and cross-sectional data were collected by way of questionnaires. Surveys were distributed to 330 meat and breeding flocks, reared in a range of systems, and approximately 100 have replied. Farmers provided weekly information about feather pecking from day-old to depopulation (meat flocks) or for 18 weeks (breeding birds) and details of environmental management on a randomly selected flock. Additional information was obtained through discussion with flock managers, and direct observation of flocks and housing.

30.5% of flocks comprised female birds only, 59.0% were male only and 10.5% were mixed. Approximately 36% of flocks were beak trimmed. Of the flocks surveyed 88.6% were reared for meat and 11.4% were breeders. Every flock reported some degree of feather pecking and initial results indicated an increase in the number of flocks with wounded birds during weeks 4 – 9 and 13 – 16. Culls and deaths associated with feather pecking injuries accounted for 27% and 16% respectively of flocks reporting mortality.

At present, two methods are used in the turkey industry to control feather pecking – the use of dim light or beak trimming birds. Analysis of the longitudinal data will determine the role of these control strategies in the prevention of feather pecking, and identify whether these control strategies themselves result in welfare problems.

LAYING HENS SHOW A PREFERENCE FOR ASTROTURF OVER CONVENTIONAL WIRE AS A DUSTBATHING SUBSTRATE IN FURNISHED CAGES

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From 2012, conventional battery cages for laying hens will be banned under European Directive 1999/74/EC. The use of furnished cages, which include a perch, nesting area and pecking and scratching area will not be banned and have certain welfare, hygiene and practical advantages over other systems of egg production. However, even when a pecking and scratching area is provided, most dustbathing occurs on the wire floor as sham dustbathing.

This study aimed to investigate whether laying hens in furnished cages would show a preference for dustbathing on a covered wire floor rather than conventional bare wire.

Eight groups of 10 birds were housed in pairs of adjoining furnished cages. All birds were leg ringed for individual identification. Each pair of cages consisted of one cage containing Astroturf and one cage with a conventional wire floor, joined by a pophole through which birds had unrestricted access. The Astroturf was shorter than that found in the nest boxes and was perforated to allow droppings to pass through. It was used as previous studies indicated this material may encourage dustbathing. Following a period of acclimatisation, the main dustbathing period was identified as occurring between 1130h and 1600h. Scan samples were then taken at five minute intervals during this period, identifying the number of birds and which individuals were dustbathing on each floor type. This was repeated on ten days.

As birds within each cage were not independent of each other, data were analysed on a per cage basis, using the binomial sign test. Birds were found to show a strong preference for dustbathing on the Astroturf flooring ($p < 0.01$), which was apparent in all cages. This demonstrates that there is potential to include Astroturf in the design of furnished cages, as a dustbathing substrate, in order to improve the welfare of laying hens.

PERCH HEIGHT PREFERENCE OF LAYING HENS IN FURNISHED CAGES: INFLUENCE OF CAGE HEIGHT

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The objective of this study was to investigate the preference for perch height and the impact of cage height on perching behaviour in laying hens.

12 groups of 2 hens were tested in a wire-mesh furnished cage (size: 240 x 110 cm) equipped with two wooden perches. These stepwise perches were designed such that hens could choose between 7 different heights (6, 11, 16, 21, 26, 31 and 36 cm). Perching behaviour was observed on 4 consecutive days with a different cage height each day: open (150 cm), high (55 cm), medium (50 cm) and low (45 cm). Behaviour was videotaped during day and night and analysed using scan sampling (5' intervals).

During the day there was a significant effect of cage height on median perch height preference (open: 26 cm; high and medium: 11 cm; low: 6 cm) (Wilcoxon, $p=0.03$). Perching behaviour was significantly more seen with cage heights of 150 cm compared to lower cage heights (14% vs 6%; 6%; 4%) (F-test, $p<0.0001$). Main behaviours on the perches were standing (57%), preening (22%) and sitting (9%). Lower perches were used significantly more for standing and walking, higher perches for sitting and sleeping. At night, cage height had a significant effect on median perch height preference (open: between 31 and 36 cm; high: 31 cm; medium: 26 cm; low: 21 cm) (Wilcoxon, $p=0.01$). Time spent perching with cage heights of 50 cm (46%) was significantly lower compared to open (72%) or low (71%) cages (F-test, $p<0.05$).

To conclude, perch use depends not only on perch height but also on the distance from the perch to the cage roof. Hens prefer higher perch levels but are limited by cage height.

ATTITUDES TOWARD FARM ANIMAL WELFARE – A COMPARISON OF U.S. ANIMAL SCIENCE AND VETERINARY COLLEGE FACULTY

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We surveyed U.S. Animal Science faculty (ANS; 58 schools) and Veterinary College faculty (VET; 27 schools) to ascertain their attitudes toward farm animal welfare. Regardless how much research is conducted, if attitudes of influential stakeholders are unfavorable toward welfare science, the findings will not be implemented to their potential. We received 445 responses from ANS (44.8% response) and 157 responses from VET (31% response). Questions pertained to respondents' comfort level with production practices for common farm animal industries; how strongly/weakly they valued the Five Freedoms; whether they agreed/disagreed with concerns voiced from a previous student survey.

When asked if they believe current production methods provide appropriate levels of welfare, both groups rated industries in the same order: greatest comfort with the sheep industry (86% ANS, 77% VET agreed), then beef, dairy, swine, meat birds, layers (51% ANS, 30% VET agreed). VET showed greater concern with each industry ($P < .01$; SPSS; Chi-Square).

When asked to express agreement with the Five Freedoms, VET and ANS chose in the same respective order with Freedom from thirst valued most highly (76% strongly agreed); on the lower end, Freedom to express normal behaviour (20% strongly agreed). No significant differences between ANS and VET regarding Freedoms.

When asked to agree/disagree with 15 welfare-related concerns, garnered from a previous student survey, relative rankings were similar between ANS and VET. Both expressed greatest concern with issues of poor stockmanship (ANS 83%, VET 80% agreed) and lameness in intensively farmed animals (ANS 83%, VET 76% agreed). Least concern was expressed for piglet early weaning (ANS 16%, VET 20% agreed).

Welfare scientists might use these findings to decide more education/more evidence is needed to engage ANS and VET colleagues in issues that are worthy of increased concern, or to focus on areas already ranked high concerns by ANS and VET.

BEHAVIOURAL REACTIONS OF DAIRY COWS TO STROKING AT DIFFERENT REGIONS

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Stroking has often been used in experimental treatments investigating the farm animals-stockperson relationship. However, the way animals perceived it has been poorly investigated. To assess possible differences in reactions to stroking at different body regions 30 Brown Swiss and 30 Austrian Simmental were stroked at two "preferred" (longest duration observed in intraspecific social licking in an additional study) regions (neck dorsal=ND, neck ventral=NV) and a "neutral" region (licked rarely, lateral chest=LC). After 1 minute standing still beside the cow, each region was stroked for 2 minutes with 1 minute pause in-between in a balanced order. Two sessions per cow were carried out with 3 weeks of treatment (3 stroking groups, 1 control) in-between. Neck stretching as a specific behavioural response observed during intra-specific licking was used during human stroking.

The three regions differed in stretching the neck in both sessions (Friedman: $p < 0,001$; NV1/ND1/LC1: 3,7/0,8/0s; NV2/ND2/LC2: 23,8/7,3/0s; Wilcoxon $p < 0,01$ to $p < 0,001$) Duration of stretching differed between breeds (Mann-Whitney $p = 0,016$): Brown Swiss showed more stretching (30,8s↔5,9s) in the first session and more contact (look/sniff/lick/headlean/headrub) to the experimenter during the first minute ($p = 0,013$; 12,2s↔3,4s). Breed differences disappeared in the second session. Comparing the two sessions ($n = 30$) stretching increased ($p = 0,027$; 27,2s↔51,2s), especially at NV. The cows held their heads more up ($p < 0,001$; 220s↔349s) respectively less down ($p < 0,001$; 249s↔96s) and defensive behaviour decreased ($p < 0,001$; 2↔0). There was more contact to the experimenter after stroking NV than LC (Friedman: $p = 0,044$; NV/ND/LC: 5,6s/4,1s/1,6s; Wilcoxon: NV↔LC, $p = 0,027$).

These results indicate that the cows' reactions to stroking match those during intraspecific social licking, Stroking the "intra-specific preferred" region encourages more neck stretching to the experimenter during stroking as well as more contact in the pause after, which might point at a preference. Breed variation can be observed in their response to stroking.

HAND FEEDING AND GENTLING: HOW DO THEY CONTRIBUTE TO THE DEVELOPMENT OF LAMBS AFFINITY FOR THEIR STOCKPERSON?

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Gentling animals (stroking) while providing food fosters affinity (approach motivation) for their stockperson. Feeding is commonly believed to be the major factor in the development of affinity. However, the role of gentling per se has hardly been explored. We assessed the relative importance of gentling and feeding for lambs' interactions with their caretaker. Lambs were reared in groups of three and artificially fed from a multiple-nipple bucket. Each group was assigned to one of the following treatment conditions: a person sat in the pen (PH, N=5); stroked the lambs (GH, N=5); or stroked the lambs while placing them at the food bucket (GFH, N=6). Treatments were performed 3 times a day over 5 days. Additional routine care was provided by a second caretaker disguised to hide his human shape. At 3.5 weeks of age, the lambs were individually tested in a 6x2m arena during three successive 2-minute phases: 1.alone, 2.with the familiar caretaker, 3.alone. All lambs were tested twice following a cross-over design: A) after 4-6 hours of starvation, B) with *ad libitum* access to food. Data were analysed with PROC Mixed of SAS. PH lambs spent less time with the human (mean±s.e =27s±7s) than did GH (59s±9s, p=0.03) and GFH lambs (59s±6s, p=0.03). GH and GFH lambs did not differ significantly. No interaction between treatments and hunger state was observed (p=0.23). In a second test a milk bucket was put in the arena with the same test procedure. No significant interaction between the treatments and the hunger state was observed (p=0.63). Only three lambs sucked from the bucket. In contrast to previous studies, gentling per se contributed to the development of lambs' affinity for a human while feeding motivation did not seem to reinforce it. Differences in the feeding procedure during treatments could explain this discrepancy.

INFLUENCE OF TIMING AND TYPE OF HANDLING ON CATTLE REACTIONS TO HUMANS

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In Experiment 1, the effect of positive handling (hand-feeding, HF) Angus calves at weaning on reactions to humans was measured in three replicates (n=15) of three treatments (n=5, HO (weaned at 7 mo and handled at 8 mo); WO (weaning only at 8 mo); WH (weaning and handling at 8 mo). Handling treatments were imposed for 15min/d for 8 d. Reactions were assessed using two behavioural tests (Flight Distance (FD), and Docility (D)) 3 weeks and 6 mo after treatment. All data were analysed by ANOVA. Handling, but not weaning, reduced FD ($p<0.01$) at both post-handling tests. Docility was significantly higher ($p<0.01$) for the WH treatment.

In Experiment 2, the effect of positive handling (HF) for lessening subsequent negative handling on reactions to humans was assessed. Forty eight 9 mo old mixed breed beef calves were allocated to 4 groups (n=12). Half of each group was comprised of calves that had been previously positively handled (hand-fed) and the remainder had not been handled. Two of the groups were subjected to a neutral handling treatment (yarded and walked quietly through a handling facility) and the remaining two were negatively handled (yarded with dogs, restrained in a head-bale and nose held to one side for 15 s with nose tongs). Treatments were imposed three times over 2 d. The responses of individual calves to humans were tested immediately before and after the treatments using FD and D tests. FD for previously positively handled animals was less ($p<0.05$) than for unhandled calves. While negative handling increased FD ($p<0.001$) by about 3 m for all calves, animals with prior positive handling animals were less reactive ($p<0.01$).

These results suggest that: type and timing of handling influence the reactivity of cattle; aversively handled animals will be less reactive if previously positively handled.

EFFECTS OF AN ENHANCED HUMAN INTERACTION PROGRAM ON THE BEHAVIOUR OF DOGS IN A LONG TERM RESCUE SHELTER

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The aim of this study was to investigate the effects of introduction and interruption of an enhanced human interaction program on long-term sheltered dogs. Twenty-three dogs, which were never subjected to similar programs, were used. The Enhanced Human Interaction Program (EHIP) consisted of walking and petting dogs for 15 minutes. Dogs were divided into two groups: dogs subjected to the program (EHIP, $n^{\circ}=10$) and control dogs not subjected to it ($n^{\circ}=13$). EHIP dogs began being walked on day 0, and were walked once a week until day 42 when the walking schedule was discontinued. When dogs were in their box their behaviours were recorded by *instantaneous scan sampling* every 3 minutes from 12.00 to 13.30 and from 15.00 to 16.30 on days - 7, - 5, 0, 2, 7, 9, 14, 16, 28, 30, 49, 51, 63, 65. Hence three periods were identified: the first in which all the dogs were not walked, the second in which EHIP dogs were walked, the third in which all the dogs were not walked. Data were arcsine transformed and analysed by means of repeated measure ANOVA and post-hoc Tukey HSD test ($\alpha=0.05$). EHIP dogs increased visibility and tail-wagging towards people, decreased agonistic behaviours towards other dogs and these effects seemed to last also when the program was discontinued. However program interruption led dogs to show significantly increased locomotion and self-grooming which could be interpreted as signs of distress. It is concluded that EHIP have positive effects, but care must be taken to avoid interruption and its adverse effects.

SELECTION OF BREEDS AND INDIVIDUAL DOGS FOR SPECIALIST SEARCH WORK

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Dogs are commonly used to search for a range of target substances such as drugs and explosives, and in the current climate of global terrorism, their demand is rapidly increasing. Therefore it is essential that we understand the best way to select suitable animals and we present two scientific studies examining this.

In the first study, we surveyed 244 experienced search dog handlers and trainers. We identified 30 characteristics which are essential in a potential search dog and prioritised these in order of their relative importance. We also identified the level of each characteristic which is most ideal for search work. The ten most important characteristics were (*ideal level in brackets*): Acuity of sense of smell (*very high*), Incentive to find an object which is out of sight (*very high*), Health (*very high*), Tendency to hunt by smell alone (*very high*), Stamina (*very high*), Ability to learn from being rewarded (*very high*), Tendency to be distracted when searching (*very low*); Agility (*high*), Consistency of behaviour from day to day (*high*), Motivation to chase an object (*high*).

Using this information, we conducted a second study, examining the suitability of a range of different breeds. We surveyed 240 dog trainers and companion animal behaviour counsellors, on their opinions of different breeds, via a questionnaire. They ranked 25 different breeds; each breed was ranked on 29 different traits, which could then be compared to the "ideal search dog" as identified in the first study. This research confirmed that the breeds which most closely match the "ideal search dog" are English Springer Spaniels and Labrador Retrievers, both of which are commonly used. However, other breeds showing appropriate behavioural characteristics included the Flat-coated Retriever, Welsh Springer Spaniel, Curly-coated Retriever and German Shorthaired Pointer. This suggests that these may be useful additional breeds for detection work.

HOW SHOULD A HEN RUN BE STRUCTURED SO THAT IT IS USED EVENLY BY LAYING HENS?

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The aim of this study was to obtain an even use of the hen run with structures as an uneven use leads to a nutrient and heavy metal overload on the frequently used areas. In particular, we looked at the preference of hens for a certain kind and amount of structuring elements.

Eight groups of 20 hens (LT) were put into pens with access to a hen run of 5m²/hen. Per group the run was divided into two parts (A, B) by marks at the fence and the entrance for the hens. In experiment 1, part A had only one shelter in the size of 1% of the area. Part B had 5 such shelters. In experiment 2, A was supplemented with 4 different objects of the same size (perch on two levels, "pecking-tree", box with fir-cones and fir-trees). Part B stayed unchanged with 5 shelters. Per experiment the hens were observed on three consecutive days after four weeks of acclimatisation. In 18 scan samples per day (interval 20 minutes), the behaviour and position of each hen was recorded. The analysis was performed using Wilcoxon paired t-test.

In experiment 1, we could not find a significant difference in the use of the two parts (T=6, ns). On average 24.4% of the hens were on part A, compared to 32.1% on part B. The hens were moving more frequently on part B (T=0, p<0.05). However, in experiment 2 there were significantly more hens on part A (38,6%) than on part B (29,2%, T=3, p<0,05). The hens were pecking and resting more frequently on part A (T=4 resp. 3, p<0.05). These results show that the quality and variation of structures is more important for the use of the hen run than the amount of structures. This is probably due to individual preferences of hens for different functions of structures, like foraging, resting, moving.

DISTRIBUTION OF GROUPS OF HENS WHEN HOUSED IN ADJOINING HIGH AND LOW FURNISHED CAGES

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From 2012 EU legislation requires cage heights to increase from a minimum of 38 cm in conventional cages to 45 cm in enriched cages. Singly-tested hens show a clear preference for more vertical space in cages but no data are available on cage height preferences of group-housed hens under commercial conditions. Our study aimed to understand how groups of hens distribute between adjoining furnished cages of equivalent width and depth but different minimum heights: 38 cm (low) and 45 cm (high). Depending on the relative importance to the hens of horizontal and vertical space we predicted three possible outcomes: 1) a random distribution, 2) more hens in either high or low cages or 3) an even distribution.

At 32 weeks of age eight groups of 10 ISA Brown hens were housed in pairs of adjoining high and low furnished cages with a pophole in the dividing wall. Each hen group was videoed for two consecutive 24-hour periods. Hens were confined briefly to either the high or low cage of the pair at the start of each 24-hour period and then allowed free access through the pophole for the remaining time. The observed frequency of scans for each number of birds was calculated separately for high and low cages and then, using a Chi-square test, compared with expected frequencies calculated from a binomial distribution based on each of 10 hens having an equal chance of being located in either cage.

Hens did not distribute randomly ($\chi^2=48.52$, $df = 4$, $P<0.001$) or show a cage height preference but distributed evenly, with five birds in each cage occurring more often ($P<0.001$) and seven or more birds less often ($P<0.001$) than expected. We conclude that, at a stocking density of 1219.2 cm² per bird, maximising inter-individual distance was a priority over any potential cage height preference.

ROOTING MATERIALS FOR PIGS – A CHOICE BETWEEN EIGHTEEN MATERIALS

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“Pigs must have permanent access to sufficient quantity of material to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such, which will not compromise the health of the animals”. This is the wording of a EU directive with effect as from January 1st 2003. However, to achieve the best possible effect on animal welfare by providing rooting materials, such materials must have the ability to stimulate several aspects of the pigs’ exploratory behaviour and to keep the pig occupied in the long run.

The aim of this experiment was to investigate pigs’ preference for rooting materials. In total, eighteen materials were divided into six categories with respect to structure, size of particles, complexity and humidity. Twelve pairs of pigs tested the materials of all categories. Within each category the pairs had 4 instantaneous choices of three materials in a three-armed maze. Each test lasted 3-4½ minute depending on how quickly the pigs chose material. The results were analysed with a random utility model incorporating random intercepts to account for the repeated use of the same pair. Significance test were made at the 0.05 (two-sided) level.

The pigs showed a significant preference for wood chip (57%) to willow chip (31%) and pine chip (10%). They preferred compost (64%) to peat (34%) and wood shavings (2%), and finally, they tended to prefer straw mixed with maize silage (49%), to straw mixed with grass silage (35%) or chopped beet root (16%). There was no indication of a significant preference in categories with toys (robe, bite-rite, stock), straw (whole, chopped or in nuts) or dry materials (straw mixed with alfalfa hay, seed grass hay, barley straw with underseed). Apparently, the pigs chose the most complex materials. Currently, the preferred materials are being ranked using an operant conditioning technique.

BLUE FOXES' (*ALOPEX LAGOPUS*) MOTIVATION FOR ACCESS TO A SAND FLOOR MEASURED BY USING OPERANT CONDITIONING**T. Koistinen, J. Mononen**

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The lack of an earth floor in cages of farmed foxes is a topical animal welfare issue. The present operant conditioning experiment was designed to evaluate blue foxes' motivation for behaviours enabled by a sand floor.

The subjects were five blue fox males, housed in standard wire-mesh cages. The foxes were trained and tested in self-made, automated operant cages. A four-minute sand floor reward was delivered after a fixed number of lever-presses (FR) by moving the cage from a wire-mesh floor (WMF) to a sand floor (SF). The experiment was repeated in autumn, winter (frozen SF) and spring. In the control experiment, in summer, the reward was a four-minute period on another WMF. In each experiment, the foxes were exposed three times to five FR values. The test sessions lasted for six hours. The duration of 'active floor use' (digging, sniffing, playing, rolling on the sand, and respective floor directed behaviours on the wire-mesh) was recorded continuously during rewards in one FR replication of each experiment. The log-transformed data was analysed by using mixed model. Demand functions were estimated by linear regression.

Since there were no differences in the demand functions for SF between the seasons, the equations were pooled: $Y=1.80-0.34X$. The equation for WMF was $Y=1.90-0.53X$. The demand elasticity was lower for SF than for WMF ($P<0.05$). No difference in equations for the active floor use was found between SF ($Y=3.80-0.24X$) and WMF ($Y=3.55-0.44X$). The mean duration of the active floor use per session was higher ($P<0.001$) in SF (61 ± 5 min, mean \pm SE) than in WMF (29 ± 7 min), representing 51.8 ± 4.0 % and 21.5 ± 1.8 % of total time spent on SF and WMF, respectively.

The blue foxes were motivated to work for access to a sand floor. Sand floor obviously enabled behaviours for which the foxes were highly motivated.

TOOLS TO MEASURE AND IMPROVE WELFARE OF LABORATORY RATS: REWARD-RELATED BEHAVIOUR AND ENVIRONMENTAL ENRICHMENT

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In this study a concept of welfare is applied that states that 'welfare is determined by the balance between positive and negative experiences'. This concept implies that an interaction exists between stress- and reward systems and, as a consequence:

- I. negative experiences (i.e. stress) can be compensated by positive experiences (i.e. reward).
- II. negative experiences induce an increased sensitivity (need) for positive experiences. Based on this, this study aims to investigate whether:
 - I. regular presentations of rewards may serve as a tool counteract stress and, thus, to *improve welfare*.
 - II. reward-sensitivity may be a tool to assess the state of an animal in terms of *welfare*, since it can be indicative of previous (stressful) experiences.

In this study, the rat is used as a model and reward-sensitivity is determined by the spontaneous behavioural response an animal shows in anticipation of a reward (i.e. anticipatory behaviour), which is evoked by a classical conditioning paradigm. The results show that regular reward-announcements can counteract the consequences of stress. Interestingly, a reward in the form of an enriched cage could even *reverse* the effects of chronic stress (i.e. depressive-like symptoms such as anhedonia and impaired synaptic plasticity in the hippocampus). Furthermore, it became apparent that previous experiences, such as standard or enriched housing, or chronic stress, influence anticipatory behaviour for a reward. Thus, this spontaneous behavioural response may serve as a welfare indicator. Summarizing, the results indicate that announcing and presenting rewards may be a useful tool to both measure and improve welfare of animals. Furthermore, the results indicate that enrichment of the currently used poor housing conditions of laboratory rats (and probably also other animals) can serve to counteract stress (e.g. induced by experimental procedures) and, thus, may be a simple first step to take to improve animal welfare.

EFFECTS OF PRE-HATCH EXPOSURE TO CORTICOSTERONE ON FILIAL IMPRINTING IN THE DOMESTIC CHICK

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The aim of the present experiment was to test for effects of pre-hatch stress on exposure learning in the form of filial imprinting in chicks. This experiment was part of a larger project aimed at illuminating factors influencing feather pecking, cannibalism and hysteria. Corticosterone injections into eggs prior to incubation were used to model pre-hatch stress. Eggs were from the white-LSL strain obtained from a commercial breeder. Prior to incubation, eggs were randomly assigned to one of two treatments. Eggs in the treatment-group received 100 µl of 6µg/ml (10ng/ml egg) corticosterone dissolved in sesame oil-solution, and eggs in the control-group received 100µl sesame oil. Solution was injected to a depth of 5 mm into the albumen through a predried elastic silicone seal on the apical end of the egg. The oil treatments gave a 59 % and the corticosterone 44 % hatchability.

After hatching (day 1), 160 chicks (80 per treatment) were put into four different pens according to treatment and imprinting stimulus so that each cage contained 40 chicks. Chicks coloured with either red or blue spray were put into the pens (one chick and one colour per pen) on the day of hatching and used as imprinting stimuli. These stimuli-chicks were kept in the same pens throughout the experiment (3 days). Percentage of time spent near the familiar and novel stimulus animals were tested for 5 animals per treatment and stimulus colour in a simultaneous discrimination test on day 2 and 3 post-hatch.

Corticosterone treated chicks showed a significantly higher preference for familiar coloured chicks, irrespective of their colour, than chicks in the control group ($F_{(19,18)} = 6.67$; $p < 0.02$). These results indicate that pre-hatch stress may affect the ability to learn by exposure learning in chicks.

EFFECTS OF PRE-HATCH EXPOSURE TO CORTICOSTERONE ON COMPETITION CAPACITY, FEAR, AND MORPHOLOGY IN CHICKS

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The aim of the present experiment was to test for effects of pre-incubation injections of corticosterone on the behaviour and morphology of chicks as a model of pre-hatch stress in laying hens. This experiment was part of a larger project aimed at illuminating factors influencing feather pecking, cannibalism and hysteria. Eggs were from the white-LSL strain obtained from a commercial breeder. Prior to incubation, eggs were randomly assigned to one of two treatments. Eggs in the treatment-group were injected with 100 μ l of 6 μ g/ml (10ng/ml egg) corticosterone dissolved in sesame oil-solution to a depth of 5 mm into the albumen through a pre-dried elastic silicone seal on the apical end of the egg. Oil treated eggs were injected using the same method with 100 μ l sesame oil. After hatching 200 chicks (100 per treatment) were put into two pens according to treatment where they lived on the floor throughout the experiment.

The treatments, oil and corticosterone, resulted in a hatchability of 59 % and 44 %, respectively, as opposed to 80% for untreated eggs. Tukey's test ($\alpha \geq 0.95$) was used for analysis of behavioural data collected during the first 4 weeks of life. The results indicated that corticosterone increased fear of a human sitting in the home pen at 12-14 days of age, reduced the ability to cross a wire wall separating chicks from their feed at 17 days of age, and decreased the ability to compete for a model worm at 4 weeks of age. Corticosterone also reduced the weight of chicks recorded at 1 week of age and reduced the length of the tarsometatarsus measured at 5 weeks of age. These results, taken together, indicate that pre-hatch stress in hens may increase hysteria and affect the functionality of behaviour in progeny.

A COMPARISON OF TWO DIFFERENT METHODS TO TEST BONDING BETWEEN SOW AND PIGLETS

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The increased use of loose-housing systems for farrowing and lactating sows has put focus on maternal variability. Some sows seem to loose interest in their piglets sooner than others. This study compared two different tests measuring bonding between sow and piglets.

Forty-eight crated sows were tested individually on two separate days within day four to seven postpartum.

Test A was performed in the home environment 10 minutes after a nursing. The piglets were removed, and the number of sow vocalisations was counted. In test B the piglets were moved to another section and placed in one out of three boxes in a three squared novel arena (2.5 x 9 m). The sow's latency to contact the piglets in the arena as well as number of vocalisations were registered. The study was designed as a 2x3 factorial experiment with "test order (AB vs. BA)" as the first factor, and "time since last nursing before test B (10, 40 or 70 minutes)" as the second factor.

The number of vocalisations in test B was significantly associated with the number of vocalisations emitted in test A ($F_{32,1} = 16.02$; $P < 0.0001$). However, neither order of the two tests nor time since last nursing affected vocalisation. Latency to find the piglets in the novel arena was not significantly affected by the elements in the model, but there was a tendency for the latency to be smaller the higher the parity of the sow ($\chi^2 = 2.8485$; $P = 0.0915$).

In conclusion, the reaction in the novel arena is not affected by time since last nursing, but experience seems to improve ability and the willingness to find the piglets. Based on these results the more easily performed test A, could be used with the same conclusions regarding vocalisation.

WHAT IS THE FUNCTION OF SOW NURSING VOCALIZATION DURING THE FIRST 24 H POST PARTUM PERIOD?

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The grunting vocalization by lactating sows has been demonstrated to serve two functions: (i) initiation of nursings and (ii) synchronisation of milk intake within the litter (through an increase in the grunting rate 25 s before milk ejection). The aim of the study was to examine whether the vocalization already serves these functions during the first 24 h post partum. This early period can be divided into two phases. The milk intake by newborn piglets is almost continuous during the first hours after birth (Phase 1- Ph1) and then becomes cyclic (Phase 2-Ph2). If the vocalization during the first 24 h has the same functions as in later lactation then (i) sows should start with grunting before nursings. (ii) there should be an increase in the grunting rate 25 s before milk ejection. Nine sows were video taped for 24 h post partum. For every sow vocalization during 9 nursings were analysed: tree nursings each during Ph1, at the begin of Ph2 and 24 h post partum. (i) The number of grunts was analysed 30 s before and after the start of a nursing. (ii) The grunt rate increase was calculated as the number of grunts 25-0 s before milk ejection minus the number of grunts 50-25 s before milk ejection. The analysis showed: (i) the amount of grunting 30 s before and after starting a nursing was not different in the examined periods (GLMM, $F_{2,27}=0.03$, NS). Sows grunted at the same level during 30 s before (median=0,34 grunts/s) and after a start of a nursing (median=0.36 grunts/s), indicating that sows initiated most nursings during the first 24 h. (ii) No grunting rate increase 25 s before milk ejection could be detected in any phase (n= 9, Wilcoxon matched-pairs signed rank tests, NS). This result indicates that the grunting pattern is not developed during the first 24 h. In conclusion the results suggest that the grunting vocalization during the first 24h serve more the function to attract the piglets to the udder than to synchronize milk intake within the litter.

DIFFERENTIAL EXPRESSION OF GENES IN FRONTAL CORTEX OF PIGS FOLLOWING WEANING AND SOCIAL ISOLATION: IMPLICATIONS FOR NEURAL UNDERPINNINGS OF WELFARE

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Pigs weaned younger than 21 days show longer aggressive encounters and decreased spatial and social memory after acute stress. Our aim was to examine whether these consequences resulted from changes in gene expression in an area involved in emotional regulation and memory, (i.e., frontal cortex). Early weaned (EW=6) pigs were weaned 10 days after birth, while non-weaned (NW=6) pigs remained with sows. Half of EW and NW animals were socially isolated (SI) for 15 minutes at 12 days of age, immediately before all animals were euthanized. Frontal cortex was collected and RNA processed to generate 12 microarrays from a cDNA porcine brain library to examine effects of SI and EW on gene expression. Real-time QRT PCR validated array findings for 5 genes and examined expression of 9 stress-related genes.

After EW and/or SI, 87 genes were differentially expressed in the microarrays, 20 with brain-specific function (mixed model; $p < 0.05$). Array results and PCR validation suggest changes occur in neuronal growth ($n=6$), cellular structure ($n=5$), communication ($n=6$), and transcription ($n=4$) genes as a result of combinations of EW and SI. PCR of stress-related genes showed significant fold changes (FC) in CRH receptor expression (FC=1.42) in NW+SI versus NW animals and in both NMDA receptors (FC=4.94) and mineralocorticoid receptors (FC=1.87) in EW versus NW animals. Dynorphin (FC=14.32), dynorphin receptors (FC=4.13), and MR receptors (FC=2.13) changed expression in EW+SI versus NW+SI. No changes in expression were seen in the 9 stress-related genes in EW+SI versus EW animals. Mean fold changes differing from controls by 2 standard errors were considered significantly different, as in a conventional t-test.

Gene expression changed in response to EW+SI, likely as a result of the cumulative effects of the stressors. Changes in gene expression following SI and EW could cause the cognitive and emotional changes reported in previous experiments.

DO HORSES GENERALISE THEIR RESPONSES TO NOVEL STIMULI?

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Behavioural and heart rate (HR) responses of horses to novel visual, auditory and olfactory stimuli were investigated. Twenty-four 2-year-old, previously unhandled stallions were habituated to a round arena and to receiving a food reward from a container inside the arena. Each horse was exposed to three 2-minute tests in a balanced design where in addition to the feed container, either a traffic cone (visual test), white noise (auditory test) or eucalyptus oil applied to the inside of the container (olfactory test) were used as the stimuli. Between test days, horses were exposed to the usual arena (control).

Data were analysed by RM ANOVA on ranks and are presented as medians with lower and upper quartiles. Compared to control days less time (s) was spent eating during all tests (Control: 105 [103,107], Visual 97 [85,104], Olfactory: 92 [76, 105], Auditory: 95 [75,105], $\chi^2=20.85$; $P<0.001$). More time (s) was spent alert towards or investigating the stimulus/food in the visual and the auditory tests (Control: 0 [0,0], Visual: 9 [4,20], Olfactory: 2 [0,8], Auditory: 9 [2,15], $\chi^2=37.14$; $P<0.001$). Backing away from the stimulus was only shown during the auditory test, indicating that this type of behaviour may be an innate response to a novel sound. The horses had increased HR (max bpm) during the visual and auditory tests, but not during the olfactory test (Control: 62 [57,68], Visual: 74 [65,91], Olfactory 59 [57,61], Auditory: 70 [64, 100], $\chi^2=10.97$; $P=0.012$).

There was a positive, significant relationship between HR in the olfactory and auditory tests (Spearman correlation, $r_s=0.66$, $P=0.013$) and between the visual and auditory tests ($r_s=0.55$, $P=0.026$), whereas there was no correlation between the visual and olfactory tests and no behavioural correlations. In conclusion, novelty responses are linked to the type of stimulus, which should be considered when interpreting novelty responses in horses.

EXPERIENCES OF SHEEP DURING LEARNING

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Hagen and Broom (2004) have shown that cattle can show changes in heart-rate and behaviour when they learn a new task which will result in positive reinforcement. Sheep studied by Elliker (in prep.) showed anxiety-related behavioural responses in various circumstances and this changed the behaviour of other sheep which detected those responses.

Would sheep show an emotional response when they learned a task? In order to investigate this we trained 12 Clun Forest ewes, which had lived together in a flock, to move a stick on a bucket in order to gain entrance to a Y-maze arm with 50g of sheep pellets in it. The sheep had been fitted with heart rate monitors, behaviour was videoed and salivary cortisol samples were taken. The responses of the sheep in ten experimental trials, during which learning occurred were compared with the same 12 animals in five control trials which were identical except that learning could not occur. The heart-rate and behaviour of the sheep changed during the trials when learning occurred (Wilcoxon matched-pairs tests). These changes were not a consequence of the reward or of the locomotor movements which occurred. Their timing suggests that they could be linked to the events during learning. Such results provide information about the extent to which sheep are aware of themselves and their own actions.

DEVELOPMENT OF A MAZE TEST TO ASSESS COGNITIVE FUNCTION AND LEARNING ABILITY OF SHEEP

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Corynetoxins cause annual ryegrass toxicity, an often fatal neurological disease. In this study, sheep were exposed to sub-lethal levels of dietary tunicamycin (toxicological equivalent of corynetoxins) over an 11-month period. A maze test was developed to assess the effect of tunicamycins on cognitive function and learning ability in sheep.

Groups of Merino sheep (12-months-old, total N=60; 30 rams, 30 ewes) received tunicamycins in their diet at 0, 0.5, 1.5, 4.5, 13.5 and 40.5 µg/kg body weight, three times per week for 46 weeks. A 18.4 x 8.2 m maze was constructed with 1.2m high opaque external walls and a number of open-barred internal barriers. All sheep were tested individually in the maze on each of three successive days.

Data were log transformed for repeated measures analysis using ASREML. The time taken to complete the maze decreased over the three days ($P < 0.01$), with mean times of 92.4, 52.4 and 35.8s on days 1, 2 and 3, respectively. This reduction between days 1 and 3 tended to be lower ($P = 0.10$) for sheep exposed to higher toxin levels (13.5 and 40.5 µg/kg body weight), with mean time differences of 31.5 and 44.4s, respectively, compared with 87.0s for controls. There was a day x sex interaction, with females faster than males on day 1, but males recording a greater reduction in time to complete the maze on days 2 and 3 ($p = 0.06$).

The results suggest that there are sex-based differences in the ability of sheep to traverse a relatively complex maze and improve their performance over a 3-day period. Sheep exposed to sub-lethal levels of tunicamycins had reduced ability to improve their performance in the maze, indicating that cognitive function and learning ability may be reduced.

BIMODAL AND UNIMODAL DISCRIMINATION OF INDIVIDUAL CONSPECIFICS BY JUVENILE DOMESTIC PIGS.

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Social stress in domestic pigs is reduced in stable hierarchies. Social recognition is essential for the formation and maintenance of such hierarchies. Given normal social cues juvenile pigs can discriminate between individuals irrespective of the familiarity or relatedness of the stimulus pigs. However, the efficiency of different modalities is unknown. We investigated the ability of six-week-old female pigs to discriminate between pairs of similar-aged conspecifics in a Y-maze using bimodal or unimodal cues.

Pairs of stimulus pigs (n=12) were littermates, familiar but unrelated to the test pigs (n=12). During the bimodal phase, test pigs were deprived of cues of one modality – olfaction (n=4), vision (n=4) or audition (n=4). Approaches to a correct stimulus were rewarded with food in daily sessions, each of 10 consecutive trials. Eight or more approaches to the correct stimulus fulfilled the criterion for successful discrimination (p=0.054: Binomial law). After three consecutive successful sessions (p<0.0002: Binomial law) test pigs were then tested on only olfactory, visual or auditory cues. Each pig completed a maximum of 30 sessions altogether.

Eight subjects learnt the bimodal task (Generalised linear regression of success on time: slope = 0.0830 ± 0.015, p<0.001), but there was no difference in learning speed between pigs deprived of different modalities (F_{2, 138} = 1.18, p=0.311).

Six out of eight pigs successfully discriminated in three consecutive sessions given unimodal cues (olfaction-3, vision-2, audition-1). Pigs were no longer learning at this stage (Generalised linear regression: slope = -0.0481 ± 0.050, p=0.399), but there were significant differences in mean accuracy using different modalities (F_{2, 32} = 5.5, p=0.009):

<u>Unimodal test</u>	<u>Predicted mean (proportion correct)</u>	<u>s.e.</u>
Audition	0.61	0.068
Olfaction	0.90	0.047
Vision	0.68	0.068

Juvenile pigs can therefore discriminate between individual conspecifics in the absence of vision, olfaction or audition, and using any of these three modalities alone.

CAN ACUTE STRESS IMPAIR THE ABILITY OF WEANED PIGLETS TO RECOGNIZE A FAMILIAR CONSPECIFIC?

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In pigs, social isolation is highly stressful and may impair cognitive abilities. Using a modified familiarization paradigm, we assessed social recognition (SR) skills of newly-weaned pigs and examined how these were affected by weaning age and/or social isolation.

The experiment was planned in a 2x2x2 factorial design with six animals per treatment. Female piglets were weaned at d11 (EW, n=24) or d22 (CW, n=24). One day after weaning, 2 weaned litters were exposed to each other for 8h in an arena separated by flexible netting to prevent mixing and fighting. On the following day, pairs of littermates were exposed to each other for two 10-minute periods after which the pigs were considered familiar. To examine whether social isolation impaired SR, 24 animals were isolated for 15 minutes prior to the SR test, while the control group (n=24) remained with their littermates. Immediately after isolation pigs were exposed to a familiar (n=24) or an unfamiliar (n=24) conspecific for a 3-minute period. The pigs were tested once at d13 or d24 of age.

Duration of social investigation is a validated measure for SR; familiar conspecifics spend less time on social investigation than unfamiliar. The results highlighted a significant interaction between weaning age and isolation during familiar exposures (GLMM; $F_{1,17}=23.13$, $p=0.0002$). Isolated EW pigs investigated more than non-isolated EW animals ($66.57s \pm 5.92$ vs. $14.28s \pm 3.54$, $p<0.0001$), isolated CW ($18.60s \pm 5.92$, $p<0.0001$) and non-isolated ($20.80s \pm 7.26$, $p<0.0001$) CW pigs. The amount of social investigation did not differ between treatments during unfamiliar exposures (54.74 ± 6.88 , $p>0.1$).

These results suggest that social isolation disrupts SR in E W piglets, but not in CW animals. Possible neural mechanisms for this disruption are currently being investigated.

PREFERENCES OF DAIRY COWS FOR WALKING AND STANDING ON DIFFERENT FLOORS

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The aim of this study was to investigate whether dairy cows show preference for soft rubber mats compared to concrete floor.

The study was conducted on a large organic farm. Floor preferences were tested in 300 cows on a 100 m² holding pen outside the parallel milking parlour and in 150 cows on a 12×3m walkway from the parlour to the cubicles. The holding pen and walkway were divided lengthwise in two equal parts. Different kinds of solid elastic rubber mats were tested vs. solid concrete (holding pen). Slatted and solid rubber mats were tested vs. slatted concrete (walkway).

Each floor type was tested 4 days on the left, following by 4 days on the right side of the holding pen and the walkway. Controls were made with concrete flooring on both sides. Floor preference was tested on group level during the afternoon milking. In the holding pen number of cows on each floor was recorded every 7th minute. On the walkway number of cows walking on one floor or changing between floors was recorded continuously. ANOVA tested the cow floor preferences in the holding pen with floor, test day, side and space availability in the pen as factors. Chi-square tested difference between test and control in cow distribution on the walkway.

With more than 7 m² per cow in the holding pen, proportion of cows choosing soft and very soft rubber mats vs. concrete floor was 71% and 73% respectively ($P < 0.05$, comparisons with control). Amount of animals choosing soft flooring vs. concrete on the walkway increased gradually with time and on the 4th test day reached 78% for solid ($\text{Chi}^2 = 28.76$, $P < 0.001$) and 77% for slatted rubber mats ($\text{Chi}^2 = 25.03$, $P < 0.001$). It is concluded that the majority of cows preferred to walk and stand on soft flooring than on concrete floors.

EFFECT OF ELECTRICAL BROODERS ON CHICKENS' FEATHER PECKING ACTIVITY

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Feather pecking continues to be a serious problem that is increasing with the move towards loose housing systems. The tendency to feather peck is influenced by events early in life, treatments should therefore be introduced from early on. Separating inactive chicks from active chicks by providing dark electrical brooders is predicted to reduce the risk of the chicks developing unfortunate pecking preferences (i.e. active individuals pecking inactive ones). The aim of the present study was to investigate the effect of dark electrical brooders on chickens' feather pecking activity.

Twelve groups of 15 layer hen chickens (Lohmann Tradition) were reared in pens (2.55 m²); six groups were provided with electrical brooders (B-groups) and six with heating lamps (H-groups). All groups were observed once a week until point of lay, and each occurrence of severe and gentle feather pecks were recorded continuously for 30 min. Data were analysed using the repeated measurements analysis in SAS® statistical programme.

At three weeks of age all H-groups had exhibited severe feather pecking, whereas no severe feather pecks were seen in the B-groups until they were five weeks old. Only sporadic severe feather pecking was observed in the B-groups throughout the observation period, whereas the frequency of severe feather pecking continued to rise for the H-groups. The interaction between treatment and week was found to be strongly significant ($P < 0.001$), e.g. from age 3-18 weeks H-groups exhibited significantly more severe feather pecking than B-groups ($P < 0.0099$), whereas no difference between B- and H-groups was found up to age three weeks. Gentle feather pecking was found to be less frequent in B-groups compared to H-groups ($P < 0.0001$).

The results suggest that provision of dark electrical brooders has a long-lasting reducing effect on the frequency of both severe and gentle feather pecking.

EFFECT OF PERCHES AND FEEDING PLATFORMS ON LAMENESS IN BROILER CHICKENS

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One of the most serious welfare problems in broiler production is the high incidence of leg disorders and lameness. We examined the incidences of leg problems in broilers raised either in standard pens or in enriched pens. Ross birds (N=312) were reared in six pens that were either control pens or that contained two platforms (8cm above the floor) which the birds had to use in order to obtain feed as well as two perches (8cm above the floor). These enrichments were introduced when the birds were 11 days old and remained there until the birds reached market weight at 41 days old. At the end of the study, weight, gait as measured by the latency to lie (LTL) test, number of jumps during the LTL test, and leg abnormalities (tibial dyscondroplasia and femoral head necrosis) were measured.

T-tests and chi-square test were used to compare means and proportions. Mean values for final body weights for control and enriched pens were 3.01 and 2.96kg, with no difference between the treatments ($p=0.139$). Mean LTL (seconds standing) was higher in enriched (403) than in control (274) pens ($p<0.001$). Enriched birds jumped more than control birds (1.12 vs. 0.77, $p=0.009$). There was no treatment difference in the proportion of birds that had tibial discondroplasia (24.5%; $p=0.297$) or femoral head necrosis (13.5%; $p=0.869$).

These results show that birds from the enriched pens were able to stand longer and to jump more times during the LTL test than the birds from the pens with no enrichment. Ability to walk (gait score) is correlated with LTL. This study, therefore, indicates that enriching the environment to increase activity can improve walking ability of broilers.

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CAGE HEIGHT AND STOCKING DENSITY EFFECTS ON COMFORT BEHAVIOUR IN LAYING HENS IN FURNISHED CAGES

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Spatial restriction and low cage height in conventional wire cages can reduce the rate at which comfort activities, such as wing-flaps, body-shakes and tail-wags, are performed by laying hens. Furnished cages offer greater opportunity to nest, forage and perch, but comfort activities may still be inhibited. We investigated the performance of comfort activities in furnished cages similar to those required in European legislation from 2012. We first compared 8 groups of 8 hens at space allowance of 762 cm² per bird with 8 pairs of hens housed at 3048 cm² per bird at cage heights of 38 cm and 45 cm. We then transferred pairs of birds from each group to a larger test cage (20000 cm² per bird) to investigate whether stocking density in the home cage influenced levels of so-called 'rebound' comfort behaviour. Incidence of all comfort behaviours was recorded by behavioural sampling and data was analysed by Anova with home cage height and stocking density as factors.

In the furnished cages, wing/leg-stretches, tail-wagging, body-shaking, wing-raising and feather-raising were rare, whilst full wing-flaps were not observed during the study. Cage height had no effect on comfort behaviour, but rates of wing/leg-stretches and tail-wags were lower in eight-bird cages than two-bird cages ($p < 0.01$).

Several comfort activities (e.g. wing-flap, wing-raise, body-shake, tail-wag, head-shake) showed a strong, rapid increase in performance when hens were moved to the test cage compared with their frequency in the home cage ($p < 0.001$). Home cage height and stocking density had no effect on frequency, though hens from the higher stocking density had a shorter latency to wing-flap in the test cage ($P < 0.05$). We conclude that reducing the number of hens in furnished cages increases opportunities to perform certain comfort activities. However, even at low stocking densities comfort activities are rarely observed and appear to be inhibited by spatial restriction.

ENVIRONMENTAL ENRICHMENT TO PREVENT TAIL BITING**J.J. Zonderland^{1*}, M. Fillerup², H. Hopster², H.A.M. Spoolder¹**¹Animal Sciences Group of Wageningen UR, Division Applied Research, Lelystad, The Netherlands²Animal Sciences Group of Wageningen UR, Division Animal Resources Development, Lelystad, The Netherlands

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Piglet tails are commonly docked to prevent tail biting at a later age. Environmental enrichment may stop tail biting as well as the need to dock. Four types of environmental enrichment were provided to 960 undocked weaned piglets (10 piglets per pen): suspended chain (C), suspended rubber toy (T), straw hopper (SH; 5g/pig/day) and twice daily provision of straw on the solid floor (DS; 20g/pig/day). The effect of enrichment on tail lesions (none, mild or serious) was recorded daily for five weeks. In addition, the effects of two curative measures, applied following the onset of tail biting in a pen, were investigated: daily straw supply or removal of the biter.

DS reduced the number of pens with one or more animals with mild or serious tail lesions considerably, compared to the three other measures. In addition, SH resulted in less serious lesions compared to C (mild lesions: 88^a, 79^a, 75^a, 16%^b; serious lesions: 58^a, 54^{ab}, 29^b, 4%^c for C, T, SH and DS respectively; Logistic regression and pair wise t-test with different superscripts meaning $P < 0.05$). Both curative measures resulted in a reduction of serious tail lesions on day 1 to 6 following the start of biting, compared to day 0 (Pair wise t-test with $P < 0.05$). However, they did not eliminate tail biting entirely.

This study indicates that supplying 20g of straw per pig twice per day can virtually eliminate tail biting in weaners. If tail biting does occur, supplying straw or removing the biter may temporary reduce the problem.

INFLUENCE OF INDIVIDUAL PREDISPOSITION, MATERNAL EXPERIENCE AND LACTATION ENVIRONMENT ON THE RESPONSES OF PIGS TO WEANING AT TWO DIFFERENT AGES

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The aim of the present study was to assess the effect of genetic and early environment factors on responses of pigs to weaning. Twenty-five gilts were selected as predisposed to perform harmful social behaviour, and twenty as non-predisposed, at 7 weeks of age. Selection was based on behaviour in a "tail chew" test and performance of harmful social behaviour after weaning. Gilts were mated with boars of a similar predisposition, and farrowed at 44 weeks of age. Half of the gilts of each predisposition were reared from selection until farrowing in barren environments, and half in enriched environments. During lactation, gilts and litters were either housed in a similar environment to that which gilts had experienced during rearing, or in a different environment (in terms of being barren or enriched). Litters from each treatment group were weaned at 3 weeks (early weaning), or at 5 weeks of age. Welfare and performance parameters were assessed in four pigs per litter.

Non-predisposition to perform harmful social behaviour was associated with reduced post weaning growth rates ($P<0.01$), and increased belly nosing behaviour in response to early weaning ($P<0.05$). It is concluded that this type of selection is not commercially viable. Rearing gilts in barren rather than enriched environments led to reduced welfare in offspring. This was reflected in increased adrenocortical reactivity during the lactation period ($P<0.01$), and increased belly nosing behaviour after early weaning ($P<0.05$). The effect of barren maternal rearing environments on belly nosing by offspring was eliminated when enriched lactation environments were used ($P<0.01$). Enrichment during the lactation period also led to improved growth rates after weaning ($P<0.01$). Overall, the results show that both genetic and early environmental factors are important determinants of responses to weaning. Adverse effects of barren maternal rearing environments may be overcome by use of enriched lactation environments.

**COMMUNAL PIGLET AREA IN A CONVENTIONAL
PIG FARM: EVALUATION OF PRE- AND POST-
WEANING BEHAVIOUR OF PIGLETS.****P. Valsecchi, A. Cavagnini**

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The aims of the present study were to: 1) introduce an alternative housing system for sow and litters in a conventional pig farm of Landrace x Large White breed, 2) assess its feasibility within the constraints imposed by the environment, and 3) evaluate its effects on piglets behaviour. We re-arranged farrowing crates, allowing the mixing of piglets of four different litters in a communal area. Sixteen sows and their litters were assigned to the communal area group (experimental) and 16 to the control group. When 11 days old, 1 male and 1 female piglets in each litter were weighted and marked as focal animals. The day after, partitions of farrowing crates of the experimental litters were removed to allow mixing of piglets in the communal areas. All litters were weaned at 30 days of age. Piglets of control litters were mixed with unfamiliar piglets of same weight (according to the standard procedure of the pig farm) while experimental piglets were maintained in the original groups of mixed familiar animals. Ten min/day/focal behavioural observations were carried out on days 12, 13, 14, 21 (pre-weaning) and on days 31, 32 and 33 (post-weaning). Data were analysed by means of repeated measure ANOVA and Tukey HSD post-hoc test. Results show that in the pre-weaning period experimental piglets did not differ from the control in suckling behaviour ($F=0.18$; ns), while they were significantly more explorative ($F=5.04$; $p=0.02$) and active ($F=6.89$; $p=0.01$) than control animals. At weaning experimental piglets did not show aggressive behaviours compared to control animals ($F=21.94$; $p<0.0001$). Weight gain of experimental and control animals were not statistically different at the end of the study ($F=2.34$; ns). The introduction of the communal piglet area system improved the welfare of piglets and did not interfere with the management of experimental litters.

VOCAL AND LYING BEHAVIOUR OF FATTENING PIGS AT LOW TEMPERATURES

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Pigs are sensitive to both high and low ambient temperatures. At low temperatures they huddle together. Preliminary studies have shown that this behaviour was often accompanied by an increase of vocal activity. In this study we tested whether high-frequency vocalisation covaries with huddling and, thus, could be used to automatically record the pigs' reaction towards low ambient temperatures. In addition, we tested whether this relationship is modified by the pigs' weight.

108 fattening pigs kept in 12 groups were observed at 25-35, 50-70, and >80 kg of weight. Mean daily temperatures in the pens ranged from 4 to 26 °C. From 22:00 to 05:00, the number of pigs showing huddling was recorded at 15-minute intervals. Vocalisation was analysed using an artificial neural network (STREMODO®) and summarized as the mean proportion of high-frequency vocalisation within 5 minutes before and 5 minutes after a behavioural record. Linear mixed-effect models were used in the statistical analysis.

In general, huddling increased with lower temperatures, but heavier pigs huddled less than small pigs (weight×temperature $p < 0.001$). We also found a positive relationship between high-frequency vocalisation and huddling, which was weaker in small pigs (huddling×weight $p < 0.001$).

The proportion of pigs >80 kg showing huddling-behaviour was low which may be due to a greater tolerance of cold in heavy pigs. With regard to the high-frequency vocalisation, pigs weighing 20-35 kg seemed to be less affected by huddling than heavier pigs. This may result from smaller piglets tolerating conspecifics lying upon them more likely than heavier pigs. In heavy pigs, huddling was related to high-frequency vocalisation which may indicate reduced welfare. The analysis of high-frequency vocalisation was a powerful indicator for behavioural thermoregulation in pigs of medium and heavy weight at low temperatures and could be used for an automatic monitoring in on-farm conditions.

OPTIMIZING THE INCLINATION OF THE LYING AREA IN CUBICLES FOR FATTENING BULLS

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The aim of the study was to determine the optimal inclination of the lying area in cubicles for fattening bulls, taking into account their behaviour as well as the dirtiness of the animals and the lying area surface. The inclination of the lying area was varied experimentally (3, 5, 8 and 10%), and three soft lying mats differing in surface texture were tested. In a balanced order, 20 finishing bulls housed in four groups were kept sequentially in pens with all inclination-mat combinations. Each experimental period lasted 7 days: 4 days of adaptation and 3 days of observation.

In each experimental condition, the duration of lying was registered automatically over 72h by means of distance sensors placed above the cubicles. The quality of standing up and lying down behaviour was recorded by direct observations on 5.5h per day. Additionally, the dirtiness of the animals and the lying area was scored once and twice a day, respectively. Data were analysed using mixed-effects models and logistic regression.

The steeper the lying area, the more lying bouts ($p < 0.01$) and the more short standing bouts ($p < 0.01$) were registered. With two of the three soft lying mats, the time spent lying per day was reduced as inclination increased (inclination-mat type interaction; $p < 0.01$). With increasing inclination, the animals also stood up more often with more than one head lunge ($p < 0.05$), showed more stepping with the fore legs ($p < 0.05$) and more investigative head sweeps ($p < 0.05$) before lying down, and the frequency of slipping with fore and hind legs was increased ($p < 0.001$). Falling while lying down or standing up was only observed with inclinations of 8 and 10%. Dirtiness of the animals was generally at a low level and there was no effect of the inclination of the lying area. The rear part of the lying area was wetter as inclination decreased ($p < 0.001$).

In conclusion, an inclination of the lying area of 5% was found to be optimal in cubicles for fattening bulls.

EFFECT OF PREWEANING AND POSTWEANING HOUSING ON LABORATORY MOUSE BEHAVIOUR

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Standard housing for laboratory mice restricts behaviour and provides little stimulation. Furnishing the cage and increasing space may allow the animals to perform more of their natural behaviour. We studied the effect of preweaning and postweaning environment on mouse behaviour.

32 animals of the strain C57BL/6j (n=16 per sex), were reared in Furnished cages (Makrolon III with sawdust bedding, a semi-transparent nestbox, tissue nesting material, a cardboard tube and a wooden chewblock). 32 animals of the same strain (n=16 per sex), were reared in a Standard cages (Makrolon II with sawdust bedding). After weaning, the type of housing was changed for half the animals in each group. This resulted in four combinations of preweaning/postweaning housing: Standard/Standard, Furnished/Furnished, Standard/Furnished, Furnished/Standard. All animals were housed in single-sex pairs of littermates. Time budgets were registered from video recordings made at age 4 and 8 weeks, over the dark, active period (12 hours). Data were analyzed using Mann-Whitney U-test with Bonferoni corrections for multiple comparisons.

At age 4 weeks, female mice in furnished cages were more inactive than those in standard cages ($38.55 \pm 0.014\%$ vs $31.47 \pm 0.021\%$; $P=0.057$). At age 8 weeks, male mice were more inactive in furnished cages ($43.88 \pm 0.017\%$ vs $34.81 \pm 0.014\%$; $P=0.03$). At this age, all animals in standard cages spent more time in allo-grooming ($1.00 \pm 0.003\%$ vs $0.00 \pm 0.004\%$; $P<0.01$) and feeding ($34.88 \pm 0.011\%$ vs $23.63 \pm 0.125\%$; $P<0.01$) activities. The only effect of preweaning environment was a weak tendency for more allo-grooming at age 4 weeks in standard cages in animals from furnished preweaning cages ($1.94 \pm 0.005\%$ vs $0.62 \pm 0.003\%$; $P<0.1$). The results are discussed in relation to common behaviour problems in mice such as barbering.

HENS IN TENTS - A WELFARE FRIENDLY SYSTEM

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We aim to develop an economically viable system for organic egg production that combines the organic principles with animal welfare. We have used a system with small flocks housed in tents containing artificial "trees". The results are from two flocks, each consisting of a mix of White Leghorns and New Hampshire.

From late October until early December the birds were observed on a daily basis. During the hours of light approximately 35% of the birds were inside or sitting on top of the tent (varying with the weather).

There was a positive correlation between the estimated dryness of the soil and the number of birds ($P < 0.001$, Spearman). The percentage of leaves on the trees in the orchard was again positively correlated with the number of hens in that part ($P < 0.001$, Spearman rank correlation). The height of the coverage had no effect.

The mean egg laying was 75%, but with a dip during a cold spell (in conventional organic systems 76%).

The birds were plumage scored at slaughter (Tauson scale). The average plumage score was 19.8 (max=20), the overall average damage score was 14.96 (max=15), with higher scores being better. Comb colour was given the highest score for all birds, as was comb damage (i.e. no comb damage). The feet were scored as 2.99 out of 3, the keel bone, 3.96 out of 4. Twelve percent of the birds disappeared, probably flew out and/or were predated (average for Danish conventional organic is 17%).

The main welfare concern is the fact that the birds do not have access to a heated area. The hens had on average 12% of their comb frost bitten (the winter was extreme for Denmark). However, before the system can finally be recommended for production this is problem that has to be addressed.

BEHAVIOURAL VARIATION BETWEEN CAPTIVE POPULATIONS OF RED JUNGLEFOWL (*GALLUS GALLUS*)

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The escalating threats to ecosystems worldwide have led to a need for efficient methods to breed animals in captivity and to prepare captive-born animals for release back to the wild. However, life in captivity may lead to modifications in the animal's behaviour mainly by genetic changes and behavioural adaptations, and this may affect survival and reproduction capacity in a reintroduction situation. The present study was a first screening of behavioural variation between four captive populations at different sites, using red junglefowl as a model species. The populations included 7-16 birds and were kept under different conditions but none had been subjected to any intended artificial selection.

The birds were tested in three standardized test situations in order to measure anti-predatory behaviour, social behaviour and exploratory behaviour. Behavioural observations were carried out using continuous recording and instantaneous sampling and non-parametric Kruskal-Wallis test was used for all analyses. The results of this study show that there are clear behavioural differences between the captive populations. For example, after a simulated predator attack, the populations differed significantly in frequency of agitated behaviour ($H_{3, 42} = 12.42$, $p = 0.006$) and behaviours without agitation ($H_{3, 42} = 10.88$, $p = 0.012$). The populations also differed significantly in number of zone changes during the exploratory behaviour and sociality test ($H_{3, 39} = 14.32$, $p = 0.003$).

Some of the differences found are relevant from a reintroduction perspective and could be crucial for an animal in a reintroduction situation. However, the extent to which these differences are due to genetic change or adaptation to the captive environment is not yet known.

Even though the red junglefowl is merely used as a model here, our results suggest that these aspects may be important to consider also in other species where reintroduction is a more central motive for keeping animals in captivity.

E² = 3R + 2Q: CALCULATING SPECIES-APPROPRIATE ENVIRONMENTAL ENRICHMENT

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Species-appropriate environmental enrichment should be provided for captive animals for two reasons. First, behavioural and physiological indicators show that non-enriched environments compromise welfare. Second, non-enriched environments adversely influence the biology of animals which can impair production in farm species or reduce the validity of scientific data in studies using laboratory species. This paper reviews why we should enrich the environments of captive animals, and how this can be achieved in species-appropriate ways.

For research animals, species-appropriate Environmental Enrichment (E²) can be considered as a function of the 3 R's (3R) and the Quantity and Quality (2Q) of space that we provide, i.e. E²=3R+2Q. The 3R's can relate to enrichment as follows. Replacement means replacing one species with another putatively less sentient species - this will determine the enrichments that are required, and could reduce the need for (complex) enrichment. Reduction means reducing the number of animals used - potentially achieved by having fewer animals/cage, thereby increasing space available for the animals and enrichments. Refinement means adjusting the protocol to ensure the greatest ethical acceptability - enriched housing increases both welfare and validity of data, and therefore can be considered as 'refinement'. The 2Q's, Quantity and Quality of space are of fundamental importance to environmental enrichment. Both can have considerable, independent impacts on animal welfare and validity of data.

Appropriate enrichment avoids anthropomorphism and anthropocentricity, promotes species-relevant behaviours and takes into account the motivations and senses of the species. This can be achieved using methods that ask questions of the animals, e.g. preference tests, consumer demand studies and self-administration of psychoactive drugs. Welfare improvements derived from environmental enrichment can be verified using behavioural and physiological indicators. This paper will review examples of species-appropriate environmental enrichment considering species as diverse as spiders, mice, cattle and primates.

ENVIRONMENTAL ENRICHMENT SHIFTS CIRCADIAN RHYTHMS IN GOLDEN HAMSTERS

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The influence of three different depths of bedding (10cm, 40cm, 80cm) on behaviour in golden hamsters was studied. Forty-five animals (15 per group) were kept singly in standardised cages (area 95x45cm) with raw sawdust bedding, a wooden shelter, carton tubes, hazel branches, a sandbath and a running-wheel. The cages for the two deeper beddings were equipped with an insert of perspex to obtain the respective depths. Light-dark cycle was 12:12h.

Behaviour was videotaped in regular intervals (analysed using the Observer[®]) during the active phase in the dark. Wheel-running activity was continuously recorded (The Chronobiology Kit, Stanford Software Syst.).

After a four weeks' familiarisation running-wheel data of the hamsters held in the low bedding showed a constant circadian pattern. The hamsters in the two deeper beddings showed a significant daily phase delay, whereas few individuals of the medium sized group ran in patterns similar to those in the smallest cages. Medians of daily shifts were significantly different for the three different depths (deep: 0.48 min.; medium: 0.28 min.; low: -0.03 min.; Kruskal-Wallis-Test: $\chi^2 = 13.77$, $df = 2$, $P = 0.001$). Positive values indicate a phase delay in circadian rhythm, negative values a phase advance.

Mrosovsky et al. (Experientia 45:696-702, 1989) found phase advances in golden hamsters being stressed by arousal at certain phases in their circadian activity. Since in our study hamsters in the deep and medium bedding showed the opposite, possibly they were disturbed less than the others which resulted in a phase delay. Therefore, deep bedding as an enrichment could decrease stress in golden hamsters.

PET TOYS AS ENRICHMENT FOR FARMED FOXES: EFFECTS ON BEHAVIOUR AND PHYSIOLOGY.

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Six different pet toy objects, manufactured for dogs by Pet Care Aps, were distributed to juvenile farmed blue foxes. Six groups of 48 foxes were formed. One group (group 0) served as a control group with no objects. Group 1 had permanent access to an object throughout the study period; Group 2 had the object changed every fortnight; Group 3 had the object changed every week; Group 4 shared the object with group 5 by allowing each group to have the object one week at a time. So group 4 and 5 also had a week's deprivation. Behavioural parameters (Stick-test and scan samplings) were recorded manually and by video recordings. Physiological parameters were recorded after exposing the foxes to euthanasia. In this presentation, results from a stick-test will be presented, as well as results from an examination of gum and teeth conditions.

No significant differences were found between the experimental groups and the control group in the first stick test. But in both the 2nd and the 3rd stick test, the control group contacted the stick less often compared to the experimental groups ($0.001 < P < 0.035$, chi-square). Latency to contact the stick within 20 seconds were not affected by group ($P > 0.12$, GLM). Dental plaque was substantial in the control foxes, and a significant group effect ($P < 0.01$, GLM) was found. The control group also showed more severe occurrence of inflammation to gums compared to experimental groups ($P < 0.005$, GLM)

Results showed that having access to a gnawing object motivated the foxes to approach a novel object and thus show more readiness to explore compared to control foxes. Having access to objects also reduced or delayed the occurrence and severity of dental plaque and gum inflammation in farmed foxes. The examined objects from the Pet industry seemed suitable from a welfare point of view, since no damages to gums and teeth were found, as opposed to earlier studies with wooden blocks as gnawing objects.

EFFECTS OF ENVIRONMENTAL ENRICHMENT AND LIMITING ACCESS TO PASTURE

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Nose-ringing in pigs inhibits a range of functional activities, suggesting a degree of reduced welfare. Without nose-rings sows damage much of the pasture, with consequently increased nitrogen leaching. This study aims at reducing rooting damage by restricting daily access to pasture or by providing additional environmental enrichment. In a 2x2 factorial study four groups of 5 sows were offered access to pasture either restricted during 2 hours in the morning (R) or unlimited over 24 hours per day (U). In addition, the 60 m² concrete floor outside the pig house was either enriched with a rooting area and additional silage (E), or left barren (B). The study was replicated twice, and each replicate lasted 3 weeks. The effects of the treatments and their interaction were analysed with Anova. The total time at pasture was not affected by access time (7.3 and 9.6% for R and U). Access time did effect time at pasture during the two morning hours (48.7 and 17.9% for R and U, respectively; $P<0.05$). Environmental enrichment on the concrete floor tended to reduce time at pasture during the two morning hours (27.7 and 38.9% for E and B respectively; $P<0.10$). Mineral nitrogen content of the soil was not affected by treatments. Rooting damage was limited during the study, but there was a tendency that limiting access resulted in more rooting damage over the 3 week period (1.03 and 0.23 m² for R and U, respectively; $P=0.09$). We conclude that access to pastures fills a need for pregnant sows, as sows compensate for limited access by more intensive use. Pasture damage is not reduced by limiting access, but may be reduced by offering additional environmental enrichment.

DOES HOUSING CONDITION AFFECT PLAY BEHAVIOUR OF PIGLETS DURING PRE-WEANING PERIOD?

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Motoric and social play has been suggested to be sensitive to environmental conditions and could be an indicator of animal welfare. Information whether restricted housing conditions influence negatively play behaviour occurrence is missing with an exception that piglets housed in farrowing crates developed play fighting into serious fights more often than those from open pens. The aim of the present study was to test whether the housing conditions and/or the mother may affect the frequency of play behaviour during the pre-weaning period. We compared 7 litters from a "poor" environment (crate without straw) with 7 litters from an "enriched" environment (crate with straw) and 7 litters from a "free" environment (pen with straw). We predicted, that (i) the housing conditions have greater influence than the mother on the frequency of play, (ii) piglets from the "poor" environment display the lowest frequency of motoric play (e.g., scamper, pivot, toss head) and social play (e.g., pushing, nudging, head-knocks) and (iii) the highest frequency of play-fights including biting than piglets from the "enriched" and the "free" environments. At the age of 8, 15 and 26 days after birth, we recorded continually play behaviour for 3 hours. Contrary to expectation, preliminary results showed (i) significant variation in the frequency of motoric (GLMM, $F_{18,21}=2.87$, $p=0.01$) and social play (GLMM, $F_{18,21}=2.13$, $p=0.01$) among the litters, suggesting an influence of the mother. Still, (ii) piglets from the "poor" environment had the lowest frequency of motoric play (GLMM, $F_{2,21}=2.87$, $p=0.03$), tended to have lowest frequency of social play (GLMM, $F_{2,21}=2.72$, $p=0.07$), but (iii) did not differ in the frequency of bites (GLMM, $F_{2,21}=1.82$, $p=0.16$). These results suggested that the housing conditions could affect the frequency of motoric play, perhaps due to the pen size. Mothers had apparently an important effect on the play behaviour of their piglets.

**ASSESSING OBJECT RECOGNITION MEMORY IN PIGS
(*SUS SCROFA*) BASED ON NOVELTY PREFERENCE****A. K. Gifford, R. C. Newberry, S. Cloutier, T. L. Skaer**

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Spontaneous exploration of novel objects versus familiar ones is a key component of object recognition memory tests. Piglets are naturally curious and also show spontaneous preference for novelty. To explore the usefulness of this type of memory test for piglets, we exposed 5-week-old weaned pigs (N = 36) to initially novel sample objects in their home pen for two periods of time, 10 minutes and 2 days. Piglets were then placed in a test pen in pairs and exposed to one of the sample objects simultaneously with a novel object after delays of 1 hour, 3 hours, and 5 days. Duration of object exploration was recorded for both objects, and the difference between time spent with the novel object and familiar one was used to determine preference. To ensure that results were due to novelty perception rather than specific object characteristics, we used a variety of objects and counter-balanced objects across treatments. Pigs did not discriminate between novel objects and 10-minute sample objects after 1 hour, 3 hours, or 5 days. However, it is unclear whether they failed to recognize the 10-minute sample objects because they also showed no discrimination between novel objects and 2-day samples after a 1-hour delay, despite a clear preference for novel objects over 2-day samples after 3-hour and 5-day delays (Wilcoxon Signed-Ranks Tests: $S \geq 68.5$; $p \leq 0.01$). These results have relevance for environmental enrichment programs for pigs, by highlighting that the enrichment value of biologically-irrelevant objects is retained longer when they are presented for brief rather than extended periods. The inconsistent behavior of the pigs towards the 2-day sample objects suggests that a non-memory component influenced object exploration, bringing into question the validity of novelty preference as an indicator of memory.

CHANGES IN WEIGHT DISTRIBUTION TO DETECT HOOF PAIN IN DAIRY COWS

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Lameness detection in dairy cows is difficult due in part to subtle behavioural responses to injuries. Sensitive and objective methods of assessing weight distribution among the four legs may provide a way of detecting injuries at an early stage. We need to understand how cows redistribute their weight among sound limbs when one limb is injured. In this experiment we measured how cows distribute their weight among their limbs, and how this distribution changes in response to discomfort. Eleven Holstein dairy cows were trained to stand on a platform consisting of independent load cells under each foot. Weight was recorded when all four feet were on a rubber surface, and when three feet were on the rubber and one was on concrete surface embedded with rocks (uncomfortable surface). On average, cows kept 54.7% of their weight on the fore limbs and 45.3% on the hind limbs. Cows placed on average (\pm S.E.) 32.38 (\pm 5.52) kg less weight on the right hind limb when it was on the rock surface compared to the rubber ($t_{10} = -5.86$, $P < 0.0002$). Most of the weight was redistributed onto the left hind limb (27.77 ± 4.70 kg, $t_{10} = 5.91$, $P < 0.0001$) and there were no significant changes for either of the fore limbs. When the rock surface was placed on the right fore unit, cows decreased the mass applied to both the right fore and left hind limbs (-48.02 ± 6.29 kg, $t_{10} = -7.64$, $P < 0.0001$ and -10.33 ± 4.50 kg, $t_{10} = -2.30$, $P < 0.05$ respectively), and increased weight on the left fore and right hind limbs (43.61 ± 23.82 kg, $t_{10} = 6.07$, $P < 0.0001$ and 12.92 ± 17.84 kg, $t_{10} = 2.40$, $P < 0.05$). This study demonstrates that dairy cows can alter their stance to accommodate discomfort, indicating that this technique may be useful in the early detection of painful injuries causing lameness.

HOOF PATHOLOGIES AND GAIT CHARACTERISTICS IN DAIRY CATTLE

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The high incidence of hoof pathologies in dairy cattle is a welfare concern, but little is known about their impact on cow gait. A novel approach is the use of computer-aided techniques to study dairy cow gait kinematics and hoof pathologies. The aims of this study were to a) provide a gait profile of dairy cows with no visible injuries, and b) investigate whether animals alter their gait profile in response to different hoof pathologies.

We filmed 46 Holstein dairy cows (parity 2-7) walking along a concrete alley with reflective markers attached to each hoof. Video recordings were digitised using motion analysis software with a 1mm marker error resolution. Six stride variables were calculated for each hoof; stride length and height, stride duration, stance and swing duration and speed. Cows were divided into three groups based on clinical hoof data (healthy, n=17, sole lesions, n=20 and digital dermatitis, n=9). A general linear model run with contrast statements found differences between healthy animals and those with hoof pathologies. For example, healthy animals walked faster and had shorter stride durations than those with sole lesions (mean \pm s.e.m.) ($1.12\text{m/s} \pm 0.02$ vs $1.03\text{m/s} \pm 0.02$, $P=0.001$ and $1.26\text{s} \pm 0.04$ vs $1.36\text{s} \pm 0.03$, $P=0.04$ respectively). Healthy animals also had longer swing durations (time that hooves were not in ground contact) than those with digital dermatitis ($0.57\text{s} \pm 0.01$ vs $0.53\text{s} \pm 0.01$, $P=0.05$). Stride height was not influenced by hoof pathology.

This use of kinematic techniques has provided the first accurate gait profile of dairy cow gait, quantifying both healthy cow gait and the gait of animals with hoof pathologies. This technique was also able to discriminate between animals with and without hoof pathologies, and is a promising approach to understanding how hoof pathologies affect dairy cow gait.

EFFECT OF OUTDOOR EXERCISE ON THE INCIDENCE OF HOCK LESIONS IN TIED DAIRY COWS

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Injuries around the tarsal joint are common in dairy cows, and are generally more often seen in tie stalls than in free housing. The aim of the present study was to investigate the influence of the frequency (number of days per month) and duration (hours per month) of outdoor exercise on the incidence of hock lesions in tied cows. Over a one-year period, cows on 66 Swiss dairy farms with tie stalls (equipped with rubber mats and bedding) were examined every two months (six times in total) for the occurrence and severity of hock lesions (hairless patches, scabs and open wounds, swellings). In addition, general farm characteristics (cow breed, milk yield, length of the stalls, type and amount of bedding material) were recorded. For statistical analyses we used a linear mixed-effects model allowing for the nested random effect of the farm.

The amount of outdoor exercise varied between farms and over the year (duration: May/June median=112 h (range 0-336), November/December median=7 h (range 0-72); frequency: May/June median=28 days (range 0-28), November/December median=7 days (range 0-28)). The incidence of scabs and wounds was negatively and positively associated with the duration ($F_{1,323}=26.716, P<0.0001$) and frequency ($F_{1,323}=14.186, P=0.0002$), respectively, of outdoor exercise and was also significantly affected by time of the year (highest rates March/April, lowest rates September/October; $F_{5,323}=31.093, P<0.0001$), the length of the stalls (range 160-225 cm; $F_{1,61}=7.727, P=0.0072$) and the type of bedding (straw with lower rates than chopped straw, sawdust or combinations; $F_{3,61}=3.393, P=0.0235$). Analyses of the other types of lesions (hairless patches, swellings) lead to very similar statistical models.

In conclusion, the results show that the incidence of hock lesions in dairy cows housed in tie stalls can be reduced by outdoor exercise. In particular, sufficient duration of each exercise period seems to be important, whereas increasing the frequency alone is not beneficial.

FACTORS AFFECTING GAIT SCORES OF FATTENING PIGS

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Factors that affect gait scores of fattening pigs were investigated by analysing a data of 19 growth performance experiments carried out at MTT with a total of 2045 pigs. The locomotor ability of pigs was scored in the average body weight of 105 kg (s.d. 7) using a scale of 1 to 5 (1 = poor and 5 = excellent gait). The smaller one of fore and rear leg gait scores was used as an overall gait score. The data of overall gait scores were analysed using the GENMOD procedure of SAS by fitting a cumulative logit function into the data.

Odds of poor gait scores (lameness) were 1.60 times higher in barrows than gilts. Odds of lameness decreased by 3.6% with 0.1 kg increase in birth weight. Arthritis in piglets increased odds of lameness 2.18 times when weaner diets contained no antimicrobials, but had no effect in the presence of them (P for interaction = 0.13).

The growth rate of growing-finishing pigs (612-1204 g/d) had no significant effect on the odds of lameness. *Ad libitum* feeding in the finishing period increased the risk for lameness compared to semi *ad libitum* (OR = 3.16) or restricted feeding (OR = 3.01), and this effect was greater in barrows than gilts. Odds of lameness increased by 6.9% with one percentage unit increase in carcass leanness, and decreased by 18.7% with 0.1 g increase in dietary digestible phosphorus content. Odds of lameness were 5.73 times higher for pigs housed alone or in pairs in pens of 2.5 m² than for those housed in groups of 3-4 in pens of 4.25 m².

INCIDENCE OF SOW LAMENESS IN TWO GESTATING HOUSING SYSTEMS

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In Australia, about 60% of sows spend part of their gestation in stalls. The lack of adequate exercise due to confinement in stalls has been suggested as a major cause of sow lameness. Lameness appears to be associated with pain, which may affect the welfare of the sows and thus, the incidence of lameness was studied in this experiment. Two groups of 18 crossbred sows (Landrace x Large White) were randomly selected each week at weaning and allocated to one of two gestation treatments, conventional stalls ("stalls") or large groups of 85 sows per pen, on deep litter ("ecoshed"). All sows had had previous experience in their housing treatment. Each of the 8 replicates (weeks) included sows returning from parity 1, 2 and 3 or more, in an equal proportion. Incidence of lameness was measured using a four-point locomotion score in which a score of 0 indicated a normal gait and a score of 3 indicated a lame animal that struggled to stand up and was unable to walk. Lameness was assessed at weeks 9 and 15 of gestation. The Chi square test was used to compare the proportion of sows scoring 2 or 3 that is those observed with the most severe lameness. The proportion of lame sows (score of 2 or 3) was lower in the ecoshed treatment (0% vs. 7% at week 9 for ecosheds and stalls, respectively; $\chi^2_1 = 9.333$, $P < 0.01$ and 0.8% vs. 13.8% at week 15 for ecosheds and stalls, respectively; $\chi^2_1 = 14.960$, $P < 0.001$,). The culling rates due to lameness were also lower in the ecosheds when compared to stalls (0.7% vs. 4.1%; $\chi^2_1 = 8.95$, $P < 0.01$). The contribution of the different factors in the ecoshed treatment to reduced lameness, such as the presence of bedding, increased exercise, etc. still remains to be determined.

THE EFFECT OF CO-MINGLING LITTERS ON PIGLETS' SOCIAL BEHAVIOR, PERFORMANCE AND BEHAVIORAL TESTS

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Previous research indicates that allowing litters to interact prior to weaning, improves piglets' ability to cope with weaning stress. Various behavioral tests have been developed to measure coping ability. The purpose of this study was to determine how social enrichment, achieved through co-mingling litters, impacted piglet growth and the results of behavioral tests before weaning. Thirty sows and their respective litters were housed in standard farrowing crates until piglets were 12 days old. At 13 days of age, the partition between two neighboring pens was removed for 20 litters allowing piglets to interact (n=10, 2 litters per group). The remaining litters served as controls (n = 10). All piglets were weighed and injury scored 2,4,9,12,15 and 18 days after birth. There were no differences in weight gained between treatments. Injury scores were higher for co-mingled litters (day 15, $P < 0.01$ Wilcoxon) but these differences disappeared by day 18. The social challenge, isolation and back tests, were performed before and after day 13. Three piglets from each litter, representing a range of weight gained between 2 and 4 days of age, were tested. Between the first and second time the social challenge was performed, co-mingled piglets increased the time spent in non-aggressive proximity to one another ($P < 0.001$ Wilcoxon) compared to control piglets. In the second social challenge, co-mingled piglets spent more time together ($P < 0.05$, Wilcoxon) and tended to be less aggressive ($P = 0.06$, Wilcoxon) than control piglets. Allowing litters to co-mingle before weaning did not affect growth and resulted in fewer aggressive interactions between piglets during the social challenge. However, the back test and the isolation test failed to detect treatment differences. Behavioral tests require additional critical investigation before being used to routinely assess coping abilities.

EFFECT OF ENVIRONMENTAL ENRICHMENT ON THE BEHAVIOUR OF SOWS HOUSED IN GROUPS WITH FREE-ACCESS STALLS

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The way in which sows in small static groups on slatted floors are to be provided with manipulable substrates under EU Directive 2001/93/EC requires further investigation. This study investigated the effect on sow behaviour of enriching such a system with racks of straw or ropes.

Eighty-four pregnant sows were used in a randomised block design experiment lasting 14 days with 7 replicates. Groups of 4 sows were assigned to one of 3 treatments: (1) BARREN - pen with slatted roaming area and four full-length stalls; (2) STRAW – same as (1) with racks of straw suspended over the trough in each stall; (3) ROPE – same as (1) with natural fibre ropes suspended in each stall. During 2hrs post-mixing, posture, behaviour and location of each sow were recorded every 5min and all instances of aggressive behaviour were recorded. Continuous recordings of behaviour were made by direct observation for 7 x 5min/sow on days 3, 8 and 11 post-mixing. Skin lesions were scored from 0 to 5 on days 0, 2, 7 and 13. Data were analysed by ANOVA and repeated measures ANOVA by methods of SAS.

At mixing BARREN sows stood for longer than sows in either of the enriched treatments ($P>0.05$). There were no other effects of treatment at mixing and the only effect of treatment during two subsequent weeks was on the nature of the exploration performed. BARREN sows spent longer exploring fixtures and fittings (BARREN: 19.0 ± 2.55 ; STRAW: 7.0 ± 1.41 ; ROPE: 8.6 ± 1.34 ; % time, $P<0.001$) while enriched sows explored the substrates (BARREN: 0; STRAW: 16.9 ± 3.16 ; ROPE: 17.2 ± 3.63 ; % time, $P<0.001$). Overall levels of exploration did not differ ($P>0.05$).

Enrichment influenced the nature of exploration but did not increase time spent in the behaviour. Neither form of enrichment influenced aggressive behaviour.

EFFECTS OF GROUP SIZE AND GROUP COMPOSITION ON BEHAVIOUR AND PERFORMANCE OF WEANER PIGS

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We investigated whether group size and group composition does affect behaviour and performance of weaner pigs. Five weeks old piglets were weaned and grouped into three trial groups with six replicates each (9s: nine piglets from one litter, 9m: three piglets each from three litters, 36m: nine piglets each from four litters) and housed under identical conditions for four weeks. On days 1, 2, 6, 13 and 27 frequencies of 16 behavioural parameters were recorded from videotapes selecting 180 minutes with high level of activity for each group and day. In small groups all animals, in group 36m 16 focus animals were observed consecutively and repeatedly for one minute (in total 180 minutes per group and day). Feed consumption and daily weight gain were calculated. By factor analysis these 16 behavioural parameters were aggregated to 5 parameter clusters ("fighting", "other agonistic", "play", "exploring piglet", "exploring pen").

Concerning the analysed behavioural parameters only few significant differences between groups were found. 9s piglets fought less on day 1, but explored the pen more frequently on day 27 compared to 9m and 36m piglets (Mann-Whitney-U-test: fighting $U_{6,6}=36$, $P=0.002$; $U_{6,6}=36$, $P=0.002$; exploring pen $U_{6,6}=34$, $P=0.009$; $U_{6,6}=36$, $P=0.002$). On day 13 "exploring piglet" occurred more often in group 36m than in other groups ($U_{6,6}=33.5$, $P=0.011$; $U_{6,6}=31$, $P=0.032$). Over the trial period mixed groups showed a decreasing trend in fighting (Page-test, $p<0.001$), but "other agonistic" behaviour increased (9m: $p<0.01$, 36m: $p<0.001$). 9s showed a constantly low level of fights. In all three groups "play" barely occurred on day 1, but increased over time. Groups did not differ significantly in feed consumption and daily weight gain.

These results corroborate that mixing piglets after weaning increases agonistic behaviour. The barely occurring play after weaning may indicate an adverse effect of the weaning process also in single litter groups.

IS REPEATED REGROUPING STRESSFUL FOR HEIFERS?**S. Raussi^{1*}, A. Boissy², S. Andanson², J. Kaihilahti³, P. Pradel²,
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This study analyses the consequences of repeated regrouping on behaviour, stress physiology and production in dairy heifers. Thirty-two Holstein heifers were housed by pair. Half were subjected to 16 pen relocations with a new partner each time (regrouped heifers), while the other half remained in the same pens (controls). Regroupings were performed from the age of 11 months twice a week for five weeks, then once a week for the next six weeks. The heifers were observed in standardised behavioural tests comprising sudden (opening of an umbrella), novel (an unfamiliar arena) or predator related (dog) stimuli. All behavioural tests were repeated for three sessions. The heifers were subjected to CRF and Dexa/ACTH challenges. Production and reproduction parameters were taken. Continuous data were analysed with ANOVA, with the group or the animal as a random factor; proportions were compared with χ^2 .

The regrouped heifers reacted less to the umbrella ($\chi^2 = 8.23$, $P < 0.05$), ate more quickly and/or for longer in all tests (e.g. latency to eat in the arena: $F = 10.8$, $P < 0.01$), tended to move less in the presence of the dog (time spent immobile: $F = 3.05$, $P < 0.10$) and tended to look at the dog less often ($F = 3.63$, $P < 0.10$). Changes from one session to the next were more rapid in the regrouped heifers (number of eating bouts: F (session x treatment) = 4.23, $P < 0.05$). The regrouped heifers had lower cortisol responses to CRF. No differences were observed in weight gain or in reproduction.

In conclusion, repeatedly regrouped heifers seem less stressed than those who stay with the same unique partner. However, this does not affect their production. Heifers repeatedly regrouped are likely to be less disturbed by unusual situations and to habituate to them more quickly.

ABSTRACTS OF POSTERS

MILK-FEEDING BEHAVIOURS OF GROUP-HOUSED CALVES WITH A WALK-THROUGH AUTOMATIC FEEDING STATION

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A problem encountered with conventional automatic milk-feeding stations for calves is that calves that have finished drinking and are trying to leave the station may block, other calves trying to enter. We improved the conventional milk-feeding station so that calves that have finished drinking can leave by walking through a chute from the side of the feeding station connected to the home pen.

Behaviours of calves fed using conventional milk-feeding stations were compared with those fed using the improved station. Calves were kept in two group pens (55-60 animals each) with either two conventional milk-feeding stations or one improved station. Every calf was fed 4.0 L of milk per day in four feeding periods daily (4× 1.0 L). Numbers of unrewarded calves during 01:30-08:30 h (time when farmers do not take care of calves, one of the feeding periods) at all days until weaning was collected automatically using a computer connected to the feeder. Duration of rewarded (milk intake, 1.0 L) and unrewarded visits to stations (including time spent in the chute) of 5 calves in each group were observed by VTR for 24 h at 2- to 8-weeks-old (once per week).

Number of unrewarded calves during 01:30-08:30 h did not differ significantly between the two groups (Wilcoxon test, $P>0.05$). Duration of rewarded visits was significantly shorter with the improved station at each of 5- to 8-weeks-old (U-test, $P<0.05$). Duration of unrewarded visits to the station was significantly shorter in calves with the improved station at 5- to 7-weeks-old, respectively (U-test, $P<0.05$). Number of visits to the station per day did not differ significantly between groups at 2-5, 7, or 8 weeks (U-test, $P>0.05$). One improved station can feed the same number of calves as two conventional stations, due to reductions in total duration of occupancy with the improved station.

WATER INTAKE AND DRINKING BEHAVIOUR OF DAIRY COWS OFFERED GRASS SILAGE

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In this study the drinking behaviour of loose-housed lactating dairy cows (Ay) during 1-20 weeks postpartum was investigated. Water and feed intake and milk production were recorded individually from 41 (29 multiparous and 12 primiparous) cows during the indoor season 1999-2000. Time and duration of the individual visits to the drinking bowls (capacity 30 l) were monitored by computer-controlled gates (RIC-access gates, Insentec) and the weight of water consumed was measured immediately after each visit. Grass silage (mean dry matter (DM) content 32.6 %) was fed *ad libitum* and concentrates were fed at two levels (9 kg/day for multiparous and 8 for primiparous (L) vs. 14 kg/d and 11.5 (H), respectively). The results were analysed statistically with SAS using GLM procedure with concentrate level and parity in the model.

The average drinking water intake was 71.5 kg/d and time spent drinking 9.0 min/d. The cows visited water bowl 10.4 times per day taking 7.8 kg water per one visit. Drinking speed was 9.4 kg/min. The average milk production was 26.8 kg/d, total DM intake 20.0 kg/d and silage DM intake 10.9 kg/d. The increase in the amount of concentrates from L to H increased significantly water consumption (66.4 vs. 69.9 kg/d), time spent drinking (8.6 vs. 9.7 min/d) and number of visits (10.4 vs. 10.7 times/d) but did not affect the average amount of water consumed per visit. Total water intake (water drunken plus water from silage, mean 93.9 kg/d) was not affected by concentrate level. The average total and drunken water intake was 4.8 and 3.7 kg/kg DM intake and 3.5 and 2.7 kg/kg milk produced. Multiparous cows drank more water than primiparous (76.7 vs. 59.6 kg/d), in shorter time (8.7 vs. 9.6 min/d), had fewer visits (9.9 vs. 11.3) and consumed more water per visit (8.8 vs. 5.9).

CAN SHEEP OPTIMISE THEIR ROUTE TO FOOD?

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Previous research has shown that sheep can learn the location of food patches. In this study we tested whether sheep can optimise their route to food patches. The experimental area (50m x 50m) consisted of 100 bowls at 4m grid spacings, with 10 of these filled with 100g of ewe nuts. The position of these full bowls was determined using an in-house designed program such that the optimum (shortest) routes to find 2 or 3 or 9 full bowls were different within a given layout. Six non-lactating, Suffolk x Mule ewes were used. Each sheep was offered the same unique layout of full bowls on each of 15 days. All sheep were accustomed to the arena with a random bowl layout for four days prior to the start of the experiment. The order in which the sheep were tested was randomised on each day of the experiment. Each sheep spent 20 minutes within the test area and every bowl visit (full or empty) the animal made within that time was recorded. Graphs of the distance walked before finding n bowls ($n = 2 \dots 7$) against day of test showed an exponential decline of distance with time, demonstrating that the animals were learning. We calculated the difference between the asymptote from the fitted exponential regressions and the optimal distance to n bowls and compared this to 0 using a t-test. For 2...7 bowls respectively these were: 3.02m, $P=0.389$; 8.10m, $P=0.274$; 10.74m, $P=0.346$; 13.69m, $P=0.313$; 14.01m, $P=0.375$; 17.49m, $P=0.433$. Although none of the asymptotic values differed significantly from the optima, it appears that the animals were close to choosing the optimal route to 2 bowls but had not learned to optimise the route to a larger number of bowls, at least within the 15 day duration of this experiment.

FEED LEVEL CONTROLLED MASH FEEDER VERSUS CONVENTIONAL TUBE MASH FEEDER: WHICH FEEDER DO PIGLETS PREFER?

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The aim of the study was to investigate the influences of a feed level controlled mash feeder (FLCMF) on eating behaviour and growth of piglets. The FLCMF is intended to mitigate weaning problems.

A force-ventilated compartment with two identical pens, equipped with one conventional tube mash feeder (TMF) each (25 piglets/pen) was used. Six rearing periods of five weeks each were analysed. All piglets were weaned at the age of 21 days and fed with the same food. In one of these pens (reference group - RG) the TMF was used exclusively. In the other pen both the TMF and the FLCMF were installed. During the first three rearing periods in this pen the FLCMF served as the exclusive feeding system (EXP1) in the first two weeks of rearing. In the next three rearing periods the FLCMF as well as TMF were activated (EXP2) in the first two weeks of rearing. From the third week piglets in EXP1 and EXP2 were fed with the TMF.

In the assessment, the number of eating animals and the number of those who wanted to eat but did not reach the trough were recorded in a two minutes interval. Behaviour of focus piglets was observed continuously in EXP2. Additionally, rearing performance was registered. The variance-analytical evaluation was carried out using the statistic program SAS.

Concerning the average number of piglets at the trough no significant differences could be detected between RG, EXP1 and EXP2. In comparison to the RG, significantly more piglets in EXP1 and EXP2 attempted to get some food but were not able to eat because of occupied feeding places. In EXP2 the majority of the piglets preferred to eat at the FLCMF. On average, piglets visited the FLCMF 79.62 minutes/day and the TMF 9.83 minutes/day during the first 14 days of rearing. After two and five weeks of rearing, piglets fed with the FLCMF showed significantly higher weight gains compared to the RG.

Compared to the TMF piglets preferred to eat at the FLCMF and gained significantly more weight.

EFFECT OF BUTYRIC ACID SUPPLEMENTATION ON POSTWEANING BEHAVIOUR IN PIGLETS

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Weaning in piglets is stressful because of the mother's departure, changes in rearing and social environments and sudden modification in food composition and presentation. Some private food companies are claiming that adding butyric acid to the diet facilitates food transition between a milk diet and a solid diet. We investigated therefore the consequences of adding butyric acid to the mother and/or to the piglet diets on litter behaviour.

Thirty-two litters reared in commercial conditions were divided into four groups of eight. From four weeks before delivering to the end of suckling at day 21, 16 sows were fed a supplemented butyric acid diet (Butyric mother group: B1) and 16 sows were fed a standard diet (Control mother group: C1). From the starting period to the end of the post-weaning period, each litter was fed either a supplemented butyric acid diet (Butyric piglet group: B2) or a standard diet (Control piglet group: C2). Piglet behaviour (time spent suckling, feeding, drinking, lying and standing, number of sniffing and nibbling environment) was studied at the three following periods : suckling (day 17), one day post-weaning (day 22) and one day after entrance in post-weaning room (day 36). Data were analysed using non parametric tests.

Time budget did not differ significantly between groups at days 17 and 22. At day 36, B1 litters spent significantly less time standing ($14 \pm 3\%$ vs. $23 \pm 5\%$), sniffed less at the floor (5.5 ± 0.7 vs. 7.8 ± 0.6 events) and nibbled less materials (2.3 ± 0.4 vs. 3.3 ± 0.3 events) than C1 litters, independently of the piglet group. Litters coming from the sows supplemented with butyric acid showed less mobile and foraging activities the day after removing, suggesting that butyric acid can help to reduce stress in changing conditions.

A COMPLEX FEEDING SYSTEM AIMED TO INDUCE SUCCESSFUL BEHAVIOURAL COPING

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Excitement and adaptive reactions of an individual going along with fulfilled expectations of a physical and/or mental positive feeling can be stated as a positive stress (eustress), which is the opposite of a negative stress (distress) characterized by the loss of control. The positive effects of stress such as improved immunity and reduced boredom could be exploited in farm animal production systems in order to increase welfare and health. Therefore, the physical and psychological reactions of pigs to a controllable and predictable challenge was investigated. Our objective was to develop a system that elicits successful coping in a complex task in the context of feeding.

Sixteen pigs (German landrace) were divided up in two groups (N=8) of which the test group was exposed to an automated training and feeding procedure using four "call-feeding-stations" (CFS) while the control group was fed conventionally. The complete experiment lasted 14 weeks. In a three step training the animals learned to operate the CFS for a reward. In the first phase the animals learned to associate an individual tone to reward. Next, they learned to enter the CFS that was calling with the individual tone. In the third phase they had to push a switch at a fixed ratio (FR), in addition. The three phases were accomplished within 3, 13 and 12 days respectively. The latency between a summon and the reward decreased significantly in the first days of a new task ($P < 0.01$) but was not influenced by the FR. Weight gain was not significantly higher for the test group ($P = 0.3$, not significant).

The results obtained from application of our method of inducing positive stress (eustress) by CFSs showed that pigs could successfully cope with demanding situations.

A PRELIMINARY STUDY TO INVESTIGATE THE EFFECT OF DIET ON THE BEHAVIOUR OF WEANLING HORSES

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This study investigated the effect of diet on the feeding behaviour of weanlings during a preference test.

Twenty Thoroughbred foals were given *ad libitum* access to pasture and their dam's pasture supplement (DPS). Dams were fed either a starch and sugar rich supplement (SSS) or a fat and fibre based supplement (FFS) prior to parturition and during lactation. Foals/weanlings were maintained on their DPS. Preference tests, of ten-minute duration, were conducted after weaning at six months of age. During testing a familiar weanling was always present. Approximately 2kg of each diet was offered: DPS, DPS plus water, low fibre pellets, whole oats, sweet feed, and soaked sugar beet pulp.

The amount eaten was recorded (kg). Behaviour was categorised based on locomotory patterns, interaction with the food provided and vocalisation as either (1) concerned in the test environment with little interaction with food or (2) relaxed in the test environment with interaction with food. Intake data was analysed using MINITAB v13.1. When assumptions with the data were not met a log transformation was used.

A comparison of the total amount eaten of all six feeds' showed the weanlings with access to the FFS ate more than the SSS weanlings (t test, $t=-2.11843$; $p=0.05$). Eight out of the ten FFS weanlings also appeared to be more relaxed in the test environment in contrast to four out of the ten for the SSS weanlings (Fishers Exact Test, $p=0.08$). When presented with the six different feeds the weanlings chose to ingest more of their DPS and DPS plus water (ANOVA, $F=3.53$; $p=0.016$).

Feeding a FFS can help improve foal health (Hoffman, Kronfeld, Herbein, Swecker, Cooper and Harris, J. Nutr. 128:2708S, 1998). Although only a preliminary study, these results highlight the benefits of feeding a FFS on the overall behaviour of weanlings.

SEXUAL AND AGGRESSIVE BEHAVIOUR IN BROILER BREEDER MALES: RELATION TO MORPHOLOGICAL AND PHYSIOLOGICAL TRAITS

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Genetic selection for faster and more efficient production of meat type chickens has been accompanied by reduced reproductive performance. Broiler breeder males have difficulties with completing matings and transferring semen. Whether this is due to their size, body conformation, musculo-skeletal disorders, leg problems, or a combination of these factors, is unclear. To contribute to the understanding of the reproductive performance in broiler breeder males the relationship between sexual and aggressive behaviour and some morphological and physiological traits has been studied.

We obtained 18 broiler breeder males and 36 females (Ross 308) from a commercial breeder farm at 28 weeks of age. The birds were randomly divided into groups of 3 males and 6 females and housed in six deep litter pens. The birds were feed-restricted and kept on 16h photoperiod.

Sexual behaviour was observed for 2 weeks between 16:00 and 19:00. Each pen was observed each day by three independent observers for 25 min. Aggressive behaviour was recorded for 30 minutes during the third week immediately after feeding. Plasma testosterone, body weight and morphometric traits (tarsus length and diameter, wattles and comb area) were measured.

Body weight and all morphometric traits correlated positively with each other. To our surprise all morphometric traits correlated negatively with mounting frequency and the tarsus length correlated negatively with the sum of sexual behaviours. Testosterone did not correlate with any behavioural or morphometric traits. Sexual behaviour correlated positively with aggressive behaviour.

Our results indicate that more aggressive males perform more sexual behaviour, independent of their plasma testosterone levels, body weight and morphometric traits.

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GENETIC AND ENVIRONMENTAL FACTORS RELATED TO THE CALF VIGOR AND MATERNAL HABILITY OF NELORE CATTLE**M.J.R. Paranhos da Costa^{1,2,*}, A. Schmidek², L.G. de Albuquerque¹,
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The fail or delay in the colostrum ingestion by cattle calves increases the risk of death. The success of beef calves in getting colostrum just after birth is dependent of their own and their mothers' behaviour. The variability of maternal and neonatal behaviour of Nelore cattle was evaluated. The behaviour of each mother-offspring pair was recorded by direct observations with instantaneous sampling (with 5 min. sample interval), from birth to the first suckle or until five hours after birth. The following variables were considered: for cows: time in contact with the calf (TCC), time avoiding suckling (TAS), and for calves: latency to stand up (LP), latency to suckle (LM) and time between stand up and suckle (TSS). Data from 256 mother-offspring pairs were considered. The statistical analyses were done applying least squares method. The heritability estimates were obtained trough restricted maximum likelihood using MTDFREML software package. There was a complex scene of environmental effects. The calving time significantly affected LP; the calves which were born early in the morning (from 0600 to 0900h) presented higher LP. The parity number (primiparous and multiparous cows) affected LM, TSS and TA significantly; with the primiparous having higher means than the multiparous ones. As a covariable, TCC influenced LP ($LP=78.80 - 0.457TCC$, $P<0.01$), LM ($LM= 134.97-0.895TCC$, $P<0.01$) and TSS ($TSS= 53.33 - 0.3864TCC$, $P<0.01$), with these variables decreasing when the cows spent more time in contact with their calves. As dependent variable TCC was influenced by the covariable latency to try to stand up (LTS), indicating a decrease in TCC when LTS increases ($TCC= 71.462 - 0.188LTS$, $P<0.01$). Although, heritability estimates standard errors were high, the estimates were moderate, specifically for TCC and LM, suggesting some genetic variability on these behavioural traits.

RESPONSE OF DAIRY CALVES TO THE EARLY SEPARATION FROM THEIR MOTHERS: EFFECTS OF CALVES' AGE AND VISUAL/AUDITORY CONTACT

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The aim of this study was to evaluate how the behavioural response of dairy calves to the early separation is affected by two factors: age at separation and post-separation visual/auditory contact between mother and calf.

We observed 46 dairy calves divided into 6 treatments according to the calf's age at separation (1, 4 and 7 days) and contact or no contact after separation. After separation, the calves were kept in individual pens. The mothers of calves from contact treatment were housed in individual pens near to their calf's pen for 48 hours after separation. The behaviour of calves was video taped 24 hours after separation. At 3 weeks of age, the calves were moved to a group pen with three unfamiliar calves, and their behaviour was recorded between 0-2 and 24-26 hours after grouping. The differences between treatments were tested with the GLM and Mixed procedures of SAS.

The calves separated at older ages spent more time standing ($p < 0.0001$), they placed their heads out of a pen more frequently ($p < 0.01$) and they sniffed the walls and bedding more often ($p < 0.01$), than calves separated at a younger age. Furthermore the calves from the contact treatments placed their heads out of the pen more ($p < 0.05$) than the calves housed without any contact. At 3 weeks of age the calves separated at 4 days were much more involved in social play than the calves separated at 1 and 7 days ($p < 0.05$) and calves from no contact treatments showed higher frequency of social play than the calves from contact treatments ($p < 0.05$).

We conclude that behavioural responses of calves to the separation from their mothers increase with calves' age at separation and when the calves can see and hear their mothers. There is also long-term effect of age at separation and post separation contact with mother on calves' later social behaviour.

EFFECT OF RESTRICTED SUCKLING ON SOME PHYSIOLOGICAL AND BEHAVIOURAL STRESS MEASURES IN DUAL PURPOSE CATTLE

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This study evaluated the effects of restricted suckling (RS) vs artificial rearing (AR) on some physiological and behavioural stress measures.

Fifteen Holstein-Zebu cows with their calves were used in each treatment. All calves were tethered in front of the cows to stimulate milk let down. Calves in the RS treatment were allowed to suckle for 30 min after milking and 30 min in the afternoon, while calves in the AR treatment were fed milk by a person using nipple bottles at the same time. Data were collected from day four to day nine after calving. Body weight of calves was recorded before and after morning feeding to estimate milk consumption. Respirations and heart rate were measured by the same person using a stethoscope. Blood samples and rectal temperature were taken from cows and calves while number of steps was recorded only for calves.

Difference between treatments in weight gain, milk intake, serum cortisol concentration and body temperature was analyzed with a t-test. The number of steps, respirations and heart rate were analyzed by the Wilcoxon-Mann-Whitney test.

AR induced significant increases in cortisol concentration (44.3 ± 12.8 vs 12.2 ± 9.4 ng/ml; $P=0.01$) and heart rate (16.4 ± 6.7 vs 7.9 ± 5.5 beats/min; $P=0.04$) in calves, compared to the RS treatment. No difference was found in weight gain, milk consumption or number of steps counted between AR and RS calves.

In cows, serum cortisol concentration and heart rate increased more in AR treatment than in RS (5.6 ± 2.8 vs 0.6 ± 2.2 ng/ml, $P=0.09$; 9.2 ± 2.5 vs 3.5 ± 1.7 beats/min, $P=0.05$). No difference was found between treatments in body temperature and respiration rate for cows and calves.

We conclude that cortisol and heart rate increased in cows and calves in the AR system. This study supports the hypothesis that RS induce fewer signs of stress than the AR system for cows and calves, and this might improve animal welfare.

MATERNAL INFANTICIDE IS MORE COMMON IN FARMED SILVER FOXES (*VULPES VULPES*) THAN BLUE FOXES (*ALOPEX LAGOPUS*)

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Maternal infanticide can be regarded as a serious animal welfare problem. We compared the frequency of infanticidal behaviour in farmed blue and silver fox vixens. The data are based on careful inspection (carried out three times a day) of the vixens' nest boxes and cubs from the periparturient period to weaning. There were altogether 6394 blue and 154 silver fox vixens with normal parturition in the study.

Maternal infanticide, defined as the vixen killing one or more of its cubs, was more frequent ($p < 0.001$, Chi-square test) in the silver (7.1% of vixens) than blue (0.8%) foxes. In both species the primiparous vixens were more ($p < 0.001$) prone to kill their cubs than the multiparous vixens: 9.4% (5/53) vs. 5.9% (6/101) in the silver and 1.2% (32/2618) vs. 0.6% (23/3776) in the blue foxes. Almost all infanticidal blue foxes (96.8%) but only slightly more than half of the infanticidal silver foxes (54.6%) committed infanticide during the first week after the parturition ($p < 0.001$). In the primiparous blue foxes infanticidal behaviour was typically observed on the day of birth (70.6% of cases), whereas in the multiparous vixens the killings took place later (35.7% of cases on the day of birth, $p < 0.001$). Such difference was not seen ($p > 0.1$) in the silver fox, 18.1% of primiparous and 9.1% of multiparous vixens killing their cubs on the day of birth. Infanticidal behaviour did not depend ($p > 0.1$) on the date of the parturition (silver: $r = -0.21$; blue: $r = -0.09$; Pearson correlation). Infanticide tended to be more ($p < 0.1$) frequent in vixens with smaller than larger litter size (silver: $r = -0.50$; blue: $r = -0.37$).

The frequency as well as the time pattern (in relation to the parturition) of maternal infanticide differed markedly between silver and blue foxes. Therefore, extrapolating results from one species to the other should be avoided.

EFFECT OF SURGICAL CASTRATION ON THE WELFARE OF 5-DAY-OLD PIGLETS

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Castration of piglets causes pain and may have long-term negative consequences for piglet welfare. The objective of this experiment was to study the effect of castration on the welfare of piglets.

Four male piglets were selected at birth from the litters of 10 multiparous sows and normal management procedures were applied to the animals (ear notching, teeth clipping and tail docking). At 5-days-of-age, piglets from each litter were randomly assigned to one of two treatments, where piglets were surgically castrated or left intact. The behaviour of animals from both groups was assessed over 2.5 hours by instantaneous scan sampling every three minutes on the day of castration and on three consecutive days thereafter. Blood samples were taken before (0h) and 12, 24, 48 and 72h after castration. Plasma samples were analysed for concentrations of cortisol and C-reactive protein (CRP). Behavioural data were analysed by repeated measures ANOVA by methods of SAS. ANOVA was also used for the statistical analysis of physiological data.

Intact males spent more time dog-sitting during the first 2.5h following castration ($p_v=0.011$), a tendency that was also evident throughout the experiment ($p_v=0.050$). Castrates also displayed more pain-related behaviours [huddling up, spasms, trembling] during the first 2.5 hours ($p_v=0.010$) and throughout the experiment ($p_v=0.005$). Castrates avoided contact with the sow and their littermates ($p_v=0.048$). No treatment effect was found in plasma concentrations of CRP or cortisol. However, concentrations of CRP varied throughout the experiment ($p_v=0.006$), the highest and lowest levels being at 0 and 48h respectively.

Castration causes an increase in pain-related behaviours and the avoidance of postures that are likely to aggravate pain. The lack of a treatment effect and the higher levels of CRP observed before castration indicate that inflammation and tissue injury were caused by other procedures, such as tail docking.

BEHAVIOUR OF PREGNANT SOWS KEPT IN TWO DIFFERENT GROUP HOUSING SYSTEMS

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Aggression between animals is one of the major welfare problems in group-housed pregnant sows. Two of the most commonly used group-housing systems for pregnant sows are electronic feeding systems (EF) and slow feeding systems (SF), where food is slowly released so that sows have to spend a considerable amount of time at the feeder.

The aim of this study was to compare the behaviour of sows in the EF and the SF systems.

Sixty pregnant LW x LD (153-288 kg) sows, from first to eighth parity, were housed during 11 weeks (from the 5th gestation week through parturition) in three different housing systems (twenty sows each): conventional individual stalls (IS), SF and EF. Animals were observed using scan sampling (10 min intervals) during 4 hours/day during 12 non-consecutive days. An average of 28 recordings per animal were taken. Activity (standing, sitting or lying), sham-chewing, bar-biting and drinking activity were registered. Observations were made between January and March (winter conditions). Data were analysed by using one-way ANOVA.

IS and SF sows spent more time standing than EF sows (45% vs 27%, $p=0.001$). When only the afternoon observations were considered, no differences appeared between groups. IS sows spent more time performing sham chewing than SF and EF sows (58% vs 32%, $p=0.001$). SF sows spent more time displaying drinking activities than IS and EF sows (9% vs 3%, $p=0.001$). IS sows spent more time showing bar biting than SF sows (12.0% vs 7.5%, $p=0.03$).

Overall, behavioural data show that the EF system appears to offer more opportunities to display normal behaviours compared with SF or IS. SF and EF systems appeared to reduce abnormal behaviours such as sham chewing compared with IS. However, these data should be further discussed once physiological and productive parameters are also taken into account.

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**WELFARE IMPLICATIONS OF A NOVEL DEVICE FOR
THE COLLECTION OF PREGNANT MARE URINE****E.C. Jongman, P.H. Hemsworth**

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This study examined the welfare risks to mares of collecting pregnant mare urine (PMU) using a novel collection procedure developed in Australia. This procedure allows mares to be loose housed either in stables or outdoors in paddocks, rather than in tether stalls as is common in Canada and the USA. The study involved 24 pregnant mares at 3 to 5 months of gestation, allocated to two treatments (PMU collection device and a control treatment) over a 6-week period and data was analysed by analysis of variance.

Mares wearing the PMU collection device showed little or no behavioural change relative to the control mares. Brief bouts of forward lifting of the hind leg in the region of the PMU collection device during the first day were the only significant ($P < 0.05$) changes in behaviour observed. There were no significant effects ($P > 0.05$) on heart rate (40.7 beats/minute for control mares vs 38.8 beats/minute for PMU mares, $SED = 1.29$) or salivary cortisol (8.2 nmol/l for control mares vs 6.2 nmol/l for PMU mares, $SED = 0.11$). Observations on the time budgets of behaviour in weeks 3 and 6 indicated similar patterns of behaviour in the two treatments. The only difference in behaviour was in lying behaviour. PMU collection mares spent less time lying (0.5% of observed time vs 2.8%, $P < 0.01$, $SED = 0.63$) during the night. It is unclear what implication this may have on horse welfare since there was no evidence of a rebound in this behaviour when the device was removed during the day. Limited measurements of salivary cortisol concentrations at week 6 of the study provided no evidence ($P > 0.05$) of an increase in basal cortisol concentrations (5.9 nmol/l for both groups, $SED = 0.59$) or an increase in the sensitivity of the adrenal cortex to ACTH in the PMU collection mares (cortisol concentration of 35.6 nmol/l vs 34.9 nmol/l for the control mares, $SED = 2.58$).

Therefore it is concluded that wearing the PMU collection device under the conditions tested during the study does not pose a serious challenge to the welfare of pregnant mares and the device may provide an alternative for collection procedures currently in use.

AGE AND GENDER DIFFERENCES IN ORLOV FOAL BEHAVIOUR

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We studied age and foal gender differences of daily rhythm and repertoire of 10 couples of mares and foals in age 15 to 27 weeks. All animals were Orlov's trotters. The animals under observation free grazed in a pen (1 ha) between 7.00hrs to 18.00hrs. We calculated average durations and frequencies of behavioral states, and relative diurnal variations in behavioural states. The significant differences between mares and foals were found in frequencies of comfort behavior (5 times per hour for foals and 0.5 time per hour for mares), in average durations of grazing bouts, looking around and rests upright. In all cases the bouts of behavioral states were shorter (in average) in the foals than in the mares. The colts had significantly longer periods between sucking (4120 sec., n=90) than the fillies (3032 sec., n=102) ($p<0.05$). The fillies more often started moving than the colts, their moving bouts (in average) were longer (541sec., n=1013) than of the colts (340 sec., n=655), ($p<0.05$). The colts played longer (25 sec. bouts in average, n=70) than the fillies (16 sec. in average, n=30), ($p<0.05$). Only the colts demonstrated flehmen, marking by urine their mother dung and urine. During the socialization period (from 3.5 to 7 months) pasturing duration became longer (from 48 to 71% of day time), but duration of rest became shorter (lying from 8 to 0.2%, rest upright from 22 to 7%). Also, duration of sucking took only 3%, and interval between sucking increased, in average, for 20 min. Duration of looking around diminished from 26 sec. to 8 sec. In the period of socialization rhythm of the foal's activities has become similar with the mare's rhythm.

EFFECTS OF GRAZING ON THE BEHAVIOUR AND WELFARE OF DAIRY BULL CALVES

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Though unusual in Finland, grazing dairy bull calves destined for beef production could be justified by increased behavioural freedom and improved animal welfare. We compared the behaviour of calves at pasture and in loose-housing to assess whether grazing had any effect on the welfare of the animals.

Twenty-seven dairy bull calves (born February-March) were assigned to three groups of 8-10 animals. Two groups were moved to two pastures (500m²/animal) and fed either 1.0kg (Pasture1) or 2.5kg (Pasture2) barley/animal/day. One group (Pen) was loose-housed in an uninsulated building with an access to an outdoor enclosure (total 7.2m²/animal) and fed silage *ad libitum* and 2.5kg barley/animal/day. All groups were observed for 21.6h in both June and July (instantaneous sampling method, 10-min sampling interval).

The behavioural data was categorized into 'feeding', 'ruminating', 'resting' (without ruminating) and 'other activity'. The distribution of these behaviours was 24.1±0.5, 31.4±0.8, 25.3±0.8 and 19.2±0.7% (mean±SE) of the observations, respectively. Month did not affect the distribution of behaviours ($p>0.05$), whereas group did (Pasture1: 29.0±0.9, 30.0±1.5, 25.1±1.4, 15.8±1.3, Pasture2: 24.4±0.8, 30.5±1.3, 22.4±1.2, 22.7±1.1, Pen: 19.0±0.8, 33.7±1.4, 28.3±1.3, 19.1±1.2% of the observations, $p<0.001$, GLM). The incidence of behaviours considered abnormal was very low, and did not differ between the groups ($p>0.1$, Kruskal-Wallis). Cross-sucking and manipulating objects constituted 0.1±0.06 and 1.0±0.16% of the observations (all groups, both months pooled), respectively. Stereotyped behaviour was absent in all groups. Aggressive butting was more frequent ($p<0.05$) in Pen group (0.3±0.1% of the observations) than in Pasture1 (0.0±0.0%) and Pasture2 (0.1±0.1%) groups.

Based on the behavioural measures, the welfare of the calves did not markedly differ at pasture and in loose-housing with these space allowances. Differences in the distribution of general behaviours between the groups may have partially resulted from the different feeding regimes. It should also be noted that group and treatment effects are inevitably

164 confounded.

DIURNAL AND SEASONAL RHYTHMS OF SELECTED BEHAVIOUR IN ARABIAN HORSES KEPT ON PASTURE THROUGHOUT THE YEAR

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The aim of this study was to determine factors that influence foraging and resting behaviour in Arabian horses which are kept under natural conditions on pasture. Over one year, changes in behaviour in ten horses have been recorded. 24-hour continuous observations were carried out for 36 days of the year. The frequency of a particular behaviour and the average duration of action were determined for each horse for the whole period of observation (one year) and within the 24-hour-time budget.

The Kendall-Concordance-Coefficient (W) was used to determine the synchronization of the 24-hour-time budget between the horses. The evaluation of seasonal variation of a behaviour was possible only by description of three-dimensional figures (x -axis = period length, y -axis = year, z -axis = intensity of significant period of a behaviour).

The synchronization of the foraging behaviour ($W = 0,419$, $P = 0,000$) and of the resting behaviour ($W = 0,504$, $P = 0,000$) have been observed in a middle degree between the horses. The individual differences could be observed with help of the mean grazing frequency of 7-11 times a day with an average duration of 17-34 minutes per action. Hay feeding was documented with a frequency of 16- 24 times a day, lasting 21-37 minutes each. During their 24-hour-time budget the horses rested 13- 23 times from 19 to 26 minutes each time. Recumbent rest was observed one to two times a day for 15-30 minutes.

Variations in time spent grazing and feeding hay in individual horses can be put down to the changing amount of hay available, rather than the general vegetation situation, also proving the dependency of feeding behaviour on social bonds. When horses are kept under natural conditions, species-specific needs like steady and peaceful movement, life in a group, interaction with the environment, and appropriate feeding are taken into consideration. Short-term interferences with the well-being of the horses in single cases and situations take place either because of inappropriate management measures, which can be influenced and changed, or because of climatic stress situations, which can only be influenced to a small extent.

FORAGING BEHAVIOUR OF FREE-RANGING NATIVE PONIES USED IN CONSERVATION GRAZING

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This project aims to investigate foraging behaviour of New Forest ponies grazing two sites on the Isle of Wight.

Conservation grazing presents a management regime for maintaining ecologically sensitive habitats. However, a clear understanding of the foraging behaviour of the species used is essential, as grazing, trampling, defecation and urination affect biodiversity.

Previous studies have provided information on habitat use, food and feeding behaviour of New Forest ponies grazing the New Forest.

This year-long project is ongoing until October 2004, with two study groups managing two sites of nature conservation interest (one SSSI and one SIN). Site 1 has a non-breeding herd of 10 individuals. Site 2 has a non-breeding herd of 7 individuals.

Behaviour has been sampled at 1-minute intervals in three 1-hour periods (1 hour after sunset, 1 hour at midday and 1 hour prior to sunset) on four days per season per site. Data on locations of individuals, habitat and environmental conditions at the time of sampling were recorded.

Initial winter results indicate that dispersal across the sites was contagious (Site 1 mean = 0.31 > variance = 8.227, Site 2 mean = 0.13 > variance = 2.212) with variety of vegetation within the sites affecting the range of the two groups and forage selected. Habitat preference has been assessed using a modification of Hunter's Index of Preference. Preference selection values at Site 1 were +0.4901 for Dry Heathland (dominated by *Calluna vulgaris*), and -0.3539 for Deciduous Woodland, (dominated by *Quercus robur* with little ground cover). At the more exposed Site 2, preference selection values were +0.6386 for Gorsebreak (dominated by *Ulex europaeus*) and -0.0429 for Dry Heathland. Selection appears based on an interaction between shelter and forage preferences

This abstract presents the first season's data only. Habitat selection is likely to vary with changes in season, environmental conditions and vegetation productivity.

BITING AND CHEWING BEHAVIOR OF GRAZING LIGHT BREED HORSES ON DIFFERENT PASTURE-CONDITIONS

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In a previous study, light breed horses could ingest CP and DE requirements for maintenance on a grazing pasture without supplement throughout their grazing season. However, grazing behavior of horses, which related to their nutrient requirements, might be affected by the pasture conditions. In this study, the biting and chewing behavior of light breed horses were compared among spring, summer and autumn on an improved pasture by set-stocking system.

Three mature light breed geldings were grazed on a pasture (2.7ha), which consisted of Kentucky bluegrass mainly, from May to October. Observations were done two times on the different herbage conditions each in June, August and October. Grazing, resting and other behavior was recorded at 10 min intervals for 24 hours, and number of biting and chewing for 1 min were counted 30 times for each horse. At the same time, dry matter intake was determined by a double-indicator method.

Mean sward height (cm) were 36.4 and 22.7, 21.1 and 14.8, 14.2 and 9.7, and mean herbage mass (gDM/m²) were 163.3 and 95.6, 77.3 and 48.8, 44.0 and 31.7 in June, August and October, respectively. Dry matter intake was decreased from 15.2 to 12.2 kg/d linearly as the herbage mass get fewer ($r=0.64$, $P<0.01$), but grazing time had no relation to the sward height and herbage mass. Biting rate was increased from 30.3 to 54.1 times/min linearly as the sward height get shorter ($r=-0.71$, $P<0.01$), and conversely the chewing rate was decreased from 84.5 to 66.5 times/min ($r=0.78$, $P<0.01$). There were not large differences on the totaled number of biting and chewing for 1 minute among the different herbage conditions. In the present study, pasture conditions was affected on the biting and chewing rate, but not on the daily number of biting and chewing related to the grazing time.

THE USE OF AUDITORY SIGNALS TO CALL INDIVIDUAL COWS FROM PASTURE IN AN AUTOMATIC MILKING SYSTEM

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The aim of the present study was to examine if it is possible to condition cows to visit the milking unit (MU), in a commercially managed automatic milking (AM) barn, in response to an auditory signal both in the barn and on pasture.

The study included ten dairy cows, randomly selected from a herd of 45 cows housed in an AM-barn. A small box emitting a short auditory signal was attached to the collar of each cow. During the training period, a person induced the signal manually from a distance and during the test period, signals were activated automatically from a computer connected to the AM-computer.

The cows were trained by operant conditioning in the barn and each cow had 12 training sessions. During the twelfth session, all cows approached the MU more often following a signal than if no signal was applied, ($P < .05$, Fisher's exact test) for eight of the cows.

When training was completed, the cows received an individual signal when 8 h had passed since the previous milking. They received another signal after 10 h if they had not already visited the MU.

The cows responded more frequently if they were indoors when they received the signal, than if they were outdoors ($P < .05$, chi square test). Overall, the cows only visited the MU within 30 min after 20-73 % (average 48 %) of the signals. However, there are many factors that motivate the cows to visit the MU. A queue of cows at the waiting area and a too small reinforcement (0.7 kg) in the MU are examples of factors that may be obstacles to a full response to the auditory stimuli.

BEHAVIOUR OF COWS MILKED WITH AN AUTOMATIC MILKING SYSTEM OR A MILKING PARLOUR

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In most Automatic Milking Systems (AMS) cows move voluntarily to the milking station following a forced pathway from the resting area to the feeding area; often they have to pass through one or more selection gates. Reaching high and regular number of milking/day/cow is a critical point for advantageous adoption of AMS. High producing cows need to have many meals in a day and each obstacle to free access to feeding area could be detrimental, especially in hot season.

Two groups of Italian Friesian cows, housed in two opposite sides of the same free stall barn with cubicles, were milked in a single box AMS or twice a day in a Milking Parlour (MP). Cows in different areas of stable at different hours were observed seasonally by video-recording. Milk yield and Temperature and Humidity Index (THI) were also recorded.

Overall mean percentage of cows counted in the feeding area was 17,84% of total in AMS group and 21,72% in the MP ($p < 0,05$); however diurnal pattern of the two groups were different, as the significant correlation between milking system and time of the day ($p < 0,05$) indicated. The overall mean percentage of cows standing or lying did not differ between AMS and MP but interaction ($p < 0,001$) with time of the day and season were found. Patterns of milk yield and milking frequency showed a significant ($p < 0,005$) advantage of AMS group over the MP group in the winter, but when the THI exceeded the critical value, milk yield and milking frequency dramatically decreased in both group, mostly in AMS.

On summary the behaviour patterns of both groups resulted rather affected by hot season but AMS group suffered more consequences than MP group. We concluded that better solutions about traffic and comfort must be investigated to improve efficiency and animal welfare in AMS.

MEASURING THE HEALTH OF COW'S LEGS DURING AUTOMATIC MILKING

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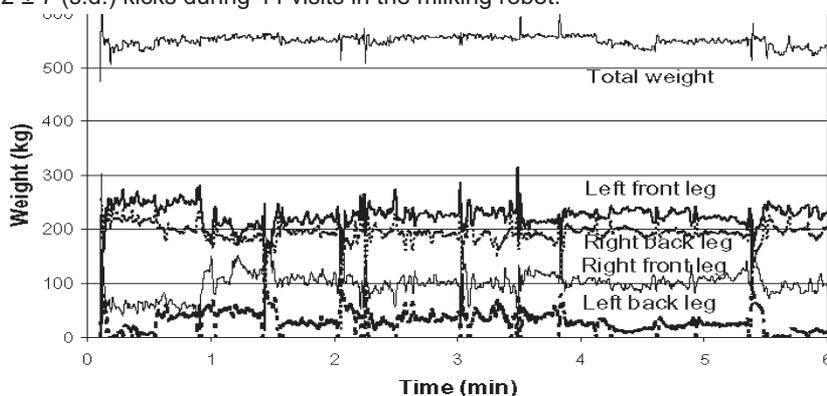
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There is a worldwide movement towards automation in cattle keeping, with the objective to fully automate every process from feeding to milking. Our aim in this study is to automate the control of the health of a cow. Milking robot offers a unique possibility for a dynamic measurement of the weights of legs. It is highly probable that e.g. an injured leg can easily be noticed by separately measuring the weight of each leg. It is also possible to analyse the behaviour of a cow during the different stages of milking, washing and disconnecting. In this way it is possible to detect the changes in the behaviour of a cow.

Four strain gauge scales were installed after careful inspection of the positions of the legs of cows. It was found that with a 95 % probability all the legs would be on scales when the area of each scale was 30*40 cm. The scales were connected to a four channel amplifier and the data was collected into PC using a dedicated computer program. The scales have been in non-stop operation for several months measuring the weights of 40 cows. Data for an insured cow is given in Fig. The left back leg is injured. Therefore the weight is on the left front leg and on the right back leg to keep balance. Occasional peaks can be noticed. They are due to lifting the leg (kick). Every rise in one scale is always connected with a decrease in another scale which measures the load of the neighbouring leg. Kicks are a measure of restlessness but a detailed correlation between the cow's behaviour and the number of kicks is yet to be studied. For a certain cow the number of kicks varies, e.g. 12 ± 7 (s.d.) kicks during 44 visits in the milking robot.



EFFECT OF LAMENESS ON DAIRY COWS' FREQUENCY OF VISITS TO AN AUTOMATIC MILKING SYSTEM (AMS)

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Lameness is a major welfare problem for dairy cows and has important economic consequences. On-farm detection of lameness is difficult, and automated methods may be useful for early diagnoses. To determine whether a low frequency of visits to an automated milking system (AMS) could serve as an indicator of lameness, data on the frequency of visits of 578 cows to 12 AMSs on eight farms were collected. From each AMS, twenty cows (from a mean of 55 cows per AMS), were classified as either the ten highest (total visits) or the ten lowest visitors, based on the total number of visits to the AMS. The selected cows were videotaped while walking in a standard test area and their gait scored on a 5-point scale (1=sound 5= severely lame). Significant differences between the two groups of cows ($p < 0.05$ Student T test) were found in 9/12 AMSs. High-visiting cows had better gait scores than low-visiting cows (mean \pm SD= 1.785 \pm 0.39 vs. 2.53 \pm 0.81 respectively). 54% of high visitors and 13% of low visitors had normal gait while 4% of high visitors and 32% of low visitors were classified as slightly or severely lame. The frequency that dairy cows visit an AMS is related to their locomotory ability, and data from the AMS may help in the early detection of lameness.

EFFECT OF AUTOMATIC MILKING AND GRAZING ON BEHAVIOUR OF DAIRY CATTLE

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Grazing may lead to a decrease in capacity use of an automatic milking system (AMS) and an increase in labour required for fetching cows with long milking intervals from pasture. Knowledge about cow behaviour may reveal useful information on which management practices may be successful and which not. The aim of this research was to study the effect of grazing combined with automatic milking on the potentially relevant behavioural aspects of a dairy herd.

A herd of about 60 Holstein-Friesian cows was automatically milked by a 2-units-in-row Galaxy AMS. Access to pasture was restricted (daytime) and regulated by a selection gate. Location of the animals in the barn or at pasture and standing or lying position were observed during 48-h periods using scan sampling (15-min-intervals) once at the end of each winter season and 3, 4 and 3 times during the grazing season in 2001, 2002 and 2003, respectively. Data was analysed using the GLM-procedure of Genstat. The presented percentages represent the relative number of cows per behavioural element as well as the mean duration of the behavioural element per day.

The mean percentage of cows in the AMS was higher in the winter season than during the grazing season (2.3 ± 1.2 vs. $2.0 \pm 1.4\%$, respectively; $P < 0.05$). No significant differences were found for mean presence in the waiting area in front of the AMS (3.5 ± 2.9 vs. $2.9 \pm 3.6\%$, respectively) or for the mean percentage of lying (45.7 ± 1.6 vs. $43.6 \pm 3.9\%$, respectively, the latter percentage representing the sum of lying in the barn and at pasture). Furthermore, no differences in mean percentages of lying with the head up high, backwards (as in deep sleep) or low were found. In our system, combining automatic milking with grazing appeared to be working well, but further research is needed to optimise the system.

SUBCLINICAL MASTITIS INDUCES FEW CHANGES IN THE BEHAVIOUR OF DAIRY COWS DURING MILKING

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Mastitis is a worldwide disease which has negative effects on welfare of dairy cows and milk production. It is expected that behavioural symptoms are not always present, varying according to the mastitis intensity – from apathy and decreasing of food ingestion to undetectable behavioural evidences. This study was carried out to test the hypothesis that subclinical mastitis would be detected by changes in some behavioural aspects of dairy cows during milking. The behaviour of 97 dairy cows (3/4 to 31/32 Hostein-Zebu) were recorded during 28 milking sessions (14 days) in January 2003. The cows were kept in semi-intensive system (staying at pasture most of the time) and being milked twice a day in a milking parlour where groups of 24 cows (12 x 12 cows tied in paralel position) were milked together. Their behaviour was observed directly and continuously, recording the occurrences of rumination, defecation and urination, besides milk yield. The diagnose of subclinical mastitis was made after all behavioural records, using the California Mastitis Test (CMT). The data was analyzed through Anova (one-way), using SPSS software package. Cows with positive CMT produced on average 1.0 kg less milk than those with negative test; but this difference was not statistically significant (Anova: $F_{1,95}=2.827$; $p=0.097$). A significant effect was detected only on defecation occurrences (Anova: $F_{1,94}=5.472$; $p=0.021$), which was more frequent among those cows with positive CMT. No statistical effects were found on urination and rumination occurrences (Anova: $F_{1,94}=0.530$; $p=0.468$ and $F_{1,94}=1.902$; $p=0.171$, respectively). These results indicate that subclinical mastitis is not easily detected through behavioural analysis, adding the fact of changes in defecation occurrences could be influenced by many other factors besides mastitis.

REDUCED FEEDING BEHAVIOUR CAN IDENTIFY COWS AT RISK FOR METRITIS

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Dairy cows experience a high incidence of disease in the weeks immediately after calving, but early and accurate diagnosis remains a challenge. Cows suffering from metritis, a common disease affecting dairy cows after calving, exhibit reduced milk yield and compromised reproductive performance. However, afflicted cows show few overt signs of illness and frequently go unnoticed in the absence of veterinary examination.

To determine if changes in feeding behaviour could be used in the early diagnosis of metritis, attendance at the feed alley was monitored continuously for 26 Holstein cows during the transition period, beginning 2 weeks before and ending 3 weeks after calving. Every 3 ± 1 days the severity of metritis was rated on a five-point scale which incorporated rectal body temperature and condition of the vaginal discharge.

Over the 3 weeks of observations after calving, 69% of cows showed some signs of metritis. Cows with metritis spent less time (on average 40.4 min /day; $t_{24}=3.57$, $p=0.0015$) at the feed alley during the transition period than did non-metritic cows. This difference in feeding time could be detected even 10 days before calving ($t_{24}=2.31$, $p=0.03$). A Spearman rank correlation indicated a strong negative relationship between feed alley attendance and severity of metritis ($r=-0.62$, $n=26$, $p=0.0006$). In conclusion, reduced time at the feeder can be used to identify dairy cows at risk for metritis. More research is required to determine how soon before calving at-risk cows can be identified, and if these behavioural differences can also be used in the early diagnosis of other diseases.

BREEDING FOR INCREASED RESISTANCE TO MASTITIS IN NORDIC DAIRY CATTLE: BIVARIATE VS UNIVARIATE MODEL

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Mastitis is the most frequent and costly disease affecting dairy cattle. Strategies to reduce mastitis frequency are important to reduce costs of production and use of antibiotics and to improve the welfare of animals. Variation in susceptibility to mastitis is in part determined by genes and hence genetic evaluation for mastitis resistance has received increasing attention in dairy cattle breeding.

Currently clinical mastitis (CM) is recorded nationwide only in Nordic countries, whilst in most countries selection is limited to indirect means by using EBVs (estimated breeding values) only for somatic cell count (SCC). However, owing to the high genetic correlation between the two traits opportunities also exist to combine both sources of information to increase the efficiency of selection for mastitis resistance.

The objective of the study was to compare bivariate and univariate models and at the same time to develop joint genetic evaluation for Nordic dairy cattle in udder health traits. Data on lactation average SCC and CM were obtained from 1.2 million Finnish Ayrshire and 1.0 million Swedish Red cows. Variance co-variance components were estimated from a sample of the joint (Finnish and Swedish) data with a DMU package using AI-REML.

Results of the bivariate model were compared to the univariate model to assess the relative efficiency of the models. Changes in genetic predictions and changes in accuracy values were also investigated by regressing most recent EBVs on less accurate earlier estimates (sire proofs) of the two models. Results showed that bivariate model resulted in more accurate evaluation with less prediction bias. Moreover, the analysis of EBVs from the two models indicated that faster genetic progress would be realized if bulls are selected on bivariate model.

SHEARING EFFECT ON WELFARE AND MILK YIELD AT MACHINE MILKING OF DAIRY SHEEP WITH DIFFERENT TEMPERAMENT

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The aim of the study was to estimate the shearing effect on welfare and milk yield at machine milking of dairy sheep according their temperament. The temperament estimation was done through a Complex Score (CS), reflecting the behavioural traits of each animal during machine milking in a milking parlour in six consecutive observations. A factor analysis for behavioural traits produced four factors: 1) Activity towards neighbours; 2) Feed reaction towards forage offered by hand; 3) Reaction towards positioning teatcups; 4) Taking position into the milking parlour; Each trait was described by four degrees. On the base of the CS varying between 24 and 96[4x(6x4)], three temperaments distinguishing significantly ($p < 0.001$) in the behavioural traits, were established: Calm (C) - 135, Nervous (N) - 60 and intermediate (I) - 177 ewes. In order to confirm the temperaments, emotions were additionally assessed by the following methods (in 54 animals): Fear inducing, Open Field and Learning tests (Novelty-Food motivation-Learning). The most typical representatives of the temperaments were chosen among them C – 12 ewes, N – 12 and I – 12 ewes. The animals were of the same age and date of lambing. Morning machine milk yield was registrated before shearing, one day after shearing and two days after shearing.

Shearing caused significant negative effect on milk yield at machine milking for the three temperaments. The biggest decrease was found in C (107ml) followed by N (103ml) and I (67ml), $p < 0.05$, one day after shearing. The most contrast were the differences in milk yield between C and N temperaments – 100ml, $p < 0.05$. The decrease continued nonsignificantly during the second day after shearing in C (38ml), I (13ml) and N (7ml).

AN EPIDEMIOLOGICAL STUDY OF THE CAUSES OF REDUCED LONGEVITY AND POOR WELFARE IN RIDING HORSES AND PONIES

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At the 2003 ISAE International Congress in Italy, the satellite meeting on equine welfare met to identify the most important issues in equine welfare and to agree upon an outline of research priorities to address them. One of the top welfare issues identified was the reduced longevity of the domestic horse population and the welfare concerns underpinning it. Agreed was the need for epidemiological studies to establish the prevalence of these welfare concerns and to identify the risk factors associated with them. Here we report a research programme that begun to answer this aim with a focus upon leisure and amateur competition horses. The first stage of this research project is a large-scale, broad-based Internet survey to identify the type and prevalence of behavioural problems, in relation to the horses' management and training regimens. From this, multiple causal factors in the development of behavioural problems will be explored, permitting more open hypothesis generation than can be considered with a priori research. A structured sample of respondents from the UK Horse Passport list will be sought to counter any bias arising from the self-selected nature of the Internet sample. The second stage of the research builds upon the initial survey, generating questionnaires more focused on specific problems and their potential causal factors. The third stage is the dissemination of the findings to the horse keeping public through a web site and in conjunction with articles in the popular equestrian press. The baseline data generated by this research will provide a platform for assessing the welfare consequences of the many aspects of horse care and handling that are based upon human convenience and traditional practices. In particular it will highlight the neglected area of equine behavioural needs and the consequences to both human keepers and their equines when these needs are overlooked.

**ANIMAL HEALTH AND WELFARE IN FREE RANGE CATTLE –
A SURVEY OF FARMS OF WESTERN OF SWEDEN****S. Gunnarsson¹, F. Cerenius², T. Jakobsson³**¹ Dept. of Animal Environment and Health, Swedish University of Agricultural Sciences, Skara² Veterinary administration, County Administration of the Western of Sweden, Skara³ Swedish Animal Welfare Agency, Skara

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The health and welfare of free range cattle may be good, but the animals must be provided with sufficient feed and water and shelter the whole year through. In the public debate in Sweden it has been questioned if shelters are needed or even used by the animals. In 2002 the veterinary administration of Western of Sweden initiated an investigation of animal welfare in farms in the area. The aim was to investigate farms with free range cattle and evaluate their compliance to the animal welfare statutory.

The local animal welfare inspectors were asked to inspect and score conditions at farms with free range animals. In total 255 forms were returned from 32 out of the 49 local administrations. Eighty-five percent of the inspected farms had cattle, and median stock size was 13 animals (min 2; max 274).

In general the animal health was good. In 11% of the farms occasional animals were lean and in 2% of the farms >50% were lean. In 5% of the farms >50% of the animals were dirty, and in these farms the animals did not have access to an appropriate indoor lying area. In farms where the indoor area was sufficiently large and clean, the animals were scored as resting indoor.

Thirteen percent of the farms were offering feed solely on the ground. In 17% of the farms the animals had no other water supply than streams. In 79% of the farms no pre-examination of the building plans had been carried out, although this is compulsory in Sweden.

The inspectors reported that 40% of the farms did not fully comply with the Swedish animal welfare statutory, and 31% got oral remarks, 30% got written remarks and 4% got injunctions to improve animal conditions. The results of this study were similar to previous reports from other parts of Sweden and from the UK.

DAIRY COW GAIT AS AN ON-FARM INDICATOR OF LAMENESS.**E. Canali***, **P. Corradi**¹, **M. V. Tosi**, **V. Ferrante**, **S. Mattiello**,
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Lameness in dairy cattle is a significant welfare and health problem, as well as causing considerable economic losses to farmers. Locomotion scores have been considered useful tools in on-farm welfare assessment protocols although they have to be improved (Waiblinghr et al., 2001). The aim of the study was to test ,on farm, a locomotion score system for lameness in dairy cows with investigators of different expertise (a generic stockman, the stockman of the herd and a veterinarian).

Three observers simultaneously scored the walking behaviour (walking score) of one hundred Holstein dairy cows on the walking alley on a dairy farm. The score was based on a five-point numerical scale (modified after Winckler & Willen, 2001; Robinson 2002) where 1 represented a sound subject and 5 represented a severely lame subject. Within 10 days each cow was assessed at a routine claw trimmer and each cow was assigned a health score (health score) where 0 represented a sound cow, 1 represented a sound cow but which needed to be trimmed and 2 represented a cow with a lesion to claw or leg (0= 67%; 1=17% and 2= 16%).

Simultaneous scoring of the walking behaviour of the cow was very similar among the 3 observers (obs1 1.49±0.07; obs2 1.65±0.09; obs3 1.48±0.08) but the relationship was higher between the generic stockman and the veterinarian (Rho= 0.71, P< 0.001) than between the herd stockman and the previous two (Rho=0.447 e Rho= 0.664, respectively). There was a significant correlation between the walking score and health score for each of the observers (Rho=0.52, P<0.001; Rho=0.43, P<0.001; Rho=0.60, P<0.001, respectively).

It can be concluded that the walking score used in this study seems to be a simple and practical method to detect lameness in dairy cows which can be used by people with different expertise.

EVALUATION OF THE EFFECT OF HOOF TRIMMING ON GAIT OF DAIRY COWS USING IMAGE ANALYSIS

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Proper hoof care promotes longevity and well being of dairy cows, particularly in confined, intensive management systems, but objective evaluation of the effectiveness of different methods is difficult. Hoof trimming practitioners generally depend on empirical knowledge rather than scientific bases when trimming and treating cows. Using a digital video camera and integrative software, we developed an image analysis system to evaluate hoof trimming methods of dairy cows. Eight Holstein cows with no apparent lameness were used to test the efficacy of the system. Markers were attached to the body surface of the cows at standard positions, including major skeletal joints. Both before and after hoof trimming by a professional trimmer using his standard procedure, the cows were videotaped while walking. Tracking hardware recorded movements of the markers on each cow, and data were stored as CSV files. Marker trajectory was tracked automatically, and the averaged trajectory as well as the cross correlation between chosen trajectories were computed. Standing and lying behaviours were video recorded during one week before and one week following the hoof trimming. Daily milk yields also were recorded during this interval. The trajectory pattern of the haunch marker showed that cows' gait patterns were more repeatable following than preceding hoof trimming. The variance of the distance that the marker moved between frames also tended to be lower following hoof trimming. Daily milk yields and the frequencies of standing and lying were significantly higher ($P < 0.05$) after than before hoof trimming. Our image analysis system shows potential to evaluate the efficacy of hoof trimming procedures, but additional studies are necessary to validate the system for practical on-farm use.

POSSIBILITIES TO SELECT FOR LEG SOUNDNESS IN PIGS

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Leg weakness can cause economic losses to pig producers in many ways, e.g. early culling of gilts, impaired appetite and reduced welfare of the animals. The aim of the study was to find out the amount of genetic variation in leg soundness traits and the genetic relationships between them to establish efficient tools for selection.

Records from seven central test stations were compiled consisting of 6,115 Large White (LW) and 7,043 Landrace (LR) pigs. Leg conformation was assessed by scoring leg action and five most severe leg weaknesses: buck-kneed, small inner claws, legs turned out on fore legs, small inner claws and upright pasterns on hind legs. Leg action was scored using a scale from 1 to 5. Leg soundness was scored with 2 (performance test) or with 4 classes (sib test). The difference in scores was removed by scaling them into frequency normalised ones.

Variance components due to animal's genetic effect and common litter environment were estimated by the restricted maximum likelihood method. The statistical model included effects due to station, year and season. Pedigree information was added to the data. The heritabilities were low for leg action (0.06 for LR and 0.05 for LW) and low to moderate (0.01 – 0.17) for individual leg traits. The proportion of variance due to common litter environment ranged from 0.03 to 0.14. There was strong genetic correlation between buck-kneed on the fore legs and overall leg action ($0.88 \pm .07$ in LR and $0.98 \pm .09$ in LW). The correlations between other traits were highly variable and had large standard errors. In conclusion, as leg soundness is unfavourably correlated with carcass quality, it is important to include leg soundness in selection goals, to collect sufficient amount of data on leg conformation traits and to make required alterations in the selection criteria.

EFFECTS OF STOCKING DENSITY AND DIETARY CA/AVP-RATIO ON LEG HEALTH IN BROILER CHICKENS

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Objective of the study was to investigate the effects of the stocking density and dietary calcium/available phosphorus (Ca/AvP) -ratio on leg health of broilers. A 36-day growth experiment was carried out with 2,976 Ross508-broilers. The experiment was conducted as a continuous design with 2x3 factorial arrangement of treatments. Treatments consisted of two dietary Ca/AvP-ratios (2.0 or 2.4) and three stocking densities (500, 650 or 800 cm² per bird). Broilers were reared in 48 shavings/peat litter floor pens. Data was analysed by using the GLM and CORR procedures of SAS.

Six broilers from each pen were Gait scored (GS) on a scale from 0 to 5 (0=normal gait with no limbing, 5=complete lameness) at 22- and 34-day-old stages and LTL-tested (measures bird's ability to remain standing in the water) at 35 days of age. Feet pads of these six birds were evaluated on a scale from 0 to 2 (0=no damage, 2=extended burn) and two tibias from each pen were taken to analyses at the end of the experiment.

Stocking density or dietary Ca/AvP-ratio had no statistical effect on broiler GS or LTL-value. There was a significant correlation between GS and body weight at 22 days of age ($r=0.393$, $P<0.01$), but no correlation at 34 days of age. Litter dry matter content increased linearly ($P<0.001$) when stocking density decreased and there was a negative correlation between feet pad condition and litter dry matter content ($r=-0.544$, $P<0.001$) at the end of the experiment. Experimental treatments had no effect on tibia dry weight or specific weight, but tibia breaking strength increased linearly ($P<0.05$) when stocking density decreased.

Although the stocking density had no effect on walking ability, the tibias were stronger and feet pads better when stocking density was lower. Therefore it seems that lower stocking density improves leg health of broilers.

THE EFFECT OF WEIGHT LOAD ON THE LEGS FOR LOCOMOTOR ACTIVITY AND RESTING BEHAVIOUR IN FAST AND SLOW GROWING CHICKENS

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It is generally known, that slow growing (SG) chickens show higher locomotor activity and less resting behaviour as compared to fast growing (FG) chickens. The question whether this difference is caused by a difference in weight load or in motivation is not clear so far.

The aim of the experiment was to study the behaviour of FG and SG broilers under the same weight load. For this purpose a harness and a suspension device were developed which allowed part of the weight load on the legs of free moving birds to be alleviated. The weight load in the SG birds was increased by fitting pieces of lead on the back and the vent at three weeks of age. Using these methods the weight load of both lines was adjusted to the average weight of both lines. The weight adjustment was made on a daily basis over a period of 3 to 6 weeks. A total of 24 male broilers, 12 ISAS257 and 12 ROSS308, were assigned to 4 groups of three birds each. One bird was weight adjusted, one was wearing the harness without weight adjustment and one was without harness. Duration and frequency of walking, resting, standing, eating and others were recorded. Time spent carrying out these types of behaviour increased by 18 % ($p < 0,0001$) in the weight reduced FG broilers. Increasing the weight load in SG broilers resulted in a decrease in activity of 20 % compared with the control birds of the same line. The difference in activity between the weight-reduced FG birds and the weight-increased SG birds was less than 5 %. The harness did not impair the birds physical constitution and behaviour.

The results show that weight load is the main influencing factor for differences in behaviour of SG and FG broiler strains.

ON-FARM ASSESSMENT OF LYING BEHAVIOUR IN DAIRY CATTLE

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The inclusion of different aspects of lying behaviour in on-farm assessment protocols led to two questions investigated in this study: 1) can standing up and lying down behaviour of loose-housed cows be reliably assessed within a 2-h period of observation, and 2) can lying positions be reliably recorded during the same time frame?

We observed three cubicle-housed herds, with herd sizes of 56, 64 and 77 cows. The total durations of lying down and standing up movements, as well as the duration of the kneeling phase on the carpal joints were scored continuously during five 2-h sessions on each of two days. Lying positions were assessed in hourly scan samples. Four sessions occurred between morning and evening milking and one after evening milking. Values from each sample were compared with the median value for the corresponding farm (calculated across all measurements of a farm), and used to determine the mean deviation as a percentage of the median.

Mean deviations of the 2-h periods ranged from 3.5 to 11.1 % and from 1.4 to 3.2 % for the duration of standing up and lying down events, respectively. For kneeling phases during standing up and lying down, 2-h samples differed by 3.6 to 9.5 % and 2.8 to 5.6 %, respectively. Of the five periods, the one ending about 1h before evening milking was closest to the overall value. For this period durations differed by less than 5 % from the farm median, suggesting that this would be a suitable time for assessing lying down and standing up movements.

With regard to lying positions, there were only small differences for the proportion of different positions from single scans from the overall mean, except for scans directly after milking.

Nevertheless, two observations are recommended for both types of lying behaviour assessment.

DEVELOPING A METHODOLOGY FOR MEASURING BEHAVIOURAL DEVELOPMENT IN DAIRY CALVES

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Behavioural development indices in calves for cognitive, exploratory, and emotional responses, such as fear and startle, may identify risks to the development and welfare of genetically modified and cloned calves. These integrated responses can be viewed as part of the animal's biological response to survive and maintain welfare. The aim of this study was to develop and refine methods for measuring cognitive, exploratory and emotional development in calves.

Thirteen Friesian bobby calves were tested in Novel Arena, Novel Object (balloon), Startle (opening umbrella near a companion animal), and Y-maze learning (social reward) tests at 2, 6 and 10 weeks of age (WOA). Heart rate was monitored, in the home pen and for 30 s prior to and during the behavioural tests, as a physiological indicator of stress.

Heart rate in the home pen increased with age (84, 106 and 127 beats/min at 2, 6 and 10 WOA respectively, $p < 0.01$). There were significant age effects for exploration activity as measured by distance travelled in the novel arena (14.6, 32.7 and 59.2 m, $p < 0.001$) and number of interactions with the umbrella (2.25, 1.50 and 0.33, $p < 0.05$). Latency to return to the companion animal after being startled also changed significantly with age (78.7, 101.68, and 110.46 s, $p < 0.05$). However, learning ability, responses to novelty, and other startle responses did not change with age ($p > 0.05$ in all cases). Correlation analyses suggests stability over time, from 2 to 10 WOA, in individual differences for a number of variables such as heart rate, total duration immobile and average decision time in the Y-maze.

Overall, the tests used were capable of detecting both changes in behaviour and stability of individual animal differences over time. This highlights the potential of these tests for studying behavioural development in calves. Some minor methodological refinement may be required to minimise external influences on the tests.

VALIDATION OF SALIVARY CORTISOL AS AN INDICATOR OF STRESS IN HORSES (EQUUS CABALLUS)

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The exposure to a stressor produces physiological responses, including increased activity in the hypothalamic-pituitary-adrenal axis (HPA) and a subsequent increase in the levels of circulating cortisol. The use of cortisol as a measure of stress however, is often complicated by the use of invasive techniques that may increase HPA activity during sample collection. Here we report the immunological and biological validation of non-invasive saliva cortisol sampling in 11 stabled riding horses and ponies (*Equus caballus*) in light work. Saliva samples were collected with swabs at 30-minute intervals between 0730 and 1730 hours over three days for each horse and pooled for immunological validation. Specificity of the assay was demonstrated with serial dilutions of the salivary pool that gave displacement curves parallel to dilutions of commercially prepared cortisol standards. Accuracy was demonstrated by linear recovery of additions of increasing concentrations of cortisol standards (mean recovery 86.55% \pm 7.98%). Precision was demonstrated by low intra-assay coefficient of variation of replicates (1.80%, N=35) and low inter-assay coefficient of variation between plates (6.55%, N=6). Sensitivity was calculated from the mean of all assays of the lowest concentration of cortisol on the 90% binding point of the standard curve (0.156 mg/ml). Biological validation of the assay was demonstrated by diurnal variation with a peak in the morning approximately twice the concentration of the nadir in the afternoon ($F_7=10.99$, $P=0.011$) which corresponded to published plasma cortisol diurnal variation (Irvine & Alexander. Dom. Anim. Endo. 11:227. 1994). Secondly, salivary cortisol was higher in the 30 minutes after exercise than in the 30 minutes before ($t_7=2.77$, $P=0.030$) again corresponding to published plasma cortisol changes (Alexander & Irvine. Endocrin. 128:65. 1991). We conclude that immunological assay of salivary cortisol is a reliable and valid non-invasive measure that can be used to quantify HPA axis in equines.

BEHAVIOURAL AND PHYSIOLOGICAL INDICATORS OF DIMINISHED WELFARE IN THE DOG

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The current consensus for assessment of welfare in farm animals is for a combination of behavioural and physiological indicators. Reliable indicators of welfare in companion animals are less well developed; additionally, the morphological and behavioural diversity exhibited by domestic dogs suggests that multiple and/or alternate measures may be needed. Previous studies of welfare indicators for the dog have largely bypassed this issue by focussing on single breeds kept under standard conditions (e.g. beagles in laboratory settings), and may not be entirely applicable to situations where there is large diversity of dogs.

We observed 26 dogs over a 10-day period following initial admittance to an animal shelter, recording their behaviour and collecting urine for measurement of cortisol/creatinine (C/C) ratios. When linear regressions of C/C over time in centre were calculated for each dog; the mean slopes were found to vary significantly with past experience ($F = 4.780$, $df = 1$, $p < 0.05$); C/C increased with time in dogs relinquished directly from homes ($b = 0.719$), and decreased in strays and returns ($b = -1.228$).

Dogs with increasing C/C also exhibited a greater mean frequency of drinking ($U = 45$, $p < 0.05$), startling ($U = 38$, $p < 0.05$) and two activity related behaviours (area transitions $U = 43$, $p < 0.05$ and walking/trotting $U = 41$, $p < 0.05$). Taking one dog at a time, changes in C/C ratio were negatively related to changes in percentage of time spent active ($b = -0.418$, $p = 0.001$). Hence the relationship between activity and C/C differed according to whether comparisons were being made between or within dogs. C/C ratios may be an effective measure of welfare in kennelled domestic dogs over this time period; however, use of behavioural indicators whilst possible, appears more complex.

LATERAL BIASES EXPRESSED BY SHEEP IN A Y MAZE AND IMPLICATIONS FOR ANALYSIS OF PREFERENCE TESTS.

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Lateral biases in behaviour have been reported in many species, including sheep. One such lateral bias expressed is the choice of one arm of a Y Maze over the other. In most Y Maze Preference Tests, it is assumed that although individual animals may show lateral biases, these biases will be balanced within the test population. In order to test the validity of this assumption in sheep, we gave crossbred male and female sheep ten free choices in an empty Y Maze.

We found that 89 (44%) of 201 sheep tested exhibited a statistically significant preference for one side of the maze over the other (Binomial test $z \geq |2.22|$ $p \leq 0.05$, $\geq 9/10$ choices). Of those animals expressing statistical biases, 67% preferred the left, while 33% preferred the right. A further 75 animals (37%) tended to prefer one side over the other ($\geq 7/10$ choices). Of all animals choosing one side 7 or more times, 59% chose left, and 41% chose right. Although less pronounced, the trend for more animals to prefer the left is still present at this level. Male and female animals had significantly different preference distributions ($\chi^2 = 6.106$ $p \leq 0.05$), with more males than females showing a left bias. In addition, males appear to have stronger preferences (regardless of direction) than females (Mann Whitney U test $z = 2.217$ $p = 0.027$).

These results imply that an uneven distribution of lateral biases may exist in this population of sheep, tested in this particular facility. Whether these lateral biases are experimentally induced, or reflect an inherent tendency of individual sheep, is unknown. However, for a specific facility, procedure and test population, it may be appropriate to characterize and incorporate the population distribution of lateral biases into subsequent analyses of Preference Test data, rather than assuming a balanced distribution.

BEHAVIOUR PATTERNS CAN BE DIVIDED INTO TWO COMPONENTS WITH DIFFERENT RANGES

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Behavioural investigations usually contain video-recordings. In a typical study, behaviour is recorded using the instantaneous sampling method. Consecutive samples from the same animal are correlated. This study aims to model this correlation.

The experiment included 40 male blue fox (*Alopex lagopus*) born in May. The animals were housed singly from July to November in wire-mesh cages within a traditional shed. The behaviour of each animal was recorded during five consecutive 24-h periods in August, September, October and November using the instantaneous sampling method with a sampling interval of 1 min. Four different behaviour patterns were selected: resting, locomotion, stereotype and self-grooming. Autocorrelation was performed using a variogram, and the variogram was modelled using different exponential models. The variogram is a function that measures the correlation between data pairs as a function of the displacement between the pairs. The amount of all behaviours varied circadianly and so the variogram was calculated separately for three different 8-h periods.

A two-component exponential model provided the best fit in each analysis. The two components can be named as the short range component and the long range component. The range of the short component was from one to four minutes and indicated minimum duration of an activity or bout of inactivity. Range of the long component was the longest for resting (60-69 minutes) and shortest for self-grooming (22-27 minutes). One explanation for the long-range component is that it is related to the animal's mental state, e.g. a stressed animal may repeat stereotypical behaviour several times during a half-hour period.

Differences between treatments have usually been examined comparing the estimated means. However, a comparison of variances or correlations can provide new information. The variogram is a valuable tool for these comparisons.

DOES FEEDER ORDER IN PIGS TELL US ABOUT SOCIAL POSITION?

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For pigs in a group, knowledge of social position can facilitate social interactions and minimise the risk of aggression. However, some animals may be victimised within social groups. We wanted to investigate if social position has a role in increasing the likelihood of being victimised. The aim of this work was to assess whether the order at which pigs stand at the feeder, relative to the feeder pipe, gives useful information about social position.

To validate the use of a ranking based on feeder order we related it to the occurrence of competitive interactions. We consider four methods for describing position in a competitive order: β -measure, weighted β -measure, Corrected David's Score (CDS) and Clutton-Brock Index (CBI). β -measure is based on winning encounters, with weighted β -measure additionally taking into consideration the number of interactions between each pair of pigs. Both winning and losing interactions are considered in CDS and CBI. CDS improves on CBI by taking into account repeated interactions and is corrected for chance.

Fifty-two Large White/Landrace pigs, aged approximately 120 days, were kept in four pens of 13 ± 1 animals. Behavioural data were collected by group scan sampling every 5 minutes, over a three week period until slaughter, with a total of 24 hours of data collection per pig. We defined competitive behaviours as mounting, nosing and sucking, and displacement. Pigs were defined as having a directed link if one of these interactions occurred at least once between them.

Spearman's correlation coefficient was used to evaluate the relationships between feeder order and competitive order. No significant correlations were found. There was high correlation between β -measure and weighed β -measure, and between CDS and CBI. This is unsurprising as there were few repeated interactions between pigs. From this study we can conclude that, for this system, feeder order does not indicate social position. However this study was a preliminary study and further investigation is required to determine whether a rapid proxy for social position can be found.

TEMPERAMENT ASSESSMENTS OF LACTATING COWS IN THREE CONTEXTS AND THEIR APPLICABILITY AS MANAGEMENT TRAITS

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Three behavioural assessments related to ease of cow handling were verified their applicability as management traits.

Flight responses to an approaching human (flight starting and walking distances, and walking speed), entrance order into the milking parlour and step-kick behaviour to cup attachment were observed for 713 cows in six Australasian herds. Cows were kept at pasture without any barns. Flight responses were measured once, and other assessments were recorded repeatedly for each cow. A principal component analysis was performed to verify whether these assessments measure the same trait. An ANOVA and correlation analyses were used to test whether obtained principal components are affected by farm, age and milking stage of cows. Australian and Japanese herd management systems were compared for flight distance using a multiple comparison test.

Three behavioural assessments clustered in different principal components, indicating that they do not measure the same trait. Factor scores of four principal components were affected by farm (all, $P < 0.01$). The scores of principal component 1 "fear of humans" ($r = -0.16$, $P < 0.01$) and component 2 "aversion to cup attachment" ($r = -0.28$, $P < 0.01$) were correlated with age. These results emphasise the necessity of data standardization to reduce the nongenetic variation resulting from these two affectors. The flight distance measured at pasture in Australia (6.06 ± 2.85 m) was different from those in paddocks (1.50 ± 0.82 m) and free-stall barns (1.22 ± 1.09 m) in Japan (both, $P < 0.05$). Mean distance was not different between the Australian herds at pasture and the Japanese herds at pasture in tie-stall barns (3.96 ± 2.16 m) or in a free-stall barn (4.03 ± 1.79 m). This difference may be due to a single measurement, so that repeated measurement may improve the usefulness of flight distance as a management trait.

THE QUALITATIVE ASSESSMENT OF HORSE TEMPERAMENT

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The present study was aimed to apply the qualitative assessment methodology to the study of horse temperament. Ten horses and ten ponies were individually filmed in an unfamiliar pen for 2.5 min. Videos were used to record quantitative behavioural data (QBD; exploration, vigilance, gallop, etc.). Twelve students of animal science were instructed to provide qualitative assessment of videos using Free Choice Profiling methodology. Data were subjected to Generalized Procrustes Analysis (GPA) which showed a significant consensus among observers ($P < 0.001$). The 2 main dimensions of the consensus profile explained 65.2% of the total variation. Observers characterised the first dimension of the consensus profile with terms ranging from calm to restless and the second one in terms of apathy/curiosity. Ponies scored more highly on the first dimension (being more nervous and restless) than horses ($P < 0.001$). There was no difference between ponies and horses on the second dimension. Principal Component Analysis (PCA) was conducted using the scores of the animals on the first two dimensions of GPA, QBD and data gathered from a questionnaire completed by the farm leader. The latter included scores for excitability, responsiveness to commands, aggression, etc.. The 2 main dimensions of PCA explained 42% of the total variation. The first dimension of GPA (restlessness; 0.36), excitability (questionnaire; 0.25) and gallop (QBD; 0.34) showed higher loadings on the first component of PCA, whereas the second component was related to the second dimension of GPA (apathy; 0.30), unresponsiveness to commands (questionnaire; 0.34) and snorting (QBD; 0.37). Although previous studies categorised horses in active and passive copers, the qualitative assessment allowed to discriminate calm and relaxed subjects from those apathic and uninterested, with the most reliable animals being those active and curious rather than the passive one. We concluded that qualitative assessment may be effectively used for the evaluation of horse temperament.

USAGE FREQUENCY OF A VERANDA AS A NEW ALTERNATIVE HOUSING SYSTEM FOR MALE TURKEYS AND EFFECTS ON ANIMAL HEALTH AND PERFORMANCE

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Normally, the majority of commercial turkeys are kept on litter in open front stables without any structure. One possibility to enhance the bird's opportunity to perform a wide range of behaviour patterns, to increase their movement and to improve their health and performance, is to offer a roofed outside run (veranda).

The present study investigated if commercial turkeys used a veranda and tested the effects on animal health and performance dependent on age and season.

One commercial turkey stable was equipped with a veranda (225m²) and littered with sand. A second conventional stable without a veranda was also included in the study. Over four fattening periods, the number of turkeys (BUT Big 6), using the veranda was observed twice every two weeks from the age of 7 weeks onwards. Usage frequency was analysed in time sampling at twenty-minute intervals. Additionally, from a sample of 100 birds, the feather condition, the walking ability and the leg posture were examined every four weeks. Furthermore, body weight, food consumption, mortality and carcass damages were recorded.

Data were analysed by a mixed model (SAS).

The mean percentage of turkeys on the veranda differed between 9 and 11 % and was significantly influenced by age of animals ($p < 0.01$), hour of day ($p < 0.001$) and the interactions season x age, season x hour and age x hour ($p < 0.01$). A significant deterioration for walking ability ($p < 0.05$) and normal leg posture ($p < 0.001$) with rising age could be observed in both stables. The mortality was reduced in the alternative stable, body weight and feed conversion was within standards and did not differ. No significant differences for carcass damages between both stables.

Turkeys used the veranda without negative effects on performance parameters. But it seems that the genetic of heavy turkeys had a greater influence compared to the enrichment of environment.

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PERCH DESIGN EFFECTS ON HENS' PERCHING BEHAVIOUR

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The aim of this study was to investigate if perch design affects perching behaviour of hens housed in furnished cages. Three different perches were compared: circular wood perch (flat upper and under side), angular wood perch with rounded edges and T-shaped plastic perch. 512 LSL hens were housed in cages for 8 hens, furnished with three perches, a nest and a dust bath. 24 cages were fitted with each wood perch designs and 16 cages with plastic perches. Experimental unit comprised of two adjacent cages with similar perches. The experiment extended from 21 to 73 weeks of age.

Perching frequency was recorded every 8th weeks on three consecutive days by a person walking slowly around the cage rows and counting birds on perches. Counting was carried out twice a day: at six hours after the lights-on and at one hour after the lights-off. The average percentage of birds perching at given time was calculated over each three days period. Feet pad condition was evaluated at 34, 55 and 70 weeks of age. Data was analysed with SAS Mixed procedure repeated measures analysis. Differences between treatments were tested with orthogonal contrasts.

At the time of inspections in the dark on average 75.6% of hens were perching. In the light the proportion was 38.1%. Differences in perching frequencies were found between perch designs at inspections made in the light. Perching frequency was greater in cages fitted with plastic perches than in cages with either of the wood perches (42.1 vs. 37.5%, $P < 0.05$). Perching frequency was greater in cages with round wood perches in comparison to cages with angular wood perches (39.5 vs. 34.5%, $P < 0.05$). Feet pad condition was poorer in cages with plastic perches ($P < 0.01$). The results suggest that hens' perching behaviour and feet pad condition is affected by perch design.

INFRARED BEAK TREATMENT VS. HOT-BLADE BEAK TRIMMING EFFECTS ON LAYING HEN WELL-BEING

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Beak trimming, removal of $\frac{1}{3}$ to $\frac{1}{2}$ of the beak, is a routine practice in the United States poultry industry to prevent feather pecking and cannibalism. However, previous studies have shown that hot blade beak trimming induces neuromas in beak stumps and causes pain in trimmed birds, which decreases bird well-being. To develop effective practices that reduce or eliminate stress and pain associated with hot blade beak trimming would be appreciable approaches before painless methods to control cannibalism have been developed. The infrared beak system produces a high intensity heat that penetrates through the corneum layer down to the corneum growing basal tissue to burn the tip of beak and to stop germ layer growth. Infrared beak treatment may be an alternative to hot-blade beak cutting. The current study investigated whether there are different effects of infrared beak treatment and hot-blade beak trimming on chicken well-being.

White Leghorns (Hy-Line W-36) were used in the study. Forty-eight chicks were randomly divided into three groups ($n=16$), i.e., control, infrared beak treatment, and hot blade beak trimming. Beaks were trimmed at 1 day of age. The chicks were housed in the same room following standard managerial guidelines. Birds' behavior was observed daily via direct observation, and a warm-water pain test (45°C) was performed at 2 and 5 weeks post-treatment. The data showed that compared to hot-blade beak trimming, infrared beak treatment caused less gross beak damage, and less effects on general behavior, such as less changes in eating and drinking (ANOVA, $P<0.05$). Infrared treated birds also exhibited few pain behaviours following a warm water pain test (ANOVA, $P<0.01$). These results suggest that infrared beak treatment may be a wellbeing-friendly alternative to hot-blade beak trimming in laying hens before painless methods to control cannibalism have been developed.

THE EFFECT OF HOUSING CONDITIONS ON ACTIVITY AND LYING BEHAVIOUR OF HORSES

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Housing conditions for domestic horses feature a high degree of confinement and, as horses are flight animals, may affect their welfare. This study aimed to determine if activity and lying behaviour of horses are affected by housing conditions and the extent to which rebound behaviour occurs when a horse is released from a stable.

Time spent lying down and in activity was recorded remotely using a tilt switch and a motion sensor attached to a data logger. These were strapped to the horse's left foreleg. Eight horses were each subject to each of four housing treatments; P-paddock, FS-fully stabled, PS-partly stabled and Y-yard. Six days of acclimatisation preceded the 24h recording period on day 7. Rebound behaviour was measured in PS on days 1 and 7. Activity (secs) during the 5 mins after release from stable to paddock was compared with activity for the same horse at the same time of day in P. Statistical analyses used were: repeated measures ANOVA for total lying down time and activity; Kruskal-Wallis for effect of housing on timing of lying bouts; chi-square for effect of time on frequency of lying bouts.

Housing conditions affected activity (P, 686; FS, 123; PS, 158; Y, 377 mins; $P < 0.001$), but not total lying down time ($P > 0.05$) or distribution of lying bouts over 24h ($P > 0.05$). More lying bouts occurred between 0100-0900 than between 0900-1700 or 1700-0100 (means: 45 vs. 17 and 16, $P < 0.001$). On release from stabling in PS, horses were more active than in P, on both days 1 ($P = 0.006$) and 7 ($P = 0.025$), indicating that rebound behaviour occurs but declines as the housing period progresses. These results suggest that time of day is a stronger influence on number of lying bouts than housing conditions but that activity is sensitive to changes in degree of confinement.

BEHAVIOUR OF BEEF BULLS IN A PEN AND IN A FOREST PADDOCK IN SUMMER

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Forest paddocks offer an alternative for raising beef cattle in the sparsely populated Finnish countryside. With highly enriched environment and high space allowance the forest paddocks may provide the animals a better opportunity to fulfil their behavioural needs. We compared the behaviour of Hereford bulls in forest paddocks and pens.

From November onwards two groups of five bulls were housed in partly deep-bedded pens (6.4m²/bull, PEN) in an uninsulated building and two groups of five bulls in forest paddocks (0.1ha/bull, PAD). All animals were fed a mixture of grass silage and rolled barley *ad libitum*. Bulls' behaviour (age 14-18 months) was observed in the next July, August and September, 15 hours (0600-2100) per month (instantaneous sampling, 5-min sampling interval).

PEN bulls lay less (42.6±4.0% of time, mean±SD, $p < 0.001$, t-test) than PAD bulls (51.1±2.8%), but there were no differences ($p > 0.1$, Mann-Whitney-test) in the time spent in sleeping postures with relaxed neck (PEN 6.6±2.0% and PAD 7.3±2.2%). There were differences ($p < 0.05$, t-test) between the PEN and PAD animals in the time spent on foraging (16.0±1.4% vs. 19.8±3.4%), drinking (5.8±1.6% vs. 1.7±0.7%), ruminating (total time, 25.7±2.1% vs. 29.0±3.3%), ruminating in standing position (7.9±2.5% vs. 4.0±1.1%), exploration (0.5±0.4% vs. 2.7±0.8%), autogrooming (0.8±0.4% vs. 3.4±1.4%), social activity (social licking and butting excluded, 9.5±2.2% vs. 7.2±1.5%) and standing inactive (16.0±2.5% vs. 9.4±3.0%, respectively). There was no difference between the PEN and PAD bulls in butting behaviour (0.8±0.5% vs. 0.7±0.3%) or social licking (1.0±0.6% vs. 0.7±0.5%, respectively). Stereotyped behaviour was not observed in either group

During daytime the bulls in the paddock utilized the possibility for more diverse behaviour (e.g. foraging, exploration, autogrooming), while the bulls in the pens spent more time standing inactive. Furthermore, lower space allowances in the pens probably resulted in suboptimal ruminating postures and disturbed drinking behaviour. However, these differences may also result from possible differences in diurnal rhythms between the environments.

WHERE CAN AVOIDANCE DISTANCE BE RECORDED ON-FARM IN DAIRY CATTLE?

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Animal-human relationship may influence health, performance and welfare in many farm animal species. Therefore, parameters of animal-human relationship such as the avoidance distance towards an unknown person are often included in animal welfare assessment protocols for cattle. Whereas mainly avoidance distance recording in the home pen is recommended, other locations may be advantageous with regard to feasibility or time frame of the assessment.

It was the aim of this study to compare the avoidance distances obtained in three locations and their relationship with the milker behaviour. For this purpose, 19 loose housed dairy herds in north-western Germany (35 to 95 cows) were assessed. Avoidance distances towards an unknown person were recorded 1) when the cows left the milking parlour, 2) at the feed gate and 3), in the home pen. All recordings were carried out by the same person. The behaviour of the milker towards the cows was also observed during one milking session.

Avoidance distances were significantly correlated between all test locations ($r_s = 0.65 - 0.74$, $n = 19$, $p < 0.01$). The strongest correlation was found between „feed gate“ and „home pen“. There were also significant relationships between avoidance distances in the different test locations and milker behaviour. The highest correlations with milker behaviour were found for the avoidance distance measures at the feed gate (positive interactions % * median $AD_{\text{feed gate}}$: $r_s = -0.61$, positive interactions % * $AD_{\text{feed gate}} = 0$ %: $r_s = 0.63$; $p < 0.01$, $n = 19$).

Our results indicate, that avoidance distance towards an unknown person is hardly influenced by the test situations chosen in this study. However, the validation approach using milker behaviour did not reveal clear preference for a specific test location.

RELATIONSHIPS BETWEEN PERSONALITY TRAITS AND ATTITUDES OF MILKERS AND THEIR BEHAVIOUR DURING MILKING

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The aim of this study was to check whether personality and attitudes scores of stockpersons, as assessed through psychological questionnaires, could predict their behaviour towards dairy cows. Sixty-eight milkers on 24 dairy farms in Central Bohemia filled two questionnaires anonymously. For measurement of personality traits (Neuroticism, Extraversion, Openness to new experiences, Agreeableness and Conscientiousness), Czech version of NEO - Big Five Personality Inventory was used. Attitude questionnaire assessed attitudes and beliefs of stockpersons towards cows through custom-made questions. Communicative and manipulative behaviours of stockpersons toward cows were recorded in one-minute intervals during two hours during afternoon milking. Seven tactile patterns (e.g., "fine touching"), four patterns of vocal signals (e.g., "quiet speech") and category of "mechanical sounds" (e.g. hand clapping) were distinguished. These twelve human behavioural patterns were submitted to principal component analysis. First three components were labelled as „ROUGHNESS“ (using stick, hitting strongly with hand, loud vocalisations and mechanical sounds loaded on it positively), „CONTACT“ (fine touching, pushing and fine hitting with hand and quiet speech contributed to it positively) and „VOCAL GUIDANCE“.

Relationships between personality traits, attitudes and PCA components were examined with Spearman correlation coefficients, after effects of farm and gender were removed through a GLM procedure.

ROUGHNESS showed positive trend with neuroticism ($r=0.23$, $p=0.07$). It was correlated negatively with conscientiousness ($r=-0.29^*$), with general attitude towards cows ($r=-0.24$), with perceived easiness of handling ($r=-0.31^*$) and negatively with self-reported positive behaviour of stockpersons towards cows ($r=-0.25^*$).

CONTACT was correlated positively with general attitude towards cows ($r=0.43^{***}$), with self-reported positive behaviour ($r=0.36^{**}$) and with positive emotional reaction towards cow behaviour ($r=0.43^{***}$). VOCAL GUIDANCE had not significant correlations.

Results show that psychological tests could predict real behaviour of stockpersons. This fact could have practical application in recruitment of suitable stockpersons respecting better animal needs.

* $p<0.05$, ** $p<0.01$, *** $p<0.001$, supported by grant QD0176NAZV

SELECTION OF ACTIVELY AFFILIATIVE INDIVIDUALS IN A JAPANESE BLACK CATTLE HERD

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Affiliative relationships between cattle have a calming effect on the animals that counters the multiple stresses of being in a herd. Moreover, the time spent on affiliative behaviour is positively correlated with milk yield and dairy gain. We tried to identify affiliative individuals based on differences in social characteristics.

The behaviour of twenty 14-month-old Japanese Black cattle, reared in the same pen, was observed continuously for six hours after feeding, for a total of 180 hours. No new cattle were introduced during the experiment. Time spent on affiliative behaviour (allogrooming) and incidences of agonistic behaviour (aggression and escape) were recorded using all-animal sampling, and performers and receivers were identified. Dominance value was calculated based on agonistic behaviour. Also, the leadership hierarchy was determined by recording the passage order during nine trips along a corridor from the barn to the pasture. Principal component analysis was used to condense multiple correlated variables into principal components.

Individual differences between cattle were found in the time spent allogrooming, and the frequency of aggression and escape (chi-squared test; $P < 0.001$). The time spent allogrooming was positively correlated with the number of allogrooming performers and receivers ($r_s = 0.64$, $P < 0.01$; $r_s = 0.54$, $P < 0.05$, respectively). The time spent receiving allogrooming was negatively correlated with the escape frequency ($r_s = -0.62$, $P < 0.01$) and dominance value ($r_s = -0.46$, $P < 0.05$), but positively correlated with dairy gain ($r_s = 0.58$, $P < 0.01$). The social nature of individual cattle was explained by three principal characteristics: aggressiveness, affiliativeness, and leadership. The social characters were categorized as actively affiliative, actively aggressive, escaper, loner, and intermediate from the data of each principal component score and the social behaviour frequency. Therefore, affiliativeness was independent of the other social characteristics. The dairy gain of actively affiliative individuals was similar to actively aggressive animals, but was higher than either passively or intermediate affiliative animals (ANOVA; $P < 0.05$).

GENERALISATION PROCESS FROM A FAMILIAR STOCKPERSON TO AN UNFAMILIAR ONE IN ARTIFICIALLY REARED LAMBS.

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Many studies demonstrated that positively handled animals are less frightened by an unfamiliar human than non handled animals. However such studies could not differentiate an absence of discrimination between familiar and unfamiliar caretaker from a generalisation process. The present experiment investigates this point in lambs by studying the responses to humans in 48 lambs according to their degree of familiarity with the humans. Animals were reared in pairs since 18 hours of age: 24 lambs received no visual human contact since the experimenter was hidden behind a wooden shield and passed his gloved hand between the shield during early training for artificial feeding ("Human unknown": HU), 24 lambs received 7 days of artificial rearing and gentling ("Human known": HK). Then, no additional contact was given to the animals until to be tested. Lambs were individually tested for 3 consecutive days at 2 months of age, one animal from each pair with an unfamiliar experimenter and the other one with the caretaker who trained the animals for artificial feeding. The test consisted of a social isolation in an unfamiliar arena for 2 min, then with a human for 2 min and finally alone again for 2 min. Two caretakers performed the training for artificial feeding. During the tests, the same caretakers were implicated as the familiar or unfamiliar experimenter, depending on the animals. HK lambs spent more time near the familiar experimenter than near the unfamiliar experimenter ($103.5 \pm 8.8s$ vs. $42.0 \pm 16.7s$, $P < 0.05$, Mann-Whitney test). This difference increased over test days ($P < 0.05$, Friedman test). Interestingly, HU lambs spent more time near the caretaker who trained the animals than near the unfamiliar one ($43.3 \pm 17.2s$ vs. $1.0 \pm 0.7s$, $P < 0.05$). They spent also less time near the unfamiliar experimenter than HK lambs ($P < 0.08$). Such results suggest both discrimination and generalisation processes in lambs towards humans. Recognition via olfactory cues is a putative explanation of the discriminative responses recorded in the HU animal towards the caretakers.

**ABILITY OF PONIES TO DISCRIMINATE AMONG COLORS
AND AMONG SIMILARLY DRESSED PEOPLE****Y. Koba^{1*}, C. Goto¹, N. Horikawa², K. Tsuchiya², H. Tanida¹**¹Graduate School of Biosphere Science, Hiroshima University, Japan²Hiroshima Prefectural Saijyo Agricultural High School, Japan

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This study examined the ability of ponies to discriminate among equally luminous colors and among similarly dressed people in a Y maze. In experiment 1, two Shetland ponies were trained to choose a positive stimulus color card and to receive a food reward. Red, green and blue, which have the same luminosity, were presented in a pair-wise fashion. One session consisted of 20 trials in which the placement of the reward card was randomly assigned according to a Gellerman series. Successful discrimination was achieved when a pony made at least 15 correct choices among 20 trials in two consecutive sessions ($P < 0.0025$ by *Chi* square test). Both ponies successfully discriminated blue from green, blue from red and green from red, establishing that ponies are able to discriminate among the primary colors. In Experiment 2, the same two ponies were trained to receive a reward from an experimenter sitting at one end of the maze while the other one was empty. After the training, four people participated as non-rewarders. Each non-rewarder was compared pair-wise against the experimenter in the maze. One of the four had previously been engaged in daily management of the ponies and the others were unfamiliar to them. Both people in the maze in any one trial wore the same color of coveralls and wore the same au de Cologne. Each session again consisted on 20 trials, people were assigned to branches of the maze according to a Gellerman series and successful discrimination was based upon 15 or more correct choices in two consecutive sessions. Both ponies successfully discriminated the experimenter from the non-rewarder who engaged in daily pony management, but only one of the ponies was able to discriminate the experimenter from a non-familiar person. Results suggest that ponies can visually discriminate among people, particularly using facial cues.

RATE OF SUCCESSFUL ADOPTIONS IN PROBLEM BEHAVIOUR DOGS SUBJECTED TO AN ASSISTED ADOPTION PROGRAM

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Behavioural problems are among the first causes of dog relinquishment in many countries. In Italy the law forbids euthanasia of shelter dogs unless they represent a proven danger to people or are severely ill. Many problem behaviour dogs do not qualify in those categories and are difficult to re-home. The aim of this study was to assess the rate of successful adoption in healthy normal and problem behaviour dogs in a rescue shelter in Northern Italy. People wishing to adopt a problem dog in this shelter had to agree to follow an assisted pre- and post- adoption program including a course on dog behaviour with specific training lessons. All the dogs are tested twice (entrance, 3rd week) for behavioural problems using a dedicated set of behavioural tests (reactivity and handling tests). In 2000-2002, of the 746 dogs admitted to the shelter, 92 had behavioural problems: 30 were fearful, 38 were aggressive, 17 were hyperactive, seven presented miscellaneous other problems. Two problem dogs were not adopted at the end of the study, and this rate did not significantly differ from that of the normal dogs (3/654). Return rate for normal dogs (13/651) was not statistically different from that of problem behaviour dogs on the whole (5/90), aggressive dogs (1/36) and hyperactive dogs (1/17). A significant difference was evident for fearful dogs (3/30; Fisher Exact test ($P=0.029$)). It is concluded that there was a high rate of successful adoption among problem behaviour dogs using this program, except for fearful dogs. This could be due to several factors: fearfulness could be more difficult to address with such a program, these dogs may have more difficulties coping after adoption because they need strong bonds with people they trust or new owners may have unrealistic expectations about the management of this problem.

**BEHAVIORAL AND PHYSIOLOGICAL STRESS RESPONSES
OF DOGS IN AN ANIMAL-ASSISTED ACTIVITY AT
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Animal-Assisted Activity (AAA) is contact with animals to improve the quality of life. Although we know AAA has positive effects on people, we do not know about the influence it has on animals. To investigate the stress level of dogs involved in AAA at a public animal shelter, the behavior and urine catecholamine (adrenalin, nor-adrenalin) concentrations of the dogs were compared according to their body size (small or large) and the day (weekdays or holidays) and time (morning or afternoon) of the AAA.

The subjects were six sheltered dogs. The dogs' behavior was recorded repeatedly (12 days, 12 times) during the AAA, and the number of bouts and the total duration of five different behaviors (yawning, licking, paw lifting, rejecting and panting) were measured. The dogs' urine samples were gathered on the morning of the AAA, before and after the AAA, and in the morning of the next day when the shelter was closed.

Panting occurred more ($P<0.05$) in large dogs than in small, and paw lifting occurred more ($P<0.05$) in small dogs. More licking ($P<0.001$) and panting ($P<0.05$) were found on holidays compared to that on weekdays. Licking ($P<0.05$) in the afternoon occurred more than in the morning. Timing of the urine sampling had no effect on the catecholamine concentrations. Adrenalin concentrations of small dogs were higher ($P<0.05$) than large dogs. Catecholamine concentrations were not different between the days and times of AAA.

Behavioral results suggested that the body size of dogs and the day and time of AAA affected the stress responses of dogs. This seemed to be related to how long they were petted by people and how many people petted them during AAA. However, the change in urine catecholamine concentrations was not clear in relation to AAA because of individual differences. Thus further investigation is necessary.

DIFFERENCES IN RED-LEGGED PARTRIDGES (*ALECTORIS RUF*A) BEHAVIOUR DEPENDING ON THE PAIRING METHOD.**M.A. Alonso*, R. Prieto, J.A. Pérez, C. Diez, V.R. Gaudioso.**

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Handling and production systems in intensive red-legged partridge farms are very different from birds wild behaviour in wild conditions. One of the aspects to consider in the management is the type of pairing, since scientific evidence exist on the positive correlation between parameters of reproductive success and the possibilities of freely choosing a partner. This study aimed to evaluate the differences in the behaviour of forced and free choice pairs of red-legged partridges .

48 birds hatched in May of the previous year on a commercial game farm that used and intensive breeding method were used. 12 pairs of free choice and 12 forced pairs were housed individually in metal mesh cages of 4 m² (2 m long x 2 m wide x 1 m high) placed such that neighbouring pairs of birds could not see each other. Video recordings were made daily throughout the first week during 4 hours in the early morning. Frequency and duration of 25 behavioural parameters have been analysed using a computer program developed for this purpose. Data were analysed by one-way ANOVA to assess the significance of differences between pairing method.

The free choice birds showed a significantly higher frequency of "alert pattern" (43,50±20,1 versus 18,19±9,6), and also shows more behaviours related to the nourishment and cohesive behaviours as "pecking" (82,69±28,5 versus 49,56±14,3), "come to peck " (6,00±3,9 versus 1,94±1,8), "pecking the two at the same time" (23,13±12,3 versus 10,75±4,4), and "follow the other" (8,00±5,7 versus 3,63±2,2). This suggests us that in the free choice red-legged partridge pairs, the performance of alert and cohesive feeding behaviours give more possibilities to survive and to have a good body condition to the female and this could contribute to the possibilities of survival of their descendants.

DISPERSION AND HOME RANGE OF HAND-REARED AND WILD RED-LEGGED PARTRIDGE (*ALECTORIS RUFA*) USED IN REPOPULATIONS.**J.A. Pérez*, M.E. Alonso, V.R. Gaudioso, C. Díez, D.J. Bartolomé.**

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On a private property with a stable population of wild red-legged partridge (*Alectoris rufa*) and an appropriate habitat for the survival of the species, reinforcement repopulation were carried out using 36 animals that where 2 to 3 months old, 24 reared on a commercial game farm and 12 wild animals captured for the study. This study aimed to evaluate the behaviour in the wild of the released partridges, specially dispersion and home range.

All the animals were released from 4-m² net cages (2 m long, 2 m width and 1 m height) after an acclimatisation period of 2 days in the field before allowing their exit with the purpose of minimizing manipulation stress. Previously all birds were equipped with radio transmitters collars (Biotrack[®]) and metallic leg-ring numbered in order to determine the behaviour of study animals in field conditions.

The post-release mean dispersion, maximum distance from the release point at which each bird was located, was 511.95 m for the hand reared partridges and 1708.65 m for the wild ones. The maximum distance registered was 1154.12 m for the hand reared and 3880.37 for the wild, and the minimum distance was 89.44 for the first and 849.00 for the second group of birds.

We also obtained differences when studied the medium home range, that was 7.81 has for the hand reared partridges and 127.95 for the wild partridges, with a maximum home range of 46.00 has for an hand reared animal and 433.00 for a wild animal.

The results seems to take us to the conclusion that the production systems and handling practices of commercial game farms have modified the ethological patterns characteristic of the species, originating problems to adapt and integrate into the wild.

THE INFLUENCE OF THE BREEDING-METHOD ON THE BEHAVIOUR OF ADULT AFRICAN GREY PARROTS

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The purpose is to see how hand-reared, parent-bred and wild-caught African grey parrots differ in their behaviour.

The hand-raised parrots were also divided into several categories in order to examine the influence of the different hand-rearing methods on the birds' behaviour.

subjects : 105 grey parrots (>3 years old, origin known)

questionnaire : 199 closed questions for the owner (about breeding method, care, housing, health, origin, previous owners, behaviour, social interactions).

11 questions : hand-rearing method (breeder asked).

Database : Access ; Statistics : Chi-square Test and Fischer's Exact Test (NCSS).

Main results :

Based on the questions. Many complex behavioural patterns (e.g. aggressiveness) were evaluated with a key considering several criterions. All subjective answers (of the owner) were checked using objective components.

Hand-reared parrots : more aggressive (p:0.027), more selective (human beings) (p:0.008), feathers chewed rather than plucked (feather-picking) (p:0.007), over- or under-preened (p:0.005), clumsier (p:0.016), infantile behaviour (p:0.003).

< 5 weeks old when removed from nest : more stereotypies (p:0.015).

Tube-feeding : more aggressive (p:0.010), tend to screech (p:0.031), poorer health (0.027).

Minimal human contact (hand-rearing) : normal sexual life between parrots more achievable (p:0.069).

Wild-caught parrots : more feather-picking (p:0.046), poorer health (p:0.006), more fearful (p:0.004).

This study leads us to conclude that the breeding method has an obvious influence on the behaviour of grey parrots. Hand-reared parrots tend to become more problematic than parent-bred and wild-caught birds. Nevertheless, some methods used to hand-raise chicks have fewer consequences on the bird's adult behaviour, such as spoon-feeding, a long stay in the nest with the parents and less social contact with human beings during hand-rearing, and therefore should be more often applied.

The importance of the imprinting and the first social interactions of grey parrots are crucial for the normal development of their behaviour and shouldn't be underestimated.

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**BEHAVIOURAL AND ADRENOCORTICAL RESPONSES
TO DIGGING DEPRIVATION IN BLUE FOXES****H.T. Korhonen, L. Kokkonen, L. Jauhiainen, T. Rekilä**MTT Agrifood Research Finland
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The aim was to investigate the effects of digging deprivation on farmed blue foxes (*Alopex lagopus*). At weaning (July 17), the following groups were formed: 1) control: without digging substrate on netting cage; 2) SB-1: sandboxes available from weaning onwards; 3) DP-1: digging plates available from weaning onwards; 4) SB-2: sandboxes available for three weeks (Sept 6-Sept 26); and 5) DP-2: digging plates available for three weeks. N=12 juvenile males/group. Before deprivation, SB-1 spent an average 5.0 ± 5.3 min/day (mean \pm SD) on digging. Two days after deprivation, a rebound effect was noted, and digging time rose to 16.3 ± 11.9 min/day ($p < 0.01$). Two weeks after deprivation, however, digging returned to pre-deprivation level ($p < 0.001$). The response was the same in DP-1: Two days after deprivation, the time spent on scratching rose from pre-deprivation level (2.5 ± 3.8 min/day) to 8.1 ± 7.0 min/day ($p < 0.05$). The initial level was re-gained two weeks after deprivation. Digging in SB-2 amounted to 80.0 ± 43.5 min/day two days after access to sandboxes. The same time was spent on digging three weeks later. In DP-2, digging amounted to 1.3 ± 3.5 min/day two days after access, but three weeks later no digging occurred. Control animals did not dig the cage floor. The amount of stereotypies increased during deprivation, and declined after re-access to the commodity only in SB-1 ($p < 0.05$). The urine cortisol: creatinine ratio also increased in SB-1 after the start of deprivation ($p < 0.05$). In conclusion, deprivation had the most pronounced effects on blue foxes having sandboxes from weaning onwards.

PLAY BEHAVIOUR OF JUVENILE FARMED MINK IN THE PRESENCE AND ABSENCE OF SWIMMING WATER

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The opportunity to perform play behaviour might be important as one of the early life activities that stimulates behavioural variability and may enhance an individual's coping capacity later in life. Rewarding stimuli such as cage enrichments might enhance play behaviour in juveniles- often proposed as a sign of well-being of the individual.

The present study aimed to investigate the occurrence of play behaviour in juvenile farmed mink reared and housed with standard cage enrichments of the Dutch housing system (cylinder and platform; C-group) and an experimental group with the same standard enrichments, but with additional access to swimming water (W-group). If swimming water is a naturally rewarding behaviour it is assumed that play behaviour is released.

On average, W-group subjects showed more play behaviour in the main cage ($17.5\% \pm 0.8$ S.E.M.) than C-group subjects ($14.1\% \pm 0.9$ S.E.M.), which was significant (MWU: $U = 230.5$, $P \leq 0.01$, $N_{C,W} = 28$). Additionally, C-group subjects spent significantly more time on solitary active behaviour ($13.6\% \pm 0.6$ S.E.M.) than W-group subjects ($10.4\% \pm 0.6$ S.E.M.) (MWU: $U = 177.0$, $P \leq 0.01$, $N_{C,W} = 28$).

The results suggest that swimming water present some relevant stimuli that may directly or indirectly stimulate the display of play behaviour in juvenile mink. At the short-term swimming water may contribute to mink's well-being; at the long-term, however, implications for animal welfare are still unclear, as this highly depends on the individual's future experiences and whether these "extra skills" will be required for better coping capacities in the adult situation: correlations between play behaviour and stereotypical behaviour should be elucidated in future studies.

OUTDOOR RANGE USE OF INDIVIDUAL LAYING HENS

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The use of outdoor range by laying hens has usually been investigated using anonymous counts of the numbers of hens in the outdoor areas. However, there is only scarce knowledge on individual differences in the outdoor range use and if such differences may be related with the animal's state such as body weight or feather condition.

For this purpose, 80 hens out of a herd of 650 hens were individually marked using "backpack" numbers which had previously been tested for compatibility and durability. The presence of marked hens in seven zones (0-5, 5-10, 10-20, 20-30, 30-40, 40-50, >50m) was recorded at 20 min scans between the opening of the outlets in the morning (about 10 am) and dusk. Observations took place during 8 days in autumn (period 1) and 6 days in winter (period 2) within a three week period each.

In both period 1 and 2, all marked hens were detected in the outdoor range and on average 99 % (period 1) and 94 % (period 2) were registered at least once per day. The animals spent significantly more time outside in autumn than in winter (35 ± 11 % vs. 22 ± 14 % of observations; $p < 0.000$, $n = 71$, Wilcoxon-test). Cluster analysis (Ward method) based on the distribution within the outdoor range revealed 4 distinct groups of hens in period 1 and 3 groups in period 2. In period 1, these groups differed in the total time spent outside and the proportion of time they spent at greater distances from the barn. However, in period 2 hens predominantly stayed within 10 m from the building and group differences originated from the time spent in this area. There were no significant differences in body weight and feather condition between the groups revealed by cluster analysis.

FIRST RESULTS ON THE ACCEPTANCE OF SHOWERING AS AN ALTERNATIVE TO BATHING IN PEKIN DUCKS

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The Council of Europe Recommendation concerning domestic ducks underlines the importance of water for Peking ducks. Under commercial conditions, however, water for bathing carries potential hygiene risks. We have therefore started to investigate the acceptance of a showering as an alternative to bathing and have looked at the development of bathing behaviour.

Two groups of 12 Peking ducks each were kept in compartments of 2.2 m². Two thirds of the floor space was littered, one third slatted. The slatted area was equipped with a shower or a bath. A passive infrared sensor activated the shower as the birds approached the area. Free access to the bath was given.

The behavioural patterns of 30 ducks kept under each set of conditions were recorded individually from 2 to 6 weeks of age. At the beginning of the study the water from the shower and bath was mostly used for drinking. In the 2nd week the mean frequency of drinking was 18.3±10.0 and 9.0±5.7 for the bath and shower respectively. In week 6 it decreased to 8.5±10.5 for the bath but increased to 21.0±13.0 for the shower. Head dipping behaviour developed later with the shower as compared to the bath (1.1±2.4 and 3.2±4.8 respectively at 2 weeks of age). In week 6 there were no differences between treatments in the frequency of head dipping (26.3±18.9 for the shower and 26.5±24.6 for the bath). The mean duration of bathing periods increased during 2 to 4 weeks of age for both treatments. From week 4 onwards the mean duration spent under the shower was slightly higher than the time spent in the bath (5.5 versus 4.4 min. in week 6).

This preliminary study presents encouraging results. Further research using higher numbers of replicates will be needed to examine the acceptance of showering in Peking ducks.

EFFECTS OF DIFFERENT TYPES OF WATER PROVISION ON THE BEHAVIOUR AND CLEANLINESS OF THE PLUMAGE OF MUSCOVY DUCKS (*CAIRINA MOSCHATA*)

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Muscovy ducks are commercially fattened without access to bathing facilities. However, the Council of Europe recommendation requires the provision of water such that ducks can cover their head with it ('head dipping') and shake it over their body ('incomplete bathing'). We investigated whether different types of water provision allow to perform such water related behaviours and the effect on the duck's plumage. From 12-h-weekly continuous focal animal observations of six ducks over ten weeks at a semi-natural pond, an ethogram of water related behaviours was constructed, comprising drinking, sieving, head dipping, bathing, swimming, diving and preening. Under near commercial housing conditions, in three replications, three groups of each 400 ducks were provided either with a water gutter (10mx0.25mx0.25m) ('G'), or just with bell drinkers with narrow rim (5cm, 'ND') or wide rim (9cm, 'WD'). Continuous focal animal sampling was executed weekly (5 hours) in replicate 1, and later at week 4, 6 and 8. All water related behaviours occurred in G over the whole period. In WD, incomplete bathing was observed until week 3, in ND in week 1. Incomplete swimming and diving occurred in week 1 in WD, and not in ND, head dipping until week 1 in WD, and until week 2 in ND. Drinking and sieving were performed in all groups. G-ducks (N=18) spent significantly more time preening (26.6%) than WD- (14.7%) and ND-ducks (14.9%, N=15, p=0.018; Kruskal-Wallis-test). Near to slaughter the plumage was scored from 1 (best) to 5 (worst), and was significantly cleaner in G-ducks (1.52, N=80) than in WD- (2.00, N=76) and ND-ducks (2.07, N=80, p=0.000; Kruskal-Wallis-test). Both types of bell drinkers do not fulfil the requirements of the Council of Europe recommendation. Lack of freedom to perform water related behaviours has adverse consequences on the bodily state of muscovy ducks. Investigations are continued.

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EFFECT OF WATER BATH ON BEHAVIOUR AND FEATHERING IN DUCKS

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The body weight, behaviour and feather development of Pekin and Muscovy ducks and their crosses, the Mulards, was studied under different environmental conditions: windowless house and free range, with and without water bath. In the experiment were used 204 animals, 68 of each species. Direct behavioural observations were made three days per week from 10 a.m. to 5 p.m. from the 1 - 10 weeks of age. The feather growth was measured of the 4th primary flight feather, the middle tail feather, feathers in the breast, abdomen and the back areas. The differences between the groups were tested by means of one-way classification. The behaviour of the ducks among the three species within management systems showed only slight differences. An extended duration of "sieving in the grass" and preening, and a reduced duration of sitting was observed in free range as compared to the pens. The presence of a water bath influenced the elements of bathing behaviour, the other behaviours only insignificantly. The development of feathers in the breast region and of legs as well as the middle tail feathers was accelerated in Pekin ducks by the bath, but no differences were found in the feathers of the back region and the 4th primary flight feather. The growth of feathers in Muscovy ducks was not influenced by the bath, only by the free range. The live weight of the Pekin ducks was higher when they were kept in free range and with a bath and that of the Muscovy ducks and Mulards was higher in free range conditions.

A SYSTEMATIC APPROACH TO SUPPORTING PRACTICAL DECISION MAKING REGARDING ENVIRONMENTAL ENRICHMENT FOR PIGS

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The EC directive regarding minimum standards for the protection of pigs (2001/93/EG) states that: "Pigs must have permanent access to a sufficient quantity of material to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such, which does not compromise the health of the animals". Implementation of this directive into practice requires farmers and policy makers to decide whether materials such as a chain, a plastic ball, a piece of hardwood or artificial plastic tails meet the objective of allowing proper investigation and manipulation activities. In order to support the decision-making process we conducted a literature review (number of references > 40), elicited expert opinion (n>50) and started to systematically log and analyse the relationships between materials, material properties and welfare indicators. The preliminary results confirm that providing a metal chain is certainly not sufficient (86% agreement) while the provision of loose, unchopped straw generates considerable credits ('straw' received 75% agreement). More importantly, however, the evidence is building up that it is possible to formalise the 'translation' from available scientific results into an index or other support-tool, which policy makers and farmers can use to make the required practical decisions. Critical evaluation from the international scientific community is recognised as a critical success-factor for the proposed methodology and its implementation to support decision-making concerning environmental enrichment for pigs and other animal welfare problems.

ANTICIPATION TO REWARD: A TOOL TO IMPROVE WELFARE IN HUSBANDRY PIGS?

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Frequent anticipation to a reward, has been shown to improve the welfare of chronically stressed rats. It was therefore hypothesized that anticipation to rewards may similarly improve the welfare of production animals that are housed under conditions that do not fulfill their behavioural needs. In the present experiment, the influence of anticipation to rewards was therefore investigated in a group of 60 newly weaned fattening pigs housed under standard production conditions.

Four days after weaning, 60 female fattening piglets were assigned to one of the three following conditions: in condition A a sound (CS) predicted the arrival of a food reward (US) with a variable delay of 2 to 20 seconds. In condition B the sound and the reward were unpaired and in condition C nothing was given at all. Piglets received the CS en US four times a day, five days a week for eight weeks. Each condition consisted of 10 pens with two sisters per pen.

Latency to first approach and first manipulation of a novel object were scored at weeks 8 and 10 respectively. At nine weeks of age the piglet's behaviour during a food restriction period (from 07:00 till 17:00) was scored. Finally, weekly 24-hours video recordings were made in order to measure general activity during the entire experimental period.

The statistical unit used was the pen ($n=10$).

Preliminary analyses with non-parametric statistic indicated that the piglets of condition A were more active during the day, approached and manipulated the novel object faster and reacted with less aggression to the food restriction period than the piglets of the other two conditions ($p \leq 0.05$ for all tests).

The results suggest that repetitive anticipation to a reward, has a positive effect on the welfare of newly weaned piglets.

AROMATHERAPY AS ENRICHMENT FOR KENNELLED DOGS

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Thousands of dogs end up in rescue shelters every year. This environment can be highly stressful and impact negatively upon animal welfare. Finding a suitable means of enriching the environment, and enhancing the well-being, of kennelled dogs is thus of utmost importance.

This study explored the value of olfactory stimulation as a method of environmental enrichment for kennelled dogs. Fifty-five dogs housed in a Dogs Trust rehoming centre were exposed to 5 types of olfactory stimulation (control [no odour], lavender, chamomile, rosemary, peppermint) for 4 hours a day for 5 days, with an intervening period of 2 days between conditions. The dogs' behaviour was recorded on days 1, 3 and 5, during each condition using a scan-sampling technique, and analysed using a series of ANOVAs.

The odours had a significant effect upon the amount of time that the dogs spent standing ($F[4,216]=3.15$, $P<0.05$), resting ($F[4,216]=18.82$, $P<0.001$), moving ($F[4,216]=30.63$, $P<0.001$) and vocalising ($F[4,216]=14.41$, $P<0.001$). Dogs spent significantly ($P<0.05$, bonferroni test) more time resting and less time moving upon exposure to lavender and chamomile than to other olfactory stimuli. These odourants also encouraged significantly ($P<0.05$, bonferroni test) less vocalisation than the other odours. The diffusion of rosemary and peppermint encouraged significantly ($P<0.05$, bonferroni test) more standing, moving and vocalising than the other conditions of olfactory stimulation.

It is concluded that the welfare of kennelled dogs may be enhanced through exposure to appropriate forms of olfactory stimulation. Lavender and chamomile appear particularly beneficial, resulting in behavioural changes suggestive of relaxation. Rescue shelters are extremely stimulating environments. Diffusing odourants with calming properties may result in a less stressful environment for the animals housed within. These odours also encourage behaviours that are considered desirable by shelter visitors and hence may result in increased adoption rates and long-term improvements in well-being.

ACTH INJECTIONS DO NOT SIMULATE EXACTLY PHYSIOLOGICAL RESPONSES TO REPEATED TRANSPORT IN PREGNANT GOATS

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The aim of this study was to compare the effects of repeated transport with the effects of stress simulation (ACTH injections) on some physiological parameters in pregnant goats. Five weeks prior to parturition goats were subjected to either 10 sessions of transport in isolation twice a week for 1 hour (TRANS, n=13), or, at the same times, 10 injections of ACTH (SynacthèneND, 0.125 IU/kg body-weight) to mimic the cortisol response to transport (ACTH, n=14) or no disturbance (CON, n=14). During the 1st, 5th and 9th test days, blood samples were taken before the start of transport or ACTH injection and at 30, 55, 90 and 120 min. The treatment and test day effects were analysed by the MIXED model procedure of SAS[®].

Cortisol, glucose and non-esterified fatty acid (NEFA) responses were higher in TRANS goats compared to CON goats ($P < 0.0001$) which confirms that transportation is a very stressful situation for goats and influences both glucose and fat metabolism. The cortisol response of TRANS goats was lower for the 9th than for the 5th and 1st transport (effect of day: $P < 0.01$), suggesting that the goats became accustomed to the stress of transport. Concerning the ACTH goats, their cortisol response was higher than that of CON goats ($P < 0.0001$) and did not decrease with time. Moreover, it was lower than in TRANS goats ($P < 0.01$) but the difference was no longer significant during the 9th test day. There was no increase in glucose and NEFA concentrations in ACTH goats emphasizing the fact that systems other than the hypothalamic-pituitary-adrenal axis are also involved in the response to transport-induced stress.

In conclusion, repeated transport of pregnant females induces physiological changes that could affect embryo development. Simulation of the physiological effects of transport by giving ACTH injections presents some limits.

HOW DOES ALLOSUCKLING AFFECT THE STEP MOTHER'S LITTER IN PIGS?

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Allosuckling is common in a group housing system of lactating sows. Little is known about the negative consequences of allosuckling for the step mother's litter, e.g. the disruption of teat order and reduced weight gain of piglets. The aim of this study was to investigate how allosuckling affects (1) the teat fidelity of the step mother's litter, (2) the individual piglets of the step mother (resident piglets) and (3) the weight gain of resident piglets which are pushed away from their teats. Lactating sows were housed in pairs next to each other and piglets had access to both sows from day 10 post partum. The behaviour of 10 pairs of sows with their litters (n=191 piglets) was videotaped for 6 hours on days 10, 11, 16 and 24 post partum. The teat fidelity of litters, the suckling behaviour of resident piglets and their weight gain (from day 10 to day 24 post partum) were analyzed. Allosuckling was observed in 13.6% of piglets, which originated from 70% of litters. (1) The teat fidelity (87±12%) was not different between the litters with and without allosuckling during the whole lactation (Proc Mixed of SAS, NS). (2) 24.5% of resident piglets (n=98) were pushed away from their teat by an allosuckler. The majority (66.7%) of them were previously suckling from two teats, so they lost one teat but they retained the other one. 25.0% of the piglets found a new teat during that nursing. Only once (4.2%) a resident piglet missed a nursing. In one case resident piglet was away during the nursing (4.2%). (3) Resident piglets, which were pushed away from their teats, did not differ in weight gain from their littermates (paired t-test, NS). These results indicate that allosuckling did not affect the teat fidelity of the step mother's litter and the weight gain of resident piglets.

POST-PARTURITION BEHAVIOUR IN MEXICAN CREOLE SHEEP AND GOATS

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Fifteen sheep gave birth to in average 1.25 lambs and 48 goats to 1.57 kids. All data were analysed with ANOVA (GLM). In continuous observations, we recorded time between birth and first occurrence of several activities of the young. Lambs performed the following activities earlier: Standing on carpal joints (7 vs. 15 min), standing on all four feet (17 vs. 31 min), first udder contact (29 vs. 56 min), and sucking (36 vs. 72 min). Lambs got licked earlier than kids (15 vs. 72 sec). Having single or multiple offspring did not affect the behaviour of the mother. Single kids showed a tendency to stand earlier (23 vs. 31 min) and to have udder contact earlier (42 vs. 56 min), and they sucked earlier (48 vs. 74 min).

From birth of the first until two hours after birth of the last offspring, we recorded activities of mother and offspring in 3-min intervals. Regarding the mothers' behaviour (standing, lying, moving, nosing offspring, licking offspring), there were no differences between species. The only recorded difference between mothers of single or multiple offspring was that mothers of single offspring spent more time nosing the offspring (3.8 vs. 1.3% of observations). Behaviour of offspring differed between species in various points. Kids spent more time with rising attempts (4 vs. 2% of observations), whereas lambs spent more time with teat seeking (10.1 vs. 7.6%) and sucking (14% vs. 6%). There were no differences in time spent lying, standing, and walking/exploring. Single offspring sucked more than multiples offspring (11 vs. 6%); no other behaviour was affected by litter size.

We conclude that lambs sucked earlier and more often than kids partly due to fewer offspring, and that lambs were generally more vital. Another explanation could be maternal traits; in particular that sheep licked the offspring earlier.

**POST-WEANING BITING, SUCKING AND CHEWING BEHAVIOUR
OF PIGLETS WEANED AT 3, 4 OR 5 WEEKS OF AGE.****C.A. Tsourgiannis, P.H. Brooks, J. Eddison**

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Weaning is a challenging and stressful period for the young piglets. Scientists relied on a variety of behaviour and immunological end-points to measure stress. This study investigates the variation in aggressive behaviour of piglets weaned at 3, 4 or 5 weeks of age that occurs post-weaning.

Nine sows were selected with similar litter-sizes. For each of three weaning ages (3, 4 or 5 weeks) the 2 heaviest, 2 lightest and 2 piglets closest to the median weight of the litter at weaning were selected. Following weaning, the piglets were offered feed and water *ad libitum*, and monitored using a time-lapse video recording device, 24 hours a day, for that week. Biting, sucking and chewing (parts of the pen) behaviour of the chosen piglets (N=54) were analysed from videotapes using *Observer 3.0* software. The values were \log_{10} or square root transformed. Analyses were carried out using GLM-ANOVA and those readings that did not conform to normal distribution were analysed using Kruskal-Wallis in Minitab 12 for Windows. Untransformed values are presented.

Piglets weaned at 4 weeks of age spent more time (9535 secs, $P < 0.05$) on biting behaviour than piglets weaned at 5 or 3 weeks (5 weeks-5093 secs, 3 weeks-6580 secs,) and also more time (5946 secs) manipulating pen objects (3 weeks-3769, $P < 0.05$, 5 weeks-4358 secs, N.S.). Finally, 4 weeks old piglets spent more time (5159 secs, $P < 0.01$) sucking their pen-mates than piglets weaned at other ages (3 weeks-334, 5 weeks-385 secs).

Other authors suggest that early weaning age has increased post-weaning stress in pigs and that the most stressful period is several days or weeks after weaning. These results suggest that piglets weaned at 4 weeks of age were under more *stress* as they expressed more abnormal or extreme adjustments to their behaviour in order to cope with adverse aspects of their environment and management.

THE EFFECTS WEANING AGE ON POST-MIXING AGGRESSIVE BEHAVIOUR OF PIGLETS

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Much research has been carried out studying the effect of age on piglets' responses to weaning, demonstrating increased levels of plasma cortisol, frequency of vocalisations, and incidences of abnormal behaviour in early weaned piglets. However, no consensus has been reached on the effects of weaning age on aggressive behaviour. Thus, this experiment assessed effect of weaning at 10 or 21 days of age on aggressive behaviour among piglets for three days after mixing of piglets from different litters.

Seventy-two weaned female piglets were used over two trials. In each trial 18 piglets were weaned at 10 days of age (early-weaned, EW, n=36) and 18 piglets at 21 days of age (conventional-weaned, CW, n=36). Two groups of nine piglets were mixed and each group was placed in nursery pens, yielding two pens per weaning age per trial for four replicates per weaning age. The experimental design was a completely randomized one-way classification.

During mixing day and for two days following mixing, piglets were videotaped from 7:00-19:00. Aggressive behaviour, specifically fights which involved only 2 piglets, bites, and pushes were monitored. The number of fights and the amount of time spent in each fight were recorded. A general linear model procedure was used to analyse the data following square root transformation.

Results show marked differences in the aggressive behaviour of the piglets weaned at 10 and 21 days of age. There were more fights among CW piglets than EW piglets (89.00 ± 6.03 vs 59.74 ± 5.86 , $P < 0.01$), however, the average duration of fights was higher for EW than CW piglets (31.74 ± 3.01 vs 20.68 ± 3.10 sec, $P < 0.05$). These results suggest that weaning age is associated with different expression of agonistic behaviour pigs, thus, further research must be conducted to examine the effects of increased fight duration on piglet welfare.

THE RELATIONSHIP BETWEEN CHICK CHARACTERISTICS AND BROILER WELFARE AND GROWTH

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In hatchery management, one-day-old chick quality is related to breeding and hatching conditions. The aim of this experiment was to relate one-day-old chick quality to broiler welfare and growth.

We selected two groups of chicks using the Pasgar©score (Boerjan, Avian and Poultry Biol Rev 13: 237;2000) for assessment of day-old chick quality: optimal chicks (score 10 (P10) chicks, n=96), and chicks having red hocks, navel abnormalities or too much yolk (score 7 (P7) chicks, n=96). Chicks were housed in groups of 8 (4 P7 and 4 P10 chicks per litter pen) in a low (d0; 0.2 m²/chick) and high (d1; 0.09 m²/chick) density. Behaviour in an open field and T-maze, vocalisation frequency, walking ability and asymmetry were measured between day 1-7 and day 35-42. Growth was measured weekly. Data were analysed by general analysis of variance.

P7 chicks were longer ($p<0.05$) and had also higher scores for asymmetry as compared to P10 chicks ($p<0.05$). P7 chicks weighed more than P10 chicks at day 1, 8 and 15 but not thereafter ($p<0.05$). Growth in the first week was significantly higher ($p<0.05$) for P10 chicks as compared to P7 chicks. In addition, d0 chicks were faster in the T-maze ($p<0.05$).

P7 broilers had a higher gait score, lower scores in the latency-to-lie test and wider steps as compared to P10 broilers ($p<0.05$). D0 broilers were more active in the open field ($p<0.05$).

In conclusion, results indicate that differences between P7 and P10 chicks are most pronounced in the first week. However, P10 broilers suffer less from leg weakness compared to P7 broilers. Little effects of housing density and no interactions between density and chick quality were found. Although day-old-chick quality seems to be related to broiler welfare we suggest that low quality chicks are able to compensate in part during rearing.

INTEGRATION OF ANIMAL WELFARE INTO THE VETERINARY CURRICULUM: THE DEVELOPMENT OF AN ONLINE COURSE IN ANIMAL WELFARE

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Educational opportunities in animal welfare are extremely inconsistent among veterinary colleges in the United States (U.S.). Using college websites to examine the curriculum of the 27 veterinary schools fully accredited by the American Veterinary Medical Association in the U.S. revealed that only five schools offer at least one course specifically on the topic of animal welfare. Seventeen schools offer at least one course in animal behaviour, and 19 schools offer a course on ethics. Of these 27 schools, 16 have faculty with a specialization and/or interest in the areas of animal welfare and behaviour. Recent surveys indicate that our society is increasingly concerned with animal welfare. Veterinarians and other professionals such as animal scientists, zoologists are being called upon to be authority figures in this field; however they need more comprehensive education to fulfil this role. Well-informed veterinarians can provide a new perspective on animal welfare by examining the condition of animals as a whole, including both physical and psychological characteristics, in order to form decisions on optimal welfare conditions. Therefore, animal welfare and behaviour education should be included consistently in veterinary curricula worldwide. Animal welfare courses aimed at veterinarians could be offered online, thus eliminating deficiencies in curricula and allowing for more complete, continuing education for both veterinary students and practicing veterinarians. An online course currently under development at Michigan State University could provide a much needed resource for current veterinary students as well as veterinarians in practice wishing to expand their knowledge of animal welfare.

IMPROVING LABORATORY ANIMAL WELFARE -REPORTS OF THE JOINT WORKING GROUPS ON REFINEMENT (JWGR)

B. Reed (RSPCA) on behalf of:

British Veterinary Association - Animal Welfare Foundation (BVAAWF)
Fund for the Replacement of Animals in Medical Experiments (FRAME)
The Royal Society for the Prevention of Cruelty to Animals (RSPCA)
Universities Federation for Animal Welfare (UFAW)

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Wherever animals are used in research, minimising pain and distress is as important an objective as achieving the experimental results. This is important for humanitarian reasons and for good science. In recent years, considerable attention has been focused on the need to recognise and control the adverse effects of scientific procedures on animals, and similarly on the need to improve and enrich the environment in which laboratory animals spend their lives.

It is possible to make significant and immediate improvements to animal husbandry and scientific procedures in a number of ways, and these improvements can be greatly facilitated by ensuring that up-to-date information is readily available. The Joint Working Groups on Refinement convened by the BVAAWF / FRAME / RSPCA & UFAW encompass a broad range of membership with representatives from science and industry, veterinary and animal welfare.

The group has produced a series of reports setting out good practice for the following:

- Removal of blood from laboratory mammals and birds
- Refinements in rabbit husbandry
- Refining rodent husbandry: the mouse
- Refining procedures for the administration of substances
- Laboratory birds: refinements in husbandry and procedures
- Refinement and reduction in production of genetically modified mice
- Refinements in telemetry procedures
- Husbandry refinements for rats, mice, dogs and non-human primates used in telemetry procedures
- Refining dog husbandry and care

The poster to be presented at ISAE will provide further details including references and highlighting the availability for many of these reports to be downloaded for free from the website of the journal 'Laboratory Animals': www.lal.org.uk.

WILD BOAR INFANTICIDE IN CONNECTION WITH FARROWING IN AN ENCLOSURE

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There is a lack of knowledge necessary for safeguarding the welfare of confined wild boars. The aim of this study was to quantitatively describe confined wild boars' behaviours and usage of an enclosure and to identify critical periods in connection with farrowing.

Data were collected during farrowing periods in the springs of 2003 and 2004. The enclosure, situated in Östergötland, Sweden, was 12 hectare and contained different kinds of habitats. The enclosure was inhabited by one male, six females and their offspring.

Focal animal sampling was used to collect a total of 1000 hours of data before, during and after a total of 10 farrowings. Instantaneous sampling was used to measure the sows' locations in the enclosure, distances to nearest individuals and activities (e.g. lying, locomoting, feeding). Social behaviours (e.g. aggressive, submissive and contact behaviours) were recorded continuously. The position of the nesting places and the surrounding habitats were recorded.

The results showed that there was no pronounced isolation behaviour during farrowing, most of the animals choosing nesting places in frequented areas. In direct connection with farrowing, a high frequency of infanticidal behaviour was observed. Other individuals than the mother killed and ate newborn piglets in both seasons. Ten piglets from a total of five litters were observed to be eaten. The infanticide was performed by four different females. In total, six out of twelve litters disappeared and there are reasons to believe that this was mainly due to infanticide.

The infanticide may be attributed to reasons specific to the used enclosure, for example the limited possibilities for pre-farrowing isolation. It can not be excluded that the infanticide is part of an adaptive, natural behavioural strategy. In any case, it constitutes a major welfare problem, and further research is needed on the subject.

**WILD BOARS AND RACCOON DOGS ON KAMAGARI
ISLAND OF THE INLAND SEA OF JAPAN****H. Tanida, K. Ishizawa, Y. Koba**

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Wild animals cause significant economic losses to crop farmers on islands of the Inland Sea of Japan. Farmers actively capture wild boars, but raccoon dogs have never been hunted or trapped on most islands. On Kamagari Island, 185 boars were captured in 2003, but no trapping of raccoon dogs was officially reported. Our objectives were 1) to examine attitudes of farmers toward the animals, 2) to examine the possibility of predicting the number of boars captured from behavioural observation and 3) to estimate the relative abundance of raccoon dogs to boars. Perceptions of farmers toward wild animals were investigated through questionnaires to 28 individuals. We also video recorded behaviour of boars and raccoon dogs at a pond in an abandoned tangerine field for 12 months in 2003. In addition, stomach contents were examined from 32 individuals among the 185 captured boars. The questionnaires showed that 50% of the farmers thought that raccoon dogs were responsible for crop damage, compared to only 8.3% holding boars responsible (*Chi-square*, $p < 0.05$). In accordance with this perception, stomach contents of boars included very small amount of crops while dunghills of raccoon dogs contained large quantities of undigested tangerines. Never-the-less, 92% of the farmers felt that boars should be exterminated. The questionnaire thus revealed that Japanese farmers feel more sympathy toward raccoon dogs than boars. It was possible to predict the number of captured boars in the following month (y) from the number of visits by boars to the pond in the current month (x) by the equation $y = 8.26 + 0.327x$, $r^2 = 0.508$ ($p < 0.01$). Based on the behavioural observations, we predict the ratio of raccoon dogs to boars inhabiting the island in 2003 to be approximately 1 to 1. For effective management of crop damage, it is important to design control measures for raccoon dogs as well as boars.

SEVERE HYDROCEPHALUS IN A COLONY OF GOLDEN HAMSTERS WITH LITTLE DETECTED BEHAVIORAL MODIFICATION

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A hereditary form of hydrocephalus that is different from that described by Yoon & Slaney (J. Hered. 63:344, 1972) was observed in golden hamsters in a behavioral experiment. The parental stock was bought from two different commercial breeders for laboratory animals, and hydrocephalic animals were derived from both breeding stocks. Twenty females and fifteen males from nine different litters were singly kept and had access to a running wheel. Their running activity was constantly recorded, and the behavior of the hamsters was videotaped. At the age of 15 weeks, the hamsters were sacrificed, and their brains were evaluated macroscopically and histologically.

Of 35 hamsters, 26% showed a severe hydrocephalus with dilation of the lateral ventricles greater than 4 mm, 28.5% had a moderate hydrocephalus (ventricular dilation between 2 and 4 mm), 28.5% had a mild hydrocephalus (dilation up to 2 mm), and only 17% were normal. The external appearance of all animals was normal. Three out of 35 animals died acutely at the age of 12 – 13 weeks without prior behavior modification, and one male was killed because of rear limb weakness.

Daily revolutions of the wheel did not differ significantly between affected and unaffected animals, but hydrocephalic hamsters ran more (with hydrocephalus: 8877, without: 4735, $F_{1,33} = 2.77$, $P = 0.11$). No significant differences in the durations of walking, resting, rising, climbing, grooming, wire-gnawing, digging were noted between hamsters with and without hydrocephalus (all $F_{1,13} < 2.58$, NS). The parents tested serologically negative for known viral causes of hydrocephalus, and tests for mycotoxins and heavy metals were below toxic levels. Test matings suggested a genetic basis. Possibly, a non-lethal hydrocephalus is common in golden hamsters. Since hydrocephalic animals are fertile, it is advisable to screen golden hamsters for the presence of hydrocephalus.

RATS SHOW AVERSION TO A GRADUALLY INCREASING CONCENTRATION OF CARBON DIOXIDE

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Laboratory rats are commonly euthanized by a gradual increase in carbon dioxide (CO₂). This study used an approach-avoidance paradigm to examine rats' aversion to an increasing concentration of CO₂.

Sprague-Dawley rats were housed in two cages connected by a wire-mesh tunnel, and had access to both cages at all times. The "home" cage contained food, water and a nestbox, and the "test" cage was empty. The rats were trained to enter the test cage for 120 s of access to chocolate and seeds. Immediately upon entry, a swing door was closed and air flow was initiated at a rate of 20% of the cage volume per minute. Rats could re-enter the home cage at any time by pushing through the swing door. On the test day, air flow was replaced with CO₂. We recorded the elapsed time before the rat left the food and pushed the swing door on the test day and on the three days prior (control days). Since all rats remained in the test cage for the entire 120 s session on control days, we compared the difference between the test day values and 120s using a one-sample t-test.

On the CO₂ test day, rats left the food reward after only 21.6 ± 2.8 s (mean \pm SEM) and pushed on the test cage door after 25.4 ± 3.7 s. Both times were significantly earlier than on control days (t-test: $n=7$; $t=25.7$ and $t=34.6$ respectively; $p<0.0001$). Concentrations of CO₂ in the test cage at these times were $5 \pm 1\%$ and $6 \pm 1\%$, respectively. Thus, rats were willing to leave the food reward to avoid CO₂ exposure, even when the concentration was gradually increasing and at a low level, indicating that CO₂ is aversive to rats.

THERMOREGULATION BEHAVIOUR OF COLD-HOUSED DAIRY BULLS

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Economical factors encourage also Finnish farmers to house bulls year-round in uninsulated cowsheds or even in outdoor yards. The cold winter poses a challenge to the animals. We compared temperature regulation behaviour of cold-housed dairy bulls in winter and summer.

Twenty dairy bull calves (initial age 5 months) were used. From November onwards two groups of five animals were housed in an uninsulated cowshed in partly deep-bedded pens (6.4 m²/bull, PEN), and two groups of five animals in forest paddocks (0.1 ha/bull) with a roofed and straw-bedded shelter (3.2 m²/bull, PAD). Behavioural observations were made for the 00-24 hours using instantaneous sampling method. The general activities of the bulls were observed in January-February and July (5-minute sampling interval) and resting behaviour in June and twice in March (10-minute sampling interval).

There were no differences ($P>0.1$, GLM) between the PEN and PAD groups in feeding, ruminating and resting (without ruminating) in January-February or July. Taken both groups together, resting and rumination decreased (28 ± 5 vs. 21 ± 5 and 39 ± 4 vs. $35\pm 4\%$ of time, respectively; mean \pm SD; $P<0.001$) and activity increased (15 ± 5 vs. $23\pm 5\%$, $P<0.001$) from winter to summer. Autohuddling decreased ($P<0.01$) slightly in March as the daily average temperature increased from 14°C (16 ± 5 and $13\pm 8\%$, PEN and PAD, respectively) to 0°C (12 ± 3 and $9\pm 6\%$) and markedly towards summer (June, $+17^{\circ}\text{C}$: 8 ± 4 and $3\pm 2\%$). The use of the straw-bedded shelter by PAD group decreased ($P<0.05$) from $69\pm 2\%$ in January-February to $56\pm 2\%$ in July.

Our results support the practical experience that dairy bulls can get over Finnish winter in uninsulated housing. The bulls coped with the aid of appropriate temperature regulation behaviour. In the winter they avoided needless activity, and chose their resting place and posture according to the weather conditions. Furthermore, increased rumination probably increased heat production.

CORRELATES OF SOCIAL SUCCESS IN DAIRY CATTLE**C.B. Tucker^{1*}, C. Winckler², and D.M. Weary¹**

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Our objective was to understand the correlates of success in social competition relative to two resources: access to the feedbunk and to freestalls. Thirty-six dairy cattle were housed in four groups of nine animals. Social behaviour of the animals was monitored over a five-week period (experimental design described in Winckler et al., Proc. ISAE, 2003). For each individual and each resource, an index of success in agonistic interactions was calculated (proportion of cows in the group that an individual was able to displace).

There was no relationship between the animals' ability to displace other animals from the feedbunk and their ability to displace others from the freestalls ($r_{\text{Pearson}} = 0.16$, $P=0.35$). Cows producing more milk tended to be more successful when displacing others from the feedbunk ($r_{\text{Pearson}} = 0.30$, $P=0.08$), but there was no relationship between milk production and ability to displace others from the freestalls. Many factors may influence the importance of a given resource for an individual. Animals producing more milk have higher energy requirements and may be more motivated to gain access to feed, while the importance of access to freestalls is not clearly linked to milk production.

The availability of the resource likely influences its importance to the animal. In this experiment, access to freestalls was limited (6 freestalls for 9 animals) during 2 of the 5 weeks. Animals that were more successful at displacing other animals from the freestalls had higher levels of faecal glucocorticoid metabolites than animals that had lower success indices ($r_{\text{Pearson}} = 0.43$, $P=0.01$). In contrast, feedbunk space was not limited (81cm/cow) during the experiment, and there was no relationship between faecal corticosterone levels and social competition at the feedbunk ($r_{\text{Pearson}} = 0.07$, $P=0.68$). In conclusion, correlates of success in social competition are related to specific resources.

THE ROLE OF GONADAL STEROIDS IN CANNIBALISM IN LAYING HENS

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We hypothesized that changes in gonadal steroid levels associated with the onset of lay predispose laying hens to express cloacal cannibalism. In Experiment 1, we compared circulating levels of estradiol (E2), progesterone (P4), testosterone (T), dihydrotestosterone (DHT) and androstenedione (A4) in Barred Rocks (BR) and White Leghorns of a cannibalistic strain (WL) before (18 weeks) and after (22 weeks) the onset of lay. We collected cannibalism data from 1 to 161 days of age. The occurrence of cloacal cannibalism coincided with the onset of lay in WL whereas BR showed no cannibalism. In both strains, E2, T and DHT varied with age (GLM on ranked data: $F \geq 7.64$; $DF=1, 24$; $P \leq 0.01$). All steroids varied with strain ($F \geq 5.63$, $DF=1, 24$; $P \leq 0.03$), P4 and E2 being higher in WL, and T, DHT and A4 being higher in BR. There was an age x strain interaction for DHT and P4 ($F \geq 5.80$, $DF=1, 24$; $P \leq 0.02$). BR had higher levels of DHT at 18 weeks compared to 22 weeks and to WL at both 18 and 22 weeks, whereas P4 was highest in WL at 22 weeks while being lowest in BR at 18 weeks. In Experiment 2, 16 groups of four 24-wk-old cannibalistic WL hens were implanted with E2 (20 mg), P4 (50 mg), T (50 mg) or control (C). P4 and T suppressed egg production ($F=15.19$, $DF=3, 10$; $P=0.0005$) whereas there were no overt effects of C or E2. The incidence of cannibalism did not differ between treatments over the subsequent 3 weeks. In conclusion, relatively high levels of E2 and P4 were associated with the onset of cannibalism whereas high levels of androgens may have prevented the development of cloacal cannibalism. However, implantation with exogenous T did not stop cannibalism in hens already exhibiting the behaviour.

STABILITY OF VISUAL DISCRIMINATION LEARNING OF DWARF GOATS UNDER CHANGING HOUSING CONDITIONS

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Two experimental groups (G1, G2, $n = 12$, each) were established after weaning. The animals were shaped for learning for 8 weeks. Thereafter, we carried out three consecutive visual discrimination tasks (T1, T1_{mo}, T2). We applied a fully automated learning device integrated in the animals home pen. Four visual stimuli were simultaneously presented on a computer screen. In each task we used 24 different combinations of the same stimuli, presented following a quasi random series. To get a reward (drinking water) goats had to choose the correct stimulus by pressing the related button.

In T1 both groups were asked to discriminate the same four stimuli under identical housing condition. In T1_{mo} we continued with this task, however, G2 was relocated to a new pen with slightly modified housing conditions. In T2 four new stimuli were introduced to both groups, and again, G2 was moved to a new pen before the task started. Differences between G1 and G2 with regard to learning success were analysed with a general mixed model with group as fixed factor and test day or number of trials as repeated factor.

Mean daily learning success was about 5 % higher in G2 compared to G1 in T1 ($p > 0.023$). Both groups reached 80 % of correct choices at the end of T1. In T1_{mo} success rate of G2 decreased only for one day compared to G1 (54 % vs. 82 %; $p < 0.001$). Relocation of G2 before T2 had no influence on learning behaviour. Success rate was above 90 % at the end of T2 in both groups. Both experiments indicated that learning behaviour in dwarf goats is relatively stable with regards to changing housing conditions. Considering learning behaviour independently of housing conditions we found a "learning to learn" effect when considering "learning speed" but not when considering "learning performance".

THE RELATIONSHIP BETWEEN HAIR WHORL POSITION AND BEHAVIOURAL AND PHYSIOLOGICAL CHARACTERISTICS IN BEEF CATTLE

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The aim of this study was to clarify the relationship between hair whorl position on the forehead and the behavioural and physiological characteristics. 35 Bos Taurus beef cattle (Japanese Black crossbred, JBC) at the age of 10,12,14,16,18 and 20 months were investigated. The whorl position of each cattle was classified according to lateral position (left, middle, right) and longitudinal position (high: above the top of the eye, middle: at the eye level, low: below the bottom of the eye). Individuals were measured in four ways: (1) handling response to weighing, (2) ultrasonic measuring (3) body size measurement, (4) blood collection from the jugular vein. A 5-point scoring method was used to rate each animal. Maintenance, social, stereotypic behaviour and the component of blood for each cattle were collected. Individual cattle were categorized by whorl position: laterally right position 31%, middle position 66%, or left position (one individual), as well a whorl longitudinal high position 54%, middle position 40%, or low position two individuals.

Animals with a longitudinal high position had higher self-grooming behaviour ($p < 0.05$), resting behaviour ($p = 0.09$), serum dopamine, and lower serum cortisol ($p < 0.01$) compared to cattle with a laterally middle position. Cattle with a longitudinal middle whorls were more likely to have self-grooming behaviour ($p = 0.09$), serum dopamine and handling scores ($p = 0.10$) compared to cattle with a laterally right whorl position. Cattle with high and laterally middle whorl position were more sensitive. Behavioural and physiological factor were not related to the age of each cattle.

It was concluded by this study that similar tendentious consequences occurred in the JBC cattle in comparison with investigations of previous reports. This study supports not only previous work relating to the hair whorl position and temperament, but also to the physiological characteristics of cattle.

THE RELATIONSHIP BETWEEN BEHAVIOURAL CHARACTERISTICS AND PHYSIOLOGICAL RESPONSES TO ISOLATION STRESS IN HOLSTEIN HEIFER

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Abstract

Several lines of evidence suggest that the social isolation is a severe stressful condition for heifers. Although the reduction of the stress response of heifers to the isolation has been attempted using acoustic, visual or olfactory stimuli, it is still unsuccessful due to a difference in the responses to stressor among individuals. The aim of the present study was to determine the relationship between behavioural characteristics and autonomic or pituitary-adrenocortical responses to the isolation stress in individual heifers.

Eight Holstein heifers (77 to 88 weeks old) were used. For the social isolation, one test cow and two other peers were maintained in the same room for 3 days, then the test cow was isolated in its own room by removing the peers for 7 hours. The duration (sec) of specific behavioural categories (standing, rumination with standing, sitting, rumination with sitting, feeding, access to water) and the number of vocalizations during the isolation were scored. These behavioural data were analyzed using a principal component test with the covariance matrix. Blood samples were collected every 30 min during isolation through the jugular catheter for the assay of ACTH and cortisol. Heart rate (HR) was continuously recorded by a HR recording system for human exercise.

A principal component test extracted two principal factors from the behavioural scores and the first and the second principal component were designated "activity" and "anxiety", respectively. When the correlation between these two factors and plasma concentrations of ACTH and cortisol, and HR were analyzed by Spearman's ranked correlation analysis, the second principal component, anxiety, was correlated with the plasma cortisol concentration ($r=-0.76$, $p<0.05$).

These results suggest that individual Holstein heifers express different behavioural characteristics during isolation stress and anxious-type heifer tended to have a higher plasma cortisol concentrations during the isolation.

REPEATABILITY, DIURNAL VARIATION AND TEMPERAMENT: FACTORS AFFECTING HEART RATE VARIABILITY IN HORSES

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Heart rate variability (HRV) describes the physiological rhythms in heart beat-to-beat interval. The power spectral analysis can be used for semi-quantitative evaluation of autonomic components of cardiovascular control. Changes in HRV parameters have been found in human conditions, including diabetes mellitus and angina. In horses, HRV has been used to study grass sickness, stereotypical behaviour and temperament. The aim of the present study was to determine repeatability, diurnal variation and the effects of temperament on HRV parameters.

Six healthy Thoroughbred horses (3 mares, 3 geldings, mean age 10 ± 4 (SD) years) were used. Electrocardiogram (ECG) datasets were obtained via a 2 lead base-apex telemetric system. Equipment was fitted 30 minutes before sampling, allowing habituation. Data were collected at 06:00 on 3 consecutive days for repeatability and temperament analysis and at 00:00, 06:00, 12:00 and 18:00 to investigate diurnal variation. Power spectral analysis was performed on datasets of 512 consecutive RR intervals. Two investigators, using a simple descriptive scale, scored response to a water spray.

No significant differences were found in any component over three consecutive days, nor between individual time points. In datasets grouped as 'day' and 'night', a trend was seen for increased high power at night (Wilcoxon signed-rank: $W=1$, $P=0.059$). Low power and water spray score showed a positive correlation (Spearman's Rank Correlation; $R=0.644$, $P=0.024$). Total power and water spray score were also positively correlated (Spearman's Rank Correlation; $R=0.633$, $P=0.027$).

The techniques used here produce repeatable HRV indices in horses. Heart rate variability components were significantly influenced by temperament. No significant circadian rhythm was seen although, the observed trend for increased high power at night may be more apparent if sleep patterns were not disturbed during sampling and warrants further work.

CHANGES OF REACTION LATENCY AND STRESS LEVELS WITH THE PROGRESS OF VERBAL COMMANDS LEARNING IN DOGS

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Since dogs are used for a variety of purposes by humans, it is important to acquire knowledge about their welfare status as well as their learning ability. The basis of training is generally to develop a dog's correct reaction to verbal commands given by humans. However, the relationship between the change of stress levels and the progress of learning in dogs are not clarified. In this study, six adult female dogs (Shiba-inu, the Japanese native breed) were trained and compared their learning process using two different verbal commands. Stress levels of the dogs during training were assessed by salivary catecholamine concentrations.

Two kinds of verbal commands in Japanese, "Fu-Se" ("Down" in English) and "Ta-Te" ("Stand up" in English) were used. The dogs were trained to change their posture from sitting to lying or standing within the 10 sec after the command presentation. A piece of dry food with clicker sound was given as a reward. Each dog was subjected daily to two sessions consisting of 20 trials. The criterion of successful learning was a session with more than 17 correct responses ($P < 0.01$, Chi-square test).

All six dogs could reach the criterion of successful learning for both commands. The salivary catecholamine concentrations were not affected by the progress of learning. Therefore, the dogs did not seem to sustain an emotional stress during the training in this study. In half of the 12 training, the reaction latency temporarily prolonged ($P < 0.05$) at the beginning session in which the correct response rate sharply raised. The dopamine concentrations also increased at the same session ($P < 0.05$). These phenomena were interpreted as reflecting the exact period that the dogs gained an insight into associative learning.

Additional research on the welfare status of dogs used by humans will be necessary.

THE EFFECT OF SIGNAL CONTEXT ON OBEDIENCE IN THE DOMESTIC DOG (*CANIS FAMILIARIS*)

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Dog training consists of establishing the correct action to verbal commands. This requires the dog to understand what behaviour must be associated with a verbal command in a range of contexts. This study was aimed at evaluating the effect of changes in the context of a command on obedience performance in a variety of pet dogs.

Eighteen dogs were trained individually over five different trials, with a change in each of the following variables: Experimenter body posture (standing versus seated), eye contact (no glasses versus blackened glasses) and command source (live command versus a play-back recording). The effect of each experimental manipulation on obedience performance was recorded for each of the two commands, "sit" and "come", which were presented according to a predetermined randomised sequence. The percent of correct responses to each command in a given session of a given training trial was recorded together with the number of sessions required to reach the success criterion (85% correct response in the session) before progression to the next trial.

ANOVA suggested that there was a difference in the number of sessions required to reach criterion in the different trials (ANOVA: "sit", $F[4,89] = 31.8$, $P < 0.001$; "come", $F[4,89] = 29.63$, $P < 0.001$). The number of training sessions required for the dog to reach the criterion when the experimenter first presented recorded commands was significantly more than the other training trials for both commands (mean \pm SD: "sit", 12 ± 4.1 trials; "come", 11.6 ± 4.1 trials, Tukey, $P < 0.05$).

There was a significant decline in performance between consecutive sessions at the end of one trial and at the start of another with a new treatment (Wilcoxon signed-ranks test: $T > 145$, $P < 0.01$ in all cases).

The results suggest that posture, eye contact and command source were all significant factors affecting the behaviour of the dogs.

THE ROLE OF SOCIAL ENVIRONMENT IN FORMING OF SPECIES AND SEXUAL ATTACMENT IN DJUNGARIAN HAMSTERS (*PHODOPUS SUNGORUS*)**I.Mastjugina*, N. Vasilieva**

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Social environment plays a very important role for establishing of species specific behavioral patters. To clarify environmental factors influencing species specific social preferences we used a suitable laboratory model, Djungarian hamsters (*Phodopus sungorus*). The aim of the presented research was to examine a role of social isolation and individual experience on the behavior related to the analysis of olfactory cues. In two choice paradigm the ability of hamster males to discriminate species (closely related Campbell's hamsters was used as the source of heterospecific odor), sex and females reproductive state via urinary cues was studied. The data were analyzed with the use of Wilcoxon matched paired and Mann-Whitney U tests. Experimental male pups were isolated at D12 (IS) after birth, as control juveniles (CN) were kept in family groups up to beginning of testing at D30. IS males demonstrated no preferences in species discrimination test (30.1 ± 4.9 vs. 32.2 ± 4.3 sec, ns), as CN hamsters preferred conspecific stimuli (22.9 ± 3.1 vs. 15.0 ± 2.1 sec, $P < 0.01$). In sex discrimination test both IS and CN males preferred females urine vs. males urine (24.9 ± 3.1 vs. 15.1 ± 2.5 sec, $P < 0.05$ and 20.1 ± 2.2 vs. 10.9 ± 1.8 sec, $P < 0.01$). There were no differences in response to urine from estrous vs. diestrous females in both IS and CN groups (36.3 ± 4.0 vs. 33.5 ± 4.8 sec and 18.3 ± 5.1 vs. 15.3 ± 5.3 respectively). In all tests IS males spent more time to investigate odor stimuli ($P < 0.01$). After being paired with females and getting sexual experience IS and CN males started to demonstrate a preference of the stimuli from receptive females (18.4 ± 3.0 vs. 13.0 ± 2.8 second 26.1 ± 2.5 vs. 17.1 ± 2.0 sec, $P < 0.05$). The data received indicate that social deprivation leads to increase of interest to odor stimuli, disrupts species affiliation, but doesn't effect sexual preferences. Discrimination of female's estrous condition prerequisite sexual experience. Supported by RFBR (#01-04-49822).

A SIMPLE ENRICHED CAGE FOR LABORATORY RATS REDUCES AGGRESSION, ENHANCES ACTIVITY AND INFLUENCES BEHAVIOUR ON THE ELEVATED PLUS MAZE

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In the past, standardization requirements for experimental purposes led to more and more impoverished housing conditions for laboratory animals. Nowadays, one of the main interests of animal welfare scientists is improvement of housing conditions by means of environmental enrichment. To ensure worldwide implementation of environmental enrichment on short term, a need exists for an easy applicable method of enrichment that is thoroughly investigated for its consequences. The present study describes a simple method of enrichment for rats that can be easily applied in standard laboratory settings and offers the possibility to express a larger repertoire of species-specific behaviour. The effects of this new type of enriched housing are investigated by means of ethological procedures. Wistar rats (males and females) that were socially housed under enriched or standard conditions have both been observed in their home cages and have been tested in a widely used test of anxiety and exploration (Elevated Plus Maze). In the home cage, the enriched rats showed an increase in exploration, mobility and general activity ($p < 0.001$ in all 3 cases). Importantly, the level of aggression was significantly lower in rats that were housed under enriched conditions ($p < 0.01$). Enriched males also moved more freely on the Elevated Plus Maze (arm entries: $p < 0.01$) and spent more time on the open areas of the platform ($p < 0.05$) indicating a lower level of anxiety. We conclude that the enriched system, although simple in construction, is effective in positively influencing rats in their behaviour in the home cage. Combined with the declined expression associated with anxiety that was seen in enriched housed male rats, this increase in behavioural possibilities and social control is very likely to increase animal welfare. Consequently, these effects of enriched housing on the behavioural response of laboratory rats may be very relevant for their validity as an animal model.

ENVIRONMENTAL ENRICHMENT FOR MICE**S. Brocklebank*, M. Mendl, C.J. Nicol & C.M. Sherwin**

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Appropriate environmental enrichment can improve the welfare of laboratory animals and the external validity of research using these species. The suitability of potential enrichments for 48 outbred (ICR CD-1) and 48 inbred (C57Bl/6J) female mice, 4/cage, was tested starting at 8 weeks of age. Each week a different potential enrichment was placed in a cage, randomised for order of presentation. Behaviour was recorded three times each week and data reported here were collected from scans conducted during the last 2 hours of the light phase. The potential enrichments were a square of hessian cloth impregnated with the odour of unfamiliar mice, a hessian hammock, half a coconut shell, playback of bird-song, and a control treatment simulating standard laboratory conditions. The preliminary analysis presented here was by 2-way ANOVA with potential enrichment and strain entered as the major variables, followed by Fisher's PLSD where appropriate. (Full repeated-measures ANOVA is currently being conducted, and supports these initial treatment findings). Compared to the control, the coconut, hammock and cloth all significantly reduced cage sniffing ($F_{4,614}=9.2$, $P<0.0001$), the coconut and hammock both significantly reduced bar climbing ($F_{4,614}=4.9$, $P=0.0006$), and the hammock increased the frequency of being stationary in the cage ($F_{4,614}=46.1$, $P<0.0001$). Between the hammock, cloth and coconut, the cloth was manipulated ($F_{2,354}=11.1$, $P<0.001$) and reared against most frequently ($F_{2,354}=4.0$, $P=0.018$) and the hammock climbed on most frequently ($F_{2,354}=11.9$, $P<0.001$). Strain differences were evident. The outbred mice more frequently manipulated the enrichments ($F_{1,354}=11.1$, $P<0.0001$) and showed more frequent locomotor stereotypy ($F_{1,614}=9.3$, $P=0.002$). These results show that simple potential enrichments had large and widely varying effects on the behaviour of laboratory mice, and these were sometimes strain-specific.

BEHAVIOURAL ACTIVITY OF LABORATORY MICE IN STANDARD AND FURNISHED CAGES WITH A RUNNING WHEEL

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In standard cages, mice are prevented from performing several natural behaviour patterns for which they are motivated; mice spend long periods inactive and abnormal behaviours can develop. To improve welfare, cages are sometimes equipped with items such as nesting material, shelters and running wheels. We have demonstrated that when allowed to self-administer an anxiolytic, mice in furnished cages with a running wheel consume less anxiolytic than mice in standard cages (Sherwin & Olsson, Anim.Welf. 13: 33-38, 2004). This poster presents the results of behaviour studies of the mice in the same experiment.

Female C57Bl/6J mice (3/cage) were housed in Standard (n=10) and Furnished (n=6) cages. Standard cages contained only sawdust, food and water. Furnished cages were double the size of Standard cages and contained nesting material, nest box, tubes, chew blocks and a running wheel. During three consecutive periods, mice had access to either only tap water (control), tap water or an anxiolytic solution on an alternating schedule (water-only or anxiolytic-only) and finally both tap water and anxiolytic (self-administration). Behaviour was analysed from video recordings of the lights-off period. Results were analysed using Mann-Whitney U-test and reported as mean \pm standard error.

Results from the control period will be presented. During the water-only phase, mice in furnished cages spent more time on exploration/locomotion than mice in standard cages (64,3 \pm 3,3 vs 32,8 \pm 1,2 % of time observed; W=55,0; P<0.05). Self-administration of the anxiolytic reduced activity; however the differences in exploration/locomotion between housing environments remained (47,6 \pm 3,8 vs 24,8 \pm 1,5 % of time observed; W=55,0; P<0.05). Stereotypies such as bar-circling, jumping and bar-wheeling were only seen in standard cages (water-only 5,0 \pm 1,1; self-administration 5,8 \pm 1,6 % of time observed).

More than half of the exploration/locomotion in furnished cages was wheel-running, indicating that the running wheel is an essential component if an increase in behavioural activity is desired.

LYING POSITION OF COWS IN STALLS IN FREE-STALL HOUSING**S. Morita, Y. Nakanishi, A. Kageyama, A. Murakami, M. Takeuchi,
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The objective of this study was to examine the lying position of cows in stalls in free-stall housing and the relationship between the lying position and the body length of cows, and lying posture.

The photograph of lying cows was taken from a position directly above the stall (1-4 photographs / cow). The position of knee and the edge of ischium were measured for 43 Holstein cows (156-191 cm body length, 644 kg average body weight). Standing up activities was recorded by digital video camera. The length of stalls was 2.4 and width was 1.2m. The height of neck rail was 1.1m.

The length from the front end of a stall to the knee of a lying cow varied between 15 and 90 cm, and modal range of the length was 40-49 cm. The modal range of the length from the rear end of stall to the edge of ischium of cows was 11 - 20 cm inside of stall. There was a significant ($P<0.05$) positive correlation between the positions of the knee and the edge of the ischium. The length between the knee and the edge of the ischium of cows that lay with their front legs expanded, tended to be longer than that of cows that bent their knees. The position of the edge of ischium moved backward with increasing body length. The standing up activity time from the start of the activity to the rear legs expansion prolonged, and the later part of the activity shortened, according to moving their knee forward.

It was concluded that the position of the edge of ischium was affected by the position of the knee, posture and body length of the cow, and also suggested that the standing up activity time was changed with the lying position of cows.

EFFECT OF FREESTALL AVAILABILITY ON DAIRY CATTLE BEHAVIOUR

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The objective of this experiment was to understand the effect of freestall availability on the lying and standing behaviour of dairy cattle. We manipulated freestall availability by providing 12, 11, 10, 9, or 8 freestalls to 4 groups of 12 animals. Treatments were applied for a week at a time in a switchback design. Each group returned to the 12-stall treatment after exposure to the other treatment levels. In addition to lying and standing behaviour, we measured each cow's ability to displace others from the freestall in order to understand the interaction between social status and freestall availability.

When groups of cows had fewer stalls available they spent less time lying down (12.9, 12.1, 12.0, 11.6, 11.2 h when housed with access to 12, 11, 10, 9, or 8 freestalls, respectively; SE=0.24, linear effect $F_{1,15}=28.5$, $P<0.001$). We found no effect of freestall availability on time spent standing with only the front hooves in the stall (1.4, 1.5, 1.4, 1.4, 1.5 h, respectively; SE=0.15, linear effect $F_{1,15}=0.1$, $P>0.7$). Instead, cows appeared to compensate for the reduced lying times by spending more time outside of the stall (8.4, 8.9, 9.1, 9.6, 9.9 h, respectively; SE=0.38, linear effect $F_{1,15}=11.9$, $P<0.004$). When fewer stalls were available, animals were more likely to be displaced from stalls (0.68, 0.88, 1.60, 2.10, 1.91 displacements per group over 5-h sampling period, respectively; SE=0.20, $F_{1,15}=30.0$, $P<0.001$). However, the animals' ability to displace others from the stalls did not explain the magnitude of their reduction in lying time when provided with fewer freestalls ($F_{1,186}=0.01$, $P>0.9$). In conclusion, reduced stall availability increased competition for stalls, increased time standing outside the stalls, and reduced the time dairy cows spent lying down.

OPTIMAL SIZE OF CUBICLES FOR FATTENING BULLS

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Cubicles with soft lying mats, a widely used housing system for dairy cattle, could also provide a lying area of good quality for fattening bulls. We investigated the space requirements of bulls by observing standing-up and lying-down behaviour before and after increasing cubicle width by 10 cm at different ages.

Twenty fattening bulls were kept in four groups and were observed at approximately 220, 330, 380 and 500 kg of weight ('time') on three days before and after cubicle dimensions were increased ('enlargement'; e.g. cubicle width before enlargement: 70, 80, 90, 100 cm, length of the lying area: 120, 140, 150, 185 cm). Cubicles were equipped with soft lying mats. Linear and generalised linear mixed-effects models were used to investigate the data with time, enlargement and the time-enlargement interaction as explanatory variables.

The proportion of standing-up with more than one head lunge decreased over time ($p=0.02$) and with enlargement ($p=0.01$). While standing up, bulls hit the rails of the partitions less over time and less with enlargement except at 220 kg (interaction: $p=0.001$). Atypical standing-up and lying-down behaviour as well as interrupted standing-up behaviour was not shown by the bulls.

While lying down, partitions were hit less with enlargement except at 220 kg (interaction: $p=0.01$). The proportion of interrupted lying-down behaviour decreased ($p<0.001$), whereas the number of investigative head sweeps increased over time ($p<0.001$), but neither changed with enlargement ($p>0.4$). Bulls slipped more often with enlargement except at 380 kg (interaction: $p=0.03$). They never fell and never turned around in the cubicles. In general, both animals and cubicles were very clean.

In conclusion, enlargement of the cubicles had little favourable effects on the behaviour of the bulls. As a consequence, the narrower cubicles also seem to provide adequate space for bulls.

EFFECT OF NOISE INTENSITY ON AGGRESSION TOWARD INTRUDER IN GROUP-HOUSED SLAUGHTER PIGS

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Aggression within groups of slaughter pigs presents a threat to both production and welfare. We investigated whether high compared to low noise intensity affected the risk of aggression in group-housed pigs.

Previously free-housed female pigs (n=64) at about 60 kg were mixed into groups of four unacquainted individuals in pens in a climate and noise controlled facility. For 28 days they were exposed to white noise (20-10.000 Hz) at either (i) low: 60 dBA (8 groups, 32 pigs) or (ii) high: 80 dBA (8 groups, 32 pigs) intensity for 3 hours in total, in randomized periods of 2-15 min at randomized times each day.

On treatment day 16-17, the experimental animals were presented individually to a c.10% lighter intruder castrate pig in their home pen. A new intruder was used for each of the four pen mates, and each intruder was used balanced and once a day on two successive days. The intruder was removed if fighting occurred, and otherwise after 10 minutes. Social interactions were recorded during the intruder test.

The high-noise pigs tended to bite the intruder sooner (sec) than did the low-noise group (medians [25%,75%]: high: 116 [51, 243] vs. low: 286 [83, 389], LR Survival test = 3.73, DF=1, 25.8% censored, P = 0.054). However, combining all aggressive interactions (push, head knock, bite) no difference was found in latencies between the two groups (high: 68 [43, 243] vs. low 73 [32, 247], LR Survival test < 0.01, DF=1, 11.3% censored, P = 0.926).

Exposure to high intensity noise, below the EEC limit of 85 dBA, may lower the threshold for biting an intruder. Further analysis of collected data, e.g. explorative interactions, aggression between pen mates and stress hormones, is needed to fully explain the effects of noise intensities on behaviour and welfare in group-housed pigs.

COMPARISON OF STANDING UP ACTIVITY OF DAIRY COWS IN THREE TYPES OF HOUSING SYSTEMS

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Allowing dairy cattle adequate opportunities to lie down, rest and stand up is important for production as well as cow comfort and welfare. This study was conducted to compare the time spent on standing up activity of cows in three types of housing system.

Data collections were carried out of three types of housing: 1) Free-stall housing (F: 5 farms, 19 cows), 2) Tie-stall housing (T: 3 farms, 20 cows) and 3) Bedded pack type loose housing (B: 3 farms, 21 cows). The still frames were extracted every 0.1 second from video clips of standing up activities.

The total standing up activity time of F, T and B cows were 5.8, 7.1 and 4.1 seconds respectively, and it was significantly longer in tie-stall housing ($P<0.05$) than the others. The time from the start of the activity to the finish of the rear legs expansion were 3.8, 2.6 and 2.2 seconds respectively, and it was significantly longer in free-stall housing ($P<0.05$). The later part of the activity were 2.0, 4.6 and 1.9 seconds respectively, and it was significantly longer in tie-stall housing ($P<0.05$). In tie-stall housing with a horizontal pipe in a high position (110cm), four out of seven cows stuck their first expanded front leg out on the trough. In free-stall housing with a neck rail at a low position (90cm), the cow's neck touched the rail when they moved their head to the front.

The seconds spent on total activity, from the start of the activity to the finish of rear legs expansion and later part of the activity was different among the three types of housing. And behavioral problems according to the structure of stalls were found in some farms. In bedded pack type loose housing, first stage of standing up activity was significantly difference ($P<0.05$) among farms.

USE OF PEN SPACE BY BROILER CHICKENS REARED IN COMMERCIAL CONDITIONS: IDENTIFICATION OF LYING AREAS

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The distribution of broiler chickens in large commercial houses and the activities performed according to the location of the birds are not well known. Though, a better knowledge of these behaviours could help to suggest an appropriate organisation of the rearing space. This study was performed to characterise the distribution of broilers, and to determine if some specific lying areas exist.

Behavioural observations were undertaken on two farms (Farm A: 1126 m², 22 birds/m²; Farm B: 584 m², 24 birds/m²), in delimited areas divided into 3 or 4 parts according to the location of the drinkers and the feeders. The number of chickens drinking, feeding, lying down or standing in each part of each area were recorded twice a week from day 7 to day 34 using the scan sampling method (6 scans from 10:00 to 19:30). Data from different days were considered as independent.

The highest densities of chickens were observed in the areas located near the walls and in the middle part of the house. The mean densities varied significantly according to the parts observed: from 19.6 ± 1.0 to 29.3 ± 1.7 birds/m² on farm A and from 17.2 ± 1.4 to 36.3 ± 1.7 birds/m² on farm B (in both farms: $df=8$, $p=0.001$, Friedman analysis of variance). The percentage of chickens lying down varied from 35% to 75% (farm A) and from 44% to 84% (farm B). This percentage was higher in those parts where the density was high (similar results were obtained if the birds eating or drinking were not taken into account when calculating the percentages).

The presence of a wall and a long distance between two lines of equipment appear to favour high local densities of chickens. Where the density of birds is high, the percentage of birds lying is high. Areas with a wall or a large space between lines of equipment probably constitute areas where chickens go to rest.

DAIRY COWS' CHOICE OF WATER TROUGH BASED ON ITS DIMENSIONS

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Water consumption affects milk production of dairy cows. In previous studies we found that dairy cows have a higher water intake when offered the trough they prefer compared to others. In this study we investigated some of the trough's characteristics that may underlie such preference. Water surface was tested using two round troughs, both 60 cm high; T1 was 120 cm wide, with 500 l capacity and T2 was 60 cm wide, with 125 l capacity. Trough height was tested using two round troughs, both 120 cm wide and 60 cm high, with 500 l capacity; T3 was on ground level, i.e. 60 cm high and T4 was buried to become 30 cm high. Trough depth was tested using two round troughs, both 30 cm high; T5 was 60 cm deep, with 500 l capacity and T6 was 30 cm deep, with 250 l capacity. In each trial, each cow was tested individually for four consecutive days for up to 180 s each time, with the drinkers randomly placed in each side. Water temperature did not vary between troughs by more than 2°C in any preference test. Data were analysed by ANOVA (n=18, df= 1). Cows chose to drink 79% of the times from T1 (larger) and 21% from T2 (smaller), took more sips ($p<0.01$), spent more time drinking ($p>0.01$) and drank more water ($p<0.01$) from T1 than T2. Cows chose to drink 57% of the tests from T3 (higher) and 39% of the tests from T4 (lower) and took more sips from T3 than from T4 ($p<0.02$). There was a tendency for cows to consume more water ($p<0.08$) and spend more time drinking ($p<0.08$) from T3 than from T4. Trough depth did not influence cow's choice. Our results indicate that when deciding on the best water trough for dairy cows its volume and surface should be considered; height has a lesser importance and depth is not important.

AGGRESSION IN DIFFERENT GROUPS OF THE EUROPEAN BISON (*BISON BONASUS*)

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Our goal was to compare an aggression level in bison groups and show factors that could influence to individual aggression in different groups. A research was made in enclosures at the Prioksko-Terrasnyj Reserve, at the bison farm. Aggression is an important factor of social stability in animals' groups.

Methods. We observed 3 bison's groups (totally 16 animals): a family with calves, a family without calves, a miscellaneous group. We observed them by periods from one rest to another. All aggression forms were recorded: aggressive actions, aggressive poses, games and specific aggressions. We compared each aggression form quantity, total aggression quantity, aggression time. We assumed 3 factors influenced to the individual aggression: sex, age, and total group aggression.

Results. We proved that the total group aggression as an independent factor influencing on individual aggression of each bison. We showed that individual aggression was not depended on sex or age. In the miscellaneous group the aggression was the highest, it took 65% of the total time, the aggressive actions prevailed (52%). In the family without calves the aggression was rather low (18% of the total time), the aggressive poses prevailed (80%). The family with calves group showed: 27% of aggression of the total time, the aggressive poses prevailed (45%). The games and specific aggressions took 31%. The female showed the specific aggression by blowing her calf by rear legs at the time when she did not want to feed her calf (the female was in lactation).

Conclusions. For our set, the total group aggression depended on the individual aggression of each bison. There was the high aggression level in the miscellaneous group with the prevalence of aggressive actions. There was a low aggression in the family without calves, in the group with the prevalence of aggressive poses (the same as in the family with calves). The games and specific aggressions were recorded in the family with calves.

EFFECTS OF AN ENVIRONMENTAL ENRICHMENT WITH A DRUM ON THE BEHAVIORAL, PHYSIOLOGICAL AND PRODUCTIVE PARAMETERS OF BEEF CATTLE

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To determine the effects of an environmental enrichment with a drum, 71 Japanese Black X Holstein steers were allocated to 3 pens: Pen C (control, n=23) consisted of a feeding alley, a trough, a water bowl and resting space; Pen D (n=24) was added a drum containing hay to the control pen; Pen GD (n=24) was added a drum put around an artificial turf for grooming. The drums were removed at 5 months after their installation. Behavioral observations were made for 2 h at 10 min intervals after morning and evening feedings for 3 d a month over 10 months. Agonistic interactions were recorded for 1 h after both feedings to assess the dominance order (DO). Blood sampling from the jugular vein and measuring body weight were performed every 2 months.

The steers accessed to the drum more frequently until after 3 months ($P<0.05$). In Pen GD, DO negatively correlated with the number of sampling points of access to the drum ($r_s = -0.59$, $P<0.01$). The number of eating was larger in Pen D and GD than in Pen C during the drum installation ($P<0.01$), while it was smallest in Pen GD after its removal ($P<0.05$). The number of grooming with the drum in Pen GD was larger than that in Pen D ($P<0.05$). Serum triglyceride concentrations were lowest in Pen GD ($P<0.05$). Beef belly was thicker in Pen D and GD than in Pen C ($P<0.01$). In Pen GD, the number of eating at the drum ($r_s = 0.79$, $P<0.01$) and grooming with it ($r_s = 0.63$, $P<0.05$) correlated with BMS number.

Although social factor affected the steers' access to the drum, installing a drum in the early fattening stage improved final productivity through its subsequent positive effects on physiological changes by encouraging eating and grooming.

FAMILIARITY OF BEDDING MATERIAL AFFECTS CUBICLE PREFERENCE IN DAIRY COWS

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Adequate rest is a prerequisite of cow welfare, and comfortable cubicles have been shown to promote rest. During our previous tests cows preferred straw bedding over sand although novelty of materials was thought to affect the results.

Therefore, we compared cows that were familiarized with straw-bedded concrete (N=18) or sand cubicles (N=19) for half a year. Afterwards, their preference for each cubicle material was tested over five days. We video-recorded the first, third and fifth day (for 24 h) and coded the cubicle choices of individual cows at 9-minute intervals.

Cows familiar with straw-bedded cubicles displayed a preference for this type of cubicle (SAND 14%, STRAW 86%; Wilcoxon Signed Ranks Test, $P= 0.018$). By contrast, cows accustomed to sand bedding chose evenly between both materials offered (SAND 48%, STRAW 52%).

In our previous experiments, cows rejected sand cubicles almost entirely. However, in this experiment their choices indicated a greater acceptance of sand. As familiarity clearly affects the choices cows make, it is important to consider the previous experience of animals when interpreting the results of preference tests.

PREFERENCE FOR INDOOR OR OUTDOOR EXERCISE DURING WINTER IN TIED DAIRY COWS

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The aim was to investigate if dairy cows had a preference for being outdoors or indoors when exercised during the winter, if different weather parameters influence their preference and if the behaviour performed indoor and outdoor differed. Twenty-two cows were trained and tested in a 47m² exercise area with half of the area being indoors and half outdoors. The cows were trained twice and tested four times each. During training the opening between the indoor and outdoor part of the exercise area was closed and each cow was moved to the exercise area and left 10 minutes in each part. During testing the cow could walk freely between the two parts of the exercise area for 20 minutes. We recorded the time spent indoors and outdoors during testing, and the frequencies of all behaviours were continuously recorded. Temperature, wind speed, intensity of light, humidity and if it rained or snowed was measured both indoors and outdoors. All data was tested with an Analysis of Variance (Mixed Effect Model). There was no difference in the time spent indoors or outdoors, but there were large individual differences. The time spent outdoors decreased with increasing temperature within the temperature range -1,3°C - +11,7°C ($p < 0,05$). There were no effects of wind speed, humidity, intensity of light or amount of rain and snow on time spent outdoors. The cows sniffed the air more outdoors ($p < 0,001$), but there were no differences in activity, explorative behaviours or standing looking between the indoor and outdoor area. Most of the cows used the whole exercise area during the testing, especially when they trotted and galloped. Only four cows stayed either indoors or outdoors during 20 min at one test each. We conclude that in this test dairy cows did not show a general preference for exercise either indoors or outdoors.

SOWS PREFER TO LIE ON A PROTOTYPE LYING MATTRESS RATHER THAN ON CONCRETE

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Considering that pregnant sows lie down for about 80% of their time, few studies and efforts have been made to improve their lying comfort. Synthetic mats are being used increasingly for cattle, while lying areas of sows predominantly consist of bare concrete. Bedding improves physical and thermal comfort, but is not commonly provided because of disadvantages (cost, labour, hygiene, manure drainage).

The preference of sows for a prototype multi-layer lying mattress as compared to bare concrete was investigated in a dynamic group of 56 sows housed in a pen with 5 communal lying areas. Lying mats were installed in 3 lying areas while the concrete floors of the remaining lying areas remained uncovered (period 1). After 5 weeks the position of the lying mats was rotated (period 2). 24h video-recordings were made every 2-4 days from 5 weeks prior to the installation of the mats (period 0) until 5 weeks after rotation of the mats. The position and behaviour of each sow was recorded every 10 min, and ambient temperature every 5 min.

Sows were 15% more likely to reside in lying areas provided with mats than expected on the basis of the proportional surface area of the lying areas (F-test, $p < 0.05$). This preference was more pronounced amongst sows that had been habituated to the experimental set-up for > 7 days versus < 7 days (F-test, $p < 0.01$). The effects of period, stocking density and ambient temperature were confounded and could not be determined unambiguously. Shortly after the experiment the top layer of some mats had become damaged.

Our results suggest that covering concrete floors with synthetic mats improves sow lying comfort. However, further research is needed to improve the durability of the mats, and to investigate the influence of ambient temperature as well as the long-term health consequences.

**PIGLET GROWTH AROUND WEANING IN TWO
DIFFERENT HOUSING ENVIRONMENTS****J. Maletínská^{1*}, B. Algers², M. Špinková¹, R. Šárová¹, K. Slámová**¹Research Institute of Animal Production, Prague-Uhrineves, Czech Republic²Dept. of Animal Environment and Health, Swedish University of Agricultural Sciences, Skara, Sweden

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In pig industry piglets are weaned earlier than in nature. Early weaning has an impact on piglet growth, but this may differ according to the housing environment. Piglets from group housing (GH) may be better prepared for weaning than those from individual housing (IH) because sows in GH have a better possibility to restrict their maternal investment. We examined following hypotheses: 1. IH piglets grow better before weaning than GH piglets. 2. GH piglets grow better than IH piglets immediately after weaning. 3. Sow nursing behaviour influences piglet growth before weaning. We recorded nursing behaviour (total and nutritive nursing frequency, proportion of nursings terminated by sow) and piglet growth two weeks before and 5 days after weaning in 5 GH (6-11 lactating sows kept in large pens) and 5 IH farms (individual pens for single lactating sows) in Sweden. Nursing behavior of 4 focal sows per farm was recorded in 2 lactation periods (4-th week, 1 day before weaning; weaning=5.5 weeks). As predicted (1) IH piglets grew slightly faster in between week 3-5 than GH piglets ($F_{(1,9)}=4.76$, $p=0.07$, means: IH=0.23 g/day, GH=0.18 g/day) and (2) GH piglets grew better in between days 3-5 after weaning ($F_{(1,8)}=6.42$, $p<0.05$, means: IH=0.07g/day, GH=0.18 g/day). (3) Piglet growth before weaning was not related to nursing behavior at the farm level. We conclude that piglets on GH farms grew slower before weaning but faster immediately after weaning than piglets on IH farms. This effect is not probably mediated by the nursing behaviour.

EFFECT OF AN OUTDOOR RUN AND NATURAL LIGHT ON WELFARE OF FAST GROWING BROILERS

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Environmental enrichment may provide a solution to moderate several welfare problems in broiler production. Broilers are often housed in closed houses, with a minimum of resources for performing motivated behaviours. By providing more resources, the birds may be stimulated to become more active, and to exercise a wider range of behaviours.

Two experiments (replicates) were conducted, one in summer- and one in wintertime. In each experiment, fast growing broilers (Cobb 500) were either placed in standard pens (n=4), in pens with natural light (n=4), or in pens equipped with outdoor runs (n=4). In each pen, approximately 390 birds were placed. With natural light, light intensity was highly variable, and was on average 9 lux. The outdoor runs were covered with a roof, and were open 24 hours from 3 weeks of age. From 2 weeks of age, behaviour of the birds was observed weekly by scan sampling. The birds were gait-scored one week before slaughter age (42 days). Data were subjected to analysis of variance.

Outdoor runs were most often used in summertime (summer vs. winter: 13 and 2%, respectively). With an outdoor run, the percentage of birds performing resting behaviour inside the house increased with 3-4% ($P<0.05$). Other behaviours did not differ from those of birds in standard housing. It seemed that the birds performed their active behaviours outside. Gait did not differ from standard housing. With natural light, birds showed more resting behaviour compared with birds in standard housing (5% increase, $P<0.01$) and less motivated behaviours, such as dust bathing, play behaviour and foraging ($P<0.05$). Gait was also worse ($P<0.05$).

To conclude, our results indicate that an outdoor run potentially improves welfare of broilers. Natural light as such does not guarantee a better welfare, but it is likely that the quality and intensity of lighting is of importance.

DEVELOPMENT OF PERCHING BEHAVIOUR IN CHICKS

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Behaviour problems in loose housing systems for laying hens may originate from the rearing period, although the actual problems occur mostly during the laying period. Early access to perches facilitates the use of three-dimensional space and therefore allows escape from threatening situations. Our aim was to study individual differences in perching behaviour and if environmental enrichment enhances perching at an early age.

Ninety LSL-chicks (day-old) were randomly allocated into 18 pens which had a similar perch arrangement and were either ^{A)} controls, or had ^{B)} floor enrichment [four wooden blocks (400*100*50mm) on the floor located so that chicks were unable to jump straight from the blocks to the perch] or ^{C)} hanging enrichment (four objects hanging from the roof so that chicks could interact with them). The behaviour of the chicks was observed directly for 6 weeks, 12 times a day. Data was analysed with a mixed model ANOVA and a survival analysis.

It appeared that the chicks in group B started to perch earlier (13.8d) than in groups A (17.3d) and C (16.6d), although the difference was not significant ($p = 0.12$). Time spent under the perches was negatively related to the day when chicks were first observed on a perch ($p < 0.05$), whereas interacting with other chicks was positively related ($p < 0.05$) to that day.

Chicks tended to start perching earlier if they were able to train the rise with the wooden blocks. They started to perch earlier if they spent more time under the perches during the first weeks investigating the pen environment instead of just being under the heating lamp. Interestingly, the less a chick interacted with other chicks the earlier it was found perching, supporting the fact that a fearful chick considers the perch as a safe place to escape from threatening situations.

MOTIVATION FOR GROUP HOUSING IN GESTATING SOWS

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Gestating sows are increasingly housed in groups, but the evidence that they are better off in groups than in stalls is equivocal. Physiological measures of welfare have yielded contradictory findings, while behavioural measures have proved difficult to interpret. This study set out to ascertain how important group housing is to dominant sows housed in stalls, using a measure of motivation.

Subjects were trained to perform a panel-pressing task, then housed in a stall and permitted each day to work for a day's access to a fully slatted group pen containing two familiar, subordinate sows at a stocking density of 2.7m²/pig. Social ranks were determined by observations at mixing and by feed competition tests. The fixed-ratio schedule was increased daily. The highest schedule reached (reservation price) was used as a measure of motivational strength. To interpret this measure, it was compared with the highest schedule subjects reached when working for access to the last 1/16th of their estimated daily ad libitum food intake after having consumed the first 15/16ths free.

Eight subjects were tested, working for the group pen first, four of which yielded useable data. All four subjects reached a higher schedule working for food than for the group pen (FR60, 70, 70, 40 for food; FR40, 10, 20, 10 for pen). Overall, subjects attached less importance to a day's access to the group pen than to the last 1/16th of estimated ad libitum food intake ($t=4.38$, $p<0.05$). It is likely that they were close to satiation when working for food. Consumption frequently fell substantially short of the 'ad libitum' allowance (mean food left uneaten was on average 6.6% of this amount). These results suggest that dominant sows are only weakly motivated to be in a group pen. Eight additional subjects will be tested, working for food first.

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