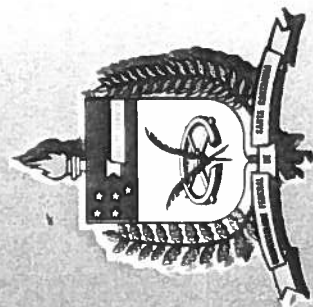


Proceedings of the 34th International Congress of the ISAE



**17-20 October 2000
Florianópolis, Brazil**



Edited by
A. Ramos
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and M.J. Hötzel

Proceedings of the 34th International Congress of the ISAE

André Ramos
Luiz Carlos Pinheiro Machado Filho
Maria José Hötzel
(Editors)

Proceedings of the 34th International Congress of the ISAE



Laboratory of Applied Ethology – UFSC
Florianópolis / Brazil
17-20 October/2000

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The organisers thank the following persons for their assistance:

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Cataloguing by the Library of the Federal University of Santa Catarina.

161p International Congress of the ISAE (34. : 2000 : Florianópolis, SC)
Proceedings of the 34th International Congress of the ISAE / André
Ramos, Luiz Carlos Pinheiro Machado, Maria José Hötzel, editors.
– Florianópolis : UFSC, Laboratory of Applied Ethology, 2000.

240p.

Includes index.

ISBN: 85-88050-01-3

1. Animais – Comportamento. 2. Animais – Trato. 3. Relações
homem-animal. I. Ramos, André. II. Machado Filho, Luiz Carlos
Pinheiro. III. Hötzel, Maria José. IV. International Society for Applied
Ethology. V. Universidade Federal de Santa Catarina. Laboratório de
Etologia Aplicada.

CDU : 591.5

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Foreword

It has been an honour and a challenge to organise the 34th International Congress of the International Society for Applied Ethology (ISAE). For the first time in its history, the Society is having a Congress in a country other than in Europe or North America. It is our opinion that organising this Congress in Latin America has made our Society truly "international". It is, for sure, a great stimulus for the development of Applied Ethology and Animal Welfare in Brazil and elsewhere in Latin America. The numbers of the Congress show it: we have 26 Latin American papers, among a total of 52 oral presentations, 113 posters and seven plenary papers. This year's David Wood-Gush Memorial Lecture will be given by Dr. Jeffrey Rushen, a dedicated member of our Society whom has given an important contribution to the research on Applied Ethology. The theme of his lecture, "Bridging the gap between basic and applied research", is an issue of current concern among researchers of all areas. We worked hard – the Organising Committee and several anonymous volunteers – to organise the best Congress we could. We welcome all the participants of the 34th Congress of ISAE.

**The Organising Committee acknowledges the following for
sponsoring the 34th International Congress of the ISAE**

Brazilian National Council of Scientific and Technological
Development (CNPq)

Federal University of Santa Catarina (UFSC)

International Society for Applied Ethology (ISAE)

ISAE 2000 Program

Tuesday, October 17th

10:00	Arrival and Registration
18:45	Congress Opening
19:45	WOOD-GUSH MEMORIAL LECTURE Chair: Luiz Carlos Pinheiro Machado Filho J. Rushen Bridging the gap between applied and fundamental research
20:45	Welcome Reception

Wednesday, October 18th

8:45	SESSION 1: Domestication and the ethology of managed wild animals Chair: Jan Ladeuwig PLENARY PAPER D.M. Broom Effects of hunting, trapping and other control methods on the welfare of vertebrate pests, p. 33	
	SESSION 1: Domestication and the ethology of managed wild animals Chair: Jan Ladeuwig	SESSION 2: Free papers Chair: Marilú Alonso-Spilsbury
9:30	C.E. O'Connor and E.B. Spurr Application of behavioural studies of stoats to wildlife management, p. 43	C.L. Gilbert and T.H.J. Burne Prostaglandin F _{2alpha} and nest building behaviour in the pig, p. 44
9:55	M.J. Harris, R. Bergeron and H.W. Gonyou Parturient Behaviour and Piglet-Directed Aggression in Farned Wild Boar, p. 45	W.G.P. Schouten, J. Lensink, N. Lakwijk and V.M. Wiegant De-arousal effect of stereotypies in tethered sows, p. 46
10:15	COFFEE BREAK	
	SESSION 1: Domestication and the ethology of managed wild animals Chair: Cheryl O'Connor	SESSION 2: Social behavior (aggression) Chair: Adroaldo Zanella
10:35	M.J.R. Paranhos da Costa, A. Andriolo, U. Piovezan, A.A. Jacob and J.M.B. Duarte The behaviour and welfare of marsh deer (<i>Blastocerus dichotomus</i>) threatened by artificial flood and rescue procedures: case studies, p. 47	L. Andersen, H. Andersen, K.E. Bøe, P. Jensen and M. Bakken The effects of weight asymmetry and resource distribution on aggression in groups of unacquainted pigs, p. 48

11:00	J.B. Kjaer and P.F. Johnsen Effects of stocking density/group size and environmental enrichment on feather pecking and plumage condition in pheasants (<i>Phasianus colchicus</i>) and partridges (<i>Perdix perdix</i>), p. 49	S.T. Millman, I.J.H. Duncan and J.R. Chambers Crouching by females reduces, but does not inhibit, aggressive attacks by sire-strain male meat chickens, p. 50
11:25	O.V. Trapezov and L.I. Trapezova Fifteen years of the river otter (<i>Lutra lutra</i> Linnaeus, 1758) domestication, p. 51	R.B. D'Eath The developmental basis of individual differences in aggression in growing pigs, p. 52
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13:35	SESSION 1: Promoting Welfare in Husbandry Systems Chair: Linda Keeling PLENARY PAPER A.L. Hall Assessing farm animal welfare within industry (with reference to commercial broiler production), p. 34	
	SESSION 1: Promoting Welfare in Husbandry Systems Chair: Linda Keeling	SESSION 2: Social behavior (mother-offspring interactions)
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14:45	M.N. Guelber Sales, R.A.M. Garcia, L.C. Pinheiro Machado Jr, J.C.F. Padilha, T. D. da Silveira and P.S.L. Dinon Isa Brown and native Brazilian chicks raised on pasture display similar behaviour, p. 57	C.M. Dwyer and A.B. Lawrence The effect of maternal undernutrition on the expression of mother-offspring behaviour at parturition in the sheep, p. 58
15:10	G. Knierim The behaviour of broiler chickens kept under free-range conditions with foster hens, p. 59	R.M. Murphy, M.J.R. Paranhos da Costa and R. Gomes da Silva Creche composition in a group of Angus calves, p. 60
15:35	B. Huber-Eicher, H. El-Iethy, T.W. Jungi and B. Wechsler The influence of stress levels on feather pecking and the immune response in laying hens, p. 61	S.J. Appleyard, A.D. Hall and A.B. Lawrence Pre-farrowing behaviour distinguishes piglet-savaging gilts from non-piglet-savaging gilts, p. 62

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21:30		

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Plenary papers

Effects of hunting, trapping and other control methods on the welfare of vertebrate pests

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Applied ethology has an important role in the control of mammal and bird pests and in the assessment of the effects of control methods on the welfare of the animals. The management activities which may affect the welfare of the pest animals include: killing by various means, restraining in traps, translocating, excluding from an area, scaring, using a repellent, withdrawing resources, changing physiologically, marking for population monitoring purposes and providing an alternative resource. When an animal dies, welfare ceases and if consciousness is lost instantly and not regained before death, there is no welfare problem. However, when an animal dies slowly after being shot, trapped or poisoned in a way which causes pain, fear or distress, its welfare is very poor. Most infection with disease also has severe effects. Restraining traps may cause limited ill effect but some, e.g. leghold traps, may cause pain and fear to the point where self-mutilation occurs. Hunting with dogs leads to substantial indications of poor welfare in deer and these effects are compared with those of other methods of killing. Scaring depends on a knowledge of the responses of the species to danger, especially to predators and has been developed using small and large scale behaviour studies. Some poor welfare may result from translocation, physical exclusion, marking and changing physiologically. In each case, welfare should be assessed. An estimate of the magnitude of the problem for the animal is the area under the curve when the level of the poor welfare is plotted against its duration. Cost-benefit analysis is useful in pest control but some methods which result in very poor welfare should be banned in all circumstances.

Assessing farm animal welfare within industry (with reference to commercial broiler production)

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There is currently much debate about the welfare of farm animals reared under different commercial husbandry systems. It is apparent that there is an urgent need for empirical data on which legislation can be based. Often small-scale experiments are not adequate models of commercial conditions. However, working within industry imposes a number of logistical, economic and experimental design constraints. It is widely accepted that a range of indicators is required to make an objective assessment of farm animal welfare, integrating measures of health, behaviour, physiology and productivity (e.g., Mason and Mendl, 1993, Animal Welfare, 2, 301-319). However, different measures vary in their suitability for use on an industrial scale and in how clearly they are believed to correlate with welfare. The main types of measure are considered with reference to their applicability within a commercial context, illustrated with empirical examples from the broiler (meat chicken) industry. Welfare indicators should satisfy a number of criteria. They should be easy to measure in industry, incurring low financial and manpower costs and minimising disturbance to the commercial operation. Representative and accurate measurement should be possible on an industrial scale. For example, suitable sampling and statistical techniques must be developed to address problems of non-independence, confounding variables and high variability in data. Measurement should not involve unnecessary distress to the animals, with non-invasive techniques being preferred. Ideally, interpretation of the measure will be clear, for example, it should be possible to differentiate negative affective states from general arousal and to decide what level of a response constitutes a welfare problem. Possible measures discussed include mortality, severity of leg problems, infectious disease measures, carcase damage (bruising, breakage and dermatitis), haematological indices, behavioural observations and behavioural tests (the tonic immobility test, open field tests and preference tests). Future research should aim to elucidate the interrelations between welfare measures, food quality and profitability.

Behavioral responses to maternal deprivation stress in domestic animals are mediated by glucocorticoid action in hippocampal cells

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There is compelling evidence that chronic high levels of glucocorticoid hormones cause both reversible and irreversible damage to brain hippocampal neurons in the form of altered function, dendritic atrophy, and eventual cell death. Hippocampal glucocorticoid actions are primarily mediated via intracellular glucocorticoid receptors (GR) and mineralocorticoid receptors (MR). MR, in the hippocampus, bind glucocorticoids (e.g. cortisol) and mineralocorticoids (e.g. aldosterone) with equally high affinity, whereas GR preferentially bind glucocorticoids, but with lower affinity. In pigs, MR showed higher affinity for cortisol than aldosterone. In rats, GR mRNA is highly expressed throughout the brain from midgestation, but MR gene expression is absent until the last few days of gestation. The effects of glucocorticoids on their target cells (GR and MR) are regulated primarily by the presence of 11 β -hydroxysteroid dehydrogenases (11 β -HSD) that catalyses the conversion of active glucocorticoids to their inert keto-metabolites. In rats, brain 11 β -HSD mRNA is expressed differentially during early development. Maternal deprivation stress reduces glucocorticoid receptor messenger RNA (GR-mRNA) expression in the hypothalamus and hippocampus. In addition, maternal deprivation causes hyperactivation of the hypothalamic-pituitary-adrenocortical axis. High glucocorticoid levels associated with early maternal deprivation impairs spatial memory and cognitive processes in rats. We demonstrated that pigs deprived from maternal care, at an early age, performed more behavioral abnormalities and showed a higher proportion of unresolved aggressive interactions than later-weaned animals. To test the hypothesis that hippocampal cells are involved on the behavioral consequences associated with maternal deprivation stress we generated porcine glucocorticoid and mineralocorticoid receptor cDNAs from porcine pituitary and hippocampal RNA. Using the GR and MR probes we performed in-situ hybridization studies in pig hippocampal tissue to assess the impact of weaning age on GR and MR mRNA expression. We hypothesize that maternal deprivation stress may thus exert long-term damaging effects on behavior and hippocampal function via changes in glucocorticoid levels and sensitivity. Such effects would be minimal in later-weaned animals because the hippocampal system at later age is less sensitive to the damaging effects of glucocorticoids.

The behaviour of African ostriches

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The african ostrich (*Struthio camelus*) is the largest living bird. The natural habitat of its various subspecies is Africa. Since approximately 15 years the ostrich is also kept in Central Europe. According to the Animal Welfare law of Germany and other european countries 1. An animal must be fed and looked after properly and it must be accommodated in a species-specific way. 2. The possibility to move in a species-specific way must not be excessively restricted. The behaviour and needs of ostriches are not well known. Therefore, research on the behaviour of this species was necessary. The observations have been made at ostrich farms in Israel and Namibia. The group observed in Israel consisted of 120 adult animals (40 m + 80 f). In Namibia the behaviour of 9 or 10 individuals in each of 3 groups was observed. Especially social behaviour, sexual behaviour, comfort behaviour and behavioural disorders have been recorded. The respective observations lasted the whole day (12 hours). Ostriches fight with each other by kicking the opponent with their feet. Within the group a social rank order evolves. Ostriches have got a coitus which is similar to mammals. The coitus lasts on average 1 min. This species has an interesting courtship behaviour. Comfort behaviour consists of grooming and dust bathing. It was noticeable that many ostriches were without feathers at places where a properly feathered ostrich has got feathers. That is because animals pecked each others feathers. It is understood that the reason for feather pecking is caused by the diet. The farmed ostriches are fed. They had to spend only a little more than two hours a day on feeding. It can be assumed that it is possible to breed the african ostrich in a species-specific manner even in countries with a temperate climate. Breeding in these regions does not necessarily lead to reduced well-being or even suffering. At temperatures below freezing the animals should be held in a barn. Food intake should be impeded in order to force the animals to spend many hours a day with this activity. In addition places for sand bathing should be available.

Behavioural and physiological indicators of stress in farmed deer

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Farmed deer are in the process of domestication, and vary along a continuum from near wild to being quite domesticated. Regardless of the level of domestication, deer behaviour is characterised by strong flight responses. The flightiness of deer and associated stress responses need to be given special consideration in the development of humane handling and farming systems. In addition, these unique features of deer have necessitated the development of sophisticated monitoring devices in order to study their responses unconfounded by any experimental procedures. Behavioural parameters can provide useful indices of the degree of disturbance that deer experience. Such measures include: flight distance, interindividual distance, frequency of agonistic responses, and changes in ultradian activity patterns and feeding behaviour. Based on behavioural measures, recent studies indicate that physical restraint and visual isolation, and to a lesser degree transportation and human proximity, are aversive events for deer. Other studies have determined the long-term effects of space, group size, social structure and seasonal variation of food availability on deer behaviour. A number of physiological measures appear to be useful for quantifying the stress reactions of deer to handling and management procedures. Research using remote controlled infusion and blood collection devices has revealed a direct relationship between the sensitivity of the animals to handling and the stress hormones in the blood. Changes in heart rate have also proved useful in measuring handling stressors. Typically, all measures rapidly return to resting values and do not appear to compromise the well-being of deer in the long run. The quantification of the effects of longer term management stressors has been assessed by measuring the adrenal response following exogenous stimulation with the pituitary hormone ACTH. In separate studies, red deer exposed to repeated mixing have shown both increased and decreased cortisol responses after ACTH stimulation in comparison to animals kept in socially stable groups. This suggests that the regulation of the hypothalamic-pituitary-adrenal axis changes in response to prolonged stress, and that the regulatory process may vary with the duration of the applied stressor. In general, farmed deer seem to respond to acute stress in a way similar to that seen in wild deer and with pronounced but short-lived activation of physiological stress systems. The long-term effects of different management procedures on deer are less clear, and less easily measured and interpreted.

The role of ecology in predicting captive animal behaviour

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The success with which humans house and exploit other animals varies greatly from species to species. Some are easy to tame and domesticate, breed readily, show little or no abnormal behaviour and respond well to enrichment programmes (e.g. rats, lions, coatis). In contrast, some species maintain a high level of fear towards humans (e.g. Arctic foxes), are difficult to tame (e.g. African elephants) and breed (e.g. clouded leopards), and are very prone to the development of stereotypic behaviour (e.g. polar bears). Can we use aspects of different species' natural biology to predict and explain why this is so? In this paper we will discuss the methodological techniques available for testing this type of question and, in particular, ways to combat the statistical non-independence introduced from relatedness between species, and to control for variation in husbandry methods. We will then present data from two recent studies that investigate the role of ecological niche in animals' response to captivity. In the first study, Mettke-Hofmann and Winkler use information on dietary niche and predation pressure in the wild to predict the response of 61 species of captive parrot to a novel object. The second study, which is our own work, investigated the role of behavioural ecology in predicting the frequency and prevalence of stereotypic pacing in 35 species of zoo Carnivore. Both studies showed that exploratory behaviour, neophobia, responses to environmental enrichment and levels of stereotypic behaviour were all related to ecological niche. This type of approach is thus ideal for testing other similar hypotheses relating to many aspects of captive behaviour. Overall, it therefore has enormous potential for enhancing the fundamental understanding of captive animal behaviour.

Domestic animals back to nature: de-domestication, feralization, naturalization?

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Many domesticated animals have escaped man and returned to the wild; they feralized. Other animals are brought back to a wild state or have been (re-)introduced in nature: they naturalized. The success of these processes can be so great that pests of feralized and naturalized species occur. In the Netherlands domesticated large herbivores, like horses and cattle are introduced in nature reserves to manage the vegetation. In a number of large nature reserves, these large herbivores are expected to survive with little or no human interference. These animals are in a process of so-called de-domestication. However, feralization, naturalization and de-domestication and their mechanisms are not clearly defined. We describe the process of adaptation of domesticated animals to new natural circumstances in terms of behavioural adaptation in time. The ability to survive is difficult to estimate as there is a lack of information about genetic changes, potential wildness of the domesticated animals, and behaviour of their wild ancestors. Therefore, special attention will be given to proximate and ultimate mechanisms that shape the nature and culture of domestic animals during adaptation to the wild. Natural selection will heavily affect survival of individual animals in such an adaptation process, often more than in wild animals. In that way, the process has a strong impact on individual welfare. An accurate description of the process of adaptation will contribute to the discussion about ethical treatment of large herbivores in nature reserves. Do they have to be considered domestic or wild animals? Do we have to see them in an individual (animal-ethic) or species (eco-ethic) perspective? Or should human responsibility be related to their ability to survive, in other words their potential wildness? De-domestication, feralization and naturalization of domestic animals will be reviewed with emphasis on behaviour and welfare. Examples from literature will be given in addition to recent research on re-introduced Przewalski horses, Konik horses and Scottish Highland cattle.

Oral papers

Application of behavioural studies of stoats to wildlife management

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Wildlife management is a novel area where applied ethologists can make a unique contribution. It concentrates on conserving biological diversity (ecosystem or species preservation), part of which includes managing pest species. We will provide examples of the contribution ethology can make to the management of one vertebrate pest species. Stoats (*Mustela erminea*) are one of New Zealand's most destructive introduced predators, implicated in the continuing decline of native bird species. Stoats have been notoriously difficult to control because of their basic biology and behaviour. They occur at low densities, have large home ranges, and no permanent den or pair bond, which makes anticipating their movements difficult. Therefore, lures are required in order to place traps and poison baits effectively. Research into the attractiveness of different prey (birds, rabbits and rodents), sounds, and odours continues to identify effective stoat lures. Once a stoat is attracted to a site, then it must interact appropriately with the trap or bait. Gender, age, time of year, and previous experience may all affect individual stoat trappability and bait acceptance. Research identifying behavioural responses to different-shaped novel objects is helping optimise trap design. Food preference studies have identified hen eggs as an alternative palatable long-life bait. A bait station was developed that allows stoat access but not egg removal so stoats cannot cache poisoned eggs and pose a risk to non-target species. Advancements continue to be made in conventional stoat control with research into target-specific and humane toxicants which include behaviour studies (e.g. food preferences, bait avoidance, and welfare assessments). The development of alternative control strategies (e.g. fertility control) will also rely on an understanding of behaviour, such as the effect of social hierarchies on breeding. There is a growing opportunity for ethologists to apply their knowledge of behavioural mechanisms to devise new, sustainable wildlife management strategies.

Prostaglandin F_{2a} and nest building behaviour in the pig

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Pregnant sows are highly motivated to build a nest before giving birth, when plasma concentrations of prostaglandin F_{2a} (PG) (measured as the major metabolite PGFM) increase. We have hypothesised that endogenous PG modulates maternal nest building in the pig since a) prepartum sows treated with indomethacin, a prostaglandin synthesis inhibitor, show reduced nesting behaviour, without other effects on parturition parameters and b) exogenously administered PG induces nest building activity in pregnant, cyclic and pseudopregnant pigs. We are using this model to study behavioural, endocrine and neural mechanisms underlying this behaviour. Both housed and free-ranging PG treated pigs show increased scratching, followed by increased locomotion and increased frequencies of ground pawing, nose rooting and substrate gathering. The induced behaviour is affected by available space and presence of substrates (straw). PG induced nest building is both dose and age dependent, whereas the scratching effect occurs at all ages studied. Separate studies have shown that PG induced no alterations in direct interactions between pseudopregnant gilts and new-born piglets. Unlike other species, we have found no dependency of PG induced nest building on circulating prolactin, and no enhancement by oestradiol. Indeed, PG induced nest building is not inhibited by ovariectomy. mRNA specific to the PGF_{2a} receptor has been localised within choroid plexus, paraventricular and supraoptic nuclei. Immediate early gene (c-fos) regulation in the porcine ovary and CNS following PG administration is being studied. In summary, current evidence implicates PG as an endogenous regulator of porcine nest building, perhaps through direct binding of PG to central receptors. However, there is no evidence to suggest a role in post partum maternal care.

Parturient behaviour and piglet-directed aggression in farmed wild boar

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Wild boar farming is becoming increasingly common. In contrast to the extensive documentation of farrowing behaviour in the domestic sow, data about parturition in wild boar is scarce. Piglet-directed aggression ('savaging') which occurs in domestic sows has not been detailed in farmed wild boar. Twenty-four farmed primiparous wild boar sows of three genetic lines (PK = Peter Kalden; SD = San Diego; S = Scandinavian) were videotaped during parturition. Sows were housed in group pens during gestation and transferred to individual well-strawed pens measuring 1.52 x 3.05 m for parturition. The duration of parturition and nature of parturient behaviour were recorded. Piglet-directed aggression was scored as 0 (none), 1 (moderate) or 2 (severe). A score of 2 indicated that one or more piglets were killed and/or human intervention was required to control the aggression. Mean litter size was 5.4 piglets. Mean duration of parturition was 81.4 min. Eight sows (33.3%) showed some piglet-directed aggression; of these, two (8.3%) killed one or more of their piglets. Analysis of variance was performed to determine whether sows with different parturient aggression scores differed in other features. Aggression score varied with sow line: SD sows were more aggressive than either PK or S (SD average score = 1.13; PK and S average score = 0.19, $p < 0.02$). Parturition lasted longer for sows scoring 2 than those scoring either 0 or 1 (211.8 min vs. 54.4 min, $p < 0.001$). Sows scoring 2 changed posture more often during parturition than other sows (65.8 vs. 7.6 changes, $p < 0.005$). One third of farmed wild boar sows were aggressive towards their piglets during parturition. Aggression varied with genetic line, and was associated with long births involving many posture changes. These findings add to our limited knowledge of wild boar behaviour and may be useful in understanding savaging in domestic sows.

De-arousal effect of stereotypies in tethered sows

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It has been suggested that stereotypies in tethered sows reduce the animals' level of arousal. It would be expected that this de-arousal is reflected in a lower heart rate (HR) and lower levels of cortisol (CS). The present study investigated the effect of post-feed stereotypies on HR and (saliva) CS in 12 sows. Using the mu-receptor antagonist naloxone we tested the possible role of endogenous opioids in de-arousal. The sows had been tethered for 7 months at the start of the experiment. Fifteen min. after feeding the animals were injected i.m. with 5 ml saline (SAL) or 1 mg/kg BW naloxon (NX) in 5 ml saline on consecutive days in a balanced design. Behaviour of the sows was recorded for 60 min. after injection. Stereotypies scored were chain chewing, bar biting, sham chewing and tether chewing. HR was monitored telemetrically and saliva samples were taken 30 and 15-min. pre-feeding and 15, 30, 45, 60 and 75-min post-feeding. Compared with SAL, NX increased post-feed CS by 56.4 % ($p < 0.05$). The increase in HR (8%) and decrease in stereotypies (13.3%) after NX were not significant. A negative correlation was found between HR and the total time spent stereotyping ($r = -0.67$, $p < 0.05$) after SAL but not after NX injection. The effect of stereotypies on HR differed between types of stereotypies. Most effective was bar biting and sham chewing. Post-feed CS was negatively correlated with the time spent stereotyping ($r = -0.60$, $p < 0.05$) after NX injection. When the behaviour was divided into bouts of stereotypic (S) and non-stereotypic (NS) behaviour, HR during S was lower than during NS bouts. A negative correlation was found between HR and the duration of S bouts ($r = -0.6$, $p < 0.001$). No correlations were found between HR and the duration of NS bouts. The results showed a de-arousal effect of stereotypies in tethered sows. Naloxon did not seem to exert profound effects, supporting Kennes' theory (1988, Eur. J Pharmacol. 153, 19-24) that "older" stereotypies become more automatic and are less under the control of endogenous opioids.

The behaviour and welfare of marsh deer (*Blastocerus dichotomus*) threatened by artificial flood and rescue procedures: case studies

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The marsh deer (*Blastocerus dichotomus*), a South American cervid, lives in areas where natural flooding occurrences are common. However, artificial floods from hydroelectric dams have successively threatened an important population living in Paraná River basin. Under these conditions usually the choice is to rescue the animals or to leave them in the threatened area. This situation give rise to questions, such as: what will happen to the animals in each case? How do they behave during the flooding or rescuing procedures? In which way do flooding and rescuing procedures affect the animal's welfare? In order to answer these questions we are studying two groups of marsh deer, a rescued (RE) and a non-rescued groups (NRE). Six months before flooding, 155 animals were captured, 40 of them received radio collars and were released in the same place (NRE), the others (115) were sent to quarantine in captivity (RE). Two animals, one from each group, died just after the capture (1.3%). The behaviour of RE group were recorded during the quarantine (30 to 120 days long). Some of them refused to eat and some tried to escape jumping against the walls in the quarantine box; the susceptibility to infections was high. Forty percent of RE animals died during quarantine and transport; after 1.5 year in captivity more 23% of them died (RE's mortality rate = 63%). The animals from NRE group have faced difficulties during the flood; in spite of their great capacity of swimming, 5% of them died by drowning. Those that escaped from the flooded areas were found in the remaining marsh areas; under this condition they were more susceptible to hunting, some presenting signs of weakness. The total mortality rate in NRE group was around 58%. We concluded that in both groups, the animals faced welfare problems. Some animals did not cope with the new environment and died; the others are still alive, but they are facing difficulties, resulting in different grades of poor welfare. Trying to find an effective strategy for conservation of this species, we can not assure yet that the animal welfare will not be impoverished by the conservation management procedures. Supported by Companhia Energética de São Paulo (CESP)

The effects of weight asymmetry and resource distribution on aggression in groups of unacquainted pigs

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The relationship between weight asymmetry and aggression when mixing groups of unacquainted pigs in two different environments was investigated. Ten groups of 4 female (Landrace x Yorkshire), unacquainted pigs with a weight asymmetry of 3.1 +/- 0.2 kg (mean weight: 16.6 +/- 0.6 kg) between each pig, and another 10 groups with a weight asymmetry of 1.2 +/- 0.1 kg (mean weight: 14.1 +/- 0.1 kg), were mixed at the age of 7 weeks. Ten of the groups (5 of each) were mixed in an experimental pen with a heterogeneous distribution of straw. The pen consisted of two main compartments with straw in one of them, and a passage area with concrete floor in between. The other ten groups were mixed in the same pen, but with a homogenous distribution of straw (straw spread all over the pen). The results showed that fighting duration was significantly shorter in groups with large weight asymmetry than in groups with small weight asymmetry irrespective of the environment. The number of bites delivered during the fights in the heterogeneous environment was lower in groups with large weight asymmetry than in groups with small weight asymmetry. In the homogenous environment, however, there was no significant difference between groups with large and small weight asymmetries regarding the number of bites. The combination of a limited straw area and a small weight asymmetry resulted in the greatest number of bites. In groups with large weight asymmetry, the largest pig won around 50 percent of the fights, and 25 % of the variation in the percentage of fights won was explained by the weight asymmetry. In groups with small weight asymmetry, less than 10 % of the variation in the percentage of fights won could be explained by weight asymmetry. The two largest pigs delivered significantly more bites and spent significantly more time fighting than the smallest pig. The second largest pig received significantly more bites and body lesions than the smallest pig in the groups. Fights between the two largest pigs had a significantly longer duration than when other pigs were involved. The results are discussed in relation to sequential assessment theory and resource defence theory.

Effects of stocking density/group size and environmental enrichment on feather pecking and plumage condition in pheasants (*Phasianus colchicus*) and partridges (*Perdix perdix*)

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In commercial game bird production, outbreaks of cannibalism or feather pecking are common, resulting in serious welfare problems. The use of beak trimming and biting (plastic rings fitted in the nostrils), which can prevent outbreaks, also have detrimental welfare consequences. Stocking density (D) is a major factor influencing feather pecking in game birds, as is environmental enrichment, and group size (G) also affects poultry behaviour. In experiment 1, pheasant chickens (8 pens, 1760 chickens in total) were reared at two levels of D (chickens per m²/G (chickens per group): 2.3/165 and 3.6/275. Two pens on each level of D/G were supplied with enrichment and two were not. Feather pecking in pheasants tended to be worse on the high D/G and in pens without enrichment (styrofoam blocks and fresh green weeds), at 2, 4, and 6 weeks of age. At 2 weeks the effect of D/G was significant (10.2 vs. 26.2 pecking bouts per hour per 100 chickens, $P < 0.01$) and at six weeks the effect of enrichment was significant (69.7 vs. 44.3, $P < 0.05$). Plumage condition (20 points = perfect, 5 points = minimum) was significantly better at 6 weeks at low D/G (17.2 vs. 14.5 points, $P < 0.01$) and in enriched pens (14.6 vs. 17.1 points, $P < 0.05$). The frequency of pheasants with pecking damage to the skin at 6 weeks was significantly lower at low D/G and in enriched pens. In experiment 2, partridge chickens were reared with D/G: 12/100 (4 pens, 1200 chickens) and 60/500 (4 pens, 1200 chickens). Rate of feather pecking was low in both treatments, but plumage condition at six weeks of age was better at the low D/G (18.7 vs. 15.7 points, $P < 0.01$). Lowering D/G (pheasants and partridges) and supplying pheasant chickens with enrichment effectively reduced pecking damages, though not to an acceptable low level.

Crouching by females reduces, but does not inhibit, aggressive attacks by sire-strain male meat chickens

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Since 1990, males of North American meat strains of domestic fowl have become extremely aggressive towards females, often injuring, and sometimes killing, them. Our previous research showed that this aggression is not due to feed restriction and that commercial laying strain males do not display overt aggression towards females. The objectives of this study were to examine if (1) males of sire vs. dam meat strains differed in aggressiveness towards females, and (2) male aggression was affected by female posture. Eighteen males each from experimental sire and dam meat strains, derived from populations synthesized from commercial broiler parent stocks of 1978, were individually tested. Aggressive and sexual behavioural elements were recorded during three 5-minute tests, during which males were observed interacting with female models in standing and crouching postures. Leaping attacks ($P < 0.0001$) and threats ($P < 0.005$) were performed more frequently by sire-strain males than dam-strain males, but there were no strain differences for mating behaviour. Fewer leaping attacks ($P < 0.05$) and aggressive pecks ($P < 0.005$) were performed towards crouching female models, than standing ones, by males of both strains. This difference was particularly clear with dam-strain males, which never attacked crouching female models. Waltzing ($P < 0.05$), wing-flapping ($P < 0.05$) and ground-pecking ($P < 0.001$) were performed more frequently by sire-strain males than dam-strain males and likely indicate conflicting sexual and aggressive motivation. Dam-strain males performed more crows ($P < 0.001$), and food-calls ($P < 0.05$). Body weights did not differ significantly between strains and there was no evidence that heavy males were more aggressive. We conclude that pronounced strain differences exist for aggressiveness towards females by meat strain males. There was no evidence that body weight is a causal factor of aggressiveness towards females. Although fewer leaping attacks were directed towards female models in a crouching posture, there was no evidence that crouching by females inhibits aggressiveness by males.

Fifteen years of the river otter (*Lutra lutra* Linnaeus, 1758) domestication

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Four generations of river otter have been captive breed for 15 years. In the mid 1999 the composition of the population was the F_0 – 2%; the F_1 – 33%; the F_2 – 63%; the F_3 2%. At the first step of domestication, selection was very strict, and genotypes providing higher resistance to stress of man-made conditions were retained through successive generations. Selection coefficients under conditions of man-made environmental stress were 67% for females and 77% for males in the F_0 ; the selection coefficients were 46% for females and 61% for males in the F_1 . Individuals exhibiting the fear response to human and, hence, susceptible to emotional stress could not breed successfully and contributed slightly to the gene pool. The actually observed fertility was 3.01 ± 0.2 pups/female for domestic otters, while it was 0.72 ± 0.5 pups / female for those responding by fear to human.

The developmental basis of individual differences in aggression in growing pigs

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Pigs are mixed with unfamiliar individuals at various stages of their lives under modern commercial conditions. Mixing usually leads to fighting between some individuals, and a period of social stress before the new group becomes socially integrated. Individual pigs are known to differ in their aggressiveness, affecting how long they fight after mixing, and the time taken before social stability returns (Erhard et al., 1997, *Appl. Anim. Behav. Sci.*, 54: 137-151). I investigated the possibility that these individual differences might result from differences in developmental history. Behavioural and other recordings were made at intervals for 112 pigs from 14 litters from birth through to weaning at 28 days, in a resident-intruder (r-i) aggressiveness test (days 46 & 47), and on mixing with unfamiliar animals (day 48). Aggression in the r-i test, together with weight, was predictive of several aggressive behaviours at mixing both between and within groups. For example groups with more aggressive pigs show increased bullying at mixing (defined as vigorous aggression without retaliation; Spearman's Rank Correlation $n=14$, $r=0.67$, $p<0.01$) and increased pushing ($r=0.74$, $p<0.005$). Aggression in the r-i test was related to several features of a pig's developmental history: For example, aggressive pigs came from litters with a high piglet/teat ratio ($n=16$, $r=0.61$, $p<0.02$), large litters ($r=0.71$, $p<0.005$) and litters with a lower proportion of males ($r=0.59$, $p<0.02$). Litters containing more pigs that would go on to become aggressive showed a number of behavioural differences prior to weaning: For example, pushing was more frequent ($r=0.53$, $p<0.05$), and play-fighting was less frequent ($r=0.52$, $p<0.05$). This work replicates previous findings in pigs and rodents showing that r-i tests are predictive of aggressive behaviour in response to a mixing situation. In addition, certain aspects of the early development of pigs have been shown to correspond to later individual differences in aggressiveness.

The cecotrophy behaviour in capybaras (*Hydrochoerus hydrochaeris*)

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Controversies exist regarding cecotrophy behavior in capybara (*Hydrochoerus hydrochaeris*). Cecotrophy is observed in certain rodents and lagomorphs, and consists of the ingestion of a specific type of excrement produced in the cecum. With the objective to observe and describe this behavior we observed, for ninety-six serial hours, six adult capybaras that were placed in individual pens. During this period a behavioral pattern we believe consisted of cecotrophy was observed 243 times. Animals sat on their hind limbs, stretched either limb out, bent over moving their head in the direction of the anus and licked a pasty material that differed from normal oval-shaped feces. This behavior was observed between 10h:48min and 11h:44min after ingestion of food. When food was supplied at 5:00 p.m., 72.84 % of the cecotrophy acts occurred between 6:00 and 12:00 a.m. while 27.16 % between midnight and 6:00 a.m. The observation of cecotrophy in capybaras is important because it suggests that maintenance expenses with protein supplements for this specie in captivity can be reduced.

Aggression and group size in weaned pigs

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Aggression following mixing of unacquainted pigs is considered a major welfare problem. Research on poultry, fish and pigs indicate that the level of aggression is reduced as the group size increase. A *traditional approach* to explain this is that the larger area at larger group sizes will increase the possibility to escape from fights and to hide from the attacker. Alternatively, a *cost/benefit approach* suggests that individuals will avoid fighting unless the probability of winning and gain control over important resources is high. The costs of an aggressive strategy will increase as the number of competitors increases. The aim of this experiment was to investigate the relationship between aggression and group size when mixing weaned pigs in light of these two alternative explanations. Six groups of 6 and 12 pigs respectively, and 3 groups of 24 pigs were mixed in an experimental pen of 0.35 m² per pigs at the age of 7 weeks. Two pigs were selected at random from each of 3, 6 and 12 litters respectively. The pigs were weaned at 5 weeks of age. The pigs were videorecorded in 12 hours after mixing, and the duration of each fight, the individuals involved and the outcome of the fight (winner/loser) were recorded continuously. At ten minutes interval, the number of pigs lying down were scored (instantaneous sampling), and body lesions were scored before and after the mixing. The total number of fights, the number of unsettled fights, proportion of animals not involved in fights and the proportion of lying pigs were calculated. The total number of fights, number of unsettled fights and the total duration of fights were significantly lower in group size 24 than in group size 6 or 12 ($P < 0.05$). In spite of the lower number of fights in group size 24, the duration of each fight were significantly longer ($P < 0.05$). This is closely linked to the fact that the proportion of pigs not participating in fights were significantly higher in group size 24 than in group size 6 and 12 ($P < 0.05$). The pigs in group size 12 and 24 had a significantly lower body lesion score than pigs in group size 6. This experiment confirms earlier findings that the level of aggression when mixing pigs is reduced as the group size increases, and supports the predictions from the cost/benefit approach.

Broiler chickens display a delayed avoidance of atmospheric ammonia

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Broiler chickens may be exposed to concentrations of atmospheric ammonia that may harm their health, lower production efficiency and compromise their perception of their own welfare. The aim of our study was to determine whether broilers would choose an environment based on its atmospheric ammonia content. Birds were given free access to compartments containing nominally 0, 10, 20 and 40 p.p.m. ammonia in an octagonal preference chamber in two experiments. In the first experiment, three batches of 12 birds were given access to all eight compartments (2 per ammonia concentration) for a period of eight days after an acclimatisation period of two days. Visit durations significantly reduced as ammonia concentration increased (70, 64, 60 and 49 min, $P < 0.05$, s.e.d. 0.014 based on log transformed data) but there were no changes in total occupancy time. The second experiment incorporated four different coloured visual cues in four compartments to assist the four batches of 12 birds in making decisions and was lengthened to 16 days. Birds spent significantly less time in the high ammonia concentrations. Moreover there was a significant interaction between light intensity and ammonia concentration. Occupancies (scan numbers/day) at 0, 10, 20 and 40 ppm ammonia were 219, 221, 96, 41 in bright light vs 322, 177, 65, 12 in dim light ($P < 0.001$, s.e.d. 59.21). Visit length was significantly lower in the two highest ammonia concentrations (38, 28, 20 and 15 min. at 0, 10, 20 and 40 ppm, $P < 0.01$, s.e.d. 0.081 based on log transformed data). These two experiments demonstrate that broiler chickens choose to spend less time overall and shorter periods of time at high ammonia concentrations, especially when they can identify the different compartments through visual cues. This does not appear to involve an aversion to entering high ammonia concentrations but a motivation to seek fresh air after short periods in high ammonia, possibly due to the delayed onset of a sense of malaise.

Factors that motivate a calf to switch teats during a nursing

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While nursing a cow, calves suckles from different teats. We examined how calves decide to switch teats. We used 16 individually housed Holstein male calves fed milk through an artificial teat at a Baseline flow rate (0.66 l/min). During the tests, in their home pen during the morning meal, calves were fed using an artificial milk feeding system with two teats and a control system that ensured precise adjustment of the milk flow rate to each teat. During the first 30 sec of a meal, calves switched teats more and did more teat directed behaviours such as stripping and releasing the teat than during the rest of the meal. During the next 2.5 min of the meal, when milk flow rate was Extremely Slow (0.04 l/min) on both teats, calves changed teats 4 times more often ($p \leq 0.001$) and butted 3 times ($p \leq 0.001$) more often than when milk flow was Baseline (0.66 l/min) on both teats. When the flow rate of one teat was Extremely Slow and the other was at Baseline, the calves remained on the Baseline teat. To examine if a sudden decrease or stoppage of flow rate caused teat switching we allowed the calves to settle on one teat during the first minute of the meal and then reduced the flow rate of that teat from Baseline to Extremely Slow or Off. The calves changed teats 8 times more ($p \leq 0.001$) and butted twice as much ($p \leq 0.001$) when the flow rate was decreased or stopped than when there was no flow change. The availability of a non-nutritive second teat did not affect the switching responses of the calf. We conclude that calves are sensitive to milk flow rate and can adjust their sucking behaviour to changes in flow rate, switching teats when flow rate decreases.

Isa Brown and native Brazilian chicks raised on pasture display similar behaviour

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Intensive genetic selection of hens in close confinement has resulted in highly productive breeds. This may have affected their behaviour. Many producers are skeptical of using these breeds in systems on pasture. In this preliminary study we compared the behaviour of the ISA Brown (IB) commercial breed with a native Brazilian breed (Caipira) and analysed if the contact within breeds would affect their behaviour. Forty eight IB birds and 48 Caipira were used. The experimental plot consisted of an outdoor aviary with eight birds, half males and half females, occupying an area of 2m². The twelve aviaries were arranged in four blocks, to which one of the three treatments (T1 = Caipira; T2 = IB; T3 = half caipira and half IB) was randomly assigned. The bird had access to pasture, shelter, a perch, a drinker and a feeder, and they were moved as the pasture was consumed. Chicks were not beak trimmed and were fed commercial ration every morning. The experiment was carried out during the summer, in a subtropical region (27° S). The animals were directly observed by scans taken every 10 minutes during 13 consecutive hours, at 42, 46, 50 and 54 days of age. The behaviours: grazing, scratching, eating, sunbathing, preening, perching, sitting on the ground, drinking, walking and other activities, were recorded. Data were analysed by SAS analysis of variance. A significant effect of the time of day and age of the birds was observed in several behaviours. No difference among the breeds was detected in most of the observed behaviours. During the hottest periods of the day IB chicks drank more frequently than T1 and T3 (respectively 7.4 vs. 4.3 and 4.4, $P < 0.0001$) and sat on the ground longer than T1 (29.2 vs. 22.7, $P < 0.01$, without difference of T3 = 28.1). Mixed groups averaged in between. As such, IB was more sensible to heat than Caipira. Despite the latter, according to data obtained in this experiment, both breeds presented the same overall behavioural pattern, indicating that the commercial breed can be successfully raised on pasture.

The effect of maternal undernutrition on the expression of mother-offspring behaviour at parturition in the sheep

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Pregnant hill sheep farmed extensively frequently experience harsh environmental conditions and poor nutrition during the winter months. The aim of this study was to examine whether undernutrition of ewes, to a similar level as experienced during a moderately poor winter, had an impact on the onset and expression of maternal and neonatal lamb behaviours at parturition in primiparous Scottish Blackface ewes. Fifty ewes (16 single-bearing, 34 twin-bearing) were randomly assigned, within litter size class, to a control (C) or restricted (R) nutritional regime from week 4 of gestation. R ewes had a mean weight loss of 6.2% over gestation, whereas C ewes had a weight gain of 5.6% ($P < 0.001$). R lambs were also significantly lighter than C lambs (mean birthweight (kg): R = 3.06, C = 3.42, s.e.d. = 0.12, $P < 0.05$). There was no overall effect of nutrition treatment on the time taken by the lambs to right, stand, and seek the udder. However, increasing lamb birth weight had a significant positive effect on the speed with which lambs stood ($P < 0.05$) and attempted to suck ($P < 0.01$). There were no effects of treatment on the frequency of ewes showing aggressive or rejection behaviours immediately after parturition. C ewes did, however, spend more time grooming their lamb in the first 30 minutes after delivery than R ewes (median time (mins): C = 24.3, R = 19.8, $P < 0.05$), but not thereafter. Two separate tests for maternal bonding were carried out, when lambs were 24 hours and 3 days old. A greater number of R ewes tended to receive low scores (indicative of less maternal motivation) than C ewes in the test at 24 hours old (% low scores: R = 33.3%, C = 8.7%, $P = 0.09$), this was significant at 3 days (R = 25%, C = 0%, $P < 0.05$). Overall, our data suggest that maternal undernutrition in pregnancy in sheep may impair ewe-lamb bonding behaviours at parturition.

The behaviour of broiler chickens kept under free-range conditions with foster hens

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The behaviour of broilers is characterised by very low activity levels. Internal factors relating to their rapid growth are made responsible, but the impact of the typically barren housing environment must be considered, too. This investigation aimed to determine the effect of maximal external stimulation on the behaviour of commercial meat type hybrids in order to assess the potential of improving broiler welfare by environmental enrichment. 19, respectively 18 randomly selected chicks from 2 successive batches of about 230 chicks were fostered to 3, respectively 4 broody hens, and 2 days later received, with one adult cockerel, free access to an outdoor area for about 12 hours daily. The remaining birds were kept in a windowless house in 2 pens (stocking density 25 kg/m²). Both pens in batch 1 and one pen in batch 2 were equipped at one side with an electrical brooder with plastic stripe side cover. Data from these 3 groups are reported. All birds received water and commercial feed pellets ad libitum. For 5 weeks, 8 focal birds from each free-range ($n = 16$) and 5 from each housed group ($n = 15$) were continuously observed within their usual environment for 10 minutes, on average 6 times a week, distributed from 600 to 2000 hours. Free-range birds walked and ran 14.4 % of time (median) in week 1 and 5.4 % in week 5. The pattern of decrease was similar, but locomotion levels were higher compared to housed birds (week 1: 5.4 %, week 5: 2.2 %, Mann-Whitney Test, $p < 0.001$, $p < 0.05$). Free-range birds pecked more at their environment (maximum week 2: 31.9 vs. 18.9 pecks/bird*hour, $p = 0.06$; minimum week 5: 17.3 vs. 2.5 pecks/bird*hour, $p < 0.001$), but not at mates (week 1: 0.2 vs. 1.1 pecks/bird*hour, $p < 0.001$; week 5: 0.0 vs. 0.3 pecks/bird*hour, $p < 0.05$), while they spent less time at the feeding trough (maximum week 4: 3.5 % vs. 6.1 %, $p < 0.05$). Sitting duration increased over time in both groups and was in week 5 not significantly different between groups with 80.0 %, respectively 84.4 %. Data indicate that the potential to improve broiler welfare by environmental enrichment is severely limited by their genetic basis. However, the increased activity, especially locomotion, may still contribute to improvements which are significant to the animals. This work was funded by the H. Wilhelm Schaumann Foundation

Creche composition in a group of Angus calves

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Ruminant creches consist of groups of young animals that are in spatial proximity of one another and separate from other conspecifics. Often an adult female of the species is nearby. Irregular configurations and numbers of individuals in groups make creches difficult to define. In this study a creche consisted of three or more calves. The nearest neighbor of each of them was another member of the group, which persisted for at least six minutes in the same location. Fifteen black and eight red Angus calves ranging from 63 to 167 days of age and their dams were observed in scan samples twice daily for 6 days on a ranch in south-central Brazil. Twenty-eight creches were studied. The animals' activities, associations among individual calves in creches and the identities of nearby cows were recorded. There was no discernable sex or color discrimination within creches. The calves tended to be with the same creche companions more often than with different companions during different observations ($t = 6.54$, $df = 44$, $p < 0.001$). Six of the 23 cows accounted for 80% of all cows near the creches. Fifteen of the 28 creches were accompanied by at least one cow. The nearby cow was the dam of one of the calves in the same creche on eight occasions, and she was the dam of a calf in a different but concurrently extant creche six times. Kinship is probably a factor in the proximity of adult cows to creches. Previous studies showed that familiarity is more important than kinship in determining social relationships in adult herds. Long-term familiarity and subsequent social preferences might have origins in alliances formed by calves in creches.

The influence of stress levels on feather pecking and the immune response in laying hens

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Incidents of feather pecking and cannibalism in flocks of laying hens remain a serious problem in commercial egg production. Several factors have been linked with the development of feather pecking, but it remains unclear how they exert their influence on behaviour. One possible mediator is stress and experiments were set up to look at this factor. Firstly we tested the effects of foraging material and feed form on feather pecking and at the same time we recorded various parameters indicating the stress levels of the birds. Sixteen groups of 11 laying hens were kept in pens with or without straw and provided with feed in the form of pellets or mash. Both factors, foraging material and feed form, had significant effects: No straw and pellets increased the amount of feather pecking. In pens without straw we found reduced egg production and reduced immune responsiveness to sheep red blood cells and tetanus toxoid. Increased heterophil/lymphocyte ratios were seen where birds had no straw and were fed pellets. All three measures indicate increased stress levels, suggesting that feather pecking in laying hens is correlated with stress. From this first study we cannot conclude whether feather pecking is the cause or whether it is the consequence of stress. We therefore conducted a second experiment. Sixteen groups of 16 birds were kept in pens with or without litter as foraging material. Half of the groups were fed corticosterone, an important stress hormone in birds, and half were not. Groups on litter and without corticosterone developed virtually no feather pecking, while groups fed corticosterone showed high rates of feather pecking. Frequency of feather pecking also increased in groups without litter and without corticosterone. Feeding corticosterone to these birds had no additional effect. We conclude that stress may, depending on the housing conditions, trigger the development of feather pecking.

Pre-farrowing behaviour distinguishes piglet-savaging gilts from non-piglet-savaging gilts

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Piglet pre-weaning mortality is a perennial problem for the pig industry. We hypothesised that variability in the quality of the sows' maternal behaviour would help explain differences between sows in the incidence of piglet pre-weaning mortality. Poor maternal behaviour can result in piglets with reduced viability and is therefore of direct welfare concern. Behavioural video records were collected for 94 gilt litters to cover 24 hours prior to parturition. Information was collected on the cause and timing of each pre-weaning piglet death. Four breeds were represented, balanced for treatment – the presence or absence of straw in the parturition environment (a crate). Canonical Variates Analysis (CVA) was used to identify behavioural traits associated with (a) savaging gilts ($n = 11$), (b) gilts that bite or snap at their piglets but do not savage ($n = 29$), and (c) non-savaging, non-aggressive gilts ($n = 54$). Heavily loaded behaviours were tested for significant group differences using residual maximum likelihood tests (REML). Gilts that went on to savage their piglets spent more time lying ventrally (on the sternum) ($t_{58} = 3.0, p < 0.01$) and shifted lying posture more ($t_{58} = 3.2, p < 0.01$), between -16 and -12 hours pre-farrowing, than non-savaging, non-aggressive gilts. Shifting lying postures was also seen more in savaging gilts than aggressive but non-savaging gilts (group c) ($t_{35} = 2.3, p < 0.05$). Savaging gilts were characterised by lower levels of straw and floor-directed behaviour, -16 to -12 hours pre-farrowing, ($t_{58} = 2.7, p < 0.01$) and higher levels of fixture-directed behaviour, -4 to 0 hours pre-farrowing, ($t_{63} = 2.7, p < 0.01$) than those seen in non-savaging (group c) gilts. This work suggests that gilts that savage their piglets show differences in behaviour from non-savaging gilts. These differences may indicate that savaging gilts are more sensitive to the thwarting of nest-building caused by the farrowing crate.

Effect of access to roughage and shelter on behavioural welfare indicators in slaughter pigs

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The aim of the study was to examine if free access to roughage (wholecrop silage of barley and peas) and shelter would enrich the environment of slaughter pigs when they had access to outdoor runs, were fed *ad libitum* with concentrate, and provided with ample straw and space. The two treatments were evaluated by examining three behaviours that are considered to be indicators of well-being in pigs: 'reduced aggression', 'reduced oral manipulation of penmates' and 'increased play'. Seven replicates were used for the investigation; each consisting of 96 pigs that were randomly distributed to 8 experimental pens at 10 weeks of age. Each pen and outdoor run housed 12 pigs (2 m² per pig). The pigs were observed by direct observations when the pigs were on average 13, 15, 17, 19, 21 and 22 weeks of age. In each of these weeks, all occurrence sampling was carried out on two successive days between 800h and 1600h. The combination of access to roughage and shelter reduced the duration of manipulating penmate compared to all other treatment combinations (2.7% vs. 3.8, 3.6 and 3.5% of observation time (SE=0.004), $P < 0.05$). Aggression frequency decreased when the pigs had access to roughage compared to non-roughage pigs (0.46 vs. 0.55 head-knocks per pig per hour (SE=0.05), $P < 0.05$), and access to roughage also decreased the duration of manipulation pen hardware (2.2% vs. 3.2% of observations time (SE=0.4), $P < 0.05$). Play frequency decreased by age ($P < 0.05$) and by increasing temperature ($P < 0.001$), but no single effects of roughage or shelter showed up. In conclusion, the behavioural welfare indicators were positively affected by shelter and roughage – but by roughage in particular, suggesting that roughage might be the main enriching factor under the given circumstances.

Interaction between social and feeding motivations on the grazing behaviour of groups of sheep

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Food preferences and social relationships are the main factors that influence the foraging decisions of domestic herbivores. Interactions between social grouping tendencies and foraging decisions are complex, and were here directly investigated in grazing sheep. In the first experiment, ewes were grazed in plots in which a preferred feeding site, i.e. a taller vegetative area, was left to grow at either 15 or 50 m from a socially attractive site, i.e. seven familiar ewes placed in a public pen. Eight ewes were tested either alone or in groups with 1, 3 or 6 familiar accompanying animals in a Latin-square design (2 distances x 4 group sizes). When the preferred site was 15-m from the public peers, ewes grazed it whether they were alone or with a few peers, but the frequency of vigilance behaviour increased in the small sub-groups. When the preferred feeding site was located at 50 m, ewes in the larger groups were the more likely to graze it. In a second experiment, the preferred feeding site was located 35-m away from the public peers. In order to assess the effect of the strength of social bonds, eight ewes were tested with 1 or 4 either familiar or unfamiliar accompanying animals. Five other familiar or unfamiliar animals were used as public peers. We used a Latin-square design with 2 degrees of affinity with public peers, 2 degrees of affinity with accompanying animals and 2 group sizes. Again, ewes in the larger groups were the more likely to graze the preferred feeding site. There was an additive but weaker effect of the quality of relationship between animals: ewes with familiar accompanying animals grazed the preferred site longer and were less vigilant. The effect of strength of social bonds decreased as animals became more habituated to experimental conditions.

Re-thinking social stress in newly weaned piglets

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Crowding and mixing with unfamiliar piglets are two of the many "stressors" that piglets experience at weaning. We subjected piglets weaned at 12-14 days to different combinations of social factors with the objective of exploring the effects of social stress on the development of oral-nasal behaviour patterns. Group composition (6 strangers vs. 6 littermates) and density (0.15 m²/pig (HD) vs. 0.4 m²/pig (LD)) were main factors in a 2x2 factorial design. Six replicates per treatment combination (n=144), were observed over three, 3-week trials. Behaviour was recorded every 5 min during one 4-h period on day 1 and two 4-h periods on days 3, 7, 10, 14, 17 and 21 post-weaning. Feed intake was measured weekly. Contrary to expectations, aggression was greater for LD piglets ($P < 0.05$) overall. Although strangers fought more on day 3 ($P < 0.05$), the severity of cuts to the head and ears was greater for littermates on day 15 ($P < 0.05$). HD piglets consumed more feed ($P < 0.05$) and tended to spend more time at the feeder ($P < 0.10$) during the first week than piglets in more spacious pens. As expected, HD piglets spent more time nosing and chewing on pen-mates overall ($P < 0.01$), and spent less time lying on days 3 ($P < 0.10$), 14 ($P < 0.05$), and 21 ($P < 0.05$). Although piglets subjected to "crowding" and mixing at weaning are thought to experience greater "stress" than piglets housed in spacious pens with littermates, the complexities of the social environment are not straightforward. Proximity to feeders and other piglets stimulated feeding, but resting piglets were disturbed more frequently by pen-mates in higher density pens. The effects of density on aggression are more difficult to explain. Perception of crowding may differ considerably for neonates than older animals. Piglets typically remain close to each other and therefore, "crowding" may be comforting to newly weaned piglets.

Social learning of food palatability by domestic hens

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Social learning could help animals avoid noxious substances or select potential foods. We examined whether this occurs in domestic laying hens. In Experiment 1, sixty-four birds observed one of 4 demonstrations, i.e. hens eating unpalatable red or green food, or eating standard red or green food. During testing, demonstrator birds feeding on unpalatable food gave highly visible 'disgust' reactions, i.e. bill-wiping and head-shaking. Despite this, for the observer birds, there was no significant effect ($P > 0.05$) of palatability or colour of food eaten by the demonstrators on the total amount of food eaten, the proportion of red or green food eaten, the latency to peck either colour, or the number of birds to peck first at red or green food. These results do not support the suggestion that social learning helps hens avoid noxious substances. In Experiment 2, eighty birds observed one of 6 demonstrations, i.e. hens eating highly palatable red or green food, standard red or green food, or, standing near a bowl of red or green food but not eating this. Observing a demonstrator standing near coloured food but not eating this reduced consumption ($P < 0.05$) of this colour by the observers by 22-36%. When demonstrators pecked more frequently or fed more quickly from coloured food, observer hens consumed a significantly greater proportion of food of the same colour ($P < 0.05$). Furthermore, when observers saw red food eaten, the proportion of red food that they subsequently ate increased with increasing demonstrated palatability ($P = 0.026$) although this relationship was less evident when the demonstrators ate green food ($P = 0.037$). This study shows that the food preferences of layer hens can be socially learned. Overall, the data support the hypothesis that social learning functions to develop preferences for potential food items, rather than develop aversions to noxious substances.

Early social experience of piglets affects rate of conflict resolution with strangers after weaning

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We hypothesised that the amount of social experience gained by piglets during early ontogeny would affect their subsequent aggressive behaviour towards unfamiliar conspecifics. With Institutional Animal Care and Use Committee approval, we manipulated social experience in three rearing treatments (1) Obstacles (interactions with littermates physically limited by thin metal bars at piglet height, one piglet width apart, throughout the pen), (2) Littermates (unobstructed interactions with littermates), and (3) Aliens (unobstructed interactions with littermates plus interactions with age peers from another litter during seven 30-min periods between 8 and 23 d). After weaning at 24 d, a male and female from each of the eight litters per treatment were placed together with an unfamiliar male and female of similar body weight from the same rearing treatment during three 30-min periods at 2-day intervals. Aggression (bites, levers and "push-overs") towards non-littermates after weaning declined most rapidly among pigs from the Aliens treatment and most slowly among pigs from the Obstacles treatment ($P < 0.05$). The number of fresh bite marks on each pig after each encounter declined sharply to a low level in pigs from the Aliens treatment, less sharply in pigs from the Littermates treatment, and did not decline over successive encounters in pigs from the Obstacles treatment ($P < 0.05$). The number of bite marks on the pigs prior to the first encounter did not differ between treatments ($P > 0.05$). Thus, the more social experience that the piglets had received prior to weaning, the more rapidly they resolved conflicts with strangers after weaning. The results suggest that stimulating social interaction among piglets early in life could reduce the trauma associated with mixing of litters following weaning.

Effects of stabling on social behaviour in stallions

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The predominant housing system for domestic horses is individual stabling, which allows horses to see, hear, and smell each other, but deprives them of physical contact. As part of a larger project on handling and social environment, nineteen 2-year-old stallions were divided into two groups, one group ($n=7$) being stabled singly, the other ($n=12$) in groups of three, for nine months at Research Centre Foulum. Subsequently, the two groups were released to semi-free conditions, and during a six week period, social interactions, such as non-contact agonistic (i.e. threats), contact agonistic (i.e. bites, kicks), and friendly (i.e. play, social grooming) were recorded, and nearest neighbour tests were conducted. Behavioural data were collected during 168 hours of direct observation, lasting 3 hours per group per day. Singly stabled stallions responded to the nine month of social deprivation by significantly increasing the level of social grooming (Mann-Whitney U (MWU), $p<0.01$) and play (MWU, $p<0.05$), when subsequently interacting freely with each other. Mouth clapping, which is a submissive behaviour, useful in avoiding aggression in social groups, was recorded more frequently in the group of previously group stabled stallions (MWU, $p<0.01$). Accordingly, more aggressive behaviour was recorded in the group of previously singly stabled stallions, i.e. bites (MWU, $p<0.05$). A former group mate was frequently the nearest neighbour of previously group stabled stallions (Wilcoxon Signed Rank (WSR), $p<0.01$), whereas previously singly stabled stallions did not associate with their former neighbours (WSR, $p>0.05$), whom they had been able to see and smell but not interact with during the previous treatment. The nearest neighbour was more frequently recorded to be within one horselength of singly stabled stallions than of group stabled stallions (MWU, $p<0.01$). It is concluded that 2-year-old domestic stallions are sensitive to social deprivation and that stabling has long-term effects; throughout a six week period at least, on the social behaviour in stallions.

Effect of individual housing on immune response in gilts

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Individual housing causes chronic behavioural and physiological changes in female pigs, which may have consequences for their health. The current experiment was performed to study the effect of type of housing on immunology in relation to behaviour and physiology. Twenty-four 5-month old gilts were housed in four groups of six. At 8 months of age, gilts of two groups were individually housed in stalls, whereas the gilts of the other two groups remained group-housed. Chain biting during a period of 2 hrs after feeding in individually housed pigs was scored over the course of 5 months. Five months after change of housing, salivary cortisol levels and heart rate around afternoon feeding were measured. In addition, 8 group-housed and 8 individually housed pigs were immunised i.m. with 1 mg KLH-DNP (a commonly used antigen), and 4 group-housed and 4 individually housed pigs were used as controls and injected with the solvent. Blood samples were drawn prior to and at 7, 14, 21 and 28 days after immunisation. KLH-specific cellular (T-cell proliferation) immune response was determined in vitro. In individually housed pigs, the percentage of chain biting gradually increased from $3.6 \pm 1.6\%$ on day 2 to $38.9 \pm 8.5\%$ after 5 months. In general, chain biting did not have an attenuating effect on heart rate. During the first half hour after feeding, heart rate in group-housed pigs decreased significantly faster than in individually housed pigs ($p<0.05$). Cortisol levels in individually housed pigs were lower (0.49 ± 0.11 ng/ml) than in group-housed pigs (0.85 ± 0.11 ng/ml, $p<0.05$). Cortisol levels did not correlate with percentage of time spent chain biting ($R_s = 0.03$, ns). KLH-specific T-cell proliferation was higher for individually housed pigs than for group-housed pigs at 28 days after immunisation, which may be related to their lower cortisol levels. The results suggest that in pigs housed individually for 5 months, chain biting does not have an attenuating effect on heart rate and cortisol levels yet, but the immune response against certain pathogens is higher than in group-housed pigs.

The effect of subdivision of bouts of social contact on the social behaviour in pigs and calves, implications for use of operant conditioning to access behavioural priorities

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The use of traditional operant conditioning techniques to access farm animals behavioural needs has been criticised because presenting short rewards repeatedly may interrupt bouts of behaviour and thereby devalue the reward. In the two reported experiments (one including twelve calves and one including twelve pigs) the aim was to investigate if subdivision of social contact affects social behaviour. In both experiments animals were housed in pairs (one test animal and one companion animal) in large pens with solid sides. The experiment included 3 periods. In period 1 and 3, behavioural recordings were conducted following an introduction after 24 hours of isolation. In period 2, each pair was isolated from one another for 24 hours and then reunited 12 times for 210 seconds in succession. This procedure was repeated 5 times. To investigate the effect of interruption of social contact, behaviour in successive 210 sec bouts during the 42 min continuous (periods 1 and 3) and interrupted (during period 2) contact were compared. In both calves and pigs, social sniffing decreased less rapidly over the 42 minutes when social contact was interrupted ($P < 0.01$), illustrating that the animals will re-examine each other after every reunion. In pigs, subdivision of social contact increased aggression. Test pigs received more bites and head knocks ($P < 0.01$) and they avoided the companion more when contact was interrupted ($P < 0.05$). Furthermore, test pigs performed more flank pushing of the companion when contact was interrupted ($P < 0.01$). This suggests that if pigs are given short periods of social contact as rewards in an operant conditioning set-up, aggressive motivation rather than affiliate social motivation may be measured. However, in calves affiliate social motivation appear to be maintained when giving short periods of social contact.

The effect of loose housing during gestation on behaviour and skin lesion scores of multiparous sows in farrowing crates

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Loose-housed sows have heavier muscles and stronger bones than sows that are housed in stalls during gestation (Marchant and Broom, 1996, Animal Science 62:105-113). We investigated whether this resulted in improved manoeuvrability and consequently skin health, in farrowing crates. Multiparous sows were housed loose [L] in groups of four ($n=23$) and in stalls [S] ($n=28$) without bedding from one month post-mating. On day 110 of pregnancy, sows were moved to farrowing crates with metal, slatted floors where they remained until 28 days post-partum. Postural time budgets, frequency of posture changes, pre-lying and lying behaviour were recorded on day 1 in the crate and on day 10 post-partum. Skin lesions to the limbs were scored on six occasions during lactation as described by Boyle et al. (Animal Welfare 2000, 9:39-48). On the first day in the crate, there was no difference between treatments in the frequency of posture changing. However, [L] sows made significantly fewer unsuccessful attempts to lie down per lie down event than [S] sows (1.3 ± 0.10 vs 2.3 ± 0.35 ; $P < 0.05$). The difficulty in lying resulted in [S] sows performing a higher level of pre-lying behaviour i.e. rooting at the floor (6.5 ± 1.83 vs 2.2 ± 0.57 ; $P < 0.05$), spending longer standing inactive (7.44 ± 1.79 vs 1.48 ± 0.36 ; $P < 0.01$) and less time lying laterally (16.7 ± 5.4 vs 31.6 ± 5.5 %; $P = 0.059$). Ten days post-partum, [L] sows spent less time in the kneeling position when lying down (3.87 ± 0.46 vs 5.84 ± 0.78 sec; $P < 0.05$) and made more posture changes, predominantly while lying, than [S] sows (42 ± 2.1 vs 33 ± 2.9 ; $P < 0.05$). [L] sows had lower lesion scores of the front limbs after 24 hours in the crate (8.91 ± 0.31 vs 11.04 ± 0.47 ; $P < 0.001$), after farrowing (9.57 ± 0.39 vs 11.96 ± 0.53 ; $P < 0.001$) and at weaning (9.41 ± 0.39 vs 10.5 ± 0.39 ; $P = 0.054$). Loose-housed sows were able to lie down more easily and required less time to complete the behaviour. This resulted in less damage to the skin of the front limbs. The high frequency of posture changing while lying by [L] sows on day 10 of lactation suggests that these sows may have been expressing some frustration due to their inability to get away from the piglets. In conclusion, loose housing during gestation has beneficial effects on sow welfare in farrowing crates although it may affect maternal behaviour.

Calves' responses to repeated social regrouping and relocation

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Because of welfare concern, calves are increasingly housed in groups. However, to reduce variability in live weight within groups, farmers usually group calves by weight and change groups when calves do not grow at the same rate. For poultry, pigs and rats, frequent mixings can be stressful. Our objective is to assess the consequences of repeated regrouping and relocation on the welfare of calves. 32 Holstein calves were housed in pairs. Half of them (mixed calves) were placed in a new pen with a new partner once a week for 14 weeks while the others (controls) stayed in the same pen with the same partner. The behaviour of the calves was observed for the three hours following each mixing. At the end of the mixing period, the functioning of the HPA axis and of the sympathetic nervous system were assessed and the calves were weighted. Calves reacted to mixing by interacting with the new partner and increasing their general activity. However, these modifications were not large (first mixing: aggressive encounters in mixed calves vs. controls: 1.2 vs. 0.4, $P < .05$; time spent walking: 6.1 vs. 2.3 min, $P < .01$) and disappeared after the fifth mixing. Cortisol responses to exogenous ACTH were higher in mixed calves than in controls (integrated response: 6688 vs. 5508 ng.mn/ml from 0 to 180 min, $P < .01$). However, basal cortisol levels, ACTH responses to injection of CRH, activities of catecholamine-synthesising enzymes (Tyrosine Hydroxylase and Phenyl-N-Methanolamine Transferase) and growth did not differ between the two groups. In conclusion, apart from the increased sensitivity of the adrenal cortex of mixed calves to ACTH (which is often thought to reveal chronic stress), there was no clear evidence that repeated regrouping and relocation stresses calves. Aggression between calves was rare and calves seemed to habituate to repeated mixing.

Costs of forgetting: how these influence spatial learning and memory in pigs

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Some recent studies in the field of applied animal behaviour and animal welfare have focused upon animal memory as a model of cognitive processes, most of which measure memory and learning in terms of performance in experimental tests. It has, however, been suggested that the accuracy shown by animals in laboratory tests of spatial memory has often been lower than the accuracy shown by animals in the field. One explanation is that information of food sites is less 'valuable' to animals in an experimental situation, where they receive regular food rations, than to animals in the field, which rely on their memory to maximize their energy intake. Manipulating the costs of decision-making in memory tests allows us to investigate how the 'value' or importance of information influences how well the memory of such information is stored and recalled. Sixteen male pigs were trained to perform a win-shift foraging task in an eight-arm radial maze. The pigs searched the maze during a sample phase to find food in four of the eight arms. After a 10-minute retention interval, they re-entered the maze to locate food in the four previously empty arms. The cost of entering arms was altered for different experimental groups by placing ropes across the entrance of every arm, at a height of 30cm, which the pigs had to walk over to investigate the trough and find food. Animals encountering the ropes during the sample phase required significantly fewer training trials to reach a criterion level of performance accuracy compared with animals experiencing no ropes (ANOVA; no-costs mean \pm SE = 21.38 ± 0.86 , costs mean \pm SE = 24.38 ± 0.94 , $p = 0.034$). Pigs incurring costs during the recall phase made significantly fewer errors following disturbance treatments than animals with no experience of costs (ANOVA; costs mean \pm SE = 0.59 ± 0.094 , no-costs mean \pm SE = 1.72 ± 0.179 , $p < 0.001$). These results suggest that the importance of 'to-be-remembered' information influences how accurately and robustly the memory is stored and recalled.

Behaviour and faecal cortisol in captive chimpanzees (*Pan troglodytes*): a non-invasive way to assess environmental manipulation

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Confined chimpanzees suffer from serious welfare problems that can be reduced with environmental enrichment programmes. However, very rarely these programmes are objectively assessed. Behaviour and faecal cortisol can be used to know how successful the manipulation of the environment is. The aim of this study was to compare the behaviour and faecal cortisol profiles of a group of confined chimpanzees before and during manipulation of their environment. The social and individual behaviour of six chimpanzees was recorded during two weeks before (P1) and two weeks during manipulation (P2). Faeces were collected from 4 individuals every other day during the 4 weeks. The average time inactive was 72.2% of time in P1 and 43% of time in P2 ($p < 0.05$). The average time feeding for P1 and P2 was 3% and 14% ($p < 0.05$) respectively, and the average time under shade for P1 and P2 was 25% and 60% ($p < 0.05$). The average frequency of agonistic and non-agonistic interactions was higher after environmental manipulation ($p < 0.05$). Average faecal cortisol for P1 was higher than that of P2 ($p < 0.05$). Two of the four chimpanzees had lower levels of faecal cortisol in P2 in comparison to P1 ($p < 0.05$), the other two did not show any differences between phases. When behaviour and cortisol levels were related negative correlations were found between time spent feeding and time spent under shade with average faecal cortisol levels ($p < 0.05$). Faecal cortisol can be a useful indicator to design and assess environmental enrichment programmes in other species.

Visual, olfactory and spatial cues in the foraging behavior of pigs: indirectly assessing cognitive abilities

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Assessing sensory and cognitive capabilities of a species are essential for establishing welfare criteria. Micropigs (*Sus scrofa*) ability to use visual, olfactory and spatial cues to locate food in a novel environment was investigated. In Experiment 1, four castrated male pigs were trained to forage for a food reward hidden underneath one of two plastic pots within a 12.8 X 6.7 m arena. Pots baited with food differed only in color from incorrect pots. In 10 trials location of baited pots was constant, and pigs were allowed to search until the food was uncovered. Pigs were then given 10 single-choice trials with constant bait location, repeated until each pig made 8 of 10 correct choices. Next, pigs were given 10 single-choice trials with location of baited pots randomized, to determine whether pigs would follow visual cues or return to previously correct locations (i.e., rely on learned spatial cues). Trials were then conducted with 4, 6, 8 and 10 pots. In random location trials, pigs performed above chance ($P < 0.05$). Experiment 2 was designed to assess performance with olfactory cues. Discriminative stimuli were food extract odors from plastic bottles placed on tops of pots. Pigs were required to select only pots containing a specific odor. Trials used 2, 4, 6, 8 or 10 pots. In all except two-pot trials, pigs performed above chance on random location trials ($P < 0.05$) and made more correct choices on random location trials using 6, 8 and 10 pots when odor cues were presented ($P < 0.05$). We propose that when multiple cues are available, pigs can use vision and olfaction to navigate, rather than relying solely on spatial memory. Further, odor appears to be a more salient cue than vision for micropigs on relatively difficult learning tasks, and perhaps during foraging for food.

Behavior following subcutaneous electrolyte treatment in transported calves

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Transportation of neonatal calves is common in the U.S. dairy industry. Stress caused by transport can be combated with various therapies to assist the calf in coping. We investigated physiological and behavioral benefits that result from subcutaneous electrolyte administration after transport. Thirty Holstein bull calves were assigned to control (C), transported (T), or transported with electrolyte therapy (TE) in a randomized complete block design. Calves were transported in the bed of a truck using an aluminum top with straw bedding. T and TE calves were transported for 4 hours one afternoon and penned with other calves overnight and transported again for 4 hours in the morning. Following the last transport, 1 liter of electrolytes was given subcutaneously to TE calves. Calves were placed in hutches 2 hours prior to instantaneous scan samples of maintenance behaviors and activity, taken every five minutes for 30 minutes prior to and 30 minutes following afternoon feeding for 4 days. Movement and vocalization increased with TE ($P < .02$) during the post-feeding period on the first day following transport. On the second day following transport (pre-feeding), lying tended to increase for T compared to TE ($P = .15$) and vocalizations increased for TE ($P < .05$). Touching the pen and hutch each decreased for TE calves and touching the hutch decreased for T calves ($P < .05$) pre-feeding on day 2. Day 2 post-feeding vocalizations of TE calves increased ($P = .02$). On d 4 post-transport, vocalizations of TE calves were greater than those of T calves ($P < .05$). This study showed an early benefit for subcutaneous electrolyte administration after transport reflected by earlier return to normal behavior.

Early social deprivation disrupts attentional but not affective shifts in rats

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Early social deprivation produces behavioural and cognitive effects in rats that are suggestive of a general inflexibility in response selection, but the exact nature of the impaired cognitive functions is unclear. We examined the effect of postweaning isolation on dissociable forms of inhibitory control of behaviour that operate at two different levels of response selection, namely (1) affective shifts within a given perceptual dimension (reversal learning), and (2) shifts in selective attention from one perceptual dimension to another (extra-dimensional shift). 48 rats were individually trained to criterion to locate four baited arms on a radial arm maze on the basis of either (i) spatial position of arms with respect to extra-maze cues or (ii) visual cues inserted at the end of arms (four each of two exemplars). All other cues were made irrelevant by random maze-rotation and redistribution of cues between trials. Isolates and social controls differed in neither acquisition nor reversal learning within sets of either spatial or non-spatial stimuli, whereas isolates were selectively impaired in shifting attention from spatial to non-spatial stimuli, and vice versa ($p < 0.01$). These findings demonstrate that postweaning isolation selectively disrupts inhibitory control in attentional selection, while leaving inhibitory control in affective processing intact. In a novel task, where rats discriminate two food bowls on the basis of either (i) digging medium or (ii) odour cues, we are presently trying to replicate these findings and investigate them in more detail, and the results will be included in the presentation. Present results demonstrate a selective impairment in socially deprived rats of a higher-order cognitive function, that has been shown in rats, primates, and man to be mediated by prefrontal cortex, and is a key-symptom in schizophrenia. They highlight the significance of the postweaning environment for the normal development and welfare of rats.

Using choice tests to evaluate dairy cow handling practices

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Aversive handling of dairy cattle can result in reduced productivity and animal welfare. We studied the aversiveness of handling practices using a y-maze. First, we validated the use of the y-maze. In this and all other experiments the control treatment consisted of the experimenter standing still, with hands at side, and looking straight ahead. 34 heifers chose between a) pail feeding vs control b) hit/shout vs control and c) hit/shout vs pail feeding. Calves chose a) pail feeding more than hitting and shouting ($P < 0.001$), b) pail feeding more than control ($P < 0.001$), and c) control more than hit/shout ($P < 0.001$). In a second experiment, 3 groups of 8 cows were given choices between a) shout vs hit, b) shout vs electric prod, and c) control versus tail twist. No differences were found. In a third experiment, 2 groups of 8 cows were used to compare hand feeding, gentling and control. Cows showed no preference between control and gentling treatments but chose hand-feeding more than control ($P < 0.05$). In a fourth experiment, 24 calves were used to compare gentling, pail feeding, or hand feeding with control. In contrast with adult cows, calves showed no preference between control and hand feeding or control and gentling but did chose pail feeding more than control ($P < 0.01$). In a final experiment, 24 cows were used to compare talking in a gentle voice, shouting and control. Cows showed no preference between talking in a gentle voice and control but chose control and talking in a gentle voice more often than shouting ($P < 0.05$). The results demonstrate that the y-maze is a valid method to compare handling treatments. Cattle show no obvious preference for gentling but are sensitive to the quality of the voice used when moving them.

Emotional reactions to learning in cattle

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When understanding something in a learning process, animals may react emotionally not only to getting a food reward, but also to their own abilities. An experiment was devised to distinguish heifers' reactions to their own understanding from their reactions to a food reward. Twelve yearling heifers were divided into two groups with a matched-pairs design. Over a 14-day period with one trial per day, heifers in the experimental group learned to press a panel, which opened a door and gave access to a food reward (fixed ratio schedule with one press required). For heifers in the control group, the door opened for access to the food after a delay equal to their matched partner's latency to open it. Experimental heifers' learning performance was classified as 'better' or 'not better' than on the previous day. The criterion for classification was based on the latency to press the panel and on the proportion of attention directed towards the panel as opposed to the gate. The heifers' heart rate throughout, and their movements during locomotion (ranging from walk to gallop and buck) after the gate had opened, were examined in relation to changes in learning performance. During trials classified as 'better', experimental heifers had higher heart rates than their controls. The heart rate increase occurred just before the door opened and was 19% greater in the experimental compared with the control heifers. During trials classified as 'not better', there was no difference in heart rate between groups. The experimental heifers were 14 times more likely to show more locomotor activity than their controls (e.g. gallop vs. trot) on days classified as 'better', than on days classified as 'not better'. It is concluded that cattle may react emotionally both to the anticipation of a new achievement and to getting better at a task.

Visual factors that facilitate movement of cattle through a handling facility: Preferences for light and slatted openings by cattle in a Y maze choice test

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We examined three visual conditions that could influence the movement of cattle through a curved chute: vertical slatted openings, overheadlights and darker or lighter colored walls. All 148 cattle were naive to the indoor experimental apparatus and tested once individually to determine their choice between alternative paths leading out of a simple Y-maze. The arms consisted of two identical curved chutes set up on a 6m radius, branching off in opposite directions at a 30 degree angle from the junction of the straight arm. At the junction of the Y it was impossible for the animal to see the exit out of the maze. Treatments were varied between right and left arms of the Y-maze in a balanced random order for all experiments. In Exp. 1, one curved arm had vertical slats positioned in the "opened" condition within the outside wall. The slats offered the impression of an opening in the outside wall ahead of the animal, while the wall directly beside the animal appeared solid. The opposite arm of the Y-maze had all the slats in the closed position. Thirty eight of 57 cattle exited via the arm with open slats (Chi-square = 6.366, $P < 0.02$). In Exp. 2 a Y-maze was used to determine the effects of overhead lighting. Twenty four of 27 cattle exited via the lit arm (Chi-square = 17.77, $P < 0.001$) when the starting position in the straight arm was also lit. When the start position in the straight arm was dark, 18 of 22 cattle exited via the lit arm (Chi-square = 11.88, $P < 0.01$). Overall, 42 of 49 cattle exited via a lit arm ($P < 0.001$). In Exp. 3, an arm of the Y-maze was fitted with light beige colored interior walls while the walls of the opposite arm were dark brown. The interior walls were interchangeable. When the start position in the straight arm was dark brown, 13 of 22 cattle exited via the beige colored arm (Fisher exact test, two-tailed, $P = 0.4015$). Nine of 20 exited via the beige arm when the starting position was also beige (Fisher exact test, two-tailed, $P = 0.0698$). Movement may be facilitated with the use of vertically slatted openings along the outside wall of a curved chute and with the use of lights, but the relative shade (light vs dark) of the chute walls may not be important.

Do cows recognize people by their faces?

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Operant conditioning was used to examine whether cows recognize people by their faces. We trained 7 lactating cows with 2 people: a familiar rewarder and an unfamiliar non-rewarder, who wore the same colour coveralls, but differed in height by at least 10cms. The two people stood within an operant chamber so they could be seen, smelt and touched by the cows. The cows received 75g of concentrate when they pushed a lever in front of the rewarder and nothing when they pushed a lever in front of the non-rewarder. The success criterion was at least 8 correct choices out of 10 in two consecutive sessions ($p < 0.002$). When both the rewarder and non-rewarder were standing at normal height and in full view of the cow, 5 out of 7 cows succeeded within 3 to 14 sessions. When the people were seated behind a curtain so that only the head was visible, none of the cows succeeded. When both people were present fully visible except for their heads, which were completely covered by identical face masks, all cows succeeded. We then changed the relative height of the people. All cows succeeded when the faces of both people were covered but both people were standing at their normal height, and 5 out of 5 cows succeeded when the two people stood so they were of equal height but with their faces visible. However, no cows succeeded when the people were both of equal height and had their faces covered. Cows use multiple cues to discriminate between people, and can use either the faces or a difference in height. Cows cannot use the face alone if the rest of the body is not visible. Operant conditioning is an effective way of examining cows' abilities to recognize people.

Relationship of flight distance to production performances and the daily routine management procedures in commercial dairy herds

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The objectives of the study were to determine (1) to what extent flight distance, as an indicator of temperament, of cows was influenced by genetic and non-genetic factors, and (2) if there was an inter-herd correlation between the flight distance and production performance in commercial dairy herds. The flight distance of 84 Holstein cows in eight commercial dairy herds was measured on four separate occasions. The daughters of nine specific sires were selected. Flight distance, how close an experimenter can come to a stationary cow before she moves away, was measured after morning routine management procedures in the free stall barns, outdoor paddocks, or pastures. The stockpersons' daily routine management procedures for the animals at the four production stages (nursing, growing, lactating and dry) were recorded on six separate days over several months. The procedures were classified into four categories by degrees of interactions between the stockperson and animal: [A] hand procedures by touch or point-blank, [B] hand procedures nearby or through a grid, [C] hand procedures apart, [D] machinery procedures. Repeated-measures ANOVA was performed with a model including the between-subject effects of sire and herd, and within-subject effects of repetition in the measuring on the flight distance. Inter-herd correlation between the flight distance and the length of time of the four categories, and production performances (milk production, somatic cell counts, first calving age and calving interval) was determined using the Pearson correlation coefficient. There was no apparent sire effect ($P=0.08$), but their daughters' flight distance was significantly different between certain sires. Effects of herd ($P < 0.01$) and repetition ($P < 0.05$) were significant. The flight distance ranged from 1.17 \pm 0.86 to 4.47 \pm 2.01 m by the herd, and gradually shortened by repetition. For all production stages, the length of time of the four categories was widely different among the herds. The flight distance, although not significant, was moderately correlated with the length of time of category [B] at the nursing stage ($r = -0.60$, $P = 0.11$), and category [A] ($r = -0.59$, $P = 0.12$) and [C] ($r = -0.56$, $P = 0.14$) at the growing stage. While flight distance tended to correlate with first calving age ($r = 0.66$, $P = 0.07$), inter-herd correlation showed no relation between flight distance and any other

production performances. In conclusion, the flight distance of dairy cows is, to some extent, molded by the sire and the interactions between stockpersons and animals especially before maturity. Although flight distance is associated with the first calving age, it may not be associated with any other production performances in commercial dairy herds.

Cardiac and behavioural responses of cows and calves to each other's vocalisations after early separation

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Current commercial dairy practice involves the removal of the calf from the dam within the first day of life. This early separation may occur before the cow-calf bond is established. The aim of this study was to determine if cows and calves respond to each other's calls after separation and whether they could distinguish their own calf's or dam's calls from another calf's or cow's calls. The study was carried out on 12, first to fourth parity, Holstein-Friesian cow-calf pairs. Immediately after calving, the cow and calf were moved to a single pen. Each calf was separated from its dam 24h later and placed in an individual calf pen in another building. The cow remained in the home pen. During the next 24h, sample calls were recorded from the cow and calf. Four or five representative calls from each cow and calf were edited together to form playback sequences for each animal. For each call sequence, a paired white-noise sequence was generated. At 24h after separation, the cow and calf were subjected to four playback sequences in two pairs; own calf or dam and white noise, other calf or other cow and white noise. Cows responded more to calf vocalisations than to white noise during and after playback. They had a greater heart rate (HR) change (Call = 16.5%, Noise = 7.3%, $P < 0.01$) carried out more head movements (Call = 1.1 min⁻¹, Noise = -0.5 min⁻¹, $P < 0.05$) and ear movements (Call = 8.6 min⁻¹, Noise = 1.9 min⁻¹, $P < 0.01$). However, they did not differentiate between own calf calls and other calf calls. Calves showed more head movements (Call = 4.2 min⁻¹, Noise = 1.8 min⁻¹, $P < 0.01$) and ear movements (Call = 9.7 min⁻¹, Noise = 2.1 min⁻¹, $P < 0.01$) during playback. They also showed greater number of ear movements (Own = 14.5 min⁻¹, Other = 4.8 min⁻¹, $P < 0.01$) and tended to show greater peak HR change (Own = 15.6%, Other = 5.8%, $P < 0.1$) during playback of own mother calls compared with other cow calls. Cows show no differential response to calls from their own calves, which may be because separation is carried out before calves are highly vocal. The calves showed subtle

behavioural and HR responses to cow calls, but these responses were greater to their own dam's calls. During the pre-separation period, the cow is vocal towards the calf and under natural conditions, overt responses to cow calls could increase risk of predation.

Effects of handling and clinical examination on dogs' behavioural reactions and heart rate

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Many dogs show both behavioural and physiological stress reactions to handling by strange people. The clinical examination context may induce acute stress; moreover the owner's presence and behaviour may affect the dog. The evaluation of the dog's behaviour together with physiology (heart rate) allow us to objectively understand the animal's reactions. In fact, both the parameters are involved in the adaptive response to stressors (Beerd et al., 1998, Appl. An. Beh. Sci., 58: 365-381). The aim of this research was to assess behavioural reactions and heart rate of dogs to handling during the clinical examination, in relation also to the owners' attitudes. Thirty two dogs, equally distributed according to sex (male and female) and genetic traits (pure-bred and not pure-bred), were studied in the clinical setting. Behaviour and heart rate were observed respectively using videorecording and the Polar[®] Vantage NV system (Vincent and Leahy, 1997, The Vet. J., 153: 179-184). Data on each subject, and on the living environment, were collected through the owners' answers to a questionnaire. All the data recorded have been analysed with multivariate and univariate statistical analyses. No differences in the dogs' reactions have been found according to sex, age and breed; only the not pure-bred females showed more fear aggression and higher heart rate levels ($P < 0.08$) compared to the other groups. All the dogs showed increased heart rate values during the clinical examination vs. baseline (from 0.25% to 39.98%). A relationship between behaviour and heart rate values has been observed, as well as a difference between type A and type B dogs, according to the literature (Vincent and Michell, 1995, Physiol. & Behav., 60: 135-138), although high individual variability exists. The owner's presence and attitude don't reduce the dog's reactions in this context. These results could add knowledge on the dogs' reactions to handling and might be useful for the Vet in order to better manage the patient according to them.

Foraging strategy, antipredation behaviour and fear responses in Red Junglefowl and White Leghorn layers

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According to the resource allocation theory, behaviours that have high energetic costs should decrease in frequency in breeds that are selected to invest a higher proportion of energy into production traits. We studied differences between Red Junglefowl and a modern White Leghorn laying strain (L13) with respect to foraging strategy, antipredation behaviour and fear responses. The behaviour of each breed was observed in four test situations: 1) A foraging-social maze of four arms where two arms contained easily obtainable familiar food and two contained hidden novel food, so the birds had to work to obtain it. One arm with each food type had a mirror, which provided a social stimulus. 2) An antipredation test where a hawk model was rapidly presented while the birds had access to food. 3) A tonic immobility test, measuring passive fear responses. 4) A test whereby the birds were restrained with a rope around one tarsus, measuring active fear responses. In the maze test, Junglefowl spent more time feeding from the novel food site and next to a mirror, whereas L13 spent more time in the arm with the easily obtainable familiar food regardless of mirrors. Both breeds responded on the simulated predator attack with an immediate decrease in foraging behaviour and an increase in "walking alert". Junglefowl walked alert and vocalised significantly more than the L13. Junglefowl had a more active restraint response than L13. For L13 it was easier to induce tonic immobility and it lasted longer than for Junglefowl. In conclusion L13 used a more energy-conserving foraging strategy, showed less social motivation and less activity in both the antipredation test and in the fear tests, compared to Junglefowls. This may be interpreted as correlated responses to selection for increased production, allowing L13 birds to allocate more resources to reproduction and growth.

Ethics in animal behaviour and welfare research

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The use of animals in toxicological testing and medical research has given rise to a lot of ethical concern. The justification for using animals in such potentially harmful experiments is that the results are of major importance and benefit to humans. Thus, we use the animals as shields to protect ourselves or to improve our own situation. The use of animals in animal behaviour and welfare research seems ethically more acceptable *per se* as the underlying aim, to understand animals better and possibly improve their welfare, may benefit the animals themselves. However, we see two problems with this argument. First, the animals used in the experiments are not the same individuals as those who may benefit from the information achieved, i.e. in both cases animals are used in experiments to benefit others. Secondly, even research for a noble cause may employ experimental procedures causing ethical concern, which calls for e.g. the application of the "3R"s. In this presentation we would like to present a guideline to ethical assessment. The first step of this assessment is to decide whether it is acceptable at all to use animals for the experiment in question. However, even when the use of animals may be justified, the experiment must meet certain criteria to be acceptable, e.g. whether the stress that the animals are put through is outweighed by the importance of the expected results. Finally, the experimental design must be evaluated to determine whether these results could be obtained through less stressful procedures. In order to promote ethical thinking in research and prevent false accusations of unethical research, it is important that if an ethical assessment has been made, this is made explicit. Thus, when presenting the results, the ethical justification for experimental choice and design must be stated. Cases from ISAE Congresses will serve as illustrations of such missing explicit ethical assessment causing – possibly unnecessary – doubt about the justification for stressful experimental procedures. It is our hope that this guideline will serve as inspiration for researchers when designing experiments and presenting the results, as well as for referee procedures and selection of material for publication.

Evidence for temperament traits in mink: Has selection for reaction towards human affected behaviour in other situations?

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The present experiment investigated whether behavioural selection in mink has affected their reaction in other potentially fear eliciting situations. A total of 192 offspring from two genetic lines, selected over ten generations for confident (C) or fearful (F) reaction towards humans, were exposed to a battery of tests including novel object, human, and unfamiliar mink. The question of general fearfulness vs. situation specific reaction, as a result of behavioural selection, is important because an overall reduced level of fearfulness is believed to improve the welfare of farmed mink. Mink from group C had a shorter latency to get near and establish exploratory contact with a human than mink from group F ($p < 0.001$). F-mink maintained a larger mean minimum distance (\pm se) to a human (62 ± 2 cm), than C-mink (6 ± 2 cm; $p < 0.001$). Accordingly, number of visits and time spent in cage areas near humans differed between the two groups ($p < 0.001$). Likewise, C-mink had a marked shorter latency than F-mink to approaching and contacting a novel object ($p < 0.001$). C-mink also manipulated the object quicker and more ($p < 0.001$). All C-mink, and 85.1% of the F-mink touched the novel object. In encounter with unfamiliar male mink, C-mink were quicker to approach, and establish non-aggressive snout contact with the unknown mink, than F-mink ($p < 0.001$). A majority of C-mink (87.9%), but just 35.2% of F-mink contacted the unknown mink within the test time. In general, males contacted test mink faster than did females ($p = 0.004$). The latency to contact, together with number and duration of contacts are highly correlated ($r_s = 0.50 - 0.65$; $p < 0.001$) between tests with human, object, and mink, indicating a general pattern of reactivity in the individual. In conclusion, selection in mink for behaviour towards humans has led to a difference in fearfulness in other social and non-social situations.

Measuring animal demand: How we ask the question can make a difference

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Measures of demand, derived from consumer demand theory, have been suggested as measures of animal needs. Demand curves can be generated by increasing the "work" required to gain access to something, and plotting the amount consumed against the work requirement (or analogue of price). Inelastic demand curves, in which consumption falls slowly with price increases, may indicate a degree of need for the event or activity. Elastic curves may indicate lesser or no need. Demand curves generated for something as fundamental as access to food can vary in shape and degree of elasticity according to the experimental parameters employed. Increasing session length can decrease the elasticity of the curves found. Increasing the "work" by increasing the force rather than the number of responses required produces curved, rather than linear, demand functions. This paper presents several demand functions derived from hens working for food under various session lengths, response requirements (key-pecking and door-pushing) and with work increases as either number or force requirement changes. Fitted curves gave parameters describing initial slopes and rates of change in slope which differed ($p < 0.05$) while initial levels of demand did not. It suggests that defining an event as needed, or not, from a single determination of a demand curve may be inappropriate and that comparisons between demand curves should be made only when experiments have manipulated work requirements in similar ways and under similar conditions.

Approaches to animal welfare: body, mind and nature

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It is now recognized that people vary in their approaches to animal welfare, emphasizing physical attributes (like growth and health), mental feelings (pleasure or suffering), naturalness (environmental or behavioural, reflecting an animal's telos), or a combination of these. These can be characterized as emphases on animal bodies, minds or natures respectively. Each approach has advantages and disadvantages. They will be illustrated by studies on rearing methods for dairy calves. Physical attributes are easiest to measure and may be easiest to apply, for example in legislation. However, interpretation is difficult. Calves fed *ad libitum* from teats grow faster than those fed from buckets, but is fast growth always an advantage? Feelings are sometimes claimed to be fundamental to welfare – 'what matters to the animal' – yet this argument is not definitive in philosophical analysis of human welfare, nor does it answer the problem of measurability. Calves separated from their mothers after birth often vocalize, and this is sometimes interpreted as distress, but our data suggest that this behaviour is more associated with the feeding regime than with the separation itself. The idea that animals should be allowed to live natural lives is the approach given least attention by scientists and appears most difficult to apply to management or legislation. Yet it is an important reminder that animals are animals, not just machines or economic units, a third leg to the tripod of body, mind and nature. It is most natural for calves to be left with the mother after birth, and this is likely also to help safeguard physical performance and feelings. However, later separation causes more distress. In developing rearing methods for calves, and in making other decisions about animal management, it is helpful to consider not just one, but all approaches to animal welfare: animal body, mind and nature.

A comparison of courtship behaviour of fat-tailed and thin-tailed rams

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After sheep were domesticated, the selection and crossbreeding processes used resulted in sheep developing longer tails. A long, thin tail developed in the breeds we refer to as standard European. In fat-tailed breeds, the lengthening of the tail allowed for a larger site of fat deposition. But in order to copulate, the fat-tail must be moved out of the way. Thin-tailed European rams have great difficulty in successfully breeding fat-tailed ewes because of their inability to do that. This poses problems in the industry with respect to crossbreeding practices. The objective of this study was to describe and quantify the discrete behaviours that comprise courtship behaviour of Rideau Arcott (thin-tailed) and Karakul (fat-tailed) breeds of sheep. Segregated by breed, two breeding groups were observed, each consisting of one ram and 14 ewes. A video camera was used to record the bouts of courtship. An ethogram (descriptions of expected behaviours) was used as a guide to compile descriptions of the courtship behaviours from the videotapes. The frequency of seven specific courtship behaviours and the sequence in which they occurred were recorded. The duration of courtship bouts in Rideau Arcotts (70.5 ± 30.14 s) was significantly longer than the Karakuls (24.0 ± 9.19 s, $p < 0.05$). The frequency of behaviour within each courtship bout was also significantly different ($\chi^2 = 62.5$, $df = 11$, $p < 0.05$). The sequence of behaviours did not differ except for inclusion of tail kicking which was shown only by the Karakul. It is speculated that the tail kicking action of the Karakul developed from the ritualized courtship straight-leg kick common to all sheep.

Bedding material for dairy cattle: preferences and effects on behaviour

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Dairy cattle spend a large portion of time lying down. The quality of the free-stall surface can affect the amount of time cattle spend lying down and hence the welfare of the animals. Two experiments examined the effect of bedding material on preferences and behaviour of dairy cattle. In experiment 1, 12 pregnant Holsteins were individually housed with access to 3 free-stalls each bedded with a different substrate: deep-bedded sawdust, deep-bedded sand, and a geotextile mattress. After 1 week of access to all 3 materials, substrate preference was determined by stall use and lying times, recorded for 24 h. Each animal was then restricted to either sand or mattress (the less preferred surfaces) for 2, 5, or 10 days. Average lying time and number of transitions between standing and lying were significantly less when the heifers were restricted to sand or mattress ($P < 0.05$). After this restriction phase, preferences were re-tested. Ten of 12 animals continued to choose sawdust. In experiment 2, 12 more animals were tested with sand, sawdust (both as described above), and geotextile mattresses covered with 2-3 cm of sawdust. Initial and final preference tests (as described above) showed that 8 of 12 cows preferred sawdust. In the middle stage of the experiment, all animals were restricted to each bedding material in turn for 2 days. Average lying time, time spent in the stall, and transitions to lying were significantly lower for the sand-bedded stalls ($P < 0.05$), but there were no differences between the other two surfaces. These results indicate that (1) cows prefer deep-bedded sawdust, (2) that lying time, time spent in the stall, and number of lying transitions are affected when cows are provided with sand or bare mattresses, but not with mattresses covered with 2-3 cm of sawdust.

Stress reactivity and meat quality in pigs: effects of breed and halothane gene

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The study investigated the effects of genetic type and slaughter conditions on meat quality in pigs and the role of differences in stress reactivity. Sixteen Large White (LW) and 32 Piétrain (P) male castrated pigs were reared on straw in individual pens (1.5 x 1.5 m) allowing clear vision and some physical contact with neighbouring pigs. All LW were non-carriers of the halothane gene (NN), 16 P were non-carriers (NN) and 16 P were heterozygous (Nn). At 50 kg, pigs were catheterised and subjected to a social isolation test of 10 min. Genotypes did not differ in behavioural, cortisol or heart rate responses. Catheters were removed after testing. At 60 kg, pigs were subjected to a restraint test. Total duration of resistance/fight was similar for all genotypes, but LWs had less bouts ($p < 0.05$). At 70 kg, a novel object test in the home cage found a higher contact frequency of LW pigs ($p < 0.05$). At 90 kg, pigs were subjected to a human exposure test. Genotypes did not differ in frequency of contact with the human. At 100 kg pigs were slaughtered after 14 h of food deprivation using lower (no mixing or lairage, 10 min of individual transport) or higher stress conditions (mixing, 3 h of transport) in a 3 x 2 factorial design. P Nn pigs showed a faster pH fall ($p < 0.001$). Higher stress conditions reduced glycolytic potential (GP) ($p < 0.05$) and increased ultimate pH of various muscles ($p < 0.05$). No genotype x slaughter conditions interactions were found. Frequency of contact with the human was negatively correlated with temperature of the *Longissimus Lumborum* (LL) and pH of the semimembranosus at 40 min after bleeding ($p < 0.05$). Frequency of contact with the novel object was negatively correlated with initial speed of LL pH drop ($p = 0.07$). In conclusion, differences in meat quality between breeds could not be simply related to differences in stress reactivity between breeds. However, on the individual level, some correlations exist between stress reactivity characteristics and peri-mortem muscle metabolism.

Behavioural studies of keeping dairy calves on foster cows

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The aim of this study was to compare the behaviour and weight gain of dairy calves raised in groups either on a foster cow or on whole milk from artificial teats. Ten multiparous cows in early lactation and 76 calves were observed. Four calves per group were randomly assigned to one of the following treatments; 1) Foster cow with gradual weaning week 8-10 ($n=5$, F-G), 2) Foster cow with abrupt weaning week 10 ($n=5$, F-A), and 3) Control given 8 l of whole milk daily through 4 artificial teats with gradual weaning week 8-10 ($n=9$, C). Calves were weighed (a.m.) and behaviour was recorded (p.m.) during 2 h direct observations once weekly per group at 1-10 weeks of age. Data was tested statistically with Analysis of Variance. All foster cows accepted being suckled by the alien calves, but 3 had to be tied to allow calves suckling during the first two meals. F-calves were standing more, and lying less than C-calves ($p < 0.001$), but did not move more. F-calves performed more sucking on cow teats vs. rubber teats ($p < 0.001$), social behaviour ($p < 0.05$) and sniffing environment ($p < 0.1$) than C-calves. These performed more ruminating ($p < 0.001$) and eating Total Mixed Rations ($p < 0.05$) than F-calves. There were no differences between F- and C-calves in eating straw, sleeping, licking-biting fittings, licking- scratching itself, drinking water and standing-lying inactive. F-calves sniffed other calves more often than C-calves ($p < 0.05$), but the latter tended to step on the body of a lying calf more often than F-calves ($p < 0.1$). F-calves tended to vocalise more often than both F-A- and C-calves ($p < 0.1$). The weight gain from one to 10 weeks was affected by rearing system ($p < 0.05$), and F-A-calves had significantly higher weight gain (0.95 kg/day) than F-G-calves (0.81 kg/day), with C-calves in between (0.87 kg/day). C-calves performed more sucking on other calves ($C=0.055/\text{calf/h}$, $F=0.003/\text{calf/h}$) and sucking fittings of the pen ($C=0.040/\text{calf/h}$, $F=0.007/\text{calf/h}$) than F-calves. It is concluded that foster calves were more active and socially interacting, but ate less and showed less abnormal behaviour than C-calves. Gradual weaning appeared to be more negative than abrupt weaning for foster calves.

Interindividual variability in maternal behaviour of domestic and wild x domestic crossbred sows

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We examined maternal behaviour of 7 domestic and 7 wild x domestic primiparous sows during 10 days pp to investigate two questions: 1. Did maternal behaviour change during domestication? 2. Can the interindividual variability of maternal behaviour be subsumed into a few personality dimensions? Within the first 9 days pp, we tested and recorded the sows' behaviour in the following situations: (a) willingness to leave the nest; (b) reactions to playbacks of various piglet distress vocalizations; (c) night-time nursing and lying-down behaviour; (d) reactions to a human presence near the piglets. Moreover, data on baseline cortisol concentration and its increase during a challenge at 5 months of age were available. Crossbred sows did not differ from domestic ones in any aspect of maternal behaviour except for a higher tendency to terminate nursings and to change body posture during night. Factor analysis (calculated for all 14 sows after removing the effect of breed) indicated that 82% of the data variability could be explained by three factors: "Calmness" on which low frequency of posture changes, carefulness of lying-down, and high propensity to remain long in nursing position loaded positively and challenge cortisol levels negatively; "Protectiveness" with high loadings of the reaction scores to piglet calls and to human presence near the piglets; and "Nursing Activity" which was associated with high nursing frequency, low proportion of nutritive nursings, and low baseline cortisol values. The results indicate that pig maternal behaviour did not change much during domestication and that its interindividual variability may be underlain by a few personality dimensions which encompass both behavioural and endocrinological variables.

Multi-media teaching program on pre-slaughter handling of pigs

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Developments in computer and communication technology and -capacity have changed the prevailing educational system. There is an increasing transition from a teacher-centred to a learner-centred environment and learning has become a continuous, lifelong process. A learner-centred multi-media teaching program on pre-slaughter handling of pigs has been developed. The program is interactive and visually rich, including pictures, animations, diagrams and video clips. The pre-slaughter handling of pigs involves a great amount of stress and gives rise to several animal welfare and meat quality problems. The present multi-media teaching program will address three major issues: Animal welfare in response to increasing public concern, meat quality motivated by its economic impact and microbiological issues of importance for human health. In the program students will be guided through the pre-slaughter handling of pigs: (A) Transport; (B) Handling at slaughter plant; (C) Stunning; and (D) Slaughtering. Each step in the handling procedures has the following modular structure:

Handling: Practical knowledge from slaughter plants is addressed incl. the use of light, group size, driving methods etc.

Legislation: The legislation and "code of practice" in several countries is presented and compared. The actual legislation's are attached.

Behaviour: Basic ethological concepts and methodology are presented. Video clips of behaviour in natural and slaughter environments are used to discuss specific pigs behaviour relevant for the pre-slaughter situation.

Physiology: Basic knowledge on stress theory and stress physiology, including measurements of several physiological reactions is presented.

Animal Welfare: Some of the more commonly quoted definitions and animal welfare problems related to pre-slaughter situation is presented.

Meat quality: Water-holding capacity, bleedings and skin damage are some of the meat quality problems discussed. The measurements used in meat science are demonstrated in a "virtual lab".

Microbiology: The relationship between pH, temperature and shelf-life of pig meat and microbial problems related to handling at slaughter is demonstrated.

A computer-based instruction program for education in animal welfare

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This interactive computer program is aimed at undergraduate students and professionals interested in broadening their knowledge about the welfare of farm, zoo, pet, laboratory and pest animals. The instruction program consists of an introduction followed by modules on ethics, social policy and science and, in its finished form, is expected to be about 500 screens of text, pictures, videos, multiple choice questions and puzzles. No previous knowledge is assumed in the different modules, making the course suitable for students of science, philosophy or the humanities. The ethics module presents an introduction to the ethical problems of dealing with animals. It then proceeds to describe different ethical views of animal welfare, giving examples of each view, together with opinions and quotes from philosophers. The aim of the longer discussion examples and puzzles on pest control, religious slaughter, biotechnology etc. are to train students to be consistent and to consider the practical consequences of their views. The social policy module gives a detailed history of the animal protection movement and animal welfare legislation. Welfare issues and attitudes towards animals around the world are presented with examples from each region e.g. sheep farming in Australia and NZ, wildlife conservation in Africa, farm animal housing in Europe, stray animals in S. America and so on. The science module is divided into 3 sub-modules dealing with health, physiology and behaviour. The topics taken up in these sub-modules include disease control and prevention, pain in animals, stress, comparisons of behaviour, motivation and cognition as well as the advantages and disadvantages of different methods of assessing welfare. In the short term this interactive CD-ROM will be used as part of other courses, but in the future it is hoped to use it as the basis for a distance course available internationally over the Internet.

Demonstration of the Encyclopedia of Farm Animal Behavior

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The study of animal welfare requires a diverse knowledge of many disciplines. A wide range of areas must be addressed to determine an animal's level of welfare. The behavior of an animal being evaluated for welfare concerns is an important component of that animal's status. Farm animal behavior has been taught in the past with a mixture of books with illustrations and diagrams, slides, videotapes, personal anecdotes and field observations during labs. Different institution's student's understanding of animal behavior are based upon the resources available by the faculty. An attempt to standardize behavioral definitions is the Dictionary of Farm Animal Behavior, second edition, by J. F. Hurmik et. al. 1995, Iowa State University Press. Permissions to use this work as a basis for a WWW based Encyclopedia of Farm Animal Behavior (EFAB) were obtained in 1997. The EFAB project is currently soliciting the opinions of the United States expert committee; NCR-131 Animal Care and Behavior, concerning which of the definitions would be appropriately illustrated with an image. There are currently about 25 video images matched with definitions. A comment form is presented with each image, past comments about a given image are presented within this form. This project has the potential to provide a standard reference for farm animal behavior to students and researchers around the world. The EFAB project is available online via the WWW at <http://www.livru.asf.ttu.edu/EFAB>.

Automating behavioral observations: techniques, tools and trends

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Continuing advances in computer hardware and software offer new opportunities for the intelligent automation of behavioral data collection and analysis. This 2-hour workshop will provide an interactive forum in which participants will hear about new technological developments and applications, and will be invited to discuss the value of current research tools and what is needed in the future. This workshop is of special interest for users of The Observer and EthoVision.

Workshop program:

- 1) *EthoVision*: advances in video tracking and automation of behavioral experiments (by Micha Oudakker). Special emphasis will be placed on the new Windows version of EthoVision, color tracking, automatic experiment control, integrating video tracking with keyboard event recording, etc.
- 2) *The Observer*: advances in coding and analyzing digital video (by Micha Oudakker). This presentation will discuss the development of a variety of new software functions for behavioral data collection and analysis.
- 3) Innovative applications. Users of The Observer and EthoVision will present cases with novel and advanced applications. Topics include color tracking, thermal imaging, automatic recording of body postures and behavioral patterns, etc.
- 4) User meeting. The last part of the workshop will be an open discussion about the behavioral researcher's toolkit of the future. Participants will be encouraged to propose new software features, products or services.

Posters

Effect of early caressing treatment on mock fighting to the handler in beef calves

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The behaviour of calves which had been caressed by handler, in order to improve the future ease of handling, in 2 experiments was investigated. Experiment 1: 10 crossbred (Japanese Black x Holstein) bull calves 3 weeks of age were used. Each calf was reared individually. The 5 caressed calves were individually stroked gently 10 minutes per day for 45 consecutive days. The 5 control calves were reared in the same manner except for the caressing treatment. The avoidance response to the handler was measured from 2 aspects: one was the touch point (TP) of each calf being touched by hand at four parts of the body during weighing; the other was the flight distance (FD) to the handler in the test way. The mock fighting to the handler, performance period (PP) and frequency of head rubbing and butting (MF) during the treatment were recorded. All caressed calves performed some type of mock fighting to the handler at the beginning of the treatment period and butting at the end of the treatment. Caressed calves showed higher TP (weak avoidance response) (9.2 point \pm 1.6 vs 5.6 point \pm 1.3, U-test $p < 0.01$), and shorter FD (0.59 m \pm 0.16 vs 1.46 m \pm 0.24, U-test $p < 0.05$) than the control calves. There were significant rank correlations between PP and TP ($R_s = 1.000$, $p < 0.01$), PP and FD ($R_s = 0.975$, $p < 0.01$), MF and FD ($R_s = 0.900$, $p < 0.05$), TP and FD ($R_s = -0.900$, $p < 0.05$). Experiment 2: 12 crossbred bull calves (Jap. Black x Hols.), 3 weeks of age, were compared in relation to the frequency of mock fighting to the handler during the caressing treatment, and then they were divided into two contrasting groups in relation to this variable. One group showed more butting than the other group (12.37 times/hour \pm 2.72 vs 3.50 times \pm 0.87, T-test $p < 0.01$). In spite of receiving the same treatment, the mock fighting to the handler by different calves was not uniform. It was concluded that caressing treatment weakened the avoidance responses of calves, but at the same time, it caused troubling behaviours such as mock fighting to the handler.

Associative learning of broiler chickens in a raceway method to assess aversion

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A raceway method was further developed for assessing aversion of broiler chickens to concurrent vibrational and thermal stressors equivalent to those experienced during transport. Birds were trained to run a raceway into a goal-box on an FR1 food-reinforcement schedule, upon which was superimposed an FR5 treatment schedule (60 min confinement + concurrent stressors; maximum of four exposures in five hours). Some birds (50%) delayed returning to feed immediately post-exposure, demonstrating either a learned response (aversion) or an unlearned treatment reaction (e.g. fatigue). To confirm the ability of female Ross-strain broiler chickens (42 +/- 3 days) to learn the required association, or establish the existence of a cognitive deficit rendering them incapable, eight made food-reinforced runs in only an unmarked raceway (Runm) and were exposed to the treatment in only a visually distinctive raceway (Rvd). It was hypothesised that if birds slowed in Runm or both raceways, the response was unlearned, but if they slowed only in Rvd, a specific association between the Rvd goal-box and the treatment had been learnt. While birds slowed in Runm immediately after each consecutive treatment exposure compared with the pre-exposure baseline (back-transformed baseline mean latency to enter goal-box - 4.9 s vs post-exposures one - 8.3 s, $p < 0.001$; two - 7.4 s, $p < 0.01$; three - 8.2 s, $p < 0.001$; four - 6.6 s, $p < 0.05$), delays in Rvd became progressively longer (back-transformed baseline mean latency to enter goal-box - 4.9 s vs post-exposures one - 5.5, $p > 0.05$; two - 13.2, $p < 0.001$; three - 357.1, $p < 0.001$; post-exposure 4 - 57.5 s, $p < 0.001$). Thus, given a visual discriminating cue and a minimum of two exposures, broiler chickens are capable of making a specific association between stressor exposure and an environment. Methods using this approach are therefore appropriate for assessing their aversion to transport stressors.

The relationship between early behaviour and feather pecking in laying hens

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Identification of consistent differences in early behaviour between high and low feather peckers would be useful for predicting feather pecking during selective breeding. This study looked for associations between early behaviour and pecking at feather bundles (as a model for feather pecking) in five different layer strains. Twenty-four birds of each strain were reared from 1 day of age. Between 4-12 weeks the birds were given three tests in a controlled order: open field, novel object, and a test (A) in which loose bundles of straw and feathers were presented. In a fourth test (B) at 26 weeks, fixed feather bundles were presented. In test A all strains pecked at feathers with similar frequencies. In test B, the number of pecks at feathers differed significantly between strains ($P < 0.001$). Feather test A data for all strains were combined and birds assigned to one of two groups: high peckers (HP, the 15% that pecked most frequently at feathers) and low peckers (LP, the remaining birds). Data on the behaviour of HP and LP birds in the novel object and open field tests were then compared. HP birds had a significantly higher mean distance from the centre of the test arena with and without the novel object present ($P < 0.05$). In both the novel object and open field tests HP birds tended to show a lower incidence of all recorded behaviours except 'sitting', but differences between HP and LP birds were not significant. When feather test B data were treated as described for feather test A data, there were no significant differences between HP and LP birds for any measured variables. Differences in fearful or exploratory behaviour, as measured by the mean distance from the centre of an arena, may have the potential to identify which birds are most likely to peck at feathers.

Effects of transportation stress and age depend on distance on β -endorphin, ACTH and cortisol levels of horses

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In order to evaluate possible relationships between stress during transport, travel distance, age, circulating levels of beta-endorphin, ACTH and cortisol were measured in horses before and after road transport. Blood samples were taken from 64 stallions of different breed, that were transported to different Sicily breeding stations. Hormonal responses to transport were evaluated on the basis of the different length of travel (50-120 Km; 120-180 Km; 240-300 Km) and age of stallions (Group A: 3-7; Group B: 8-12; Group C: 13-20 years old). Results showed a significant increase of beta-endorphin levels after transport length of 50-120 Km ($P < 0.01$); the increase was significant in 3-7 years old horses ($P < 0.05$), while after 240-300 Km a decrease was recorded. A significant relationship was found between ACTH levels and distance of travel (50-120 Km, $P < 0.001$; 120-180 Km, $P < 0.01$; 240-300 Km, $P = 0.05$). The highest increase was seen after transport of 50-120 Km in 3-7 years old horses ($P < 0.001$) and in 13-20 years old horses ($P < 0.05$), while ACTH levels decreased after 240-300 Km in 3-7 years old horses. ACTH and beta-endorphin patterns were similar inside every age group after different lengths, although no correlation between these hormones was found. Cortisol levels significantly increased after short distance transport (50-120 Km) in all study groups, (Groups A, C: $P < 0.001$; Group B: $P < 0.005$) while after transport of 120-180 Km and 240-300 Km the increase was significant only in Groups B ($P < 0.001$) and C ($P < 0.05$). These results suggest that horses are more stressed during the initial period of transportation (short transport) and that the degree of stress is greater in young inexperienced horses than in older ones; however young horses seem to be better adapted than old horses to long transport.

Reproductive behaviour of the Mexican gray wolf (*Canis lupus baileyi*) in captivity

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The present is the first extensive study on the sexual behaviour of a Mexican gray wolf (*Canis lupus baileyi*) couple kept under captivity. The observed wolves, quartered at the Zacango Zoo in the State of Mexico, are part of the Mexican Wolf Recovery Plan; this wolf is an endangered specie; there are only 215 pure breed animals, most of them kept under captivity. During three months, behaviour observations were made by focal and scan sampling methods, utilizing a modification of Servin's courtship ethogram. The data were analyzed in two periods: before and after the AI (artificial insemination), which was performed because exfoliative vaginal cytology proved the female was in oestrus, and the specie is considered to show oestrus only once a year. Double AI was performed by electroejaculation two days before the male started breeding. A total of 355 mates during 11 consecutive days were observed, most of them with pelvic movements but only two, culminating with copulation (0.6%); both were performed when the zoo was closed to visitors. Unfortunately, fertilization didn't occur. Significant differences were observed between the animals ($P < 0.001$) in the use of space, before and after the AI, showing a clear preference for doing most of their courtship behaviour (91%) on quadrant 1, being the most distant from human contact. Many of the couples that are part of the Recovery Plan are of recent integration and this won't allow them to become acquainted with each other satisfactorily, in order to guarantee their reproduction. It is expected that this couple of wolves of recent acceptance at Zacango will be kept accordingly, in order to ensure their reproduction on the next reproductive cycle. It is concluded that captive wolves need to be alone while they are in their reproductive stage.

Social and maintenance behaviour of the Mexican gray wolf (*Canis lupus baileyi*) at the Zacango Zoo in Mexico

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The present is the first study on the social and maintenance behaviour of a Mexican gray wolf (*Canis lupus baileyi*) couple kept under conditions of captivity. The observed wolves, kept at the Zacango Zoo in the State of Mexico, are part of the Mexican Wolf Recovery Plan. Animals have different lineages and were kept in different zoos before the observations started. This specie is under threat of becoming extinct; there are only 215 pure breed animals, most of them kept under captivity. During three months, social and maintenance behaviour observations with focal and scan sampling methods were made. A database of more than 10,000 records were analyzed in two periods: before and after the AI (artificial insemination). Significant differences were observed ($P < 0.05$) between individuals for all social behaviours except for the neutral ones (snout-snout contact, snout-skin contact and skin bite). The female wolf turned out to be the dominant one, urine-marking food and eating before her mate. No defensive behaviour took place after the IA was performed. Significant differences were observed between the animals ($P < 0.001$) in the use of space, before and after the AI, showing a clear preference for doing most of their activities on quadrant 1, being this the most distant from human contact. Future behaviour analysis at different hours and days of the week will allow us to give advice on the management and housing conditions of the animals by the zoo-keepers, since presence of visitors may affect space use.

Domestication effects on anti-predation behaviour in poultry

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Domestication may have modified behaviour that no longer has the same adaptive advantage to the animals. This study includes two different experiments on anti-predation behaviour of Swedish bantam hens (*Gallus gallus f. domesticus*) ("domestic", $n=16$) and a crossing between Swedish bantam and Jungle Fowl (*Gallus gallus*) ("wild-type", $n=16$). The Swedish bantam has not undergone any strong selection for production traits, and any difference between it and the Jungle Fowl crossings are therefore likely to be caused by adaptation to a reduced selection pressure from, for example, predation. In the first experiment we investigated the behaviour when the birds had a choice of foraging in a "protected" environment with possibility of seeking cover, but with a low gain of food and an unprotected environment without cover but a high gain of food. The second experiment focused on the response to a direct approach of a predator model. The average number of birds in the open area was higher in domestic birds than in wild-type birds. Domestic birds spent more time in the open area, and the interaction between sex (females and males) and breed was also significant. The wild-type birds responded significantly stronger to the simulated predator attack than the domestic birds. The duration to first peck after the simulated predator attack was not different between the breeds or between sexes. The differences between the wild-type and the domestic breed might be a result of the reduction of the natural selection pressure from predation which follows with domestication. This reduction in selection pressure may have reduced the net benefits of using energy demanding anti-predation strategies.

Cows prefer streams to troughs in all seasons

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It is important to establish the reasons cattle use streams and surrounding areas, so that methods for reducing any damage can be established. This study was located on four similar hill-country fields (1 Ha). The fields were divided into Top, Middle and Bottom zones, the latter incorporating a stream. The Stream zone was a 2 metre wide strip either side of the stream. A trough was placed in the Top zone of half of the fields, and the treatments were alternated over successive seasons over 2 years. Fifteen Poll-Angus cows were placed in each field in the Autumn and Winter, and 10 cows with calves in the Spring and Summer, for five days at a time. Observers recorded the location and behaviour of the animals every 10 minutes. There were no significant effects of season on either the total time cows spent grazing or resting in the zones. Cows spent more time resting in the Middle zone on Day 1, and, thereafter rested most in the Top zone ($p < .05$). Cows grazed less in the Top zone on Day 1 ($p < .01$) and thereafter grazing increased in this zone. Both trough and stream were utilised and there was tendency for higher frequency of drinking when the trough was available. Stream drinks appeared to be the same over all days of the trial. The presence of an alternative water supply does not alter the distribution of cattle in the field. This study suggested that there are factors other than having water available that may influence the use of stream environments (e.g. feed supply) by cattle.

Behaviour of young, middle-age and old dogs in Central-Europe households

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The behaviour of dogs living in households undergoes changes with advancing age. In order to assess these changes, we used a questionnaire based on Askew (1997, *Behandlung von Verhaltensproblemen bei Hund und Katze*. Parey Buchverlag, Berlin. 372 p.) and Podberscek and Serpell (1997, *Appl. Anim. Behav. Sci.* 52: 215-227). It was published in a dog breeder journal. Data on 305 dogs belonging to 80 breeds and 36 mongrels were analyzed. They were divided into groups of young, middle-age and old dogs (Kraft 1998: *Geriatie bei Hund und Katze*. Parey Buchverlag, Berlin, pp. 1-26). Answers on the different behaviours in these groups were evaluated using the chi square test. We found that young dogs were fed more frequently yet they stole human food more often than middle-age and old dogs. They were given treats less frequently. Further significant differences were as follows: young dogs preferred tug-o-war games (85.7 vs. 60.4%), play with strange dogs, were more active (89.3 vs. 61.1%), more aggressive when brushed, less reliable when obeying commands, eliminated in the house (42.9 vs. 11.6%), destroyed household items (42.9 vs. 11.6%); on the other hand, they licked and scratched themselves less, were less aggressive when threatened, protected family members less frequently (53.4 vs. 73.6%). The senior dogs were difficult to control, barked and growled in excess but they exhibited anxiety more often, aggression when touched, and eliminated in the house. They were aggressive less frequently when threatened, and obeyed the command "come" less frequently. All the above-mentioned differences were statistically significant ($p < 0.05$). Our findings document that the behaviour of dogs living in Central-Europe households changed during their individual development. The importance of these behaviours, even if sometimes interpreted in anthropomorphic terms by the respondents, are characterized and analyzed in more detail in this study. We thank the Ministry of Education of the Czech Republic for financial support (grants No. 1192/1999 and 828/2000).

Does being motivated to perform the same behaviour as others explain the occurrence of social facilitation?

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Social facilitation occurs in many species, but the mechanisms involved have been researched very little. A motivation to do whatever others are doing may be a possible mechanism to explain the occurrence of social facilitation. An experiment testing this proposed mechanism was conducted using the feeding and drinking behaviour of domestic chickens (*Gallus gallus domesticus*). Pairs of hens were placed in an apparatus with each bird separated from the other by a transparent screen. In the baseline treatment, food and water were placed on each side of the screen so that the birds could feed facing each other, or drink facing each other, but would be on different sides of the apparatus if they performed different behaviours at the same time. Each pair was tested when both members were food deprived, both water deprived, or each differently deprived (one food deprived, one water deprived). Differences between the number of pecks and drinks performed by subject birds with similarly and differently deprived companions were used to determine how much social facilitation occurred. Subject birds switching to the behaviour performed by their differently deprived companions would provide evidence of a motivation to perform the same behaviour as others. Subject birds were tested under different social and physical treatments. Food and water-deprived subjects showed no significant switching behaviour in the baseline condition. Food-deprived subjects showed no significant changes in their behaviour when paired with water-deprived companions in any treatment. Increasing the deprivation of the companion in both similarly and differently deprived pairs caused a significant switching effect in water-deprived subjects, with increased pecking (Mann-Whitney U; $P=0.008$) and decreased drinking ($P=0.008$). Changing the positions of the food and water also caused similar significant results in water-deprived subjects ($P=0.015$ pecks; $P=0.001$ drinks). Increased companion deprivation and positional cues affect the degree of social facilitation shown.

Motivation and ability to walk in broilers and layer chicks on two diets

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In order to get insight in motivation and ability to walk, behaviour of broilers and layer chicks on two diets was studied during the first seven weeks of life. 48 Broilers and 48 layer chicks were housed in pens (1 m²/pen) on wood shavings: a) three pens with eight broilers fed with broiler food; b) three pens with eight layer chicks fed with layer food; c) three pens with four broilers and four layer chicks fed with broiler food and d) three pens with four broilers and four layer chicks fed with layer food. Two times a week, of four individuals per pen motivation to walk was tested in a runway (180 cm long). Every 30 cm a bowl (six in total) with one mealworm was placed in the runway. Latency to the first peck in each bowl was measured. Walking ability of all birds was assessed weekly by the gait score (Kestin et al., 1992. *Vet. Rec.* 131: 190-194). The gait score has a six point scale: 0 = no detectable walking abnormalities, up to 5 = incapable of sustained walking on its feet. Before the birds had reached an age of 4.5 weeks no difference in walking speed was found, thereafter layer chicks walked quicker through the runway than broilers ($p<0.01$). Type of food had no effect on walking speed. Layer chicks showed no gait abnormalities in contrast to broilers. At six and seven weeks of age, the broilers fed with broiler food had a higher gait score than those fed with layer food ($p<0.05$). Motivation to walk for a reward in the runway, indicated by walking speed, was equal for broilers and layer chicks, but ability to walk was partly hampered in broilers at a later age. Type of food had an influence on ability, but not on motivation to walk.

Rearing conditions, coping characteristics and responses of pigs in a T-maze test

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In the present study we investigated the effects of rearing conditions and individual coping characteristics on the response to novelty of pigs in a T-maze task. Pigs were reared either in standard pens with concrete floor and metal slats (S pigs, 4 litters) or in pens enriched with straw (E pigs, 4 litters). The Backtest response of each pig, which is presumed to be indicative of its coping style, was assessed at 10 and 17 days of age and pigs were typified according to Hessing et al., 1993 (Appl. Anim. Behav. Sci. 37:285-295). Twenty-three Low Resisting (LR, 10 S and 13 E) and 40 High Resisting (HR, 19 S and 21 E) pigs were used. At 8 weeks of age pigs were trained to find a food reward in one of the arms of a T-maze (left or right arm balanced for rearing conditions and Backtest typification) and were allowed to feed for 60 sec. After 9 consecutive correct trials, a novel object (NO) was placed in the arm that contained the reward. Heart rate was measured telemetrically during the 8th correct trial and NO-trial. Backtest typification and rearing conditions did not affect speed of learning. S pigs tended to have a higher heart rate than E pigs during normal trials. S-LR pigs showed the sharpest decline in heart rate when reaching the food ($p < 0.05$). In the NO-trial, rearing conditions x Backtest typification interactions affected the number of errors (i.e. line crossings in wrong direction, $p < 0.05$), latency to reach the food ($p < 0.10$), number of vocalisations ($p < 0.06$) and latency to enter the section where the NO was placed ($p < 0.05$). Performance of E-LR pigs in the maze was more affected by the NO than that of HR pigs and S-LR pigs. The results suggest that behavioural responses of LR pigs are more influenced by rearing conditions than those of HR pigs.

The effect of group housing on the feeding behaviour of growing pigs

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Group housed pigs make fewer feeder visits of longer duration, and eat at a faster rate than pigs housed individually. The aim was to investigate the effect of grouping on feeding behaviour of pigs kept as individuals from weaning. Twelve Large White X Landrace unrelated, male pigs (4 pigs per block) mean (\pm s.e) start weight 22.5 ± 0.7 kg were housed individually for 3 weeks (Period 1) after which, in 2 replicates (Blocks 1 and 3), pigs were combined into a group of 4 (Period 2). In a final period, Period 3, pigs were returned to individual housing for a further 3 weeks. In Block 2 the 4 pigs remained as individuals throughout but were moved between pens at the end of Periods 1 and 2. Feeding pattern, food intake, time budgets and social behaviour were recorded. Pigs were weighed three times a week. In Period 2, grouped pigs made fewer visits to the feeder ($P < 0.001$), of a longer duration ($P < 0.01$) than in Periods 1 and 3. Food intake and weight gain were greater in Period 3 than in Periods 1 and 2 ($P < 0.001$ and $P < 0.01$ respectively). There were no significant effects of moving pigs between pens in Block 2 on feeding behaviour and time budgets except an unexplainable increase in visit duration in Period 2 ($P < 0.05$). Grouped pigs slept more ($P < 0.01$) and spent less time feeding ($P < 0.01$) and rooting ($P < 0.01$) in Period 2 than in Periods 1 and 3. The frequency of aggression decreased over time from mixing ($P < 0.001$). Possible mechanisms for the differences in feeding behaviour include competition, group cohesion (group housing) or lack of social stimulation (individual housing), group cohesion being most likely.

Behaviour and fecal cortisol as non-invasive indicators for the assessment of welfare in captive small mexican felines

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The aim of this project was to assess behaviour and baseline fecal cortisol levels in three different species of native felines kept in captivity. This is part of a project where these will be related with fecal reproductive hormones profiles, and once all the data are collected, different types of environmental enrichment will be assessed. Direct observations (50h/animal) and 24 h videotapes (168 h/animal) of 31 felines (14 ocelots, 12 jaguarundis and 5 margays) were used to obtain information on behaviour repertoire, individual time budget, social interactions and abnormalities. At the same time, fecal samples were collected 3 times per week, as a non-invasive technique, and kept frozen for RIA analysis. All cats showed stereotypic pacing (mean 3.09%) of total day and spent 51.3% on average inactivity. The average relative frequency of non-agonistic and agonistic interactions was 3.61 and 0.43 respectively. Despite the fact that these species are considered solitary, they spent about 22.05% of the total day time resting in close proximity. The effect of species, sex, time in captivity, origin of the animal, complexity of the enclosure, contact with the public and number of animals was assessed. Animals in barren enclosures showed overall less activity (total locomotion: 14.09% $P < 0.05$) and spent more time for both stereotypic pacing (3.87%) and to being alert (9.14%) than the animals in complex enclosures (19.01%, 2.37% and 7.4%, respectively). Jaguarundis had an average higher cortisol values than ocelots and margays ($P < 0.05$). Cats that were in contact with public, as well as those that had been pets previous to being housed at the zoo, presented higher levels of faecal cortisol ($P < 0.05$). A negative correlation was found between time spent alert and faecal cortisol levels ($R_s = -0.4$, $P < 0.05$).

The stand up and first suckling latency of pure and crossbred nellore calves

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The behaviour of the cow-calf pair after birth is important to the beef production systems since it is related to the survival and development of the newborn. The objective of this study was to compare the latency to stand up (TS, min.) and the latency for the first suckling (FSL, min.) in 137 calves from four different groups (purebred Nellore - N and crossbred Simmental x Nellore - SN, Aberdeen Angus x Nellore - AN and Canchim x Nellore - CN), born during the 1998 and 1999 calving seasons. The purebred Nellore calves and their dams were kept in two production systems: intensive (NIS; 5 ALU/ha) and extensive (NES; 1 ALU/ha). The crossbred groups were kept in the intensive production system. Cow-calf behaviour was recorded by direct and continuous observation from the beginning of parturition until the end of the first suckling. The teats of the cows were classified after parturition according to length (short, median and long) and caliber (small, median and large), and the udder, by conformation (flat, normal and pendulous). The data were analyzed by the least squares method and the model for TS included the fixed effects of month and year of birth, sex, and group. For the analysis of FSL the model included also TT, TC, and UC. The calves from AN group were faster ($P < 0.05$) to stand up after birth (22.22 \pm 5.05) than the calves from all other groups (48.88 \pm 4.72, 41.52 \pm 4.31, 41.49 \pm 4.78, and 41.47 \pm 4.31, for NIS, NES, CN, and SN, respectively). FSL was affected by group and TT ($P < 0.05$). Again, AN calves were faster ($P < 0.01$) to suckle for the first time (34.59 \pm 10.32) than NIS (75.10 \pm 8.69), NES (64.75 \pm 8.69), and CN (72.39 \pm 9.81) but not SN (54.35 \pm 8.65). Independently of group, calves suckled faster when cows had long (49.03 \pm 9.75) and median (55.29 \pm 7.98) TT as compared to small (76.39 \pm 8.97). The results suggest that there are differences among the different groups studied, for TS and FSL, and that short teats in Nellore cows can difficult FSL in newborn calves.

Heart rate variability assessment in dairy cattle: a preliminary study

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Many authors suggest that a stress response induces changes in the neural control of the heart (Porges, 1985, in Moberg, Animal Stress, American Physiological Society, Bethesda: 97-111). Sympathetic activity increases during times of psychological stress with concomitant increase in heart rate (Forde and Marchant, 1999, ISAE proc.:121). Heart rate variability (HRV), that is the amount of heart rate fluctuations around the mean heart rate, represents one of the most promising markers of the control of the autonomic nervous system on the heart (Conny and others, 1993, Ann. of Int. Med., 118: 436-447). HRV has been quantified in several lines of human clinical research and only recently has been investigated in farm animals (Forde and Marchant, 1999, ISAE proc.:121; Hansen and others, 1997, Ethology, suppl.32). The aims of this research were: to develop standards of measurement for farm evaluation of HRV and to assess HRV in a group of dairy cattle of the same gender and different age. Heart rate and HRV were measured using a non-invasive telemetric system (Polar Vantage NV) in 6 female calves, 6 heifers, 8 primiparous and 7 cows. HRV was recorded during sessions lasting 15 minutes while the animals were in their usual pen. Two metallic pins were used as electrodes and were placed on the right jugular sulcus and in correspondence of the thoracic projection of the heart. The heart rate signal was telemetrically transmitted to a receiver which was fixed to a girth belt. When each recording session was completed, the data were transferred into a notebook for analysis. HRV was assessed by calculation of indices based on statistical operations on R-R intervals (time domain analysis). HRV decreased with age of the animals (SD $p < 0.01$) as already assessed in humans (Lipsitz and others, 1990, Circulation, 81: 1803-1810). Heifers showed statistically different HRV, probably due to the restraint needed with these animals (Tab. 1). Further studies are needed to investigate if HRV could be used to test the effects of different management and housing conditions on stress reaction of farm animals.

	MEAN HEART RATE (b.p.m.)	SD	INDA	MAXMIN
FEMALE CALVES	109.8±17.6	40±17.3	55±20.3	205.2±102.5
HEIFERS	88.8±13.5	62.2±24.2	82.2±30.5	464.5±257.3
PRIMIPAROUS	80±6.7	34.7±12.9	47±17.5	243±103.3
COWS	84±9.3	32.8±9.8	44.2±13.6	248±141.4

Table 1: HRV indices (mean ± SD) for each group of animals

The effect of age and cage modification on stereotypic behaviour in two strains of laboratory mice

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Many captive animals perform repetitive, relatively invariant and apparently functionless stereotypic behaviours. The underlying causes of stereotypy are unclear though it has been argued that they are indicative of poor welfare. Objectively quantifying individual variation in the behaviour is a useful primary step in assessing the impact of stereotypy on the animal's quality of life. This study formed a preliminary investigation into stereotypic behaviour, using laboratory mice as a model species. Behaviour patterns were monitored in a population of 16 laboratory mice comprising both sexes and two common outbred strains (CD-1 and NIH/S). These were housed in single sex pairs in standard laboratory conditions with sawdust bedding on a 12:12 light:dark lighting schedule. Half of the population received pressed cotton "Nestlets" (Datesand Ltd.) to investigate any effect of nesting material on stereotypy. Observations were carried out at 6, 11 and 16 weeks of age. At each age, time-lapse video was used to record behaviour over 14 hours including the entire period of darkness, and real-time video was used to record behaviour for four hours during the dark phase. Behavioural data were collected from time-lapse videotapes through scan sampling, and from real-time video through continuous sampling. Statistical analyses focused on the frequency and duration of any behaviour directed towards the cage lid that may be regarded as stereotypic. The frequency and total duration of lid-directed behaviour was significantly greater in the CD-1 strain at six and eleven weeks of age ($P < 0.05$). No significant differences were found in the frequency or total duration of lid-directed behaviour in environment or gender comparisons. These preliminary results suggest that genotype may have a greater influence on lid-directed behaviour than the other factors considered. Individual differences in the frequency and total duration of lid-directed behaviour were stable over the three ages, thereby suggesting that incidence of stereotypy maintained consistency over time.

The effect of *Psoroptes ovis* infestation on the behaviour and welfare of sheep

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The welfare of animals with clinical disease is an important area for study. Sheep scab (*Psoroptes ovis* infestation of sheep) is a disease of considerable economic significance in temperate latitudes. It causes damage to the wool and skin of the sheep, and may result in severe loss of production and even death in some cases. Behavioural changes are an important symptom of this disease. The behaviour of sheep with sheep scab was studied using focal and scan sampling, before and after clinical treatment, in six infested flocks in Great Britain. The data for the flocks were combined to minimise the effects of other environmental factors on the behaviour. The duration and frequency of rubbing, scratching and biting behaviours were greater in infested than in treated sheep. Non functional nibbling of the lips or 'mouthing' was seen only in infested sheep, either alone, or accompanied by rubbing or scratching. Mouthing is a stereotypic behaviour, perhaps induced by the pruritus of sheep scab. Bout-lengths of grazing and idling behaviours were significantly shorter in infested sheep than in treated sheep, although the duration of grazing and idling did not differ significantly between observations. The bout length and duration of cudling (ruminating) did not differ between infested and treated sheep. It is suggested that the oral behaviour associated with cudling, but not grazing, may provide the sheep with some relief from the pruritus of sheep scab. It is clear from the behavioural changes described, that *Psoroptes ovis* infestation of sheep results in poor welfare of affected animals.

The influence of social stress on plasmatic levels of testosterone and cortisol in Nile tilapia (*Oreochromis niloticus*)

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In the actual system of production, fish are exposed to a very high population density, causing an increase in the number, intensity of agonistic interactions and susceptibility to stress. Some authors related that in Salmonids exposed to stress there is an increase in plasma cortisol and a decrease in testosterone levels. Therefore, two hypothesis were studied in the present work: to verify if the cortisol/testosterone relation could be influenced by social stress in Nile tilapia (*Oreochromis niloticus*), and the influence of this relation in dominant and subordinated fish. Thirty mature male tilapia, averaging 240,8 \pm 2,7 g initial live weight, were used. The animals were kept during 15 days in individual tanks for acclimatization. Data were collected when the animals were isolated (control) and after confrontation (stressor). Animals closely matched in weight were paired during four hours, and the five initial and final minutes were video-recorded. Isolated and paired animals were anaesthetized (phenoxy-ethanol) before blood collection. Plasmatic levels of cortisol and testosterone were determined using commercial kits (Diagnostic Systems Laboratories, Inc.). For the classification in dominant and subordinated individuals, three aspects were analyzed: swimming time, nipping, and change in the coloration of the animal in the end of the observation time. The results showed that cortisol and testosterone levels did not differ between dominant and subordinated individuals. However, after the confrontations, cortisol levels were significantly higher than the levels measured when animals were isolated ($P < 0,001$). Plasmatic levels of testosterone presented a significant decrease after animals being paired ($p < 0,05$). No correlation between plasmatic levels of cortisol and testosterone and animals hierarchical position (dominant and subordinated) were found. These results demonstrated that cortisol/testosterone relation is influenced by social stress in Nile tilapia.

Sequential analysis of sexual behaviour of Nelore bulls (*Bos taurus indicus*) during libido tests at Brazilian Pantanal

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There are some controversy about the relationship between the zebu bulls' performance during the libido tests and fertility in natural breeding, since it was developed considering the sexual behaviour of European bulls. It is known that zebu present lower frequencies of mount attempts and complete services than European bulls and, consequently, lower scores in the tests. Are the behavioural categories usually considered in the libido tests biologically relevant for zebu bulls? Are there other ones, which must be considered? How are these categories organised? In order to answer these questions, we studied the behaviour of 62 Nelore bulls during libido test, (Chenoweth, 1983: J. Dairy Sci., 66:173-179). The usual behavioural categories (sniffing/licking the cow's genitalia, Flehmen reflex, sniffing cow's body, self-excitation – penis exposition and prepuce contractions – (SEB), cow's active following, mount attempt (MA); aborted mount and complete service (CS)) were recorded. A new category is proposed, the mount impulse (IMP), which is characterised as follow: the bull is stand up, positioned diagonally or behind the cow, its head is turned to the cow's posterior and often placed at a lower level than the cow's knee joint. All the hoofs are on the ground and one of the thoracic members is positioned forward from the other. Finally, the bull presents a body movement towards the cow, without to move its hoofs and, it always vocalise. We present the hypothesis that this behaviour has the same function of MA, that is to verify if the female is receptive or not. The records were transformed into first-order transition matrices, and then we run a sequential analysis through a method based on search of oriented trees, a graph theory concept. MA and IMP were presented with similar frequencies ($P > 0.05$, Mann-Whitney U test). MA, IMP and SEB were statistically associated ($P < 0.0001$), such result confirm our hypothesis that MA and IMP have similar functions during courtship. SEB could be considered as a complementary category, happening before or after the expression of IMP or MA. CS was preceded by any other category ($P < 0.016$), suggesting that it depends how female react, independently of which behaviour the bull was presenting just before. IMP could have a important role during the courtship of zebu bulls, but before including it in a practical libido test, further researches are necessary. Financial support: CECITEC – SEMADES/MS; FUFMS; EMBRAPA Pantanal. Part of E.V. Costa e Silva's PhD Thesis in Animal Production at FCAV/UNESP, Jaboticabal-SP

The role of domestication in the ethology of the feral cat (*Felis silvestris catus*)

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Wildcats were first attracted to the wholly agronomic Egyptian civilisations 5,000 years ago by the ample source of prey in the form of rodent pests. The domestication of this solitary species thus occurred through a process of commensalism. The domestic cat's tremendous adaptability, flexibility and fecundity have given it a world-wide distribution. Despite the importance of the cat as a pet and companion animal in many of today's societies and cultures, the vast numbers of domestic cats on every populated continent means that the potential for feralisation to occur is very great. The feral cat represents an intermediate between a wild and domesticated felid. It shows a highly variable degree of dependence on humans but usually seeks both shelter and supplementary feeding. Though man has little or no direct influence on its reproductive or ranging behaviour, indirectly, its social behaviour is determined largely by the resources afforded by man. The farm cat represents an example of a feral animal profiting from a managed domestic environment. Observational studies of the demographics of a feral cat colony on a UK farm (resident adult males $n = 4$; females $n = 8$; visiting males $n = 2$) show adult females to be strongly philopatric, utilising the farmyard, the central resource area, to a maximum over the winter months when climate and prey availability are poor. Adult males are being radiotracked; their ranging behaviour during winter shows parallels with that of the females, but preliminary results indicate that distance travelled from the farm during springtime increases threefold for the dominant male. The subject of dominance is being further investigated by the use of microsatellite analysis to determine kinship relationships. This will permit quantification of the success of the adult males' strategy of seeking additional resources by increasing their home ranges during the breeding seasons. It would appear that in spite of its domestication and commensal relationship with man, the cat has retained much of its ancestral behaviour.

A comparison of the maternal behaviour of sows in confined and outdoor systems

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The well being of space-restricted sows during lactation is of concern. In pigs, good maternal behaviour is essential for the survival of the young. Sows from a Large White-Landrace herd, ages between 1.5 to 4.0 years old, were housed in gestation stalls (GS, n=8) or kept in na outdoor system (OS; n=4), and directly observed at Embrapa Suíne and Poultry, in Santa Catarina State, Brazil. The maternal behaviour of sows under different husbandry systems and its implications on their welfare was studied. The maternal behaviours (MB) analysed were: maternal attention by sniffing at a piglet or touching it with snout (MA), lying on the side with piglets massaging the udder, but not suckling (LM), and nursing (NI). Observations started at the day of parturition and lasted until six days after farrowing. The sows were observed during 4 hours each day. The mean frequencies of each behaviour were analysed by Student t-test. There was no significant difference ($p > 0.20$) for the total MB, between GS (4.90%) and OS (6.69%) treatments. Results differed significantly according to the behaviour; LM was significantly more frequent ($p < 0.0001$) in GS (7.52%) than in OS (1.84%); while MA was significantly more frequent ($p < 0.0001$) in OS (3.26%) than GS (0.39%) and nursing (NI) was more frequent ($p < 0.05$) in OS (11.52%) than in GS (5.43%). We concluded that sows kept in OS presented more intensive maternal behavioural (MA and NI) than sows kept in GS. The maternal behaviour shown by OS could contribute to the survival of the piglets.

The presence of a farrowing nest affects gilt responsiveness to neonatal piglets and interval from birth to first suckle

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In many countries, interest in loose housing of farrowing and lactating sows is increasing. However, piglet mortality is often higher in these systems. Prior to parturition, sows are highly motivated to nest-build. The nesting and farrowing environment can affect sow and piglet periparturient behaviour with consequences for piglet growth and survival. We investigated whether feed-back from a nest affected: 1) sow responsiveness to neonatal piglets, 2) interval from birth to first suckle. The results presented are preliminary as this is an ongoing experiment. Fifteen gilts were housed in individual farrowing pens (6.8m²) with a peat (8cm deep) and straw (5cm deep) covered nesting area (3m²) and an activity area (3.8m²) in which the gilts had continuous access to long-stemmed straw and fir branches. Nine gilts were allowed to complete nest-building (control), whereas six gilts had the nest removed 10h after onset of nest-building and again every 4h until parturition (treatment). Therefore, the treatment gilts could perform all nest-building behaviours but not obtain feed-back from a completed nest. For each piglet, the interval from birth until the first suckle was observed directly. From parturition until 24h postpartum, timelapse video-recordings were observed for sow reactions to piglet contact and an index of maternal responsiveness was calculated for each gilt (Index = (number of reactions-number of no reactions)/(number of piglet contacts)). Treatment gilts had a higher responsiveness index during the first 6h after onset of parturition than control gilts (0.42 v -0.22, $P=0.002$). In addition, piglets from treatment gilts tended to have a longer interval to first suckle compared with piglets from control gilts (70min v 44min, $P=0.07$). Low maternal responsiveness during and immediately after parturition and a short birth to suckle interval may have positive effects on piglet survival. Therefore, allowing sows to build functional nests with appropriate materials may improve welfare and productivity in loose farrowing systems.

Uncovering the "secrets" of stable life

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Measurement of activity can provide useful information about the well being of an animal under certain environmental conditions. Activity measurement in the stabled horse has been limited; the aim of the present study was to compare a variety of techniques (Infrared beams (IR), Passive Infrared (PIR), Accelerometer, Pressure mats and Pedometers) that were used to assess activity of the stabled horse. These techniques were validated against video observation of behaviour in three trials over a period of several weeks using the Observer 3. Activity parameters recorded included walking, stepping, lift leg, stand, move head and flick tail.

Recording Technique	Number of Horses		
	Trial 1	Trial 2	Trial 3
Infrared Beams	12	6	6
Pressure Mats	12	-	-
Pedometers	12	6	6
Accelerometer	-	6	6
Passive Infrared	-	-	6
Observer 3.0	12	6	6

Each horse was observed in the stable (top door shut) for 90 minutes; replicated once for trial 1 and twice for trials 2 and 3. A 12' x 12' stable was fitted with four IR mini-beams; pressure mats covered the floor and a PIR was suspended from the ceiling. Prior to each test, an accelerometer was fitted around the right fore metacarpus and 2 pedometers around the left fore and hind metacarpus. A final total was noted for each pedometer; counts were logged at intervals for all other equipment. Correlation and multiple step-wise regression analyses were carried out to determine which of the techniques were best able to detect an individual or combination of activity parameters. The results show that IR is highly correlated ($R^2=75\%$, $p<0.001$) with walking, stepping, lift leg and flick tail combined. The pedometers were highly correlated ($R^2=81\%$, $p<0.001$) with walk duration and step. The PIR readily picks up head movement ($R^2=68\%$, $p<0.001$). The accelerometer, however, was sensitive to the intensity of limb placement ($R^2=54\%$, $p<0.001$). The pressure mats did not complete the trial due to damage. This preliminary study suggests that the IR system in combination with the pedometers provide a useful measure when evaluating total activity of the stabled horse. And gives an indication of how we could develop reliable methods for measuring ambulatory movement.

Information exchange and farm animal welfare: Using surveys to assess information transfer to producers, and public awareness of agricultural practices, in Southwestern Ontario

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Information exchange between scientists, producers and the general public is important in the consideration of farm animal welfare. To investigate information exchange, a survey was conducted of pork producers who have recently had sow barns built or renovated. The survey explored what information sources were used in the planning of the barn, awareness of various swine behaviour or welfare research projects, and what sources of information the producers considered most helpful in relaying scientific research findings. Another area of information exchange was investigated by surveying the general public, as the level of public education and interest in welfare issues can influence the introduction of welfare-based innovations. Both public awareness of current agricultural practices and consumer initiative to support change through purchasing practices were assessed by questionnaire.

The economics of meat procurement, welfare assurance and animal welfare: a conceptual model

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Various elements of the journey from farm to abattoir may adversely affect the welfare of transported livestock. These elements include amongst others: mixing, loading and unloading. The costs incurred by meat processing and retail companies in assuring welfare during the journey from farm to supermarket display are incorporated in the transaction cost associated with each link in the meat supply chain. The transaction costs of assuring animal welfare in a chain that includes several separate organisations are such that meat processors and retailers are increasingly adopting a policy of vertical integration. Such integration should enable the retailers to exercise more control over the overall procurement chain, thereby reducing the transaction costs of welfare assurance. The outcomes of this vertical integration are an increased number of preferred supply relationships involving fewer numbers of organisations, with an increasing level of control exerted by the retail organisation. Examples include: the development of producer clubs organised by the meat processing companies, and a reduction in the number of abattoirs that are used by the major retail organisations. A conceptual model has been developed and will be presented that describes these changes to the meat supply chain and their impact on animal welfare. A reduction in the number of abattoirs will lead to increases in the duration and complexity of journeys between farm and abattoir. Long and complex journeys include those elements of a journey that reduce the welfare of transported livestock. Therefore, the ironic result of an effort to reduce the cost of welfare assurance will be a reduction in animal welfare.

Observations on hematophagous bats, when feeding on dogs

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The biology of Vampire Bats (*Desmodus rotundus*) has been extensively studied, due to its health and economic relevance, as its role as a rabies transmitter and its contribution for high losses in livestock farming. Little is known, however, about their habits in urban areas. The attack to dogs was either rarely described in the literature. Adaptability aspects of the bat, in relation to attacks on domestic dogs, were analyzed in eight sites, reported by the owners. In these locals we spent 14 nights. In five sites, we captured *D. rotundus*, near their prey. The prey, reported until now included only large breed of dogs, such as Brazilian Fila (2), German shepherds (2), Rottweiler (2), Dalmatian (1) and a large mongrel (1). Smaller breed of dogs were not attacked, although kept in the same conditions, in three sites. All the attacked animals slept free in the yard, or were confined in kennels, in part of the night. The number of attacked dogs, in each site, varied from 1 to 4. All the dogs reduced their activity, quieting down and going to sleep, after their owners' arrival. Two to six recent bites were noted in each animal: in the snout (1), footpads (1), vagina (2), lowest part of the dorsum (4), flank (2) and hindlimbs (5). In five places, recent faeces were found, confirming the utilization of the feeding roost by the bats, placed 2-12 meters away from where the prey slept. The bats, were active during the first hours after sundown. One to 19 bats were captured in each local, varying from 1 to 8 bats per attacked dog and 1 to 8 per bite. Attacks occurred for variable periods (10 days to 18 months). Preference for larger dogs suggests that these bats prefer prey less active.

Relationships between lameness and the time budgets of broiler chickens in conventional and enriched pens

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Selection for rapid growth and increased breast weight in broiler chickens has resulted in a tendency for leg problems and lameness in these strains. We investigated the relationships between lameness, changes in behavioral time budgets, and interaction with enrichment devices placed in the home pen. Three control and three enriched pens were each stocked with 100 day-old Hubbard-Petersen chicks. Enriched pens contained perches, dustbaths, and other resources connected by ramps. From 4 wk of age onwards, weekly time budgets were calculated for 200 focal birds and lameness in these birds was assessed on a 6-point scale. The data were subjected to factor analysis, with each week analyzed separately. Two factors were consistently identified each week in the control pens. The first, which we labeled "feeding motivation", showed that birds that feed more spend less time performing other behaviors. The second, labeled "lameness", showed that lame birds sit rather than stand when inactive, feeding, preening, or ground pecking/scratching. These birds also walk less and feed more. In the enriched pens a similar "lameness" factor was present in the first two weeks, and lame birds spent less time interacting with enrichments. A new factor, "perching tendency", was evident during all weeks in the enriched birds. Birds that perched on the apparatus were lamers and more likely to choose to sit, and preen while sitting, on the apparatus than on the pen floor. These results describe a wider-ranging effect of lameness on the organization of behavior in broilers than previously reported, and have implications for broiler welfare. This project was funded by USDA-CSREES-NRI/CGP Award No. 98-35204-6586.

Evaluation of the effect of energetic and proteic supplementation on the grazing behavior of sheep on Italian ryegrass pasture

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Changes in grazing behavior in animals receiving different supplementation sources (energetic or proteic) are refereed in literature. The objective of this trial was to compare ingestive behavior of sheeps grazing Italian ryegrass (*Lolium multiflorum*) under three treatments: (1) pasture only, (2) pasture and maize grain (energetic supplementation), (3) pasture and soybean meal (proteic supplementation). The supplementation was available at one % of sheep liveweight/day. The animals, lactating ewes with their lambs, were managed in rotational grazing in six plots (0.1 ha) divided by an electric fence. The grazing trial was held from 08/15 to 10/18, three periods of 21 days. Grazing, rumination and resting time were observed during 14 hours in two consecutive days (09/02-03; 09/17-18 and 10/08-09) in each of the 21 days period. The evaluation was subdivided in morning time (06 to 12 hours), afternoon (12 to 18 hours) and night (18 and 20 hours). Bite rate was obtained by cronometrating 20 bites of each ewe two times in the morning and afternoon. Data was analysed by randomization tests performed by MGLTIV software. Treatments did not show any significant difference in behavioral variables ($P > 0.38$, in the first period; $P > 0.15$, in the second and $P > 0.18$, in the third one). Comparing periods ($P > 0.15$) and treatments ($P > 0.21$), no difference was found in the whole grazing trial. Animals showed significantly ($P = 0.0001$) different behavior during the day, indicating circadian rythms. Grazing time and biting rate was higher in the afternoon, in the first two periods and was higher in the morning in the third period. Gregarious behavior had a major influence in the grazing pattern.

Reducing pain after dehorning in dairy calves

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Although animals might experienced prolonged pain in the hours following routine surgical procedures such as dehorning and castration, identifying methods of reducing this post-operative pain has received relatively little attention. In this study, we tested the effects of a non-steroidal anti-inflammatory drug (ketoprofen) in reducing pain after dehorning in dairy calves aged 4-8 weeks ($n = 20$). Calves were given either ketoprofen before dehorning as well as 2 and 7 h after the procedure, or were assigned to a control group. All calves received a sedative (xylazine) and local anaesthetic (lidocaine) before dehorning or sham dehorning (during which animals were treated identically but not dehorned). Responses were scored during the 24 h following the procedure. After sham dehorning, the behavior of the control and ketoprofen treated calves was similar and frequencies of pain related behaviors (head shaking, ear flicking and head rubbing) were near zero. After hot-iron dehorning, calves treated with ketoprofen also showed little head shaking or ear flicking but control animals showed much higher frequencies of these behaviors, with both responses peaking 6 h after dehorning. Differences between the treatment groups remained statistically significant ($P < 0.05$) until 12 h (head shaking) and 24 h (ear flicking) after dehorning. A low frequency of head rubbing was observed in both treatment groups, but control calves were more frequently observed engaged in this behavior. There was no statistically significant effect of treatment on any of the other behavioral measures. Calves treated with ketoprofen also tended to gain more weight (1.2 ± 0.4 kg) during the 24 h after dehorning than did control calves (0.2 ± 0.4 kg) ($P = 0.07$). These results indicate that ketoprofen reduces pain after hot-iron dehorning in dairy calves.

Feeding in captive collared peccaries (*Tayassu tajacu*): an ethological contribution

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Due to the gradual reduction of the collared peccary natural environment, captive groups represent an alternative of preservation and help to get a better knowledge of this species. To analyse the feeding behaviour under these conditions, in order to get to its optimisation, we studied a group of four to six captive individuals. During twenty-six periods of one hour, using the focal group technique, we observed the deliver of food and we registered if each individual ate or not food, where (into the group or in the edges), and their income order. We distinguished three income mechanisms, applying the CONCOR algorithm (Pearl & Schulman, 1983, Advances in the study of behaviour, 13: 107-146; Ferrari & Catanesi, 1998, Mastozoologia neotropical, 5 (2): 117-121) a) being the first one, eating for shorter periods b) acceding neither among the first ones, nor among the last ones, staying more time into the group, and reducing the time in the edge c) being the last one, spending more time into the group and in the edges. Three behaviour patterns not described previously, "eating alone" (the subject takes a piece of food and moves away from the group to eat it), "stealing food" (the subject takes a piece of food which is near another one's mouth) and "pulling" (two individuals hold a piece of food and each one gets a portion by pulling it), allow individuals to get the resource without disputes. When animals eat chopped food or pellets they remain together and their behaviour includes agonistic interactions. Observations in outdoors have contributed with similar evidence. We recommend to serve food outside any container, in order to avoid monopolisation by the first incomers; portions must be large to allow them to be separated or divided by individuals.

Searching for imprinting stimuli in the domestic chick: effect of experience on the out-of-sight out-of-mind issue

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A series of experiments was conducted to investigate the issue of whether out-of-sight is out-of-mind in the domestic chicken. Following visible displacement of an imprinting object, chicks searched for the occluded object where it was previously seen, possibly indicating a mental representation of the occluded object. However, following presentation of an object moving along a constant trajectory and disappearing behind a screen, chicks searched near the last seen location suggesting an inability to mentally represent hidden motion. Although this provides no evidence of object permanence in the domestic chick, search strategy following occlusion was strongly influenced by experience. That is, chicks reared in enriched pens that provided the opportunity to leave sight of the imprinting object showed a greater preference to search where a moving object was seen when compared to chicks reared in control pens providing no opportunity to leave sight of the object. Presumably, in enriched pens moving towards the previous location of an occluded imprinting object was reinforced by obtaining the goal. Imprinting chicks on live hens and rearing in enriched or control environments was undertaken to further investigate the effect of experience on search behaviour. Preliminary findings suggest that imprinting on a stationary object leads to the development of a strategy for locating a concealed social stimulus that is unrepresentative of chicks reared by a hen.

Validation of faecal corticosteroid analysis (the dummies' guide to measuring faecal corticosteroids)

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The measurement of corticosteroids can be a useful supplement to other welfare indicators. The relatively recent use of faecal corticosteroid measurement in welfare research is appealing due to its non-invasive nature, but validation is vital for each species used. We describe the basic steps of this procedure in simple terms, using examples from our research on primates and poultry. We also provide a comprehensive list of general advantages and disadvantages of faecal corticosteroid measurement. Unlike in plasma, saliva and urine, corticosteroids in faeces are often present as metabolites. These vary between species due to different metabolic pathways of digestion. Metabolites can often be detected by radioimmunoassay assays (RIA) or enzyme-linked immunoassays (ELIA) designed for the non-metabolised hormone, but their suitability must be validated. The validation steps, which require some laboratory experience or expert advice, are as follows:

- 1) *Extraction*: Hormones are extracted from freeze-dried and ground faeces using a solvent. Spiking samples with a known amount of labelled hormone should result in its recovery at a repeatable and high level.
- 2) *Parallelism*: Serial dilutions of the extract are assayed. The concentrations detected should produce a curve similar to serial dilutions of hormone standards, indicating that faecal metabolites are correctly recognised by the antibody without interference.
- 3) *Accuracy*: Different amounts of hormone are added to samples. The assay should accurately detect the added concentration plus the sample's original hormone level.
- 4) *Challenge*: Corticosteroids are increased in the animal in a controlled manner (by application of a stressor, or administration of ACTH or corticosteroid). The increase should be clearly evident in the faeces when compared to basal levels.

Comparison of behaviour and adrenal activity in first lactation and adult dairy cows under intensive conditions

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Heifers at first parturition have to cope with several changes in their environment that can be very stressful. In addition to being separated from their calves, they have to compete for eating and lying places with older and more experienced cows once they are introduced to the milking herd. The aim of this study was to compare individual behavioural and plasma cortisol levels after an ACTH challenge test of first parturition heifers with those of adult cows. The behaviour and the adrenal activity were related. Thirty cows, fifteen in each group, were observed during 180h in a cubicle building where social and individual behaviour was recorded. An ACTH challenge test was carried out after the observation period to determine cortisol levels in plasma. The adult cows had a higher index of displacement than first lactation cows ($p < 0.05$). Heifers spent on average more time walking during the day, walking at night, eating at night, standing and lying on slurry than adult cows ($p < 0.05$). Cortisol levels at 60 and 90 minutes after injection of ACTH were lower in adult cows than in heifers ($p < 0.05$). Significant relationships were found between cortisol levels at 60 and 90 minutes after ACTH injection and total time walking, time walking at night, time standing on slurry and with the index of displacement ($p < 0.05$). This information is useful to make recommendations of management procedures that can reduce welfare problems in first lactation cows.

Does associating with kin affect growth and production of juvenile Atlantic salmon in the wild?

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The factors that determine the growth of individual fish have been extensively studied, but the influence of social structure on growth and production is poorly understood. Laboratory experiments have shown that juvenile salmon use the water-borne odours to recognise their relatives, and are less aggressive and defend smaller territories when they associate with kin. Growth and density should be much greater in populations of related fish because kin use less energy for aggressive territory defence. Data collected in a recirculating laboratory stream tank confirmed this prediction (Brown & Brown, 1993, *Behav. Ecol. Sociobiol.*, 33: 225-231). However, rivers differ markedly in character from laboratory aquaria because there is little recirculation of water. Here we ask, first whether water recirculation influences kin-biased territorial interactions. Secondly we describe a field study designed to test directly whether growth of wild fish in the wild is influenced by kinship. Levels of aggression were similar between pairs of kin and pairs of non-kin when there was negligible recirculation of water. However, when water was recirculated, pairs of nonkin were on average 1.56 times more aggressive than pairs of kin (Griffiths & Armstrong, 2000, *Anim. Behav.* 59: 1019-1023). In the second experiment, juvenile salmon were stocked into sections of a tributary of the River Conon, UK, either in single family groups (low genetic diversity, $n=8$) or in mixed relatedness groups (high genetic diversity, $n=8$). On resampling, growth rates were similar between kin and mixed groups. Intriguingly however, density was significantly lower in kin (40% lower) than mixed groups. The results of the first experiment suggest that odour concentration influences aggression among juvenile Atlantic salmon. Differences in growth between groups of kin and mixed relatedness salmon observed in laboratory stream-tanks may therefore be exaggerated. The results of the second experiment confirm this prediction. It seems that in natural riffle conditions where there is little recirculation of water, growth rates do not differ between groups of mixed relatedness and full siblings. These results are in complete contrast to the predictions of previously reported laboratory-based experiments, and are important for fisheries managers facing the decision of whether to restore rivers by stocking family members together.

The effect of response type on the demand for food in mink

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The behavioural priorities of farm animals may be quantified by demand functions generated by use of operant conditioning techniques. However, there are several aspects of this method that still need to be investigated in more detail. The aim of this study was to investigate the effect of response type on the demand for food in mink. The responses examined were pressing a lever and pulling a chain. The experiment was conducted with eight mature female mink. During each of two periods, the mink went through 5 runs of successively increasing FR-levels (4, 8, 16, 25, 60, 80 and 100). The rewards were available for 24 hours per day and each reward was 0.5 gram of food. Half of the animals worked on the lever in the first period and on the chain in the second period, the other half of the animals vice versa. All minks were weighed at the start of the experiment and subsequently each Monday, Wednesday and Friday until the end of the experiment. The number of rewards and thereby the amount of food earned decreased as the FR values increased for all animals. There was a significant interaction between method and FR value ($P < 0.001$). The demand curve for food obtained by chain pulling was steeper than the demand curve obtained by lever pressing. There was a significant interaction between method and run regarding the weight of the animals ($P < 0.01$). The mink lost weight throughout the runs, most when working on the chain. On the low FR values, the mink gained weight but on the higher FR-levels the minks lost weight. This support the assumption that the minks used much more energy than necessary to carry out the pulling response and much more than on the lever. One reason for the difference in slopes of the demand curves could be, that the unit price paid on the chain and on the lever at a given FR value was not the same, even though the minimum force required was 35 - 40 gram for each type of response.

The effect of systematic desensitization on the fear response patterns of women experiencing dog phobia

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Animal phobias are a subtype of specific phobias which are characterized by strong, persistent and unwarranted fears of a specific kind/group of animals. Phobic fear is an emotional response syndrome with three groups of response patterns: cognitive-affective, motor-behavioral and physiological aspects. Most studies on human-animal interactions focus on its positive social and psychological aspects, while studies on animal phobias focus mostly on spider and snake phobia. The problem is that dog phobia didn't receive the necessary attention in interaction or psychological research. The aim of this study was to examine the effect of systematic desensitization, which is recognized as an effective treatment for phobic disorders, on the response patterns associated with dog phobia in order to better understand its description and treatment. Young adult females were assigned to an experimental group consisting of subjects suffering from dog phobia, and a control group. The study consisted of three experimental stages: the resting stage measured baseline values, while the pre- and postintervention stages measured values in the presence of a dog stimulus. The cognitive-affective aspect was assessed with an anxiety scale. The motor-behavioral aspect was measured as the termination distance during a dog approach test, while plasma adrenocorticotrophic hormone (ACTH) levels represented the physiological aspect. Systematic desensitization was found to be significantly effective in alleviating the motor-behavioral and cognitive-affective aspects of phobic fear, while its effect on the physiological aspect was inconclusive. No significant differences were found between the experimental group's plasma ACTH-levels during any of the experimental stages, or between the two groups during the resting and preintervention stages. The plasma ACTH-levels of the control group were significantly lower than that of the experimental group during the postintervention stage. In conclusion, this study found an incongruence between the three aspects of fear response patterns following psychological treatment of women experiencing dog phobia.

Automatic milking in dairy cows: technophobia or better welfare?

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To evaluate effects of automatic milking on the welfare of dairy cows, physiological and behavioural responses during both automatic (Lely Astronaut®; AM) and conventional (double-three open-tandem parlour; TM) milking were studied. Eighteen pairs of HF-heifers were balanced for estimated breeding value and calving date and were randomly assigned to two independent groups of either 50-60 cows. Except for milking, groups were kept under similar management conditions. At least 4 weeks after calving, heart rate (Polar Vantage®), behaviour (video) and quarter milk flow (Lactocorder®) were continuously recorded during either a voluntary visit to the milking system (AM-cows) or a usual afternoon milking session (TM-cows). In addition, cortisol, oxytocin, adrenaline and noradrenaline were determined in blood that was collected through a cannula with 1 min intervals. After milking cows received 10 IU oxytocin and were re-milked to collect residual milk. AM-cows were milked 3 times a day compared to 2 times for the TM-cows and had 10% lower heart rates ($P < 0.05$) from 30 min before entering the milking site and during milking. No differences were found in the total number of steps during milking (AM: 4.7; TM: 8.0), in maximum plasma cortisol during milking (AM: 12.0; TM: 9.5 ng/ml), in faecal 11,17-dioxandrostane (AM: 122.9; TM: 159.9 nmol/kg), in machine-on milking time (AM: 426; TM: 431 sec) and in residual milk (AM: 10.2; TM: 8.6%). AM-cows, however, spent less time with their head upright (AM: 39; TM: 67%, $P < 0.05$) and had significantly shorter blind milking time (AM: 6; TM: 103s, $P < 0.05$). From these results it is not likely that cows experience technophobia during automatic milking. Lower heart rates in AM-cows, on the other hand, as well as lower plasma catecholamine concentrations at the start of milking, suggest a lower sympathetic nervous system activation. This corresponds with the experimenters' impression that AM-cows generally behaved less agitated when handled and therefore may experience better welfare.

Inter- and intra-individual variation in resting behaviour in dairy cows

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Interpretation of lying behaviour in terms of welfare is difficult since quantitative information on parameter values e.g. variation between and within animals, the relevance of changes in lying time and bouts and the interaction between lying behaviour and management is scarce. Because it is almost impossible to reliably estimate such values without automated 24 hr recordings over time, a system has been developed at ILD-Lelystad for continuous recording of lying behaviour of dairy cows. In a free stall system 16 cubicles have been supplied with electronic identification equipment supported by two photoelectric cells. Validation of the system by parallel video observations revealed that after correction for double identification through adjacent receivers in empty cubicles 93.7% of 4203 lying periods could be reliably recorded. Zero identification (3%) was restricted to lying bouts shorter than 5 min. To study intra- and inter-individual variation in lying behaviour 16 Holstein Friesian dairy cows (days in lactation: 156) were housed in the system for 6 wks. After habituation, the last 19 days were used for the analysis. On average (19 days) cows lied down for 723 min a day (16 cows; s.d. between cows: ± 115). Individual 24hr lying times (19 day means) ranged between 483 and 985 min. Lowest and highest standard deviations within cows were 44.6 and 97.6 min. In addition, the number of lying bouts over these 19 days averages 12.1 (16 cows; s.d. between cows ± 2.37), ranging between 7.7-16.4. Standard deviations within cows ranged between 1.12 and 2.49. The large differences between cows together with the low standard deviation within cows suggest that lying behaviour (time and bouts) is consistent over time and characteristic for the individual cow.

Behaviour of dairy cows in the lying area of different loose housing systems

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To test possible differences between loose housing systems, behaviour of dairy cows was observed on 24 farms with an average of 48 cows. There were 6 farms included for each of the 4 systems studied: straw yards (SY), bedded sloped floor (SF) and cubicle houses with either traditional (TC) or more comfortable cubicles (CC: larger dimensions, softer lying surfaces, less restrictive partitions). 16 behaviour variables were recorded directly during the time between two milkings (6 – 7 hours). Cows in TC needed more time to stand up or to lie down than in SY and SF, CC was intermediate. In the same order longer preparation to lie down, more "tripping" before lying down, more lying down and standing up attempts and more raising with forelegs first were observed. The maximum number of cows lying simultaneously was lowest in TC. Lying with stretched hind- or forelegs was lowest in TC, followed by CC. In TC, more standing up with head lunging sideways occurred than in CC. Lying in a fully stretched position was more common in SY than in SF and in SF was greater compared to CC and TC. Lying periods lasted longer in SY and SF than in CC and TC. Cows in SF mostly laid parallel to the slope. In SF more cows laid with body contact with other cows than in SY. In conclusion, a longer duration or more deviations of standing up and lying down behaviour, fewer simultaneous lying cows or fewer leg stretchings could indicate that the normal lying behaviour was more affected in cubicle housing, especially in the traditional one.

	Straw yard		Sloped floor		Comf. Cubicle		Trad. cubicle	
	mean	SD	mean	SD	mean	SD	mean	SD
Duration of lying periods (min)	69.3a	10.9	70.3a	7.9	65.6b	9.4	64.8b	9.6
Max. synchron. lying cows (% of cows)	81.8a	13.1	81.3a	7.8	74.1a	8.3	60.7b	7.9
"Tripping" before lying down (%)	2.8a	0.5	2.8a	0.5	5.1b	2.0	7.8c	2.2
Attempts to lie down (%)	0a	0	0.6a	1.4	2.6b	1.9	6.4c	1.4
Preparation to lie down (sec)	15.2a	6.3	17.0b	4.8	18.9b	2.3	20.1c	6.3
Duration of lying down (sec)	4.6a	1.0	4.7a	1.3	7.0b	2.3	9.0c	2.4
Attempts to stand up (%)	0a	0	0.2a	0.5	2.9b	2.5	6.5c	1.3
Raising with forelegs first (%)	0a	0	0a	0	2.1b	2.4	5.5c	2.0
Duration of standing up (sec)	4.4a	0.9	4.5a	1.3	7.1b	2.2	8.1c	2.0
Lying with stretched forelegs (%)	33.5ab	12.6	35.4a	4.1	23.8b	9.5	10.4c	3.6
Lying with stretched hindlegs (%)	52.9ab	9.7	55.4a	7.1	47.7b	7.5	40.4c	7.4
Lying in fully stretched posture (%)	22.3a	14.1	11.9b	3.9	4.6c	3.9	3.8c	4.3

Different letters indicate significant differences in each line, SD = Standard deviation

Effect of water availability on the drinking behaviour and milk production of Holstein cows

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In the small and medium dairy farms in the state of Santa Catarina, Brazil, water is often offered in a single drinker in the milking shed. Due to the effect of social dominance, this may cause water restriction, for subordinate individuals, which may have negative consequences on the animal's welfare and production. This study aimed at verifying the effect of water availability on the behaviour and milk production of Holstein cows, in the subtropical region of Florianópolis (27° S), Brazil. We used a 2 x 2 factorial design, with two seasons (winter and summer) and two levels of water availability (ad libitum – AL – and restricted – R). While AL cows (n=8) had water 24 hours/day, R cows (n=8) were offered water for only 45 min during the afternoon milking. A five days habituation period with the treatments procedures was allowed before each phase of the study. After 5 days on the treatments, cows were observed during 48 hours on alternate periods on the 5 following days. Every ten minutes a scan of the group was made, and the frequency of ruminating, standing, laying, grazing, and eating at trough, was recorded. Agonistic interactions, drinking, licking mineral, defecating and urinating were recorded as events during the same observational period. Milk production was recorded before and after the treatments. Data were analysed using SAS analysis of variance. Cows in the water-restricted treatment spent less time drinking, ruminating, licking mineral and laying down ($P < 0.001$), and more time standing, than cows with water ad libitum ($P < 0.001$). A higher frequency of agonistic interactions was also observed among R cows ($P < 0.0001$). Milk production and other behaviours were not affected by water availability. The level of water restriction imposed to Holstein cows in this experiment did not affect their production. However, the welfare of the animals was probably compromised, as shown by the increase in agonistic interactions.

Do lactating sows influence each others' nursing frequencies through nursing vocalizations?

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Lactating sows have a high tendency to synchronise their nursing bouts. We hypothesised that acoustic cues are involved and that nursing grunts by one sow can incite another sow to start nursing before she would do so by herself, thus increasing her nursing frequency. The present experiment assessed how frequency of nursings, the proportion of nursings without milk ejection and the sow's and piglet's behaviour within the nursing bouts were affected by hearing nursing vocalizations of alien sows. As vocal cues, several 3-min sections of tape recordings containing nursing vocalizations of several sows were prepared. Sixteen lactating sows, on average 12.5 days p.p. were used in a repeated-measures design. Nursing behaviour of each sow was video taped for 6 h on two consecutive days in an acoustically isolated room where no other sows or piglets were present. On one of the days (control, C) spontaneous nursing behaviour was recorded without any interference. On the other day (playback, PB), the vocal cues were reproduced from a loudspeaker near the pen 30 min after each nursing. If no nursing occurred, further cues were reproduced at 10 min intervals. During PB days the sows had significantly higher nursing frequency (9 vs. 7.3 nursings per 6 h, paired t-test, $p < 0.0001$) and also a higher frequency of nursings with milk ejection (7.5 vs. 6.5, paired t-test, $p < 0.05$). However, the frequency of nursings without milk ejection tended to be higher in PB (16% vs. 10%, paired t-test, $p < 0.1$). There were no significant differences in PB vs. C days in the proportion of nursings initiated by the piglets (70% vs. 85%), terminated by the piglets (64% vs. 47%) or in the duration of post-ejection udder massage (338 s vs. 310 s). Multiple linear regression analysis showed that the probability that a sow will react to the playback could not be predicted from variables like piglet age (range 9-18 days), litter size (range 5-16 piglets), or the sow's spontaneous nursing frequency on the C day (range 5-8 nursings per 6 h). The results indicate that vocalizations of other lactating sows can increase nursing frequency. From the present experiment, we cannot exclude that less specific acoustic cues would have a similar effect, although this seems improbable. The effect in the number of milk ejection's is lower, because the proportion of nursings without milk ejection's tends to increase as a result of the stimulation as well.

The effects of an escape box to prevent agonistic behavior after regrouping in weaning pigs

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In intensive pig production, growing pigs are often regrouped and this generally leads to vigorous fighting. Pigs with hides to use in escaping attack fight less during the initial 30 min after regrouping (McGlone and Curtis, 1985). Twenty-four weaning pigs from five litters kept in three pens post weaning were used to determine the effects of an escape box on reducing a pig's agonistic behavior after regrouping. The pigs were allocated to six pens (1.8 x 3.0 m each) of four animals each and kept with their peers for two weeks. Then the lightest pig from each pen was removed and isolated for two weeks, and then regrouped with its original peers. At the time of regrouping, half of the pens were equipped with an escape box (70 x 80 x 70 cm). The behavior of the pigs was videotaped from 9:00 to 16:00, and the duration and frequency of agonistic behavior and access to the escape box was measured for four days after regrouping. Body weight was measured for individuals every week over the experiment period, which included the day of removing, the day before regrouping and six days after regrouping. The back of each pig's ears were photographed on the days of the body weight measuring, and 21 hours and three days after regrouping to score injuries. The duration of agonistic behavior was longer on the first day after regrouping in the pen without a box than those on the 2nd-4th days and all four days in the pen with a box (Sefc's test, $df = 16$, $P < 0.05$ in all comparisons). The frequency of agonistic behavior tended to be higher in the pen without a box than in the pen with a box ($F_{1,16} = 2.38$, $P = 0.14$). The frequency was especially high during the initial 20 min after regrouping in both pens. The frequency of access to the escape box for the isolated pig was higher than that of the pigs who remained as a group. The frequencies of agonistic behavior and access to the escape box were significantly correlated ($r_s = 0.79$, $n = 24$, $P < 0.01$). As for the injury score and body weight gain, there was no difference between the pen with a box and the pen without a box. It is suggested that the escape box may have effects on reducing agonistic behavior, but could have no effect on preventing injuries or promoting weight gain in regrouped weaning pigs. Further observation will ascertain the relevance of these results.

The role of opioids and oxytocin in mediating species differences in maternal behavioural expression

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The behaviours associated with maternal care-giving are species specific and reflect underlying reproductive strategies. Pigs and sheep, differ markedly in both reproductive strategy (e.g. litter size, relative size of offspring, nesting, offspring recognition) and in their maternal behaviours. Here we discuss results from various experiments concerned with the description and understanding of maternal behaviour involving 23 ewes and 67 pigs in total. Maternal behaviour in the sheep is associated with active, responsive behaviours towards the lamb characterised by intensive licking and low-pitched vocalisation. High maternal responsiveness is related to a close bond between ewe and lamb and low lamb mortality. In the pig maternal behaviour is associated with decreased activity (increased time spent lying to allow full udder exposure and reduce crushing) and unresponsiveness towards their piglets. Maternal responsiveness to piglets declines as parturition progresses, reaching a trough at 3-4 hours after delivery of the first piglet ($p < 0.001$). High maternal responsiveness in the pig is associated with increased savaging of piglets ($p < 0.001$). These divergent maternal behaviours may be arrived at by similar or differing neuroendocrine substrates. In the sheep, administration of the opioid antagonist, naltrexone, at the onset of labour causes a decrease in grooming attention (Control: 64.9% of time vs. Naltrexone: 50.5% of time, $p = 0.015$). In contrast, antagonism of opioids by naloxone in the pig stimulates an increase in maternal responsiveness to piglets. In our studies opioid antagonism did not cause an increase in circulating cortisol (sheep: $p = 0.32$, pigs: $p = 0.82$). We suggest that these differences may be related to the effects of opioids on oxytocin (OT) release. Sheep show a rapid onset of maternal behaviour at delivery, associated with a 50-fold increase in circulating OT levels. OT release is decreased by opioid antagonists in the sheep. In the pig, the birth of the first piglet is associated with an increase in plasma OT and a continuous rise in OT over the expulsive phase. Naloxone administration causes an immediate and sustained increase in plasma OT (Control: 157.2 pg ml⁻¹ vs. Naloxone: 290.3 pg ml⁻¹, $p < 0.001$). This suggests that the same neuroendocrine substrate, opioids, has divergent effects on maternal behaviour that may be mediated via OT. The differing behavioural responses of the two species to opioids may be a reflection of what constitutes good maternal care in different reproductive strategies.

Stress reactions in pigs with different growth rates – possible domestication effects of resource allocation strategies

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Stress involves physiological and behavioural reactions which are energy demanding. When an animal is genetically selected to allocate a high proportion of available resources to, for example, growth, a correlated decrease in allocation to other responses, such as coping, could be expected. In the present study, we attempted to use the large within-litter individual variation of piglets in growth patterns and food consumption as a means for studying effects of different resource allocation strategies. In each of 15 different litters we weighed every piglet at birth, and then three more times during the suckling period (at ages 17, 26, and 33 days). Based on the weight curves generated by these weighings, we selected three piglets in each litter, one with a steep increase in weight, one with low, but constant growth, and one intermediate. In addition, the focal piglets were weighed at 42 days of age, i.e. one week after weaning. At the age of approximately 33 days, each piglet was exposed to an open-field test (OFT). Immediately before and after the OFT, saliva was obtained for cortisol analysis, and heart rate was measured during five minutes of immobilisation. Piglets with low growth rate (L) tended to have a higher relative weight gain after weaning than those with high (H) or intermediate (I) growth rates. L pigs urinated/defecated significantly more in the OFT and had a significantly higher cortisol increase and increase in heart rate than I and H pigs. There were some tendencies that the L pigs were more active in the OFT. The results indicate that L pigs had stronger physiological reactions to the acute stressors of the OFT, used a more energy-demanding behaviour in the OFT, and had a less affected growth after weaning. This may be a result of H pigs being less able to allocate adequate energy to adaptation and coping.

Phenotypic relationships between different fear reactions in F₂-intercrosses of red junglefowl and White Leghorn layers: Effects of sex and resource allocation

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Laying hens have been selected to allocate a large proportion of available resources to growth and reproduction, at the expense of other energy expenditure. Reactions to fearful stimuli sometimes involve energy-demanding behaviour, and may therefore be affected as a correlated selection response. To study the effects of resource allocation and sex on responses to different fearful situations, we used 267 F₂-intercrosses (28 weeks old) between red junglefowl and White Leghorn layers. Such crossings show very high phenotypical variation. Residual food intake (RFI) was estimated from the regression of food intake on metabolic body weight. RFI is a common measure of available resources which are not allocated to growth and reproduction. We studied the behaviour during three tests: Novel object test, where an unknown object was presented together with novel food in the food trough of the individually caged birds; Tonic immobility test; Restraint test, where the birds were restrained with a rope around one tarsus for five minutes. Factor analysis of the behavioural variables showed that 49.6% of the variation in response correlations were explained by four factors: (1) "Tonic immobility-responses", (2) "Avoidance of novel object", (3) "Mild resistance to restraint", and (4) "Strong resistance to restraint". ANOVA showed that males had significantly higher scores than females for "Avoidance of novel object", "Mild resistance to restraint" and "Strong resistance to restraint". In females, higher RFI was associated with higher scores on "Mild resistance to restraint" and on "Strong resistance to restraint". The results show that fear reactions in fowl is a complex of at least four different factors, and that sex as well as resource allocation pattern may affect reactions to fearful situations in fowl. Females with high RFI appear to be able to allocate more resources than those with low RFI to active fear responses.

Interactions between the stimulating calf and milk yield in dual purpose cattle

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In many tropical countries dairy cows of cross-bred *Bos taurus/indicus* cattle are kept in a dual purpose system called 'restricted suckling' where the calves are allowed to suck the residual milk after milking. According to many authors the calves' suckling increases milk yield by 20 to 40%. In a study with 22 cow-calf pairs we differentiated between the effects of udder emptying and tactile stimulation. When having 30 min access to the dam after milking the focal calves spent an average of 15 min sucking. We interrupted the nursing after half of the nursing time and found that the calves ingested 715 g of milk during the first half of the nursing but only 12 g during the remaining time. Why do the calves continue to suck an empty udder without ingesting more milk? We know from previous studies that hungrier calves suck the empty udder for a longer time. Our hypotheses was that suckling beyond udder emptying serves as a signal to the cow to produce more milk in future. We tested the hypothesis that longer suckling may increase milk yield in future nursings in a study with 18 cow-calf pairs. For 3 weeks 9 calves got 30 min access to the cow after milking whereas the other 9 calves' access was limited to 8 min. The cows with 30 min calf contact increased daily milk yield by 6 % compared to the 8-min cows. The conclusion of our studies is that suckling beyond udder emptying probably serves as a signal to the cow to produce more milk in future.

The effect of environmental enrichment on aggressive head pecking in commercially housed broiler breeders subject to feed restriction

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Broiler breeders, the parent stock of meat chickens, are selected for broiler traits of maximal growth rate and feed conversion efficiency. Feed restriction is employed during rear to maintain physiological health but is also associated with increased aggression (relative to ad libitum fed birds), increased drinking and stereotyped pecking. This study assessed the effect of provision of a pecking and foraging resource on aggression in commercially housed breeders. 16388 Ross 508 broiler breeder pullets were reared in three identical commercial houses. Each house was divided into two treatments: standard rearing conditions (control) and standard husbandry with plastic-wrapped wood-shavings bales placed on the house floor (enriched). Birds were reared from 0-18 weeks in either treatment or control. At 18 weeks old, simultaneous video recordings were taken from cameras above each pen, on six occasions throughout the light period (sample length ten minutes; one sample per hour from 10am-3pm). Focal samples tracked one bird, chosen from a random position on a gridded video screen, for ten minutes. Behaviour, bout duration and resource use were recorded. Rate of aggressive head-pecking was calculated as pecks per bird per hour and compared between enriched versus control hens using one-way repeated measures ANOVA, blocking by house. Production and environmental measures were also considered, to control for confounding variables. Aggressive head-peck rate was reduced in hens reared with enrichment (mean pecks/bird/hour: enriched = 8.74, control = 13.13; $F(1,15) = 12.15$, $p=0.003$). This effect was pronounced when birds used the drinker (mean enriched = 1.87, control = 54.0; $F(1,15) = 15.04$, $p=0.001$). Focal hens in the enriched condition approached the drinker less frequently ($F(1,34) = 4.42$, $p=0.04$) and encountered fewer birds at the drinker (lme, $z=3.03$, $p=0.002$). Enriched breeders spent 30% of the time budget interacting with bales. Bale provision reduces aggression in young broiler breeders and may provide a simple and practical means of improving bird welfare.

The use of olfactory cues in social recognition of juvenile pigs

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Social recognition is essential in maintaining a stable social group structure. Failure to recognise familiar conspecifics in social groups of juvenile pigs may initiate agonistic encounters that can compromise welfare and productivity. Current housing systems may allow build up of atmospheric ammonia, which may interfere with the olfactory system and compromise olfactory perception. This study aimed to assess the role of olfaction in social recognition of juvenile pigs and determine whether chronic ammonia exposure compromises a pig's ability to distinguish between a familiar and an unfamiliar conspecific. Thirty-two weaned, male Duroc x Landrace pigs (*Sus scrofa*) were kept in either 35 +/- 4.88 ppm ammonia or in fresh air, 3.2 +/- 0.97 ppm. At 6-7 weeks of age, sixteen randomly selected pigs were tested in a modified Y-maze for their reactions to a familiar and an unfamiliar pig in a near test (providing visual, tactile, olfactory and auditory cues) and a remote test (providing olfactory cues only). Each test lasted five minutes and the latency to approach, time spent with and number of visits made to the familiar and the unfamiliar stimulus pig were recorded continuously. Overall, pigs spent significantly more time visiting both the familiar and the unfamiliar pig in the near test than in the remote one (ANOVA, $p<0.001$). Pigs that had received chronic exposure to ammonia visited the familiar pig more often and spent longer near it than the unfamiliar one regardless of the test situation ($p<0.05$) whereas those reared in fresh air spent longer near the unfamiliar animal ($p<0.05$). The present results suggest that pigs from both treatment groups employed olfactory cues in social recognition but that chronic exposure to ammonia did not interfere with this ability. However, ammonia treatment seemingly affected social preferences, thus indicating an unknown and more fundamental effect of living in ammoniated atmospheres.

Effects of presence of the dams during handling of young calves

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In many dairy farms calves are separated from their mother immediately after birth and reared artificially. The caretaker handles the calf and hand-feeds it with milk from the first day of life, which leads to animals that are less timid and easier to handle. These positive effects of the close relationship between caretaker and calf during early life may be disturbed by the presence of the dam. Forty Danish Holstein-Friesian calves were divided into four treatment groups during the first four days of life. Single pen immediately after birth – no handling (group S), single pen – handling during the first four days (group SH), cow and calf together in a maternity pen – no handling (group C), and cow and calf together – handling during the first four days (group CH). The handling consisted of hand-feeding with milk from a teat-bucket and patting, stroking and talking to the calf for 6 minutes three times a day. All calves were placed in single pens from day 5 until the end of the experiment at day 55 and with a minimum of human contact in this period. All calves were individually tested for their reaction to humans (voluntary approach test) in their home pen at days 20 and 40. The latency to approach a test person as well as the shortest distance between the calf and the person during the 5-min. test were recorded. The calves position (rear or front of the pen), orientation (facing towards or away from the person) were recorded immediately before the test started and during the test. The latency to approach (s) for the four groups at days 20 and 40 were 240, 13, 241 and 234 (KW 23.94, $P=0.0001$) and 238, 29, 202 and 229 (KW 21.30, $P=0.0001$), respectively. Percentages of calves in front of the pen during the tests were for the two test days 37, 100, 18 and 55 (KW = 17.80, $P=0.0005$) and 15, 90, 30 and 10 (KW = 20.12, $P=0.0002$), respectively. The calves appear not to perceive the human contact when the dams are present during the handling sessions.

Intra- and interbreed variability of domestication-related behaviour in pigs

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This study investigated the behaviour of pigs in a situation of conflict between feeding motivation and fear of humans (Lankin, 1997, Genet. Sel. Evol., 29:73-92). The experimental subjects used were female pigs of the breeds Large White (LW, $n=35$) and Mei-Shan (MS, $n=13$) and 29 females and 29 males of the each of the breeds Lacombe (L) and Tia-Meslan (TM). The newly created synthetic breeds L and TM have not been directly selected for behavioural traits such as the animals' resistance to emotional stress (neither LW nor MS). A certain level of variability particularly in behaviour related to domestication, such as fear-motivated defence reactions can therefore still be expected. The animals were tested first in groups of 5, than individually under social stress. Each animal received a score between 1 and 6, based on the number of times the experimenter was able to mark them with a painting stick when they approached the food behind which he stood. When tested in groups, MS pigs had low scores (1.0 ± 0.00), which was the result of withdrawal from the human ("wild" phenotype). On the other end of the scale, LW pigs had high scores (5.8 ± 0.13) as a result of their lack of withdrawal from the human ("domesticated" phenotype). At the age of 3 months, female L pigs showed less withdrawal from the human than female TM pigs (scores: 4.5 ± 0.45 and 3.3 ± 0.45 , respectively; $P<0.05$). At 6 months of age, there were differences between the breeds in both sexes (female L and TM: 3.1 vs 5.1 ; $P<0.005$; male L and TM: 5.1 vs 3.6 ; $P<0.025$). There were no sex differences in either breed at the age of 3 months, but at the age of 6 months, female L pigs showed higher levels of withdrawal than males when tested in isolation (scores: 2.5 ± 0.39 and 4.3 ± 0.55 , respectively). There were no sex differences in TM pigs. Social isolation increased fear reactions in all breeds except MS, but the order of breeds was the same as in the group tests (MS (1.6 ± 0.21) < L (2.5 ± 0.39) < TM (4.2 ± 0.57) = LW (5.1 ± 0.22)). It is concluded that in contrast to the basal LW and MS, the synthetic breeds – genetically homogeneous on the traits of halothane resistance and glycolysis potential – are heterogeneous with respect to the "domestic" behaviour.

Welfare: It's all in the Mind

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Vertebrates receive inputs via sensory modalities such as vision and chemoreception, and homeostatic systems monitoring internal states such as nutrition. Inputs are identified in the primary sensory cortices, before being transmitted to the secondary sensory areas in the orbitofrontal cortex, where information is stored regarding their reward value. The reward values for some stimuli are innate, but most others are learned via stimulus association learning – mediated by the orbitofrontal cortex and amygdala (Rolls, 1999, *The Brain and Emotion*: 75-147). These values may be affected by environmental conditions, with moderately poor conditions enhancing the value of positive stimuli, whilst severe impoverishment may result in anhedonia or depression (Spruijt et al, in press, *Applied Animal Behaviour Science*). Cognitive processing of stimulus reward values gives rise to states of emotion (Rolls, 1999; Spruijt et al, in press). Stimuli causing emotion also cause changes monitored by welfare scientists: autonomic changes (e.g. heart rate – mediated by the pons and medulla); endocrine changes (e.g. CRH secretion – mediated by the hypothalamus); opioid mediated hypo/hyperalgesia; reflex actions (mediated by the spinal cord); and motivated behaviour. Motivated behaviour patterns are initiated and modulated by the basal ganglia and prefrontal cortex (Norman and Shallice, 1986, *Consciousness and self-regulation: advances in research and theory*: 1-18). Some are species-typical 'fixed action patterns' or schemas, stored in the motor cortex, and others develop into stereotyped schemas via pathway-sensitisation in the cerebellum (Fentress, 1976, *Perspectives in Ethology*, 1: 135-169; Carpenter, 1990, *Neurophysiology*: 279-301). Repetitive stereotypic behaviours in captive animals may occur because motivated behaviours become abnormally rewarding (Spruijt et al, in press), but they are also known to result from basal ganglia dysfunction (Norman and Shallice, 1986; Garner, 2000, *The aetiology of stereotypy in caged animals*, PhD thesis: 26-40). Appreciating these central processes is essential for understanding normal and abnormal responses to captivity, and for understanding why these physiological and behavioural responses differ between individuals and across vertebrate taxa.

Identification of factors important in managing deep bedded vs. non-bedded confinement (NBC) facilities for swine

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The effect of housing on environment and behavior of 580 crossbred feeder pigs have been studied in a comparative trial with three deep-bedded hoop structures and one totally, environmentally- controlled slatted-floor building. Pigs were fed from round feeder with separate covered feeding surfaces. In order to assess animal welfare, behavior indicative of both poor and rich welfare were quantified. Behavior indicative of poor welfare were considered to be the performance of aberrant behavior, stereotypical behavior (such as belly nosing) and excessive fighting. Behaviors indicative of rich behavior were normal maintenance behaviors and play behavior. Hoop structures experienced lower winter air temperatures than did the confinement building (mean, 4.8° vs. 18.1° C), but effective temperatures for the animals were enhanced in the hoop structure by heat generated by the decomposing bedded pack (ranging from approximately -1.1° C to 47° C). Pigs raised in the NBC system were found to be resting more often ($P < .03$); however, they were also found to perform more aberrant and stereotypical behavior in addition to more fighting ($P < .03$). NBC pigs were found to perform more play behavior than confinement raised pigs ($P < .03$). Cortisol concentrations during handling were also greater ($P < .04$) for the pigs raised in the NBC system indicating that they were more stressed than the hoop pigs. Respiration rates were not different between pigs in the two treatment groups. Based on the greater incidence of aberrant, stereotyped, and agonistic behavior of confinement pigs and the greater incidence of play behavior by hoop raised pigs, the welfare of hoop raised pigs is considered to be richer than that of confinement raised pigs. The major contributing factor to explain this is likely the provision of bedding, which allows the pigs an opportunity to perform species typical behavior.

Ranking the humanness of possum poisons

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Every year, millions of brushtail possums (*Trichosurus vulpecula*) are poisoned in large-scale control operations in New Zealand because they damage indigenous forests, kill endangered fauna, and carry tuberculosis. Recent legislation changes, driven by an increasing awareness of animal welfare, demand the use of humane control methods. Prior to our study, the humanness of possum poisons was not known. This paper describes the difficulties we encountered ranking possum poison humanness, and our final assessment. All research was conducted with prior approval from an independent animal ethics committee. We lethally dosed possums with poisons normally used for possum control (cyanide, 1080 (sodium monofluoroacetate), phosphorus, cholecalciferol or brodifacoum). Possums were bled to determine physiological changes, or observed for changes in behaviour and clinical signs of poisoning, then autopsied after death to assess pathological changes. The mean time until death, mean duration of illness, and the type and prevalence of changes differed between poisons. On average, death occurred 18 minutes after cyanide, 11.5 hours after 1080, 18 hours after phosphorus, 9 days after cholecalciferol, and 21 days after brodifacoum poisoning. Main signs included retching during an 8 hour illness period after 1080, restlessness and a crouching posture for 16 hours after phosphorus, inappetence and listlessness for 47 hours before death after cholecalciferol, and listlessness and abnormal postures for 6 days before death after brodifacoum ingestion. Our ranking method therefore had to allow for comparison between shorter acting poisons with more severe noxious effects and longer acting poisons, sometimes with less severe effects. We tried various methods to rank possum poisons based on the duration, type, prevalence and severity of noxious effects. Based on our final ranking, recommendations are given for the use of possum poisons in New Zealand.

The development of a welfare checklist for captive possums

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Brushtail possums (*Trichosurus vulpecula*) are a managed, introduced pest in New Zealand. As a result, they are the subject of extensive research and large numbers are kept in facilities throughout New Zealand. In the course of our research on possums, we have observed a number of general and treatment-specific sickness behaviours. We aimed to develop a welfare checklist for the general husbandry of captive possums based on these observations. The checklist could also be used to define humane end-points for possum research (typically, points beyond which animals will die, and at which they can be humanely euthanased to reduce suffering). General behavioural and clinical signs seen in sick possums include inactivity, listlessness, depressed reactivity, changed appearance (e.g. ears lowered, unfocused staring, sunken eyes, staring coat, abnormal postures), resting outside the nest and abnormal breathing. A reduction in normal behaviour, including eating, drinking and grooming, eventually leads to body weight loss, dehydration and an unkempt coat. Comparative behavioural changes observed in possums given mitigating drugs often supported our interpretation of these behaviours. For example, analgesics given with certain poisons appeared to delay the onset of abnormal postures, suggesting that these are pain-related in possums, as in other animals. We developed a welfare checklist which has been used successfully in our facility to develop new humane endpoints. In the past we have relied solely on body weight loss, but now we use a suite of indicators to specify endpoints at which possums are humanely euthanased. We suggest our checklist could be adapted for use in other possum facilities throughout New Zealand.

Effect of stage of lactation and breed on how dairy cows accept foster calves

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We examined at what time after separation from their own calf dairy cows best accepts four foster calves, and if there are differences between two breeds in their ability to accept foster calves. In total 48 cows, 24 Swedish Red and White (SRB) and 24 Swedish Holstein-Friesian (SLB) were used. They were tested at four different times after separation from their own calf 1) directly 2) four days 3) 30 days and 4) 180 days after (n=6 cows/treatment). Twelve groups, with two calves of each breed were used to test the cows, which were loose in the pen. Each group met four cows of the same breed from different treatments in a random balanced order during 29 h. Behaviours were recorded with direct observation the first and last two h, using one-zero sampling at 3-min. intervals. The behaviours were tested statistically with ANOVA. There was no significant effect of the different stages of lactation. SRB cows sniffed the calves significantly more than SLB cows during both observation periods ($p < 0.05$). Aggressive behaviour did not differ between the two breeds. Two SLB cows were so aggressive that they had to be tied immediately, and were excluded from further analysis. Seven cows (2 SLB, 5 SRB) were so aggressive that they had to be tied between observation periods. Cows that were tied between observation periods butted the calves more during the first observation than the cows that were kept loose ($p < 0.001$). Calves suckled less on cows 180 days after than on cows that were taken directly or four days after separation from their own calf ($p < 0.05$). The SRB calves suckled and tried to suckle the cows more than the SLB calves ($p < 0.001$; $p < 0.05$). It is concluded that dairy cows of both breeds and from different stages of lactation accept alien foster calves equally well.

Sow-piglets recognition in early postpartum period

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Based on olfactory cues, sows can discriminate their own one-day old piglets from alien ones. Based on previous results, we concluded that the early recognition is probably mediated by the individual smell of each piglet rather than by some smell which is shared by the whole litter. Consequently, we investigated how is the recognition modified by the presence of visual and acoustic cues. We used twenty sows individually housed in farrowing pens. Parturitions were induced in two sows on the same day. From each litter four piglets were selected after birth. For the next 24 hours, two of them (Own Nonsniffed) stayed with the litter, but were prevented to go near mother's snout. Two other piglets (Alien Sniffed) were suckled by their mother, but between nursings, they were transferred into the pen of the second sow, where she could sniff them through a wire mesh partition. At the end of manipulation period, each sow was subjected to two testing situations: first, a preference test with anaesthetized piglets, the results of which were reported previously. Second, to three 2.5 min preference tests in which the following combinations of vigilant (vocalizing and moving) piglets were used: Own Control vs. Alien Control; Own Control vs. Own Nonsniffed and Alien Control vs. Alien Sniffed. The interest of the sow in these two piglets and her accompanying grunting rate was recorded. In none of the three tests did the sows show a preference for a specific type of piglet (Own Control vs. Alien Control; duration of interest, 22% vs. 19% of 2.5 min., grunting frequency, 39 vs. 36 grunts per 2.5 min.; Own Control vs. Own Nonsniffed: duration of interest, 17% vs. 20% of 2.5 min., grunting frequency, 41 vs. 42 grunts per 2.5 min.; Alien Control vs. Alien Sniffed: duration of interest, 22% vs. 12% of 2.5 min., grunting frequency, 55 vs. 28 grunts per 2.5 min.). This is in contrast with the previously reported results, in which the sows showed a significantly higher frequency of interest for Own Control than for Own Nonsniffed and Alien Control piglets. We conclude that in the presence of visual and acoustic cues from distressed piglets, sows on the second day post partum do not distinguish between own and alien piglets, even though they are potentially able to do so based on olfaction.

Thermoregulation in deer during transport

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Little is known of the vulnerability of deer to heat stress, or of successful techniques to ameliorate thermoregulatory challenge during transport. This study aimed to quantify the body temperature (T_b) profiles for undisturbed deer at pasture and during transport (with and without additional cooling). Fifteen non-pregnant mature red deer (*Cervus elaphus*) hinds (allocated to three groups) were used during summer. T_b was recorded at 5 minute intervals for 24 h each day for the duration of the 14 day study using an intravaginal sensor and data logger (Vemco MiniLog-Tx). Ambient and black bulb temperatures and relative humidities (RH) were also measured in the field and in the transporter. The three groups received three treatments in a 3 x 3 Latin square design. The treatments were: remain in home paddock, transport (4 h) in the front pen, and transport (4 h) in the rear pen. During the experimental period, the animals were transported on Days 3, 5 and 7 (during which the front pen was sprayed with water for 60 min) and on Days 10, 12 and 14 (when the rear pen was sprayed for 60 min). On other days the deer were at pasture. Mean ambient temperatures in the transporter and at pasture were about 25 degrees Centigrade and the RHs were about 60%. Undisturbed hinds at pasture exhibited a circadian rhythm in T_b with an amplitude of 1.3°C, peaking from mid to late afternoon until 0300 h. Overall, mean T_b was 38.2°C. Handling and loading deer onto the transporter increased T_b ($p < 0.05$) from 37.9 to 39.1°C. As travel proceeded the T_b declined by about 0.5°C. Sprinkling animals with water had no significant effect on T_b . Overall, the mean T_b of transported animals was significantly ($p < 0.05$) elevated (by 0.8°C) throughout the journey and returned to normal levels 60 min after unloading. Handling animals prior to transport had the biggest influence on T_b which did not return to basal values until after return to pasture. Sprinkling with water for 60 min was ineffective in assisting thermoregulation, but there was little need for additional cooling as there was little evidence of heat stress (as body temperatures were below 40°C) in the transported animals.

Does my feather pecking behaviour affect yours?

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Feather pecking is a particular problem in loose-housing systems where many hens can be affected by few feather peckers. It is an even larger problem if it spreads throughout the flock. If this occurs by social disruption within the group or imitation of one bird by another then we would expect that hens of a low feather pecking (LFP) strain would feather peck more when they were housed with a high feather pecking (HFP) strain than when they were housed with only low feather peckers. The environment (cages or litter-floor pens) might also have an effect on the spread of feather pecking. 330 hens were divided between three treatments: all from a HFP strain, all from a LFP strain, or half of each strain. Numbers of gentle and severe feather pecks given were recorded at 13-15 weeks (3 treatments x 5 pens; 3 treatments x 10 cages) after which hens from mixed groups were discarded and the remainder were put into new groups. Behavioural observations were carried out when these 234 hens were 30-32 weeks (3 treatments x 3 pens; 3 treatments x 8 cages). In only cages, and only at 30-32 weeks old, LFPs housed with HFPs gave significantly more gentle feather pecks ($p = 0.005$) than LFPs housed alone. Conversely, HFPs housed with LFPs gave significantly fewer gentle feather pecks ($p = 0.003$) than hens who were housed with only HFPs. No significant effects on severe feather pecking were found in either the pens or cages. Despite large numbers of gentle feather pecks there was no significant effect in pens at any age. Thus, there is evidence that gentle feather pecking behaviour of older hens in cages is affected by feather pecking behaviour of others, but there is no evidence of an effect in pens or on severe feather pecking.

Supplemental Vitamin C and a Beta-glucan product enhance dairy calf welfare

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In the US, dairy calves are removed from the dam within hours of birth and placed in new environments. Calves may become ill and lose weight indicating that calf management is a serious animal welfare and production issue. The objectives of this study were to evaluate the effects of 2 dietary supplements on health, growth, immune function and behavior and to determine the efficacy of these supplements to replace antibiotics in milk replacer. Forty-eight Holsteins dairy calves were removed from dam within 4-12 hours after birth, fed pooled colostrum for three days, and then placed on 1 of 4 supplements added to calf milk replacer; Control, Beta-glucan, Vitamin C, and Beta-glucan plus Vitamin C. Calves were fed 10 percent of their body weight per day in 2 equal feedings. Vitamin C was given at 250mg per feeding and Beta-glucan product was added at 2.5 percent of dry milk replacer. Animals were video taped continuously for 6 weeks. Weekly body weight, body temperature, and blood samples were taken for 6 weeks. Fecal scores were recorded daily. Weekly hematology measures included hematocrit and fibrinogen. Hematocrit showed a main effect of Beta-glucan. Interactions for Vitamin C and Beta-glucan were significant ($P < 0.01$) for body weight change percent hematocrit, fecal scores, and fibrinogen. Analysis of behavior data ($n=24$) showed that animals receiving both supplements spent less time standing ($P < 0.10$) at week 2 (9 vs 18 percent) than Vitamin C only, and less time standing than Beta-glucan only (29 vs 14 percent) at week 5. Calves given Beta-glucan or Beta-glucan and Vitamin C spent more time with their head in the bucket indicating more interest in feeding ($P < 0.05$). This study shows that supplemental Vitamin C and Beta-glucan synergistically improve welfare, weight gain, and health status of dairy calves.

Circulating beta-endorphin, ACTH and cortisol levels of dairy cows after machine milking

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Previous studies demonstrated an increase of plasma cortisol levels 5-15 min after milking. Recently it was found that cortisol increase is higher after manual than after machine milking. On these basis, aim of this study was to evaluate beta-endorphin, ACTH and cortisol responses to machine milking in dairy cows to better evaluate the degree of stress related to this procedure. The research was carried out on 11 Friesian dairy cows, 3-10 years old, at the 5th month of pregnancy. The cows were usually milked twice daily (08:00 a.m. - 3:30 p.m.) and blood samples were obtained before and immediately after both milking (in order to appreciate any influence of circadian rhythm of these hormones) on 4 different days. Beta-endorphin levels were unchanged after morning milking (-1.45%), while increased after afternoon milking (+5.27%); no differences between morning and afternoon basal levels were found. ACTH basal levels were higher in afternoon than in morning (+14.5%), but no significant differences were detected in response to the two milking. No correlation between beta-endorphin and ACTH were found. Basal cortisol levels were significantly higher in afternoon ($P < 0.001$) than in morning, likely as an effect of circadian rhythm. A significant increase of cortisol levels in morning (+23.22%; $P < 0.05$) and a significant decrease in afternoon (-30.96%; $P < 0.01$) after milking were detected. These results suggest that machine milking, usually adopted in these subjects, does not induce modifications on beta-endorphin and ACTH levels. On the contrary cortisol response is significant, although its modifications are depending on the sampling hour. The decrease of cortisol levels after afternoon milking could be an effect of a negative feed-back on hypothalamus-hypophysis-adrenocortical axis due to the overlapping of the highest afternoon basal cortisol level and the response to morning milking.

Assessing and improving the welfare of farm mink by selection for explorative behaviour

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The welfare of production animals may be improved by adapting the production system to the needs of the animals and by selecting those animals best adapted to the production system. As standard production systems provide a nest box and ample cage space for the mink, no significant welfare improvements are readily available for further adapting the housing system to the need of the mink. Instead, a temperament test (the stick test) providing an efficient tool for selection of those animals best adapted to the production system is now being applied for use under commercial farm conditions. By inserting a stick into the cage the test classifies the mink as timid, explorative or aggressive. The explorative temperament indicates better adaptation and better welfare than the timid or aggressive temperament. The stick test has been developed and used for selection under experimental conditions for 11 generations. The temperament classified in the stick test is positively correlated to the mink's reaction in novel object and intruder tests as well as to cortisone response to handling. Therefore, the test reflects the general temperament of the mink rather than the specific reaction towards humans. In order to facilitate the use of the stick test in practice, the test has been simplified and implemented on six Danish mink farms. On average, 62% of 1800 adult mink females were characterised as explorative in August, ranging from 40 to 74% on the six farms. In February, 55% of 1300 9-month old female kits were characterised as explorative (farm range from 32 to 75%). In order to improve the welfare at farm level, a selection line of approximately 200 explorative females has been established on each farm for the mating season in March 2000. The effects of the behavioural selection in the first generation will be presented at the congress.

Response of cull dairy cows to pre-slaughter management

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Cull dairy cows are a high-risk category of livestock for welfare problems, as they generally arrive at an abattoir in poor body condition. A study was carried out to describe pre-stunning behaviour and characteristics of cull Holstein cows. This study investigated the effects of (1) reducing the noise of air-exhaust valves on vertical doors in the single file chute, and of (2) a workshop with abattoir staff aimed at reducing electric prodding of cows. Seven hundred and fifty two cull Holstein cows were observed as they were handled in the stunning-box area just prior to slaughter. Using zero-one sampling across all treatments average frequencies of 58.4% balking, 50% struggling, 29.4% attempting to turn around, and 36.6% trembling ($n=752$). Exsanguinated blood showed an average packed cell volume (PCV%) of 35.8 ± 0.24 ($n=625$), 22.2 ± 1.0 ng/ml plasma cortisol ($n=209$). The *longissimus dorsi* muscle of the carcasses showed an average pH of 6.76 ± 0.01 at 45 min post mortem ($n=534$), and 6.14 ± 0.01 at 72 hours post mortem. Forty-one point eight percent of the cows were emaciated (Body Condition Score=1, $n=744$), 82.4% were lactating, 15.6% were pregnant, and 65% of the carcasses were classified as dark-cutters (pH ultimate > 6.0). The installation of mufflers to reduce noise of air-relief valves on hydraulic doors in the chute did not make a detectable difference in the cows' behaviour ($P>0.10$). A workshop on humane handling of cattle appeared to lead to a reduction in the use of the electric prod from 96% to 67% ($P<0.0001$, $n=752$). It is suggested that initial training of staff at an abattoir led to marginal yet positive improvements in the welfare of cull Holstein cows during the immediate pre-slaughter period.

Behavior of young pigs in response to isolation or transport stress

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Due to health related issues piglets may be weaned at an early age and transported to specific environments at distant locations. It has been reported that younger animals experience less stress due to transportation and that they recover faster than older animals but few studies have been conducted to study the behavior of young pigs in response to transport. Eight sows and their litters were used in this study. Three male and 3 female pigs (7 to 10 d of age) were selected from each litter and randomly assigned to treatments. Treatments were: control (C), pigs left in the farrowing crate with the sow (N = 16); isolated (I), pigs moved to a separate building and placed in a straw-bedded kennel for 8 hr without access to creep feed and water (N = 16, 0.08m²/pig); and transport (T), pigs placed in a straw-bedded kennel and transported for 8 hr (N = 16, 0.08m²/pig). Behavior was continuously video recorded in each of the three environments. Data were analyzed using GLM within SAS. Transported pigs spent more time lying than C or I (50.6, 70.3 and 84.2% for C, I and T respectively) and time spent lying increased over time for C but decreased for I and T pigs ($P < .001$ for time by treatment interaction). Standing behavior increased over time for all three treatments ($P < .05$). Only C pigs showed nursing or agonistic behavior ($P < .01$). Transported pigs preferred to lie down during transport. Transport also caused a reduction in ability to maintain body temperature and weight without impacting glucose levels. Isolation of pigs at 7-10 d of age appears to play a large role in transport stress.

Group-housing systems for gestation sows: welfare and reproduction

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Animal welfare has become an increasingly important issue for the Danish pig industry during the last decade. In the late 1980s pigs were primarily housed in confinement systems. However, in the 1990's the public has expressed increasing concern about pig welfare. This has led to development of new housing systems allowing the animals more freedom to move as well as their application in commercial practice. These developments have been fortified by national legislation requiring that pregnant sows be kept loose in groups, while weaners and finishing pigs must have access to rooting materials and a cooling system. Over the last decade a large number of our studies have provided information regarding housing details that are important for animal welfare and production. Research of sows in group-housing systems indicates that space allowance, control of feed intake, grouping procedure and pen design are important constituents of management and pen design. Several on-farm comparisons of time of group formation have demonstrated that number of total born might be reduced by .5 pig/litter if sows are mixed in groups earlier than 4 weeks after mating. Apparently, there is interaction between type of group and production. Thus, we have found that litter size is compromised in small static groups (same number of animals throughout gestation), but not in large dynamic groups. Pens for large dynamic groups are characterized by providing more space for escape with respect to aggressive encounters. Moreover, sows are normally fed individually via an electronic sow feeding system or via feeding stalls. Fulfillment of the sows' nutritional requirements as well as reduction of stressors, which might affect implantation of fetuses should therefore carefully be considered when designing accommodations for group-housed gestation sows.

Preference for the middle teats in the mexican hairless piglets

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Literature has revealed that there is a tendency for the piglets on the more anterior end of the udder to make particularly large live weight gains during the suckling period, leaving the middle teats for the smaller piglets. The present is the first study made on the Mexican Hairless swine teat order behaviour and preference. This porcine breed is under the risk of extinction due to the constant introduction of genetically improved breeds, their litter size is not very large (2-10), and newborn piglets are not very heavy (1.06 Kg. average). Observations were made on 30 first and second parity sows and their litters. Latency to first sucking (LFS) and observations of teat order were done every six hours during the first three days post-partum, and then one every week until weaning, making a total of 16 observations per piglet. Only the primary teat was included in the analysis if a piglet regularly sucked more than one teat, which was common to see since there were surplus teats because litter size was not large. The teats were numbered from anterior to posterior. LFS was 10.8 min., a shorter period than reported by others. Teat order was relatively stable after 48 hours, the heavier piglets showed a marked preference to suckle the middle teats, 4 and 9. We conclude that teat order establishment of the native Mexican Hairless is similar to that of the improved white breed swine, nevertheless their preferred teats were not the anterior but the middle ones. Therefore, piglet performance prediction on the basis of information about the teat position is not easy in this breed. Further analysis will let us know if there is a relationship between suckling position and weight at birth and 4 weeks.

Behavioral responses of Mediterranean termite *Reticulitermes lucifugus* (Isoptera: Rhinotermitidae) under presence effects of ant *Pheidole pallidula* (Hymenoptera: Formicidae)

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Ants may play an important role in limiting termite distribution through predation, competition for nesting sites and disruption of foraging activities. In this study, we examined the effects of *Pheidole pallidula* Nyl. on the foraging and survival of subterranean termite *Reticulitermes lucifugus*. Bioassays were performed in a three chambered apparatus consisting of three plastic vials connected by 5 mm diameter tube, 10 cm in length. Fifty termites (workers and soldiers) were introduced into the first vial contained 5g of moist sand some hours before the experiment; in the second vial we put 2.5 cm diameter No. 3 filter paper as a food source for termites. After 1 hour, 20 ants (only minor workers) were added to the third vial. The presence of ants caused greater mortality of termites when compared with control experiments (with no ants). Ants limited termite foraging in 70% of trials, although, ant mortality was high. Termites were able to build physical barriers with sand to avoid invasion by ants.

Analysis of rat behavior in the elevated plus maze: Risk assessment as an anxiety parameter evaluated by pharmacological manipulation

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Anxiety models often lack behavioral validation due to infliction of stronger stimuli than necessary to induce anxiety, or utilization of few parameters that, regardless of behavior significance, are sensible to changes with benzodiazepines. Using rats submitted to low stress procedure (vehicle i.p. injection), we aimed at quantifying general activity and four behaviors in an elevated plus maze (EPM), with subsequent factor analysis to determine relationship among measures. I.p. treatment with pentyleneetetrazole (PTZ: 1, 3, 10 and 20mg/kg) and diazepam (DZP: 0.3, 1 and 3mg/kg), comparing with control groups (saline and DZP vehicle), was done to check pharmacological parameters modulation. Wistar rats were observed in the EPM for 5 minutes, during which the occurrence and duration of behaviors (risk assessment, head-dipping, rearing and grooming) were scored. Automatically-measured parameters taken with EthoVision (Noldus) tracking system were distance moved and time moving, and the conventional EPM measures: time spent and number of entries in each zone. General activity didn't change with any drug treatment. Absolute time in closed arms was enhanced by PTZ 20mg/kg, while no changes in the percentages of time spent in open and closed arms, under any treatment, were detected. Rearing in the EPM was reduced by PTZ 20mg/kg, as well as percentage of time rearing in closed arms under DZP 3 mg/kg. Head-dipping time in the EPM was reduced by PTZ 20mg/kg. Grooming was reduced only by DZP 3mg/kg. Risk assessment, which loaded on two factors where also loaded conventional measures of anxiety, was enhanced by PTZ 3, 10 and 20mg/kg, and reduced by DZP 1 and 3mg/kg, being the most sensible variable to anxiety-modulating drugs. This investigative behavior detected both anxiolytic and anxiogenic effects of drug doses that weren't able to produce changes in conventional measures, thus confirming the importance of ethological measures to the study of anxiety.

The effects of rearing experience on the development of feather pecking and of substrate preferences in laying hens

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Vestergaard and Lisborg (1993, Behav., 126: 291-308) proposed that chicks acquire substrate preferences during an early 'sensitive period' and argued that, if a suitable substrate was absent during this period, chicks may develop alternative preferences for pecking at feathers. Indirect support is provided by studies that show reduced feather pecking in birds given early access to substrates that allow foraging or dustbathing behaviour. However, the 'imprinting' hypothesis has not been tested by the provision of substrates at other ages, or by controlling for effects of substrate familiarity. We housed 144 birds in pairs from Day 1 to Day 210 on wire floors and provided them with shavings litter at different ages, and for different durations, by allocation to one of 12 rearing treatments. Pairs were generally taken as independent units for analysis. Control birds, reared solely on wire, performed significantly more feather pecking as adults (3.92 pecks per hour) than every other treatment group (combined mean 0.31 pecks per hour). Thus, exposure to shavings for a minimum period of 10 days at any stage during the rearing period was protective. From Day 211 substrate preferences were examined in a 10 day trial of alternate exposure to shavings or straw, counterbalanced for order. Rearing treatment affected substrate preference for dustbathing ($F=2.41$; $P<0.01$) but not foraging. Regression analysis showed that exposure to shavings at approximately Day 60 was an important descriptive factor ($F=8.0$; $P<0.01$). Birds that received shavings before or after Day 60 were less likely to dustbathe on shavings in the test. Duration of exposure was not important, and the time since exposure and testing was of minor significance. The rate of performance of dustbathing over the 10 day test period was relatively constant in all groups, suggesting the effects were not transient responses to novelty, or abnormally high internal motivation. These results show that stable substrate preferences in laying hens are not determined solely by an 'imprinting' process in the first few days of life.

Breed and feed effects on the range behaviour of broiler chickens

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The present experiment investigated the use of outdoor areas by two breeds of broilers, Ross 208 (ROSS), and LaBresse x LB6 (LAB), housed as day-old (day 1) in groups of 125 birds (13.2 birds/m²). They were fed one of two feeds *ad libitum* (C or V, with V having higher protein:energy ratio and more varied composition than C) in a 2x2 factorial design. Four replicates were carried out, and after 42 days, 102 birds from each group were moved to other housing (3x5 m²) with two feed troughs and nipple-drinkers, and free access to a grass covered outdoor area (9x22 m²). The birds were observed on two consecutive days every second week seven times a day using three time samples within an hour each time (126 times in total). Feather condition on the back was scored twice, and gait once. More LAB than ROSS birds were observed outside (median 36.3% and 11.1%, respectively); LAB went further away from the house entrance, and more birds were standing (all $p < 0.001$) than ROSS. Independent of breed more birds were outside at all times when fed the C feed ($p < 0.001$). Only LAB were found to feather peck, with more birds affected on day 64 than on day 80 (10.9 vs. 6.0% \pm 0.5; $p < 0.05$) and on feed V than on feed C (11.2 vs. 5.7% \pm 0.5; $p < 0.05$). LAB had better gait scores (scale 0-5) than ROSS (0.25 vs. 2.18 \pm 0.04 on day 79; $p < 0.001$). On day 84 ROSS birds weighed 3890g and 3791g on feeds C and V, respectively, whereas LAB weighed 2573g and 2753g (interaction $p < 0.001$). Deep pectoral myopathy was found in 3.9% of the ROSS birds at slaughter on day 84. Feed composition affected the range behaviour across breeds. ROSS birds are unsuitable for 12 weeks growth in traditional free-range production.

Electronic sow feeding – start of feeding cycle

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Danish pig producers have shown a growing interest in alternatives to confinement of gestation sows over the last few years. Simple systems as well as more advanced systems such as electronic sow feeding, are of particular interest. Simultaneous feeding of sows is not possible in pens with electronic sow feeding, thus increasing the risk of confrontations at feeding time. Manipulating the feeding cycle might reduce aggressive encounters. The following feeding cycles were studied in a gestation unit with 80 sows and two feeding stations during a period of 8 months: start at 04.00 am (high feeding motivation) and start at 10.00 pm (low feeding motivation). Sow behaviour was recorded for a total period of 72 hrs. Recordings were carried out shortly after the dominance hierarchy was considered being stable on day 8, day 10 and day 12 post mixing. For each feeding cycle 18 video recordings were sampled and six of those recordings were randomly selected for data analysis. The frequency of confrontations was reduced by 15% ($p < 0.05$) when the feeding cycle was initiated at 10.00 pm as compared to 04.00 am. When the feeding cycle started at 10.00 pm, the behaviour pattern was changed. Sows were more active during the night and morning than during the morning and afternoon. Thus, the sows' main resting period took place in the daytime. Most confrontations (90%) occurred at the entrance of the feeding stations. It is therefore necessary that the design of the waiting area at the feeding stations be given a high priority with respect to space allowance and options for escape. It is recommended to start the feeding cycle at 10.00 pm while sows are highly motivated for resting in order to reduce competition and aggression associated with feed intake. As a consequence of lower aggression risk of injuries might be minimized.

Effects of exhibiting puppies in an acrylic pen in a nursing home and evaluation of reactions of the elderly residents

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Exhibiting puppies in a nursing home is useful to improve the quality of life of elderly residents. Expected effects are reduction of loneliness and anxiety, reduction of wandering, recreation, increase of communication and prevention of physical and mental weakening. For effective exhibition, it is necessary to know a pattern of responses of an individual elder to puppies, and to set a goal to be helped. The purpose of this study is to establish methods to exhibit puppies and to evaluate the pattern of the response of the elders to the animals. Three puppies were exhibited in a colorless transparent acrylic pen of 180W x 65D x 60Hcm to limit their unconstrained actions, and were often used to contact or play with the receptive elders. Responses to the puppies of the 81 elders and the communications among the 100 residents (average age 83.4) were recorded on video and the recording sheets. Responses of each elder were evaluated according to the seven categories of actions to the puppies, i.e. looking, touching, holding on the lap, holding in the arms, giving a food to the puppies, playing with puppies and communications in five degrees by the level of their expressions and motions. The acrylic pen was proved to be an useful tool to exhibit puppies. Violent motions such as running or fighting were not observed. Eighty percent of the 81 participants reacted in a friendly manner when looking at the puppies. Only 15 elders who have linking for dog played with puppies using toys, but their plays were very attractive for other participants. Accumulated data of the response pattern of the same elder make the helpers possible to pursue the change for long term.

Avoiding infanticide and deadly fights in capybaras (*Hydrochoerus hydrochaeris*) breeding in captivity

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The capybara (*Hydrochoerus hydrochaeris*) is bred in captivity for its meat and skin. For this, its high birth rate is an advantage, but often the infanticide rate (within 12 hours of birth) in captivity is excessive. High infanticide rates occur when groups contain females that have not been raised together. They live together without apparent conflict until they give birth when each kills other's offspring. Also, on reaching ten months of age, males of different origins fight – often to the death. The following technique identifies the categories of individuals in a herd. We observed a group of 4 male and 14 female capybaras on a private farm (Villas de São José, Itacaré, Bahia, Brazil) in two-hour sessions totaling 20 hours of observations. The locations of all 18 members of the group were recorded every 15 minutes using a scan-sampling method. The frequencies when individuals were close to others were determined by the LIPGMA method (cluster analysis) through SAS software, version 6.08. The proximity analysis was chosen because capybaras form cohesive, non-aggressive groups in the wild. The animals lived in sub-groups within this herd, which was formed of individuals from different places and this resulted in conflicts. We conclude that, with a little training, the farmer can analyze group behavior based on few observations and separate the animals when necessary to avoid these conflicts.

Behaviour and salivary cortisol of captive dolphins (*Tursiops truncatus*) in two aquaria: a descriptive study

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Dolphins in captivity have to cope with severe changes in their physical and social environment. So far, there are few studies on the welfare of these animals but no studies have identified specific behavioural problems. Although there are some reports on plasma cortisol of this species, no information on salivary cortisol profiles as a non-invasive technique to measure stress in captive dolphins is available. Six bottlenose dolphins were observed daily during a month in two different aquaria in Mexico City (4 dolphins in aquarium A and 2 in aquarium B). Aquarium A has four show sessions a day and aquarium B has two sessions a day. Direct observations (60h) distributed in 30 days were used to record individual and social behaviours. During this time, saliva was collected non-invasively from the four dolphins that responded to previous training in order to determine a profile of salivary cortisol. Although individual time budgets were similar in all dolphins, the counter-clockwise bias in swimming direction was stronger in the dolphins kept in aquarium A. The frequency of jumps and hops was higher in aquarium B. There was a tendency for lower cortisol levels as time playing with objects increased. The only dolphin sampled in aquarium B had the lowest profile of cortisol. It is possible that swimming in one direction and less jumps can be related to poor welfare conditions. Further studies with bigger samples are needed to better understand the relationships between behaviour and adrenal in captive dolphins.

Circadian water intake in pigs: prediction of disease and stressors

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A uniform water or feed intake pattern is required for assessment of changes in pig health and pig well-being. Under practical conditions it is complicated and expensive to measure animal water and feed intake accurately, while water and feed disappearance, i.e. consumed and wasted water, might be assessed without difficulty. Therefore, water and feed disappearance were measured and monitored continuously in pigs from 4 to 11 weeks of age. The study comprised three herds and 18 batches of pigs. Water and feed disappearance was measured electronically and data were transferred to a computer for time series analysis. Management interference such as change of diet and treatment of pigs were recorded daily in an electronic logbook. The results indicated that water disappearance was associated with a distinct circadian rhythm. Water disappearance rate peaked between 5 and 6 pm and was lowest between 3 and 4 am regardless of herd and housing system. The circadian pattern persisted throughout the growing period while total water disappearance rate increased. A similar pattern was not evident for feed disappearance, which could not be recorded as accurately as water in the current study. Water disappearance rate was then expressed as a curvilinear trend by computing data as 24 hour rolling averages of hourly water use. Comparison of changes in water disappearance rate from the curve with logbook data indicated that gastro-intestinal disorders could be predicted approximately 24 hours before symptoms of diarrhoea were observed in pens. Changes in water disappearance rate were also associated with blockage of feeders, movement of pigs and tail biting. This study indicates that stressors and disease in pigs may be predicted from changes in water disappearance, which might provide useful information for caretakers. Therefore, an electronic management system (FARWATCHO) based on continuous monitoring of water disappearance has been developed.

The influence of early social experiences of piglets on response pattern to social and non-social challenges

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Cross fostering of piglets is frequently used in commercial production. This procedure may increase agonistic interactions during the early suckling period. These early social experiences may change the behavioural strategy of piglets when coping with social and non-social challenges. These aspects were investigated. The experiment included litters from 28 sows randomly distributed between two treatments: a control treatment (C) and a mix treatment (M), where two piglets from a foreign litter were exchanged with two non-experimental piglets from the mix litters 3 times during lactation (day 5, 10 and 15). In 15 litters video recording around each mixing were made in order to observe teat fight and teat fidelity. At 4 weeks and again at 8 weeks of age three experimental female piglets from each litter were subjected to 2 different social tests and 2 non-social challenge tests (tonic immobility test, open field/novel object test). No significant differences in neither teat fidelity nor teat fights were found. However, the probability of piglets to attack an intruder pig in a social test was significantly higher for piglets from mix litters than from control litters at 8 weeks of age ($\chi^2=5.3$, $P=0.02$). Also the probability to attack a smaller resident pig in the residents home pen was significantly higher for piglets from mix litters than from control litters at 8 weeks of age ($\chi^2=5.4$, $P=0.02$), whereas it only tended to be higher at 4 weeks of age ($\chi^2=2.8$, $P=0.08$). In the tonic immobility test, the probability of responding with immobility was significantly lower for mix litters than for control litters ($\chi^2=4.1$, $P=0.03$). No significant treatment differences were found in the open field/novel object test. In conclusion, the mix treatment seemed to change the coping pattern of the piglets towards a more active pattern.

Effects of different housing conditions and artificial weaning age on behavioural, physiological and production-related parameters in adult female mink (*Mustela vison*)

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There is substantial evidence that the abrupt artificial weaning procedure imposed on domestic animals negatively influences the welfare of both mother and offspring. In farmed mink, it has been shown that artificially weaning kits at 6 weeks of age causes development of abnormal behaviours such as stereotypies and tail-biting. In addition it has been demonstrated that family housing (no artificial weaning) reduces the welfare of adult female mink. The present contribution deals with behavioural, physiological and production-related parameters in traditionally (1-room cages, $n=74$) or alternatively (3-room cages, $n=83$) housed adult female mink, when their kits were weaned at either 6, 8 or 10 weeks of age. The results showed that the number of kits born and weaned was not affected by housing system ($P>0.05$). In both housing systems, weaning at 6 weeks of age caused a greater weight loss in the mother during the following 2 weeks than in mothers which continued to be housed with their kits ($P<0.05$). Weight loss in the adult female from the time of mating until the kits were aged 6 weeks was greater in the traditional system than in the alternative system ($P<0.01$). In addition, the body weight of the mother was significantly reduced in the traditional system compared to the alternative system, when the kits were weaned at either 6 or 10 weeks of age ($P<0.05$ and $P<0.005$). Production-related parameters such as skin size, length and quality at pelting time were not significantly affected by housing system ($P>0.10$). Behavioural data from 6 months of weekly scanning observations are being analysed and will be presented at the Congress. The preliminary conclusion is that early weaning of mink kits negatively affects the adult female irrespective of housing system, and that the alternative housing system appears to reduce the negative consequences of weaning on the mother, irrespective of weaning age.

Social behaviour and endocrine correlates during intrabreed pair encounters in a fighting breed (Héréns) and a dairy breed (Brune des Alpes) of cattle

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Cattle of the Héréns breed (H), have been empirically selected for fighting and dominance ability and constitute a unique opportunity to study correlated responses. As part of a more comprehensive study concerning behavioural and physiological differences between this breed and a non selected dairy breed (Brune des Alpes, BA), 36 pair encounters were studied in each breed. Two unfamiliar groups of 6 H and two unfamiliar groups of 6 BA were used. Each cow met successively each cow of the other group at one day intervals. The number, duration, and latency of fights, and the number of agonistic and non agonistic acts were recorded for 15 minutes. Blood samples were taken at rest, 15 and 30 minutes after the end of the encounter. No differences were found between the two breeds concerning fighting behaviour, but H cows tended to be more aggressive (median number and interquartile range of butts and threats per animal : 7.5[4.5, 9.5] vs 4.5[3, 5.5], $U=35$, $z=-2.14$, $p=0.06$). By contrast, BA cows sniffed each other more often than H cows (5.5[3.5, 11] vs 14[9.5, 19.5], $U=31$, $z=-2.37$, $p=0.03$). Dominance value was positively correlated with aggressiveness in H cows ($R=0.71$, $p=0.009$) and negatively correlated with submissive behaviours (avoidances and withdrawals) in BA cows ($R=-0.74$, $p=0.006$). After each encounter, there was an increase in cortisol level that was not significantly different between breeds. In BA cows only, dominance value tended to be negatively correlated with plasma cortisol level increase ($R=-0.54$, $p=0.07$). Selection in the Héréns breed appears to have led to heightened aggressiveness, at least at the time when dominance relationships are established, and may have resulted in changes in factors influencing dominance as indicated by the correlations between dominance value, aggressiveness and avoidance behaviour, which differ between the two breeds.

Effect of Synchro-Mate-B and different calf stimuli on mounting behavior and ovarian activity of non-estrous Zebu cattle

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The effect of Synchro-mate-B (SMB) was measured on the estrous response and the establishment of cyclicity in Zebu cattle using different calf stimuli. Multiparous cows with 30-90 days postpartum were divided in 3 groups. In the first, 32 animals were treated with SMB leaving the calves present (SMB+CP). In the second, 33 cows received SMB and calves separated for 48h allowing fence-line contact (SMB+ CPR). In the third ($n=33$), cows received SMB and calves were removed for 48h (SMB+CCR) with no contact. A control group CG $n=33$ no SMB or calf separation was applied. Blood samples for progesterone assessment were obtained at 11 and 4d prior to SMB treatment and in the 7th and 11th day after average response to estrus. All animals were observed continuously for mounting activity during 72h after SMB implant removal. A difference ($P<0.05$) in estrous response was found between SMB-treated and non-treated animals, in spite of calf management. Cows with SMB+CCR and SMB+ CPR came into estrus sooner ($P<0.05$) (26.5 \pm 2.6 h and 18.1 \pm 4.94, respectively), than those that remained with their calf (40.4 \pm 12.8 h). Cows with SMB+CCR displayed larger ($P<0.05$) periods of mounting behavior (13 \pm 4.4h) in comparison with SMB+ CPR and SMB+ CP (7.4 \pm 1.8 and 8.1 \pm 4.0h), respectively. Furthermore, 80% ($P<0.05$) of the cows in this treatment showed high levels of progesterone after mounting behavior was displayed, in comparison with 66 and 50% in the other two groups, respectively. No difference was found ($P>0.05$) in the number of mounts per hour in estrus. It was concluded that: 1) SMB increases the number of cows that display estrus. 2) Temporary weaning shortens the period from SMB implant withdrawal to mounting activity, and 3) SMB+CCR, increases the length of sexual receptivity and the number of cows that continue to cycle.

Maintenance and proximity behaviour of two groups of llamas

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Despite some information being published on the husbandry and management of llamas there are few detailed studies of their maintenance and social behaviour. A clear understanding of their behaviour is fundamental to providing appropriate systems to keep them in. It is necessary to have detailed knowledge of the social structure typical in the wild, their basic physical requirements and how they adapt to the ecological environment/system in which they evolved. The aims of this study were to investigate the maintenance behaviour of llamas and to assess the social relations between male, female and juvenile individuals within the group in order to determine whether associations exist between individual llamas or not. The llamas studied were kept in two groups on Little Ash Eco Farm, Dartmoor, Devon, UK, as part of a multi-species grazing system. Group 1 comprised 1 male, 6 adult females and 2 crias. Group 2 comprised 1 male, 3 adult females and 1 cria. During the study Group 1 were kept outside at pasture the entire time and observed from September to November 1998, whilst Group 2 were at pasture during the day and housed at night (with access to ad libitum silage and hay) (November 1998 to March 1999). 20 types of behaviour were recorded using a scan sampling method at 15 minute intervals. Maintenance behaviours were subsequently combined into five categories: ingestion, elimination, resting, locomotion and social interaction. Proximity data were also collected by scan sampling at 15 minute intervals, in the form of Nearest Neighbour identity and distance in coded form. There were no significant differences between the frequency of each of the five categories of maintenance behaviour between the two groups (all $P > 0.05$). In both groups the majority of the time was spent feeding. Assessment of types of activity engaged in by type of llama demonstrated that crias spend less time feeding and more time resting and engaging in social interaction than adults. The most frequent distance between two llamas in Group 1 was 5-10m, and it was very rare for an individual to be more than 30m away from another llama. In Group 2 the most frequent distance between two llamas was 0.01-2m. Furthermore, there was evidence of patterns of social grouping and associations between some members of the group.

The effect of lameness on milking behaviour

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Lameness in dairy cows is a serious welfare and economic problem which has progressively worsened over the last twenty years. Behaviour plays an important role in the assessment of welfare of lame dairy cows. However, most studies have focussed on changes in the out-of-parlour behaviour of housed dairy cows. The aim of this study was to examine the behaviour of lame and non lame dairy cattle in the milking parlour, before and after foot trimming/veterinary treatment. 20 lame cows and 20 matched non lame cows were selected. The lame cows were foot trimmed and treated. All subjects had their feet lifted. The cows were observed during the pm (15.30h) and am (04.30h) milking periods prior to treatment (stage 1), immediately after treatment (stage 2), one week later (stage 3), one month later (stage 4) and two months later (stage 5) (10 observation periods). Data comprised Locomotion Score and Body Condition Score (BCS) recorded on entering the parlour, a general posture score recorded whilst standing in the parlour, milk yield (l), milk let down time (s) and behaviour during milking. Eighteen behavioural actions during milking were recorded using the 'all occurrences' method, including leg actions and body and tail movements. Lame cows exhibited lower lameness and posture scores (indicating more lame, more abnormal postures) and lower BCS than non lame cows (all $P < 0.001$). Whilst there was no significant difference in yield, lame cows exhibited longer milk let down times than non lame cows ($P < 0.05$). Lame cows engaged in more weight shifting (WS), hind leg lifting (HL) and total movement (TM) than non lame cows (all $P < 0.001$). WS, HL and TM decreased with time after treatment ($P < 0.001$). Clearly lameness has a significant effect on the behaviour of lame cows in the milking parlour. This study identifies behaviours of potential use for predicting the onset of lameness.

Effect of high ambient temperatures on feeding- and drinking behaviour of laying hens with different water intake

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Ambient temperature is a crucial environmental factor in poultry production. It is assumed that high temperature reduces laying rate by decreased feed intake. There is a high variation of water intake among individual laying hens under moderate climatic conditions which cannot be explained by the requirement for production and maintenance. On the basis of earlier observations it has been hypothesized that high water intake under moderate conditions may be a mechanism to cope with heat stress. In the present study 6 hens with extremely high (H) and low (L) water intake have been selected from a total of 160 hens of a brown layer line. The birds were kept individually in cages, and a commercial layer mash and water were given *ad libitum*. The feeders and drinkers were fitted on scales which were connected with a PC. The feeding and drinking behaviour were recorded continuously. A special program allowed to record feeding and drinking activity as well as the ingested amount of feed and water in 1-minutes intervals. The room was under climatic control. The ambient temperature was adjusted to 18/19 °C at the beginning and raised to 29/30 °C. Feeding and drinking behaviour was recorded for one week under both temperature conditions. The mean daily water intake for the L and H birds was 158 and 242 ml at 18/19°C and 185 and 514 ml at 29/30 °C respectively. Feed intake in the L and H birds decreased for 46 and 7 %, and laying rate for 48 and 10 % respectively. Under 29/30 °C conditions hens of the H type drank more during the dark period, showed more feeding and drinking bouts and shifted from feeder to drinker more frequently as compared to birds of the L type. Water consumption per drinking bout was also higher in the H type hens. Hens of the H and L type may represent two different coping strategies to heat stress: While H type birds use excess water to dissipate metabolic heat, L type hens reduce heat generation by lower feed intake and egg production. The employment of laying hens with higher water intake may be a means to maintain high production under hot climatic conditions.

Assessment of post-weaning biting and licking behaviour and its relationships with production in piglets between 14 and 56 days of age

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Early weaning in piglets can cause serious welfare and production problems as the incidence of redirected behaviour increases in those animals. The aim of this study was to assess the effects of environmental enrichment on the frequency of bites and licking behaviours of piglets weaned at 14 days of age. Behaviour was related to daily weight gain (DWG) and to food conversion (FC) during the 42 days of the study. Two groups (G1=control, G2=enriched) of 43 piglets each, were observed for a total of 120h distributed throughout the 42 days of the study. Group G2 was enriched by introducing nylon ropes, tin cans and rubber tires in the pens. Behaviour sampling was used to record bites and licks to other pigs. The piglets were weighed at day 1 and at day 42 of the study and food consumption during the period of the study was calculated by dividing total food given by the number of piglets in each group. The average frequency of bites and licks performed were significantly lower in G2 than in G1 ($P<0.05$). Food conversion was also significantly different, as G1 needed 1.142 kg of food to gain 1kg of weight, while G2 needed 0.923kg of food for the same conversion ($P<0.05$). On the other hand, DWG was significantly higher in G1 than in G2. Daily weight gain for both groups respectively was 0.532kg and 0.457kg ($P<0.05$). Further analysis is being carried out to determine the relationships of those behaviour differences with physiological responses of stress.

Feather pecking and reaction to frustration in two lines of laying hens

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Feather pecking (FP) causes both economic and welfare problems in laying hens. FP is thought to be redirected ground pecking behaviour. The propensity of individual animals to develop FP seems to vary with other individual characteristics. The objective of these experiments was to compare differences in development of FP and reaction to frustration in two lines of laying hens. For the experiments two lines of laying hens were used: a high feather pecking (HFP) and a low feather pecking (LFP) line. These lines have been selected for productive traits, but showed a consistent difference in FP as well. Twelve groups of five animals, six groups per line, were housed in pens on wood shavings with a perch and two laying nests. Food and water were available *ad libitum*. From 7 to 34 weeks of age, every three weeks behaviour in the homepens was observed. Eight other animals of each line were trained to peck a key in a Skinnerbox for a food reward. The animals were submitted to two sessions of 15 minutes on subsequent days: a control session, where food was normally available and a frustration session, where the feeder was covered with Perspex. Four animals per line were frustrated on day one and rewarded on day two and vice versa. In the homepens, HFP animals showed more gentle ($P < 0.001$) and severe ($P < 0.05$) FP than LFP chickens. LFP birds performed more food ($P < 0.001$) and ground ($P < 0.001$) pecking behaviour. When HFP and LFP animals were frustrated in the Skinnerbox, LFP birds pecked more at the covered feeder ($P < 0.05$) and also tended to show more ground pecking ($P < 0.1$) than HFP birds. HFP animals may prefer feathers for redirected pecking. These experiments indicate that development of FP may be related to the way an animal reacts to frustration.

Ingestive behaviour patterns of dairy cows using out-of-parlour concentrate feeders at pasture

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We know that cows have a distinctive temporal pattern of grazing but is there a complementary pattern of concentrate intake? Four groups of 8 cows, balanced for live weight and milk yield, were continuously stocked at 7cm sward surface height, and offered 8 kg per cow per 24h (commencing 1600h) in as many meals as the cow wished, of either a standard dairy concentrate, sugar beet pulp, bicarbonate treated wheat or protected soya, from automatic feeders situated in each paddock. Only one cow per group could feed at a time. Feeding time and amount eaten were recorded automatically. Feeders were video-monitored continuously on 31 July, 14 August and 28 August giving 96 cow-day records. Concentrate type had no effect after individual cow effects were removed. For 3 records the cows failed to feed, for 11, more than one meal was taken, and for 82, cows consumed 8 kg in one meal during the period 1600-1900h. Duration of this meal did not change over time (mean 24.7 min) but differed significantly between cows ($P < 0.001$, range 20-39 min). Number of revisits to the feeder declined linearly over time ($P < 0.001$) from 2.41 to 0.97 per day. Order of entry to the feeder for the first meal significantly affected number of revisits ($P < 0.001$) (first cow 4.08, last cow 0.83). Order of entry was highly stable over 24 measurement days during August (mean Kendall W 0.593 $P < 0.001$). The last animal ate its first meal on average 175 minutes later than the first animal. In conclusion, cows have a high drive to eat concentrates as soon as these are available. Low ranking cows may be disadvantaged where feeder access is limited.

The behaviour of cows following a total solar eclipse: Shedding new light on the control of diurnal patterns of grazing behaviour

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Studies of the grazing behaviour of ruminants show that there is a recurrent daily pattern of grazing behaviour. Cattle typically have approximately six meals per day, with the longest meal occurring in the 3-4 hour period before sunset. Various researchers have hypothesised that this pattern is controlled by daylight, but this theory is difficult to test with grazing animals under field conditions. The total solar eclipse that occurred across parts of Europe on the 11th August 1999 gave a rare opportunity to test this hypothesis. Twelve lactating Holstein-Friesian dairy cows were divided into four groups of three cows. Each group grazed a 0.96ha grass paddock for seven days before and five days following the eclipse. During this time, the grazing behaviour of all 12 cows was recorded automatically using the IGER Behaviour Recorder. The cows were milked twice daily, at approximately 07:00 and 16:30hrs. The period of total solar eclipse started at 11:11hrs and lasted 2'02". Ambient light levels dropped to below 10 lux i.e. similar to night-time levels. Analysis of the foraging patterns of the cows showed no within-group synchrony of grazing behaviour and therefore individual cows were used as replicates. Technical problems with some of the recordings led to the records of three cows being rejected, and the analysis was performed on the remaining nine cows. Typically, the cows missed a mid-afternoon meal on the day of the eclipse, with the average number of meals being lower on the day of the eclipse compared with the other days ($P=0.082$). The results indicate that even a short period of darkness during the day can affect the grazing patterns of dairy cows, supporting the hypothesis that daylight influences the grazing behaviour of ruminants.

Sows' reactivity towards piglet scream

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Crushing by the sow is a main cause of piglet death. To test the sows' reactivity towards piglets being crushed, "the piglet screaming test" is performed in this field study. The farmer tests sows on the farrowing day or the day after farrowing. Before test, the sow should lie down and the farmer should quietly walk up to the front of the pen. Then the farmer plays a recorded piglet scream during 20 seconds. The strongest reaction showed during the test is recorded in four ordered categories: no reaction, looking, sitting, standing.

Ten herds with pure-bred Swedish Yorkshire sows are included in the study. The sows are housed in farrowing pens without crates. So far, test results from 679 sows with 814 farrowings have been analysed. The most frequent response is looking for the sound. Herd, season of the year and parity significantly influence the response, the reaction being stronger in the first parity. 135 sows have been tested after two farrowings. Their repeatability for test response is 0.25. No significant relation between test response and piglet mortality is found.

Test response	Frequency of test response N=814	% sows vocalising during test N=766	% piglet mortality ¹ 0-4 days ² N=690	% piglet mortality ³ 0-3 weeks ³ N=576
No reaction	190	29.0	8.7	13.0
Looking	323	74.9	8.0	12.0
Sitting	115	93.6	9.5	13.6
Standing	186	92.9	9.5	13.4

¹ L.S. means, corrected for the effects of herd, quarter of the year, parity and litter size

² Mean age 4 days, stand. dev. 2 days

³ Mean age 25 days, stand. dev. 7 days

Leg problems in broilers: A survey of conventional production systems in Denmark

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Skeletal disorders including leg weakness in commercially raised broilers is still a big problem. This survey included 3000 broiler chicks from 30 different producers (10 % of producers in Denmark). One hundred chicks per house per producer reared with continuous lighting regimes were randomly selected for investigation. Each bird was individually evaluated for their walking ability, the development of tibia dyschondroplasia (TD), twisted legs, ammonia burns on foot pads and hocks, crooked toes and for asymmetry measurements. The average prevalence of gait and TD (scores > 0) among chicks were 75.0 % and 57.1 % respectively. Gender and the body weight significantly influenced the risk of developing gait as well as TD problems. An increase in body weight by 100 g significantly increased the risk of TD (OR = 1.26). The average prevalence of ammonia burns, crooked toes and twisted leg was 42%, 32.6% and 37% respectively. However, there was substantial variation in the prevalence of these problems between flocks. The average relative asymmetry was 0.0177 (0.0110-0.0370), 0.0314 (0.0210-0.0708) and 0.0318 (0.0185-0.0638) for the length, the thickness (at the upper joint) and width of the tarsometatarsus, respectively. Significant correlations were found between gait score and TD ($r=0.41$; $P<0.0001$), gait score and crooked toes ($r=0.41$; $P<0.0001$), gait score and twisted legs ($r=0.55$; $P<0.0001$), between gait score and body weight ($r=0.47$; $P<0.0001$) as well as between twisted legs and body weight ($r=0.35$; $P<0.0001$). It is concluded that in conventional production systems the prevalence of leg problems in broiler is very high and their welfare is compromised.

Standing and lying behavior of cattle on two different sloped stall floors

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Comparison of two types of the stall floors were performed based on cows' standing and lying behavior using four cows. One was a commonly recommended conventional floor having downward slope from the front to the end (A stall). Another was a newly proposed floor having upward slope from the front to the center and counter slope in the rear side (B stall). The front part of the B stall was intended to prevent the cow's foreknees from slipping backward. The counter slope of the B stall was intended to prevent the cow's hind foot from slipping outward. The behavior of the tested cow was video recorded every 0.2s. The time ratio of lying in the experiment period on the A stall and on the B stall were 44 +/- 2% and 45 +/- 2% (average +/- standard error), respectively. The mean duration of lying was 86 +/- 4min for the A stall and 92 +/- 4min for the B stall. The time needed for standing up on the A stall and on the B stall were 9.6 +/- 0.26s and 9.4 +/- 0.26s, respectively. These parameters were not significantly different between the two stall floors. The time needed for lying down on the B stall (6.6 +/- 0.10s) was significantly shorter ($p<0.01$) than on the A stall (7.0 +/- 0.10s). The plasma cortisol concentration was 0.96 +/- 0.38 microgram/dl for the A stall and 1.16 +/- 0.38 microgram/dl for the B stall, and was not significantly different between the two stall floors. These results suggest that it is possible to develop more comfortable stall floor than that currently used based on the analysis of dairy cattle behavior.

“Tail-in-mouth” behaviour among weaned pigs in relation to sex, age, weight and group composition

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Male pigs are significantly more often found tail bitten at slaughter as compared to females and weight is thought to be a crucial factor in relation to tail-biting among slaughter pigs. “Tail-in-mouth” behaviour (TIM) among younger pigs is suggested to be the precursor for the damaging tail-biting in older pigs. Hence, the present experiment aimed to elucidate the TIM frequency in relation to sex, age, weight and group composition in weaned pigs. Four groups each of 24 docked, five weeks old weaners were observed. The pigs were divided into three pens, consisting of 1) eight female pigs, 2) eight castrated male pigs and 3) four female- and four castrated male pigs. The pigs were weighed at the beginning (BW) and the end (EW) of the experiment. The pigs were video recorded 12 h one day pr. week, for four consecutive weeks. When analysing the video recordings, the number of TIM as well as the identity of the performer and the receiver of TIM was recorded. The highest frequency of TIM activity (48 %) occurred in the mixed pen. The distribution of TIM in the female pen (27 %) and the male pen (26 %) were significantly lower than in the mixed pen ($P < 0.05$). In the mixed pen, pigs with higher BW, EW and growth rate in average performed more TIM than pigs with lower values (ANOVA, $P < 0.05$). Furthermore, there was a trend for the frequency of TIM to increase with age (ANOVA, $P < 0.10$), but no significant sex difference in TIM was found. In the last week of the experiment, there was a tendency for male pigs and pigs with high BW in the mixed pen to receive more TIM (ANOVA, $P < 0.10$, $P < 0.05$). In conclusion, the highest frequency of TIM among weaners occurred when male and female pigs were penned together and when the pigs had high BW, EW and growth rate.

What do rabbits want? Measuring motivation in laboratory rabbits

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Assessing how hard an animal is willing to work to gain access to a particular resource can be used as a measure of how strong its motivation for the resource is at that time. Ten group housed female New Zealand White rabbits were used to investigate whether or not rabbits would overcome ‘obstacles’ to gain visual contact with a lower ranking rabbit at the end of a runway. These were an air-stream and a water bath which could be increased in air-speed and depth respectively, and a push-door which could be weighted. The air-stream and water bath did not appear to be aversive at the speeds and depths used and the latter were not increased further for practical and ethical reasons. The push-door method was repeated using ‘luxury’ food items (vegetables) and in a control treatment with no reward at the end of the runway. The rabbits pushed through heavier weights for the two resources compared to the control treatment, and for visual contact compared to food. The maximum weights pushed through for visual contact and food were positively correlated with social rank. This cannot be explained by body weight as the heaviest rabbit was low ranking. Possible explanations are that nudging the door was seen as an act of dominance, or it was due to ‘territory’ inspection. This would mean that gaining access to the reinforcer was not the motivating factor. However, although some of the rabbits pushed through the door in the control treatment, the maximum weights pushed were low in comparison to visual contact and food. These weights were not correlated to social rank. The push-door approach shows potential as a method for measuring motivation in rabbits. The use of such a method to assess motivation of rabbits for key environmental features of housing systems could generate recommendations for improving current laboratory rabbit housing.

Behaviour patterns of horses can be used to establish a dominant-subordinate relationship between man and horse

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The aim of this work was to point out the behavioural patterns of a dominant horse that man can assume to set up, with horses, a social hierarchy instead of a predator-prey relationship. Mainly using visual communication, man introduces himself as a dominant horse, mimicking postures and behaviours of a dominant horse. Five Haflinger (mares, 2 year old), bred in a natural state and not accustomed to being handled by man, were used. The trainer-horse relationship was carried out in three phases. *First phase*: the trainer sent away from himself the horse (action) trying to recreate the same psychological condition of a horse separated from its herd; in this manner a higher-ranking horse punishes an undisciplined lower-ranking one, and relegates it in a insecure position. The studied subjects responded with a submissive behaviour, moving the jaw in a chewing motion (snapping), with extended head and neck and looking at the trainer (reaction); action-reaction time was (mean \pm sd) 7.5 \pm 4 minutes. *Second phase*: once the horse accepted the trainer like higher-ranking subject, the trainer approached the horse (action) until it accepted to be in contact (reaction); action-reaction time was (mean \pm sd) 6.1 \pm 2 minutes. *Third phase*: the trainer mimicked the postures usually used by a dominant horse for herding. To obtain a forward movement from the horse the trainer's position was beside it and behind its eye; when the trainer moved beyond the horse's eye, the horse stopped and when the trainer put himself in front of the horse, it moved in the opposite direction. Time to complete the 3rd phase was (mean \pm sd) 11.5 \pm 2 minutes. At the end of the work sessions, all subjects were able to carry out trainer's requests without imposition or coercion. These observations suggest that it would be possible to handle horses using their behaviour patterns.

Utilization of the hand-plucking method to estimate intake of grazing sheep

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ABSTRACT: An experiment was carried out at the Agronomic Experimental Station of the Federal University of Rio Grande do Sul, located at southern Brazil (30°05'S e 51°31'W), to evaluate a modified hand-plucking technique on the estimation of intake of ewes grazing on a native grassland field. Unlike other methods, the proposed technique causes a minimal alteration of the animal natural behavior and it is based on the "intake = grazing time x number of bites x bite size" equation. Observations were made on a pasture composed mainly by *Paspalum notatum*, *Cynodon dactylon* and *Desmodium intarum* with five ideal ewes with similar weight, age and dental archade width, selected from a group of twenty animals. Grazing time was recorded by direct observation made at intervals of ten minutes during five 24-hour periods, with two repetitions. The number and the size of each bite were registered for the diurnal period, between every actively rhythm observation. The hand plucking was conducted in a way to replicate the bite size of the five animals assigned and also the number of bites per minute. Corrections of the original hand-plucking values were made by linear equation, generated by the regression of the hand-plucking records against intake samples collected in esophageal fistulated animals. Mean intake results obtained by the modified behavioral method were 1480 and 1584 g DM/animal/day, corresponding to 3.52 and 3.68 % BW to period 1 and 2, respectively. Intake estimation done by chrome oxide method also showed similar values. These results indicate perspectives for improvements in the hand-plucking method as a reliable tool to determine intake in grazing animals and to define management practices which allow a better balance between the available grazing resources and the animal nutritional needs.

Effect of rearing systems on behavior and long-term reproductive performance of ewe-lambs

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Three rearing systems largely used in the southern French Alps region were studied in terms of eco-ethological aspects, in order to assess their technical and economic responses. From 1992 to 1999, three groups of 13 replacement ewe-lambs, were grazed: a) on rangeland, associated with ewes (RE); b) on rescuegrass + tall fescue + white clover pastures, with ewes (PE); and c) on cultivated pastures with supplemental feeding, without adults (BE). From the second year on, all animals were grazed as a single flock, under RE conditions. Two sets of investigation were carried-out: a) behavioral observations in 1992 and 1993; b) animal performance evaluation from 1992 to 1999. Results from the first year showed significant differences ($P < 0.05$) between rearing systems for inter-individual distance, diet selection, grazing time, ADG and body fat condition. In the second year, as a consequence of the early contact with both the grazed environment and adult sheep, RE animals had a closer inter-individual distance and higher feeding similarity index for young and adult sheep. On the other hand, animals in PE and BE groups showed a great difficulty to integrate into the flock and a low ability to graze the available herbage. This fact probably induced a physiological imbalance, thus resulting in reduced ADG and low body condition. Nevertheless, ewe-lambs from the three different groups did not show significant differences ($P > 0.05$) on animal performance by the end of second year. During the next years, a larger mortality within BE group and a lower culling rate in RE group were observed, pointing up to similar average productive lamb/ewe rates between all groups and a likely economic advantage of RE ewes at the end of their reproductive lives. Both eco-ethological and techno-economic factors as a way to improve the long-term adaptation of animals to grazing situations are discussed.

Stereotyped behaviours of sows kept on confined and outdoor systems

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Stereotypes may be indicators of poor welfare. The environment can influence the occurrence of stereotypes. Our objective was to investigate the influence of two systems: confined (CS) or outdoor (OS) systems on the occurrence of stereotypes in sows. Females from a Large White-Landrace herd, ages between 1.5 to 4.0 years old, were housed in CS ($n=8$) or OS ($n=4$) and used for direct observations at Embrapa Swine and Poultry. The following behaviours classified as stereotypes were observed: bar-biting (BB), creaking teeth (CT), head on bars (HB), sham chewing (SC). Observations begun five days before until 6 after farrowing. The sows were observed during 4 hours per day. The mean frequencies of each behaviour were analysed by Student t-test. Results differ significantly according to the behaviour: BB (3.57%), HB (1.16%) and SC (7.53%) were more frequent in CS than in OS (0.22%; 0.25%; 1.83%, respectively; $p < 0.0001$) while CT was not significant ($p > 0.10$) in CS (0.40%) and OS (0.65%). The mean of total stereotypes for CS (2.93%) was significantly higher ($p < 0.0001$) than for OS (0.45%). Analysis of the behaviour of each group made it clear that sows kept in CS presented more behavioural problems than sows kept in OS. Confinement alters the behavioural repertoire of the sows. Behavioural changes could be used to assess the reactivity of the sows to its environment.

Expression of rooting motivation in gilts following different length of deprivation on concrete

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Outdoor sows are provided with a nose ring in order to prevent them from uprooting the grass. If the ring is placed properly, it effectively prevents the sows from rooting. Under semi-natural conditions, sows spend 10-20% of their active time rooting. Outdoor pigs that have been prevented from rooting for several weeks engage more in rooting during the first days after having been allowed to root. The present experiment examines the motivation to root in gilts. Sixteen gilts were housed in pairs in "home pens" supplied with spagnum as rooting material, and at intervals moved to a neighbouring concrete pen thereby depriving them from rooting. Lengths of deprivation were 0, 0.5, 2, 5, 8, 24.5, 26 and 32 hours. Each of the periods of deprivation was followed by 24 hours in the home pen, where the behaviour of the gilts was video recorded. Three measures, which are considered to indicate rooting motivation, were estimated from the recorded behaviour: time with snout to floor, latency to first snout to floor and number of rooting bouts. On the first day of the experiment gilts deprived of rooting longer than 24 hours spent more time with snouts to the floor (3.5 min/h) the first 24 hours after returning to the home pen, than pigs deprived less than 24 hours (2.2 min/h), $p=0.02$. There was a tendency ($p=0.08$) to longer latency to first snout to floor with longer period of deprivation. Effects on latency and number of bouts were diminished during the experiment. Thus overall, there were no clear effects of different lengths of deprivation on the gilts motivation to root.

The elimination behavior patterns of domestic cats (*Felis catus*) with and without elimination behaviour problems

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The elimination patterns of single housed domestic cats were studied to test three hypotheses regarding the relationship between litterbox location and the cats' use of space in the house. 1) The litterbox location will differ between cats that eliminate in the litterbox and cats that eliminate outside the litterbox. Specifically, the control cats will have the litterboxes located within the core area and problem cats will be more likely to have the litterboxes located within the non-core area. 2) There will be an inverse correlation between the time any cat spends digging, sniffing, covering and pawing and the distance of the litterbox from the central core area. 3) There will be a difference in elimination behavior at the litterbox between control cats and problem cats. Specifically, when they do use the litterbox, the problem cats will spend less time digging prior to elimination and covering after elimination than control cats. A total of forty single household cats were observed, twenty cats without any elimination behavior problem and twenty cats with elimination behavior problems. A camcorder was positioned outside of the litterbox to record the sequence of behavior of each cat prior to and during elimination and the behavior exhibited afterwards. In households with problem cats, one camcorder was focused on the litterbox and a second and if necessary, a third camera were used to record the pattern of behavior at the areas in which the cats prefer to eliminate. The camcorders recorded the elimination behavior for 72 hours. Use of space in the house was recorded by direct observation during 400 minutes of these 72 hours. Litterbox location did not differ between cats with and without elimination behavior problems. Problem cats spent significantly less time covering and digging than control cats.

Interactive effects of transport duration and nutritional status on the physiology and behaviour of calves

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Sixty-four male Friesian-Holstein calves were used. Calves were reared in straw-bedded individual stalls that allowed clear vision and physical contact with other calves. A milk replacer was fed twice daily. At 2.5 months of age animals were subjected to a 10-min test where 3 min after introduction of the animal, a traffic cone was lowered from the ceiling. Heart rate responses were not correlated with behavioural responses, but negatively correlated with hematocrit ($p < 0.05$). At 3.5 months of age animals were transported for 0 min (controls), 20 min, 3.45 or 7.30 h. Half of each transport group was not fed before transport. Loading and unloading increased plasma NEFA, glucose, lactate and cortisol levels, partial pressure (p) of CO₂, and decreased plasma pH ($p < 0.05$). Rapidly appearing short-lasting changes were decreased plasma calcium levels and pCO₂, and increased potassium levels and heart rate ($p < 0.05$). Rapidly appearing long-lasting changes were increased pO₂ and plasma cortisol, lactate and NEFA levels ($p < 0.05$). Slowly appearing changes (at 3.45 and 7.30 h) were increased plasma sodium and creatine kinase levels. NEFA levels showed a transport duration x nutritional status interaction ($p < 0.05$). Irrespectively of transport duration, at the end of transport (same time of day) non-feeding led to higher heart rate and plasma NEFA levels, and lower plasma glucose levels, pCO₂ and pH ($p < 0.05$). Lactate and glycolytic potential of the *Longissimus Lumborum* were not changed by any of the treatments. Non-fed animals weighed less before and after transport. Absolute and relative weight loss increased with longer transport duration but was lower in non-fed animals ($p < 0.001$). Immediately after transport, feeding motivation was tested in a novel environment. More animals drank after 7.30 h of transport than controls ($p < 0.10$). Irrespectively of transport duration, non-fed animals drank sooner than fed animals and animals that drank had lower muscle lactate content ($p < 0.05$). Reactivity to the novel object was not correlated with reactivity to transport. Thus, transport caused short-lasting and long-lasting adaptive physiological changes. Nutritional status influenced physiological status but showed little interaction with transport. Although treatments had no effect on energy status of the *Longissimus Lumborum*, other muscles more implicated in balance and posture may give different results.

Does tail docking adversely affect adult dairy cattle?

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Tail docking is being increasingly practised by dairy farmers in many countries, without full assessment of the costs to the cow. The effect of tail docking lactating Holstein cows using a rubber ring with and without epidural anaesthetic was investigated using 64 cows in a 2x2 factorial design. Measurements of behaviour, feed intake and milk production were taken on Day 1 (before and after ring application), 2, 3, and 7 (after tails below the rings were surgically amputated). Cows' postures and tail positions were monitored using instantaneous scan sampling and active behaviour (e.g. tail shaking, vocalising) was recorded using focal animal sampling. Results indicated no significant differences in milk production and feed intake between treatments. No significant differences were found for most behaviour monitored, however some differences in tail shaking and tail position were observed. On Day 1, the rubber ring (RR), rubber ring with anaesthetic (RRA), as well as the anaesthetic control (CA) groups displayed significantly less ($P < .05$) tail shaking than the control (C) group after docking. The RR and RRA cows continued to exhibit less tail shaking on Day 2, 3, and 7. Additionally, RR and RRA held their tails in a raised position significantly less ($P < .05$) on Day 1. On Day 7, after amputation, RR and RRA cows held their tail stumps pressed against their bodies significantly more ($P < .05$) and C and CA cows held their tails in the relaxed position significantly more ($P < .05$). These data indicate that cows exhibit subtle behavioural changes following not only application of rubber rings, but also epidural administration and surgical removal of the tail below the ring on Day 7. Results suggest that tail-docking adult dairy cattle using rubber rings causes, at most, mild discomfort and that there is no benefit in using an epidural anaesthetic.

Aspects of social and sexual behaviour of differently aged bulls in an extensively kept herd

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Knowledge about behaviour of groups of domestic bulls within mixed sexed herds is almost lacking. Better understanding may help to optimize management of breeding bulls in beef-suckler or dairy herds. The presence of more than one breeding bull increases fertility and supports social stability within the herd. Behaviour of entire bulls was studied within a Simmental herd including 70 cows, 80 subadults and 30 bulls aged 2 – 9 years. The herd splitted into a 'big herd' and a 'small herd' (150 resp. 30 animals). Since 17 years the herd was kept outside during the whole year on an enclosure of 50 ha and human interference was low. Behaviour of bulls was recorded by direct observations from 1997 until 1999. Bulls aged 2 – 3 years lived in the centre of mixed herds. Bulls aged 3 – 4 left the mixed herd in early summer to join instable bachelor groups. Bulls aged 5 – 9 lived mostly separately in year to year stable areas, often shared with another bull. Within both herds, an alpha-bull was present (4 – 6 years). These bulls were highest in social ranking. If an alpha-bull was replaced, the successor was always member of the mixed herd and never a solitary bull. Dominance relationships were determined by fights and aggressive displays. Older bulls fought less and showed more display behaviour than younger bulls. These interactions occurred mainly between bulls of similar social status. Older bulls showed more vocalization than younger ones and corresponded more to bulls of similar social status. Number of answer calls reproduced well to emitter calls. High ranking bulls assessed cow's reproductive status evenly distributed during the whole year while lower ranking bulls did this mainly in spring and early summer when most estrous occurred. Guarding of cows during proestrus was highest in younger bulls and during estrous in alpha-bulls. Alpha-bulls had most successful matings. All results mentioned were significant. Behaviour patterns observed proved similar to those of wild or feral domestic cattle. Under almost natural conditions cattle still behave like their wild ancestors, obviously domestication had only low influence on their behaviour repertoire.

Effect of different rearing of heifers during the milking period on their behaviour in the maze learning ability tests after weaning

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The aim of this experiment was to test the hypothesis of whether natural and artificial rearing of heifers affect their behaviour in maze learning ability tests. At birth 92 Holstein heifers were randomly divided into five groups: A-from 2nd day to 7th day in a hutch (individual outside pen), then in loose housing in the calf barn with automated drinking feeder until weaning; D-pen with mother until the seventh day, then in loose housing with automated drinking feeder until weaning. H-hutch from the second day until weaning; M-pen with mother until the seventh day, then hutch until weaning. N-pen with mother until the seventh day, then with nursing cows until weaning. Animals of all groups were kept after weaning at 8 weeks in common group pens in loose housing. At 15 weeks of age, a maze behaviour was determined. The maze facility was constructed in a pen 16.4 x 4.5 m fencing 1.5 m high covered with a black plastic sheet. Five barriers were installed inside. On the first observation day the calves were tested five times, the first test was for training. On the second day there were four runs. In the first task (learning), the passage was open on the left side, and on the right side (reversal) on the next day. The longest standing time in the maze was in N (88 s in the learning task, runs 2 to 5; 138 s in the reversal task, runs 6 to 9) and the shortest in A (15 s and 49 s). Differences between N and other groups were significant in individual runs also in the evaluation of particular tasks. In the evaluation of the average time in all 8 runs, animals ran across the maze in this order: A (54 s), D (64 s), M (65 s), H (70 s) and N (139 s). Calves from A and D made the least of total number of mistakes per animal (0.12) in learning task, N the most (0.65). In the total number of mistakes per calf made in reversal task, D and M were the best (2, 19 and 2, 20), and H and N the worst (3, 17; 3, 00). In the evaluation of the entire maze test, A, M and D proved most adaptable, and N the least adaptable. Calves reared by nursing cows were lacking independence and showed reduced orientation abilities. This research was sponsored by the U.S.- Slovak Science and Technology Joint Fund Project Number 010-95.

Behaviour of calves separated from cows by two types of gates

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When cows and calves are kept in a pasture, calves can get sufficient rest if they remain in a small paddock. For this rearing system, we designed two types of gates and investigated whether calves attempted to pass through the gate. Twenty Japanese Black cows and their calves were divided into three groups (G1, G2, G3) and reared under these conditions for 3 months from birth. For each group, there was a 2ha pasture for grazing cows and a 9a paddock for calves. Pasture and paddock were divided by an electric fence, and on of two types of gates. The first type of gate (used for G1) was a wooden board attached to the fence with hinges and springs on one side so that it could easily be opened both side by a calf. The second type (used for G2) consisted of only a square wooden frame so that calves could see the other side. Calves in G1 and G2 were enclosed with dams in a paddock from the second day after birth. Calves in G3 were reared without fence separation until 1 month after birth, when they were enclosed in a paddock connected with the second type of gate. None of the calves in G1 or G2 made any attempt to pass through the gates, even though they could easily have entered the pasture by pushing the gate. This result shows that even though calves can see the other side through the gate (G2), this may not be effective for them to pass through the gate. Calves in G3, on the other hand, passed through easily. During the early period after birth, when locomotor abilities aren't fully developed, imprinting that they can't pass through the gate may work effectively.

Basic and applied considerations related with the use of the "ram effect"

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If anestrus ewes are isolated from rams for a period, rams reintroduction induces some neuroendocrine changes that determine in many ewes a "silent" ovulation. If ewes are primed with progestogens, estrous behaviour is elicited coincident with that ovulation. We studied ovañan dynamics by ultrasonography and its relationship with circulating gonadotropins and steroids concentrations, and how hormone levels influence the responding pattern. We observed a widespread pattern of responses, most of them different from the classically reported patterns. Anestrus depth was related to LH pulsatility and FSH levels existing before the rams were introduced, and seemed to determine if a ewe responded or not to the "ram-effect". Increases in both the number of large follicles, and the diameter of the largest follicle, were related with an increase of LH pulsatility. The endocrine environment in which a follicle grows, rather than the maximum size it attains, determines whether a ewe would respond or not to rams reintroduction. We observed two increments in FSH concentration, occurring coincident with the LH preovulatory surge and 24 h later. Cortisol concentrations were measured to test whether stress may be a component of the "ram effect" response, but levels remained unchanged throughout the experiment. We also evaluated different short-term progestogen primings with two experiments. First, we concluded that medroxyprogesterone, (MAP) fluorogestone or progesterone were equally effective in improving the response to the "ram effect", observing an estrus distribution different from that previously reported. In a second experiment, we concluded that the use of sponges containing lower MAP contents than the commercial ones allowed obtaining the same results as with these ones. We also tested if reintroduction of rams can induce responses in cycling ewes, concluding that interval to estrus was shortened and synchronization results were improved if "ram effect" was used combined with traditional progestagen treatments.

Interactions between sow nursing behaviour, catabolic state and piglet growth

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Milk production of the sow is essential for piglet survival. We aimed at investigating how nursing behaviour and catabolic state of the sow influences milk production (measured as piglet weight gain). Twenty-one Yorkshire sows were studied during a five-week lactation. Average daily weight gain (DWG) of piglets was calculated for the following periods: d. 1-4, 5-8, 9-15, 16-22 post partum (pp), and d 23 pp-weaning. The following behavioural variables were observed during 24 h on d. 3, 6, 13, 20 and 30 pp: frequency of successful (SFREQ) and unsuccessful nursings (USFREQ), total duration of all nursings (NURSDUR) and percentage of sow-terminated nursings (%SOW). Mean NEFA-levels were calculated from 16 hourly blood samples (plus four samples from the hour after feedings) on d. 7 and 21 pp. Interactions with DWG were tested with linear regression analyses including piglet weight at the beginning of each period (BW) and number of piglets born alive (LS). DWG during lactation as a whole was negatively dependent on NURSDUR ($p=0.04$). NURSDUR affected DWG negatively during d1-4 and d5-8 ($p=0.05$ vs. 0.01), while there was a positive effect of NEFA during d9-15 ($p=0.04$). BW interacted positively with DWG during d1-4 and d16-22 and LS tended to interact negatively during d16-22 ($p=0.06$). No effect of SFREQ or USFREQ on DWG was found. This gives no evidence that sows limit milk production by changing nursing behaviour, but rather suggests that slow-growing piglets try to increase their milk intake by increasing nursing time. DWG seems to be determined differently at different stages of lactation. At the beginning litters with higher starting weight have grow faster, while the sow's ability to increase her catabolic state is important at the of peak lactation. As the demand on milk production reaches its peak, litter size begins to limit individual piglet milk intake.

The influence of air velocity on pig choice

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Climatic environment is important with regard to pig production and welfare. To investigate the influence of air movement on pig choice, experiments were performed in two draft proof double pens. In each double pen two pigs were present. Pigs could move freely between both pens of a double pen by opening a gate with one nose push on a plate. For each individual all changes between both pens were noted during six days, on basis of videorecordings. In the first experiment 4.5 month old pigs were tested in straw-bedded pens where the air velocity was less than 0.1 m/sec and environmental temperature was 20-23°C. Equal time was spent in the two pens during the day but at night one pen was preferred. In a second experiment pigs, aged 5 months, were kept at a higher environmental temperature (24-26°C) and a choice was offered between a pen with an air velocity of 0.1 m/sec and one with an air velocity of 1.0 m/sec. The results, being very similar to the first experiment, suggested that air velocity did not influence choice of pens. In a third experiment, suggested that air velocity were offered the same choice as in the second experiment. However, pigs were kept on a bare floor and at a lower environmental temperature (as in experiment 1). All pigs chose the low air velocity pen during the day and at night. These experiments show that air velocity has an influence on choice behaviour in older pigs. Air velocity did not influence choice when pens were bedded with straw and maintained at higher environmental temperatures. Further research has to establish the influence of each factor on pig choices.

Maternal influence on fearfulness in sheep

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Fearfulness is a general characteristic of individuals and influences a variety of fundamental behaviours. In turn fearfulness is influenced both by internal (e.g. genotype, hormonal balance) and environmental factors (e.g. conspecifics, rearing conditions). In sheep the presence of the mother may modulate fear reactions of the offspring (e.g. increase fearfulness in mothered lambs as compared to artificial rearing, or mask the fear reducing effect of an enriched environment). The present study is a first attempt to assess the possible transmission of fearfulness from mothers to their lambs depending on their sex and rearing conditions. Fear reactions of Ile-de-France ewes were tested in early pregnancy according to the methodology developed by Romeyer and Bouissou, 1992. (*Appl. Anim. Behav. Sci.*, 34: 93-119) and Vandenhede *et al.*, 1998, (*Appl. Anim. Behav. Sci.*, 53: 293-310) and which includes reaction to social isolation, a surprise effect or a human. The fear reactions of their offspring were measured with the same methodology after weaning. Two experiments were conducted: the first one included 30 multiparous ewes and their 30 mother-reared female lambs. The second included 44 primiparous ewes and their 63 lambs reared either by the mother (21 females, 15 males) or artificially (15 females, 12 males). In both experiments there was a significant positive correlation between fear scores of mothers and their daughters in the surprise test (exp. 1: $R_s=0.36$, $p<0.05$; exp. 2: $R_s=0.51$, $p<0.01$). However the correlations were not significant when the daughters had been artificially reared. The correlations between mother and their sons were never significant whatever the rearing conditions. These results suggest that the transmission of fearfulness is mainly of a social nature and depends on the sex of the offspring, which may receive differential attention or treatment from their dam.

Identification of social strategies in a herd of dairy cows

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Studies of social behaviour in cattle often concentrated on dominance relationships. However, dominant-subordinate classification has been shown to be insufficient in explaining differences in physiological state and health of animals in several species. The strategy an animal adopts in a social context is probably more important than the actual social status achieved. The aim of this study was to identify different social strategies. Social behaviour of a herd of 56 cubicle housed Brown Swiss dairy cows was observed for 50 days distributed over a 5 month period. Agonistic and non-agonistic social interactions were recorded with continuous behaviour sampling during 6 h per day. Every case of illness requiring veterinary treatment during the observation period was recorded. Social strategy groups were identified by performing principal components analysis with Varimax rotation on 12 social behaviours for 47 cows and following cluster analysis using factor scores. ANOVA or non-parametric statistics, respectively, were used to evaluate group differences. Three factors were extracted, explaining 65% of the variance: 'aggressive' (AG), 'receiving aggression' (RA) and 'non-agonistic' (NA). The following cluster analysis led to three groups of animals mainly characterised according to the factors (AG: $n=17$; RA: $n=18$; NA: $n=12$). Clusters were stable to a high degree when using different algorithms. AG-animals initiated the highest amount of aggressive interactions (AG/NA: $p<0.01$; AG/RA $p<0.05$). NA performed distinctly more social licking than AG and RA ($p<0.01$) and received less aggressive displacements than RA. The three strategy groups did not differ in age and only partly in rank. Dominance values of AG animals were highest (0.66 ± 0.16 , $p<0.01$), but no difference was found between NA (0.39 ± 0.14) and RA (0.33 ± 0.10). Disease incidence did not differ between strategy groups, but correlated with age of the cows. Dairy cows in this herd showed clear behavioural differences. Performing a higher degree of social positive behaviour seems to be used successfully to reduce aggression received. Further evaluation is necessary to investigate the importance for the physiological state of the animals and possible determinants of the differences. We acknowledge funding by the Austrian Science Fund FWF, project number P13585-B10.

Behavioral response to and recovery from early pre-pubertal castration

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Castration is one of the most common surgeries performed in the horse (Blanchard, Varner & Schumacher, 1998). At present, little is known about the animals' behavioral response to or recovery from the procedure. The procedure is assumed to be painful based on genital swelling and decreased mobility in the animal. Early Pre-Pubertal Castration (EPC) performed with the Henderson castration instrument may provide a less stressful method of castration in the horse. EPC is performed between two days and two months of age. Recovery for EPCs may be shorter than that of yearling or other castrates. This study is the first in a series to assess the behavioral responses to and recovery from the EPC. For each procedure, the castrate (N=7) was paired with a control animal (N=7) of roughly equal age. Each animal was anesthetized, tied, and if a treatment animal, castrated. Each animal was observed for one hour immediate post-castration as well as one hour the day preceding the procedure and one hour on the two days following the procedure. A GLM procedure was run to assess any differences between treatment groups as well as the expression of the behaviors by each subject. No differences were found between castrates and controls in the percentage of sample spent in the following behaviors: walking (p>0.14), grazing (p>0.35), nursing (p>0.09), lateral rest (p>0.24), sternal rest (p>0.14) and upright rest (p>.14). Hence, the castrates suffered no adverse behavioral effects from the procedure. Further research will assess the behavioral differences in recovery between EPCs and yearling castrates.

Measuring vigilance as an indicator of fear in dairy cattle

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Wild animals will alter their vigilance levels, at the expense of feeding time, in response to predation risk. We tested dairy cattle to determine whether they had maintained this behaviour and whether time spent vigilant changed in response to an aversive, gentle or neutral handler. We conducted 12 trials per cow in large enclosures with a food source for 3 (exp. 1) and 5 (exp. 2) minutes per trial. The feeders used restricted the animal's view so that it could not feed and scan simultaneously. Vigilance time was defined as any time the animal's head was not in the feeder. In experiment 1, 40 cows were tested with the dog, human, and with no stimulus (control) following a balanced order in trials 6, 9, and 12. Time vigilant was 46.9%, 57.3%, and 71.8% ($\pm 4.0\%$ SEM) for the control, human, and dog test trials. Compared to the control, both stimuli increased vigilance time (p<0.05). During the non-test trials (no stimulus), vigilance time decreased with repeated experience. In experiment 2, 20 cows were trained with an aversive and gentle handler for 3 weeks prior to testing. They were tested with the aversive, gentle, and neutral handler present following a balanced order in trials 10, 11, and 12. Time vigilant was 43.0%, 46.5%, and 61.5% ($\pm 4.4\%$ SEM) for the neutral, gentle, and aversive test trials. The aversive handler increased vigilance time compared to the neutral (p<0.05) and gentle (p<0.07) handlers. However, during the non-test trials (no stimulus), vigilance did not decrease with repeated experience suggesting that the cows were less fearful of the enclosure in experiment 2. These results suggest that cows have not only retained vigilance in their behavioural repertoire but that this behaviour might be used to measure their degree of fearfulness towards people, and potentially, towards different environments.

Effects of feeding system and manger space allowance on feeding behaviour and agonistic interactions in dairy cattle

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Total mixed rations (TMR) have been developed to increase dry matter intake and to better fulfill the nutrient requirements of high producing cattle. However, selectivity which is shown during grazing as well as eating conserved feeds may be impaired. Additionally, manger space is often reduced when TMR feeding is implemented. Therefore, it was the aim of this study to investigate the effect of different feed provision systems and reduction in manger space on the feeding and social behaviour of dairy cattle. 20 dairy cows were selected and randomly assigned to 2 loose housed groups. A ration containing grass silage, corn silage, brewer's grains and concentrates was offered as (I) single components in layers (manger width 70 cm per cow) and concentrates partially provided in feeding stations, (II) total mixed ration (TMR, 70 cm) or (III), TMR with 40 cm space allowance. Both groups were submitted to all treatments, and experimental periods consisted of adaptation (2 weeks) and data collection (2 weeks), respectively. Three direct 10 min observations per cow and experimental period were carried out at the trough within 2 h periods after feeding. Continuous behaviour sampling included ingestive behaviour (e.g. feeding, rooting, nosing, sniffing) and agonistic interactions (e.g. butting, displacements). Furthermore, 24h time lapse video recordings are currently being analysed for time budgets and feed intake characteristics. At a manger width of 70 cm per cow, TMR feeding resulted in an increased proportion of selective behaviours ($p < 0.01$) which was mainly due to rooting activities ($p < 0.001$) while nosing and sniffing remained unaffected. However, reduction to 40 cm (III) led to a decrease in rooting behaviour ($p < 0.05$) which was intermediate to treatment I and II. Butting at the feeding place increased with TMR only at reduced space allowance ($p < 0.05$) and displacements were more frequently observed during treatment I. In conclusion, the results give evidence that mixed rations enhance selective behaviours although aiming at the intake of an unaltered composition. With regard to animal welfare, all cows should be allowed to feed at once to reduce agonistic interactions.

The different role of endogenous AVP and CRH in psychological stress response in sheep

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We have previously reported the effects of centrally infused arginine vasopressin (AVP) or corticotropin-releasing factor (CRH) in sheep. They can be summarized as follows. AVP and CRH had equal potential to activate pituitary-adrenal axis. Centrally infused CRH lowered the body temperature (BT) as opposed to the reports using rats and pigs. CRH induced bleeding, AVP induced oral stereotypies. To apply these results to the endogenous role of these hormones, we designed the psychological stress context and determined the effects of centrally infused antagonist for these hormones. Four sheep kept in individual stanchion cages were used. The psychological stress context was that only 1 of 4 sheep was not fed for 1 hour (feed deprivation [FD] period) from the onset of the daily 2 hours-feeding period. Blood samplings for plasma cortisol measurement were done -30, 0, 30 and 60 min after the onset of FD period. The mean BT and heart rate were obtained at -30, 0, 30 and 60 min. The total number of conflict and abnormal behavior from 0 to 60 min were counted. The plasma cortisol concentration and the BT of the sheep significantly rose, and conflict behavior, scraping and abnormal behavior, sham chewing significantly increased as compared with the context that none of 4 sheep was fed at the same period ($p < 0.05$). The AVP V_1 receptor antagonist, [Pmp¹, Tyr (Me)²]-Arg⁸-Vasopressin (115 microgram/0.5ml artificial cerebrospinal fluid [aCSF]/30min) suppressed the increase in plasma cortisol concentration and the hyperthermia. On the other hand, CRH-receptor antagonist, alpha-Helical CRF [9-41] (80 microgram/0.5ml aCSF/30min) suppressed the increase in scraping and sham chewing. These data suggest that endogenous central CRH and AVP have different roles in psychological stress response in sheep. AVP mainly stimulates pituitary-adrenal axis and might be essential for stress-induced hyperthermia. On the other hand, CRH might relate with the increment in conflict and abnormal behavior.

Sexual behavior of sows raised on confined and outdoor systems

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Carefully observation of the sexual behavior shown by sows are essential for high reproductive rates. This study evaluated the sexual behavior of weaned sows in confined (CS, n=8) and outdoor (OS, n=4) systems at Embrapa Suíne and Poultry. F1 sows were approximately 1.5 to 4.0 years old. Observations were taken during summer 2000. The sows were observed for 1 hour a day (30' in the morning and 30' in the afternoon) during 8 days for the following behaviors: exploratory (sniffing, rooting, alert), comfort (stretching, lying awake, sleeping), physiologic (drinking, eating, defecating) and stereotypes. The mean frequencies of each behavior were analyzed by Student *t*-test. The percentage of time of CS and OS sows devoted to exploratory, comfort and physiologic behaviors one day prior to heat detection was 16.1 and 17.0 (p>0.05), 27.0 and 14.4 (p<0.05), and 2.4 and 9.4 (p<0.01), respectively. Sows in the OS, had a larger numerical variation on the frequency of exploratory, physiologic and comfort behaviors, when compared to CS sows. CS sows demonstrated discrete changes over time in the first two behaviors. Sows in CS showed restlessness behavior during 4 days prior and one after heat; on average 3.78%, in contrast to sows in the OS, that showed this behavior on the day of heat and day after only (average=0.87%; p<0.01). We observed that sows in the OS showed an intense exploratory and physiologic behavior, in contrast to a less intense comfort behavior, mainly in the pro-estrus period, however, was not statistically significant. The OS allowed sows to display sexual behavior (sniffing genitals, trying to mount, searching the boar, pushing other sows with the snout) in a specific time close to the observed heat (pro-estrus). The data suggests that this sexual behavior in the OS could lead to a better reproductive performance.

The cardiac response of laying hens to frustration in classical and operant conditioning

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Changes in heart rate can occur in response to either pleasant or aversive conditions. We studied the cardiac response to frustration in laying hens in a conditioning paradigm. The hypothesis was that omission of a food reward that previously was predictable (classical conditioning) would cause a lower cardiac response than omission of a food reward that was both predictable and controllable (operant conditioning). Ten hens were subjected to classical conditioning and 10 to operant conditioning in a Skinnerbox. The conditioned stimulus (CS) was a red light appearing every 30 sec during 15-min sessions. In classical conditioning the duration of the CS was 10 sec, in operant conditioning the CS was terminated by a key-peck. In both modes of conditioning the unconditioned stimulus (US) was 5-sec access to food. Heart rate was measured during the last training session and the subsequent frustration session, in which the birds were presented a feeder covered with Perspex. A session contained approximately 20 trials. From 16 trials heart rate was calculated in 5-sec periods. Cardiac response was expressed as the difference between basal heart rate at the start of a trial and heart rate in the anticipatory period (CS), the period US (training session: Food, frustration session: No-Food) and the period Post-US of that trial. In classical conditioning an increase in heart rate ($P<0.05$) was found in both the anticipatory period and in the period Food. In operant conditioning no increase in heart rate was found. In both classical and operant conditioning a lower heart rate was found ($P<0.05$) in the period No-Food than in Food. Heart rate was still lower in the period Post-US in the frustration session compared to the training session. No change in heart rate was found during anticipation and reward in operant conditioning probably because of the controllability of the situation. Frustration seems to be expressed by a decrease in heart rate in both modes of conditioning.

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