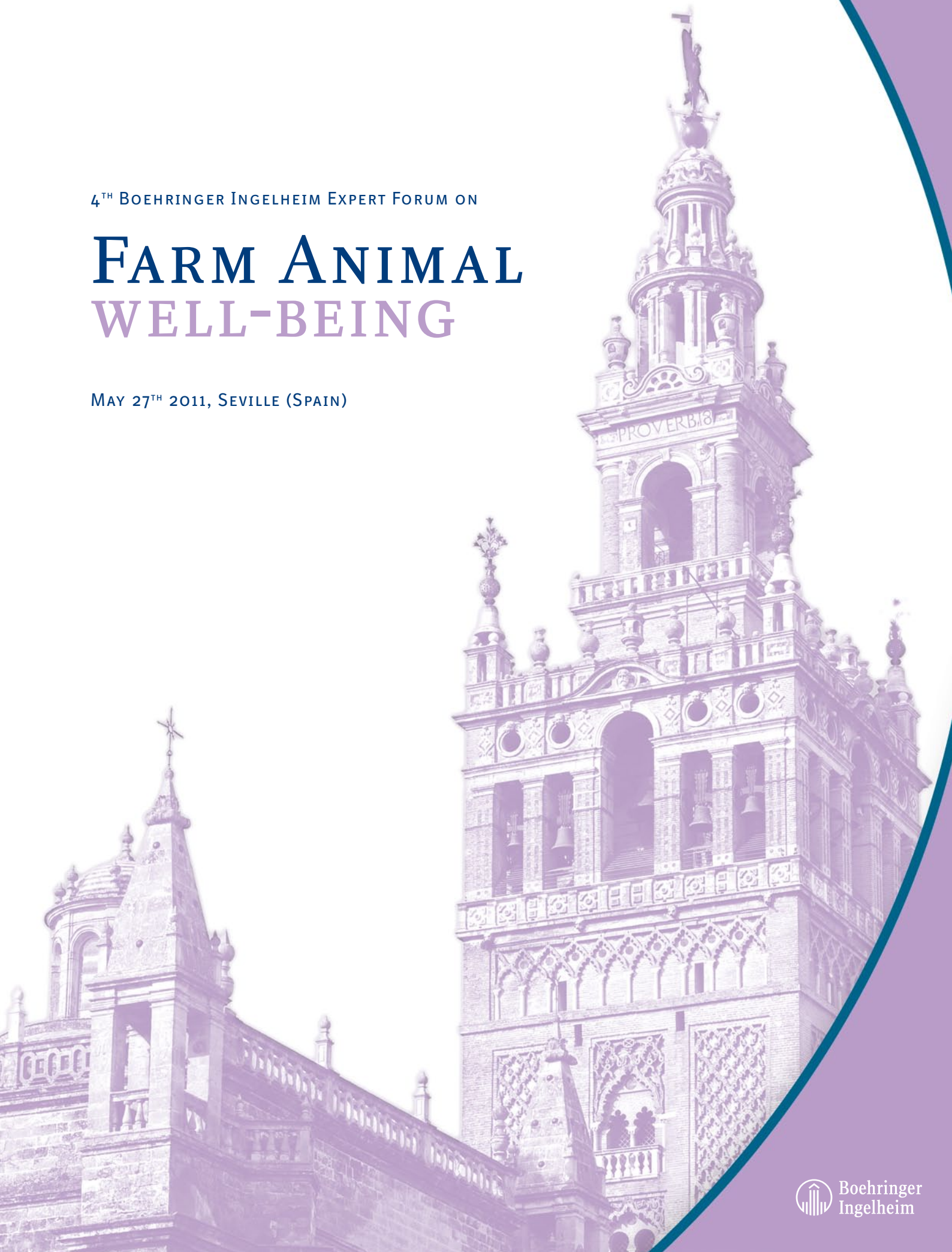
4th Boehringer Ingelheim Expert Forum on

Farm Animal Well-being

May 27th 2011, Seville (Spain)



Boehringer Ingelheim

Welcome to Seville.

Thank you for your interest in attending the 4th Boehringer Ingelheim Expert Forum on Farm Animal Well-Being.

Over the last few years, Animal Welfare has become a crucial issue for anyone involved in the food industry. The recent decision, taken by several main players in the EU pig meat chain, to perform castration of pigs only with prolonged analgesia and/or anaesthesia illustrates that the Well-Being of Farm Animals is definitely on the political agenda. Such a step, which will affect all stakeholders in the pig industry, surely results from an increased consciousness that farm animals should suffer less pain and, therefore, that our farming practices must change.

At Boehringer Ingelheim, we believe that field veterinarians can play a key role, by promoting public awareness of animal Well-Being and educating and transferring new skills to their clients. The forum on Farm Animal Well-Being aims to be an effective discussion platform to facilitate communication and transfer of knowledge, as well as a highly commended place to mingle and socialise.

Because of the multi-disciplinary nature of the topic and following a science-based approach, we have invited guests from different backgrounds: veterinarians, animal scientists and specialists in sociology, economy or psychology.

Distinguished speakers have accepted to take part in the program, which, we hope, will be relevant, attractive.....and challenging!

Among the topics covered this year, the following questions will be addressed:

How do animals react to fear and novel stimuli? How can human-induced stress in farm animals be reduced?

Can farmers' attitudes impact upon animals' productivity?

What is the impact of dystocia on the transfer of immunity from mother to offspring, and on the welfare of offspring and their further development?

Is improved animal welfare affordable? What are the cost limiting factors for farmers?

And finally, are improved animal welfare and profitable farming compatible?

We are very proud to welcoming you to Seville, host of several UNESCO World Heritage Sites. We trust that this inspiring city will be the place of constructive and fruitful exchange.

Dr. Laurent Goby
Boehringer Ingelheim Animal Health

4TH BOEHRINGER INGELHEIM EXPERT FORUM ON

FARM ANIMAL WELL-BEING

CONTENT


Prof. Paul H. Hemsworth

Paul Hemsworth is a professor in the Melbourne School of Land and Environment at the University of Melbourne and is Director of the Animal Welfare Science Centre, a joint centre of The University of Melbourne, Monash University, the Department of Primary Industries (Victoria) and The Ohio State University. He is also an Adjunct Professor in the Department of Animal Science, Ohio State University.

Paul has had an extensive research career studying the behaviour and welfare of farm and companion animals. He is particularly recognised for his research on human-animal interactions but also for his research on housing and husbandry effects on animal welfare and behaviour. Paul teaches subjects, such as animal behaviour and animal welfare, to undergraduate and masters students at the University of Melbourne.

Human-animal interactions in livestock production

Prof. Paul Hemsworth
Animal Welfare Science Centre, University of Melbourne, Australia

Introduction

The principle that management, including supervising and managing animals, affects farm animal welfare, is widely recognised within the livestock industries. However, the manner in which management affects animal welfare, both directly and indirectly, is probably not fully appreciated (Hemsworth and Coleman, 2010a). At the level of farm management, human resource management practices, including employee selection and training, and animal management practices, such as best practice in housing and husbandry, and implementation of welfare protocols and audits, all impact on farm animal welfare. At the stockperson level, together with the opportunity to perform their tasks well, stockpeople require a range of well developed husbandry skills and knowledge to effectively care for and manage farm animals.

There are three main classes of factors that can be considered to contribute to a stockperson's work performance: capacity, willingness and opportunity (Hemsworth and Coleman, 2010b). 'Capacity' includes variables such as skills, health, ability and knowledge, while 'willingness' includes motivation, job satisfaction, attitude to the animals and work attitude and 'opportunity' includes working conditions, actions of co-workers and organisational policies and rules. The focus of this paper is the human-animal relationship in the livestock industries and its impact on animal welfare. In relation to the stockperson, emphasis will be given to the stockperson's attitude and behaviour towards the animals since these two characteristics are central to the stockperson's work performance and thus animal welfare outcomes. In addition to considering the impact of the stockperson on animal welfare, this paper will also review the opportunities for the livestock industries, through both the training and selection of stockpeople, to improve animal welfare.

The concept of the human-animal relationship and its assessment

As with social relationships, human-animal relationships can be viewed to allow the partners to predict the actions and responses of their partners and therefore guide their own actions and responses. Consequently, these relationships between humans and animals can be studied by investigating each partner's perception of the other, which should reflect their perception of the relationship.

Therefore, the quality of the relationship from the animal's perspective can be studied by examining the behavioural and physiological response of the animal to humans. Similarly, the quality of the relationship from the human's perspective can be studied by examining the behaviour of the human towards the animal and, as we will see later, the attitude of the human towards interacting with the animal.

Effects of human contact on animal welfare

There are three main lines of evidence that demonstrate the implications of human contact for the welfare of farm animals: handling studies under controlled conditions; observed relationships in the field; and intervention studies in the field targeting stockperson behaviour.

Evidence from handling studies

Handling studies, predominantly with dairy cattle, pigs and poultry, indicate that negative or aversive handling, imposed briefly but regularly, will increase fear of humans and reduce the growth, feed conversion efficiency, reproduction and health of farm animals (see reviews by Waiblinger et al., 2006; Hemsworth et al., 2009; Hemsworth and Coleman, 2010b). A chronic stress response has been implicated in these effects on productivity since in many of the pig studies (Hemsworth and Coleman, 2010b), handling treatments that resulted in high fear levels also produced a sustained elevation in the basal free cortisol concentrations.

These findings raise concerns for the welfare of farm animals that are negatively handled. Fear is generally considered an undesirable emotional state of suffering in both humans and animals (Jones and Waddington, 1992) and one of the key recommendations proposed to the United Kingdom Parliament by the Brambell Committee in 1965 (Brambell et al., 1965) was that intensively-housed livestock should be free from fear. There are several reasons why fear of humans will reduce the welfare of farm animals. Fearful animals are likely to be stressed and are more likely to sustain injuries trying to avoid humans during routine inspections and handling. Furthermore as discussed later, in situations where human contact is negative, the stockperson's attitude towards the animal is likely to be poor and thus the stockperson's commitment to the surveillance of and the attendance to welfare (and production) problems facing the animal may be less than desirable.

Evidence from field observations

Field studies examining inter-farm correlations indicate sequential relationships between stockperson attitudes, stockperson behaviour, animal fear of humans and animal productivity (Fig. 1). These studies have been reviewed by Hemsworth and Coleman (2010b) but the main findings are described below.

First, consistent negative inter-farm correlations have been found between fear of humans, as assessed on the basis of the animal's behavioural response to humans, and the productivity of dairy cattle, pigs and poultry. High fear responses were associated with reduced productivity in terms of reproductive performance of sows, milk yield of dairy cows and feed conversion of meat chickens.

Second, inter-farm correlations have been found between the behaviour of stockpeople and animal fear of humans. The frequent use of handling behaviours, which can be considered as negative in nature, was associated with high fear levels in farms animals. These negative behaviours include slapping, hitting and pushing pigs; slapping,

pushing, hitting, twisting tails and shouting at dairy cows; fast speed of movement amongst meat chickens; and loud noise, such as shouting and cleaning with an air hose or leaf-blower near caged hens. Conversely the frequent use of handling behaviours, which can be considered as positive in nature, was associated with reduced fear levels in farms animals. These positive behaviours included patting and stroking sows as well as resting the hand on the sow's back; patting, stroking, resting the hand on the cow's flanks or legs when attaching or detaching milking clusters or steadying the cow during milking and talking to cows; and spending time close to the hen's cage.

Third, correlations were been found between stockperson attitudes and behaviour. Questionnaires were used to assess the attitudes of the stockpeople on the basis of their beliefs about their behaviour and the behaviour of their animals. In general, positive attitudes to the use of petting and the use of verbal and physical effort to handle dairy cows and pigs were associated with reduced use of negative behaviour to dairy cows and pigs. Furthermore, a positive attitude to the sensitivity of calves to human contact was associated with frequent use of positive behaviours to veal calves, while negative attitudes to the sensitivity of hens to human contact as well as negative general beliefs about hens were associated with more noise, faster speed of movement and less time spent stationary near the hens.

Thus evidence from handling studies and observations on human-animal interactions in the livestock industries indicate that it is this history of human interactions with the animal that leads to the development of a stimulus-specific response of farm animals to humans: through conditioning, farm animals may associate humans with rewarding and punishing events that occur at the time of human-animal interactions and thus conditioned responses to humans develop. Furthermore, because attitudes are the main dispositional factor affecting volitional human behaviour, there are likely to be opportunities to manipulate human-animal interactions in order to influence farm animal welfare and productivity, by improving the attitudes and behaviour of stockpeople towards farm animals.

Evidence from intervention studies in the field

Studies in the dairy and pork industries (Coleman et al., 2000; Hemsworth et al., 1994, 2002) have shown that cognitive-behavioural training, in which the key attitudes and behaviour of stockpeople are targeted, can be successfully used to

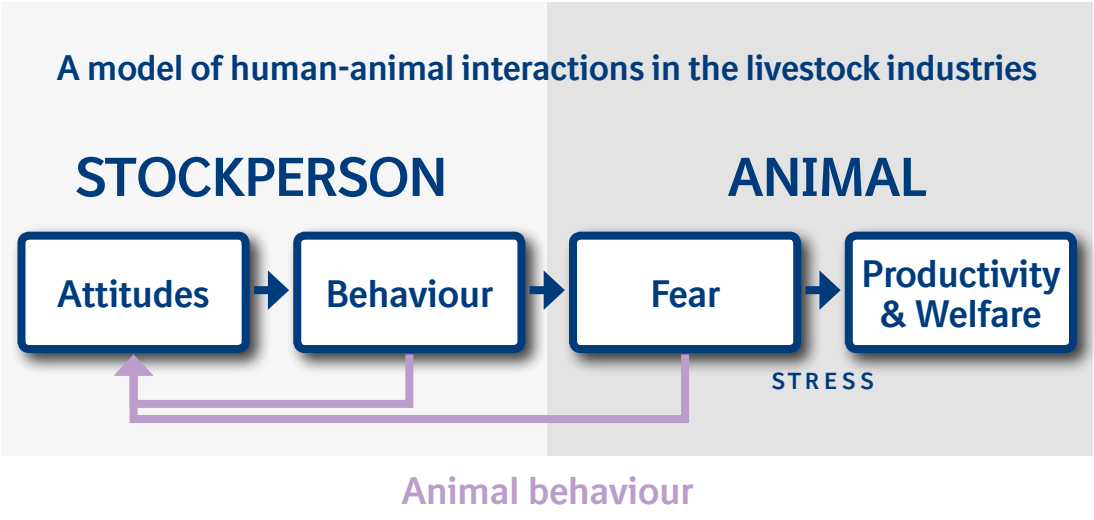


Figure 1. Sequential relationships between some key stockperson and animal variables. (Hemsworth and Coleman, 1998)

improve animal welfare and productivity. These intervention studies resulted in improvements in the attitudes and behaviour of stockpeople and, in turn, reductions in fear of humans and improvements in the milk yield of dairy cows and the reproductive performance of sows. Recent studies on human-animal interactions at cattle and sheep abattoirs indicate similar training opportunities to improve animal welfare (Hemsworth and Coleman, 2010b).

Cognitive-behavioural techniques basically involve retraining stockpeople's behaviour by targeting both the beliefs that underlie the behaviour (attitude) and the behaviour in question, and then by maintaining these changed beliefs and behaviours (Hemsworth and Coleman 2010b).

Opportunities to improve human-animal relationships

The results of these intervention studies, taken in conjunction with handling studies and field observations on the relationships between stockperson attitudes, stockperson behaviour, animal fear and animal productivity, provide evidence of causal relationships between these stockperson and animal variables. Furthermore, this research provides a strong case for introducing stockperson training courses in the livestock industries that target the attitudes and behaviour of the stockperson. Cognitive-behavioural training is presently used in the dairy and pig industries in several countries.

Stockpeople clearly require a basic knowledge of both the requirements and behaviour of farm animals, and also must possess a range of well developed husbandry and management skills to care for and manage their animals effectively. Therefore, while cognitive-behavioural training addressing the key attitudes and behaviour of stockpeople that affect animal fear is important in improving animal welfare, it is obvious that knowledge and skills training are also fundamental to improving the welfare of commercial livestock.

Stockperson selection may provide another opportunity to improve animal welfare. The potential value of selecting stockpeople using screening aids is illustrated by a study of stockpersons in the Australian pig industry (Coleman, 2001, Carless et al., 2007). The pertinent findings were that some measures of stockperson characteristics taken at a selection interview were correlated with performance measures taken six months later. For example, a positive attitude towards pigs and empathy towards animals were correlated with the behaviour of the stockperson towards pigs and the technical skills and knowledge of the stockperson. A pre-employment measure of work reliability and job satisfaction was also found to be a good predictor of the work motivation, behaviour towards pigs, and technical knowledge of the stockperson. These results suggest that measures of attitude, empathy, work reliability and job satisfaction may be useful in assisting to select stockpeople who will perform well in the ways studied here.

Conclusions

This discussion demonstrates the important role and responsibility of the stockperson in the development of human–animal relationships in the livestock industries and thus underlines the need to understand not only these relationships but also the opportunities to improve them in order to safeguard animal welfare. Stockperson attitudes are amenable to change, so stockperson training can improve human-animal relationships in the livestock industries. Stockperson selection tools may have limited utility where the pool of available recruits is limited and it may be appropriate to use selection tools to assist in identifying the nature and extent of training that may be necessary to ensure that the recruit is suited to the role of a stockperson.

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Notes


Notes

Jenny Gibbons

I graduated in Animal Science (University of Aberdeen) and then completed my MSc in Applied Animal Behaviour and Welfare Science (University of Edinburgh). After completing my MSc thesis I joined the Animal Behaviour and Welfare Team at SAC Edinburgh as a research assistant where i worked on many multidisciplinary projects. Later, I completed my PhD with SAC and the University of Edinburgh. My PhD focused on understanding the causes and consequences of individual differences in social, aggressive and responsive behaviour in dairy cattle. Currently, I am a NSERC post-doctoral fellow at Agriculture and Agri-Food Canada in British Columbia. My research interests focus on welfare and behaviour of dairy cattle including development and validation of temperament in dairy cattle, welfare assessment and cow comfort.

Responsiveness of dairy cows to human approach and novel stimuli

Jenny Gibbons
Agriculture and Agri-Food Canada BC, Canada

Introduction

Research into livestock temperament has been performed to provide answers to specific problems, such as how to minimise danger from fearful or maternally defensive cattle, how to minimise aggression and how to prevent the occurrence of damaging behaviours such as tail-biting in pigs and feather pecking in laying hens. At the heart of these issues is the observation that individuals tend to consistently respond in the same way to certain stressors and that variation exists between individuals. There are nervous and calm animals in every breed of cattle, and therefore all herds stand to benefit from careful attention to temperament. People who routinely work with animals notice individual animals have different temperaments. It has been shown that cattle react to humans and novelty with a strong inter-individual variability (Kilgour et al., 2006; Gibbons et al., 2009). An animal's temperament can reflect how individual animals cope and interact with their environment (Boissy and Bouissou, 1995). In farm animals, individuals that are highly responsive or fearful during normal management routine may experience poor welfare due to increased stress as a result of their inability to cope. This has been shown to lead to a reduction in production (dairy: Hemsworth et al., 2002; beef: Petherick et al., 2002) and health (Fell et al., 1999).

Why measure temperament?

Traditionally, research on dairy cattle welfare has focused on assessing the effects of housing conditions and management practices on animals (e.g. Haskell et al., 2006; Huzzey et al., 2006). It is beneficial to the animal to modify the environment in which it is kept. Once the environment has been modified to best meet the demands of the animal, selecting animals with desirable temperament characteristics that are more suited to their production environment can additionally improve welfare and productivity. However, ethical considerations must be taken into account. For example, it is not ethically responsible to alter temperament so that animals will adapt to inappropriate environments. It is generally thought that selective breeding to reduce fearfulness and aggressiveness and improve mothering ability in beef cattle and pigs is ethically sensible. Breeding values are now routinely calculated for behavioural traits such as docility in Limousin cattle to help breeders identify and remove aggressive and dangerous animals (Donoghue et al., 2006). Breeding values for response of dairy cows to milking have also been calculated (Brotherstone, 1995).

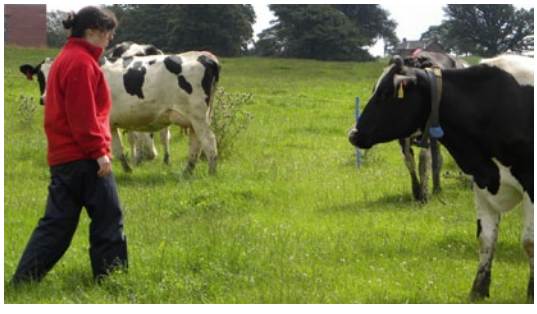
Defining temperament in dairy cattle

Temperament defines the behavioural responses of cattle when exposed to environmental challenges (e.g. restraint in a crush or human handling). Individual animals have been shown to react in a consistent manner. This consistency in behaviour can be assessed at many levels. The basic level is where there is consistency within the cow in its reaction to stimuli in a single situation (e.g a fearful cow may run quickly from a handling area). The next level is where the individual cow reacts consistently in a number of related situations (e.g. a fearful cow runs quickly from a handling area and avoids approaching humans). The highest level is where different types of behaviours are correlated across situations, for example, we might find that not only is a cow fearful in many situations but she also shows low levels of exploration in novel situation (Turner et al., 2010).

Measuring temperament on dairy cattle

Human handling procedures may elicit stronger responses in some animals than others causing them stress, while animals that are over-reactive in response to novelty may not respond well to changes in their daily routine or environment. An ideal level of responsiveness is one that is adaptive, resulting in functional reactions to challenging situations. Therefore, one important aspect of temperament is responsiveness of individual cows towards human interaction and towards challenge within the environment. Human approach tests have been measured in a range of experimental conditions including at pasture (Murphey et al., 1980; Gibbons et al., 2010b) and in the home pen (Winckler et al., 2007). These tests have been adapted for use on commercial farms as part of on-farm welfare assessment audits (Waiblinger et al., 2003; Windschnurer et al., 2008). When developing a temperament test it is important to investigate if the test measures the animal's response consistently across time. Next, it is necessary to check if the temperament trait that is being assessed is consistent across different situations. In previous work, we evaluated human approach tests at three locations in the pen (alley, stall and feeder) at three intervals over a month and three novel stimuli tests (striped board, flashing and water-

spray) to measure responsiveness in dairy cows. The tests were designed to provide a challenging situation which drew out aspects of the animal's individual temperament in a familiar environment. Dairy cattle vary widely in their responses to human and novel tests and response to human and reaction to novelty was not related (Gibbons et al., 2009). Only the responses to a human approach in the alley were consistent over one month, and therefore, the only type of test which can indicate some core factor of temperament (Gibbons et al., 2009). However, for the human approach test to be a reliable temperament measure it is important to investigate if response varies over a longer period. Our next study investigated if the response to humans changes with age. If response does vary with age, then this may unfairly bias farms with younger or older cow age profiles. Cows were tested at regular intervals (at breeding, pre-calving, early, mid and late lactation) across their productive lifetime (1st, 2nd and 3rd lactation). In general, cows became more approachable with increasing age, up until the middle of the first lactation. Beyond this stage, response to humans became stable. Cows are bolder and more at ease, and less fearful with increasing age. The results suggest that response to humans can be successfully used to compare responsiveness across farms if the human approach test is performed on cows which are in the middle of their first lactation or older (Haskell et al., unpublished).



Many studies have shown that fearfulness or reactivity is consistent across different situations (e.g. Grignard et al., 2001; Lansade et al., 2008). Our next experiment assessed if an animal's response in a human approach test is related to its response in a handling crate. In the beef cattle industry, cattle temperament is evaluated using an objective measure of flight speed (which measures the speed or time taken to exit a handling crush over a given distance; e.g. Burrow et al., 1988; Kilgour et al., 2006). The flight speed test has been used extensively because of its objectivity, and also because it is repeatable (Burrow and Dillon, 1997; Petherick et al., 2002; Müller and von Keyserlingk, 2006) and heritable (Burrow, 2001). In addition, these tests are safe, quick and simple to implement on-farm (Burrow, 1997). Beef cattle with higher flight speeds (i.e. with highly responsive temperaments) exhibit lower weight gain (Voisinet et al., 1997a) and produce tougher meat (Voisinet et al., 1997b). Flight speed is consistent over time in young dairy animals (Gibbons et al., 2011) indicating that this measure is assessing an underlying characteristic of the animal. However, in many systems, dairy cattle are not routinely weighed or held in a crush. A significant correlation exits between flight speed and human approach indicating that either technique can be used (Gibbons et al., 2011). However, as the human approach test can be measured in standard dairy cow housing systems, it may be a more practical way of assessing responsiveness in dairy cattle where flight speed cannot be measured.

Genetics and temperament in dairy cattle

There is increasing evidence for a genetic influence on cattle temperament (Gutiérrez-Gil et al., 2008) although the genetic contribution will vary

depending on the behavioural trait in question (Turner and Lawrence, 2007; Turner et al., 2008a). In recent years, a lot of attention has focused on the unfavourable genetic relationships with milk production and cow health and longevity on farms. This thinking led to the UK's Farm Animal Welfare Council suggesting that 'breeding companies should devote their selection to health traits to reduce lameness, mastitis and fertility' (FAWC, 1997). These sorts of concerns have generally given rise to the view that there should be a focus on breeding for what are described as 'robust' animals that are healthier, more productive and live longer (Star et al., 2008). In response to this SAC organised a research consortium of government funders, animal breeders and relevant charities to explore the potential for selecting for robust dairy cows. One aspect of this large collaborative project was to explore the behavioural characteristics associated with robustness. We were particularly concerned to understand whether selecting for robust dairy cows would have undesirable outcomes on behaviour and cow temperament. The aim of this on-farm study was to compare the behaviour of daughters of 'high robust' and 'low robust' bulls toward humans and novelty. For this study, first lactation Holstein-Friesian dairy cows were selected from their sires that scored high and low on the robustness traits (longevity, health and fertility). Overall daughters of bulls scoring high for robustness showed more positive responses (approach and exploration behaviours) to novel object and human approach tests. This indicates that challenging situations may cause less stress to cows selected for high health because they are more capable of adapting to changes in their environment (Gibbons et al., 2007; Lawrence et al., 2009).

Conclusion

There are many and varied ways of assessing behavioral consistency in livestock species and this paper focuses on two tests that are suitable for use with dairy cattle. There is a major consensus that an underlying consistency of behavior does exist in individuals, and that it can affect the productivity, health and welfare of the animal and also the welfare of its conspecifics and human handlers. A long-term objective is to develop suitable temperament scores that can be used in future breeding programmes or as part of welfare assessment schemes. Temperament is a combination of genetics and the environment (e.g.handling). Selection for easy-going disposition when purchasing a bull or keeping a heifer, along with careful handling when cattle are young (and each time the cows are handled for vaccinating, sorting and any other management processing) can contribute to future profitability.

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Xavier Boivin

Xavier Boivin is currently acting as an applied ethologist at the French National Institute of Agronomical Research (INRA). He performed his PhD on beef cattle docility and for the past 20 years he has been studying factors influencing farm herbivores' perceptions of humans.
He gives lectures in several agricultural schools and produced more than 40 papers on cattle, sheep, horses and goats in internationally recognised scientific journals.
Within the European Welfare Quality® Project, he coordinated the work package related to stress associated with animal handling and contributed to the production of a multi-media training package "Quality Handling" for improving the human-animal relationship.

Marko Ruis

Dr Marko A.W. Ruis is a biologist and got his M.Sc. degree at Wageningen University. He is involved in animal welfare research since 1994. He is specialized in both fundamental and applied animal welfare research. He has a broad expertise in measuring and monitoring of animal welfare, including aspects of behaviour, health, physiology and immunology. As a projectleader and scientist he has been involved in research dealing with improvements and innovations in housing systems and management methods for pigs, laying hens, broilers, ducks, turkeys, mink and rabbits. In 2001 Marko obtained a PhD in pig welfare. He is the author or co-author of almost 20 refereed publications and book chapters on animal welfare.
Marko is increasingly involved in translation and transfer of knowledge to different groups of users, including farmers and students of lower and higher education. Within the large EU-project Welfare Quality® he is involved in development of multimedia training packages for pig and poultry farmers, being available in the English and Dutch languages. With regard to education, he maintains a close working relationship with the Van Hall Larenstein Institute for higher education. He is currently responsible for the website www.dierenwelzijnsweb.nl (www.animalwelfareweb.nl) which bridges welfare science, lower and higher agricultural education, and societal and agricultural issues.

“Quality Handling” a training program to reduce fear and stress in farm animals

Xavier Boivin, INRA, France & Marko Ruis, Wageningen University, The Netherlands

Introduction

Animal welfare is a critical challenge, not only for ethical reasons but also from an technical point of view (work conditions, safety, animal health and production). Animal welfare can be defined as the response of the animal to its living conditions in terms of stress and well-being. Improving animal welfare can be achieved by a) selecting the animals not only for production traits but lower susceptibility to diseases and stress and preferred behavioural traits, b) improving the husbandry conditions to match animals’ physical, physiological and psychological needs, and c) improving handling of the animals. Improving the animal-human relationship, i.e., how animals perceive humans - ranging from fearful of humans on the one side to confident in the presence of humans on the other side, is a key factor for animal welfare particularly where the number of animals on farms is increasing rapidly. Because of the increases in animal numbers, farmers have or may choose to have less and less time to spent in contact with their animals. As a consequence, research programs in genetics attempt to identify less reactive or animals that are less aggressive towards humans (e.g. the French program COSADD, Benhajali et al, 2010). In addition, environmental factors (e.g design of handling facilities) that induce fear and injuries in animals during animal handling on farm or at the abattoirs need to be identified and removed. Finally, research programs such as the European Welfare Quality® program, have attempted to improve animal welfare by developing training programs for improving stockperson behaviour towards the animals. We will illustrate these different approches in this paper, with a special focus on the Quality Handling program, a multi-media training for improving animal handling in pigs, laying hens and cattle farming.

Factors influencing the human-farm animal relationship

Genetics and maternal experiences

Research in many countries (France, Australia, United-state, Ireland, Germany...) have shown that animals’ responses to handling have a

significant genetic component (h^2>0.2) allowing them to be selected on this basis (e.g. in beef cattle, Le Neindre et al, 1995, Burrow, 1997, Gauly et al, 2001,...). Collaborations between geneticists and ethologists have investigated situations relevant to evaluation in large scale operations such as during weighing (Benhajali et al, 2010). Apart from the elimination of genetic lines that are at risk, correlations between docility and husbandry parameters (growing rate, ease of calving, precocity and fertility) suggest that genetic selection on this basis would be, at the very least, not detrimental but even favourable for many economic parameters (Burrow, 1997, Phocas et al, 2006). In addition, the influence of the parents on their offsprings is not only genetically inheritated. Recent research confirm farmers' opinions that calves, foals and quail chicks learn from their mother how to react to humans (Bertin and Richard-Yris, 2004, Henry et al, 2005, Boivin et al, 2009).

Physical and human environment

The physical and human environment is a critical factor for the development of good human-animal relationships. In addition to the genetic factors mentioned above, differences between farms can be induced by the design of housing systems or handling facilities (Grandin et al, 2007). Farm animals' sensory capacities and perception of their world is quite different from those of humans. For example, cattle are strongly sensitive to light constrast, sudden noises, novelty or social isolation. The wrong design of the handling facilities can frighten animals and even make them panic, leading to flee or remain motionless when they should be moved calmly by the handler. Handlers then can become nervous, impatient or sometimes even violent, increasing risks of injuries for both human and animals. Well-designed, good facilities help human-animal contact and quick and calm handling.

Stockperson handling behaviour

Farmers generally have high levels of expertise, experience and competency. Nevertheless, there is widespread recognition that animals' agitation and fear responses during handling vary markedly between farms. The perception of the human by the animal is the result of regular interactions between them (animals and humans) building their relationship from an early age. Both animals and humans remember their previous encounters and predict their confidence or fear in their future interactions (Estep and Hetts, 1992). This relationship is the result of a daily learning process. Differences between farms in animals' reactions to human are prob-


ably mainly induced by people present on the farm and in visual, audible or physical contact with the animals. Sensitive periods of contact (early age, weaning time or calving) seem to exist allowing good human-animal relationship to develop through positive interactions at this stage (e.g. Boivin et al, 1992, 2000, Krohn et al, 2001, Hemsworth et al, 1987, 1989). However these contacts vary among farmers and the daily contact outside of these periods is probably also crucial as the influence of the dam or other animals of the group.

Several studies, particularly in Australia on pigs and dairy have clearly supported variation in animal fear is a consequence of the behavioural habits of the stockpersons (e.g. Hemsworth and Coleman, 2010, Lensink et al, 2001, Waiblinger et al, 2003, Boivin et al, 2007). They also supported the links between animals' fear of human contact and stress, production, growth rate, health, and welfare. Fear was reduced if the animals had received regular, gentle human contact. Improving farmers' habits and handling behaviours in order to improve the human-animal relationship and also animal welfare is not easy and needs a careful training methodology.

Quality Handling®: a multi-media training program

Targeting attitudes

In collaboration with Australian researchers, the European research project Welfare Quality® developed the multimedia training package Quality Handling®, designed to help farmers improve their human-animal relationships. It uses a cognitive behavioural approach to target farmer attitudes and habits that were previously thought difficult to change. In Australia and United States, cognitive-behavioural intervention programmes have been designed to specifically target key attitudes and behaviours of stockpeople. These training programmes have produced substantial improvements in the attitude and behaviour of stockpeople and a marked reduction in the level of fear of humans by pigs and cattle (e.g. Coleman et al., 2000).

Based on the Australian experiences, Quality Handling® was developed specifically for the European context. The training program emphasises the important relationships between stockperson attitude, stockperson and animal behaviour, animal stress, productivity and welfare. Information on research results from controlled experiments as well as on-farm studies is given. As also shown in the training programmes, in pigs, cattle and laying hen production, the human-farm animal relationship varies strongly between farms, offering considerable opportunities for improvement.

Field tests

Following development of the training packages, their effectiveness in achieving changes in attitudes and behaviour of stockpeople was evaluated in field tests (Ruis et al., 2010). The field tests were carried out in The Netherlands (laying hens and pigs), and Austria (dairy cattle). Stockpeople were randomly allocated to training

groups (dairy cattle: 10 farms, 14 people; pigs: 8 farms, 12 people; laying hens: 7 farms, 10 people) or control groups (dairy cattle: 9 farms, 9 people; pigs: 9 farms, 12 people; laying hens: 8 farms, 11 people). All farms were visited twice. Only stockpeople in the training group were trained before the second visit. The period between the training and the second farm visit of the training farms was between 4-6 weeks for pigs and laying hens, and on average 9 weeks for cattle. Human attitudes towards animals were determined by means of a questionnaire filled in during the visits. Average scores were obtained for beliefs about animal characteristics (general attitude) and handling situations (behavioural attitude). Stockpeoples' behaviour was assessed by means of behavioural observations during handling, and expressed in % of positive behaviours per unit or animal. Finally, the animal's avoidance behaviour to the approach of an unfamiliar person was measured to assess fear for humans.

To analyze the results of the field tests, a combined analysis was performed for the three species with stockperson as the replicate. Sixty four stockpeople participated although some missing data resulted in varying sample sizes for the analyses. Data were first standardized within each species to remove the effects of the species-specific units of measurement of each variable. Data were analyzed by a 3 (species) by 2 (treatment group) analysis of covariance with the post training score as the dependent variable and the pre training score as the covariate. There was a significant increase in positive general attitude ($F_{1,57}=4.77$, $p<0.05$) and in positive behavioural attitude towards animals under care ($F_{1,57}=7.03$, $p<0.01$) for the trained group compared to the control group. Moreover, the percentage of positive behaviours towards animals under care increased significantly in the trained group compared to the controls ($F_{1,49}=9.48$, $p<.01$). The training tend to affect avoidance behaviour upon human approach ($F_{1,43}=3.52$, $p=.07$).


The results demonstrate that Quality Handling is a promising tool to improve the attitudes and handling behaviours of stockpeople in European livestock farming. In the field tests, the period between the training and second visit may have been too short to result in a significant effect on animal fear and behaviour.

Training packages

The training packages were finalized in 2009 and are now available for training sessions in English (pig and laying hen programmes also in Dutch; cattle program also in French and German).
The basis of each package is a computerized multi-media training program (with voice-overs, videos, animations) describing:

- How animals' fear responses to people vary between farms
- How fear of humans can affect productivity and ease of handling
- How animals perceive their environment,
- How to build a positive human-animal relationship
- How to improve and maintain handlers' attitudes and behaviour when they return to the farm.

The packages also include videos, group discussions, manuals, newsletters, and posters later sent to the trainees to put on their working place. This will allow to reactivate attitudes and behavioural changes obtained through the training process.

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Notes

Dr. Tom Noffsinger

Dr. Noffsinger earned his Doctorate in Veterinary Medicine from Colorado State University in 1973. He completed the University of Nebraska's Great Plains Veterinary Educational Center Beef Cattle Production Management Series in 1994.

From 1973 to 2005, Dr. Tom Noffsinger was senior partner of Twin Forks Clinic in Benkelman, Nebraska. His daily activities include consultation to beef feeding and cow-calf operations in the areas of health, performance, and animal behavior.

In 2005 he began working as an independent feedlot consultant. This includes facility design, and stockmanship (www.cattlexpressions.com).

In 1999, Dr. Noffsinger received the Distinguished Service Award from the Nebraska Veterinary Medical Association. In 2001, he received the Consultant of the Year Award from the Academy Veterinary Consultants. In 2008, he was given the American Association of Bovine Practitioners (AABP) Merial Preventative Medicine Award–Beef. Dr. Noffsinger is a member of the AVC, Nebraska VMA and AABP. He's a Past President of AVC.

Caregiver impact on cattle performance and health

Dr. Tom Noffsinger

Presentation will include applications of Low Stress Handling Concepts as a dimension of management that enables caregivers to have positive effects on cattle health and performance. Our goal will be to encourage caregivers to understand more about cattle in order to apply handling concepts during calving, new cattle acclimation, processing, pen riding, and sick cattle management.

Veterinarians, managers, and owners can encourage and train caregivers to make every interaction between caregivers and cattle a positive learning experience that enhances cattle health and well-being.

The implementation of consistent Stockmanship Concepts offers a golden opportunity to train cattle to be confident of their surroundings. Event intervention at arrival, processing, and pen checking can have a positive effect on arrival feed and water intakes, arrival weight gains, immune function, and disease resistance.

Cattle exhibit very strong prey animal instincts. Prey animals have survived in nature aware that predators select the lame, depressed, and weak to harvest. If caretakers behave like predators, cattle will hide signs of depression and disease from these people as long as possible. Understanding more about the visual, auditory and sensory abilities of cattle encourages handlers to override their predator tendencies, such as to chase and yell.

The handler's goal is to convince cattle to accept leadership and guidance. Reduction of relocation anxiety is a realistic goal for handlers in all stages of Beef Production. Understanding prey animal instincts and sensory adaptations allows handlers to communicate with cattle via position, distance, angles, and speed. Position, angles, distance and speed are the ABCs of prey animal language. Simple behavior requests prepare cattle to be confident in their surroundings. Investing small amounts of time greeting new cattle pays dividends in anxiety reduction and improved water and feed intake levels. Multiple, short lessons teach cattle to trust handlers

enough to be willing to approach a handler and pass by to continue straight in single file fashion. These behaviors are the foundation for voluntary flow through processing facilities, communication of their true state of health, and eventual pen removal, sorting and loading.

Handlers that reward cattle motion with release of pressure can quickly train cattle – and in doing so create mutual respect and develop trust between themselves and the cattle. Understanding that cattle like to see what is pressuring them and like to see where they can go is fundamental to low stress handling. Cattle that trust handlers, volunteer to move away from handlers and will walk straight away and move as directed. This attitude of willingness has a positive effect on herd social interaction. Sensitive cattle are more content and timid cattle are more willing to compete for feed and water. Handling opportunities become positive to cattle health and performance instead of a stress.

Trained cattle recoup transport weight losses and demonstrate more efficient response to processing vaccines. Confident cattle communicate early signs of lameness and respiratory disease. Early disease detection is crucial to successful therapies. Trained cattle achieve their genetic potential based on carcass grade and yield.

Tangible management expectations should include improved worker safety, higher levels of employee retention, reduced absenteeism, and improved worker efficiencies.

Caregivers can have a positive impact on cattle health and performance. Cattle are easily trained to respond to the release of pressure and become more willing to communicate their true state of health when they realize that handlers are not predators.
Caretakers that concentrate on low-stress handling skills increase their powers of observation, recognize abnormal behavior and attitude and develop the confidence and skill to manipulate behavior to improve levels of animal welfare.

Understanding Stockmanship principles and the willingness of caregivers to respect and complement prey animal instincts and sensory abilities is the foundation for caregiver provision of optimum cattle well-being and worker efficiency and safety.


Notes

Dr. Ken Leslie

Dr. Ken Leslie was raised on a central Ontario dairy farm. He graduated from the Ontario Veterinary College (OVC) in 1974, and developed bovine practice skills in Brampton, Ontario. In 1977, he accepted a clinical faculty position at the University of Guelph. Subsequently, Ken completed his M.Sc. graduate training in dairy cattle reproductive management. Dr. Leslie is currently a Full Professor in Ruminant Health Management in the Department of Population Medicine at the University of Guelph. He has responsibilities for teaching, research and extension of dairy health management programs. He has developed an international reputation for his research and extension in mastitis control, calf health management and dairy cattle well-being. His special interests are udder health, dairy replacement animals, transition cows, and dairy cattle behaviour. Dr. Leslie originated the concept of continuing education certificate programs at the University of Guelph. This program, the Dairy Health Management Certificate Program, has been conducted for more than 100 dairy practitioners, and continues to be held each spring as an annual extension education conference. Dr. Leslie has put a great deal of effort into fostering networks of dairy health management veterinarians, and research workers, on issues relative to dairy cattle health. He is an active supervisor of graduate students, and veterinary students with a food animal emphasis. Through all of these efforts, his primary objective is to foster awareness and interest in the implementation of progressive health management programs for the dairy industry. Dr. Leslie has received the Intervet Schering-Plough Awards for Preventive Veterinary Medicine and AABP Mentor of the Year, the AABP Cyanamid Award of Excellence, the Canadian Animal Health Institute Industry Leadership Award, the Pfizer Award for Research Excellence, the Ontario Veal Association Award of Merit and the OABP Award of Excellence.

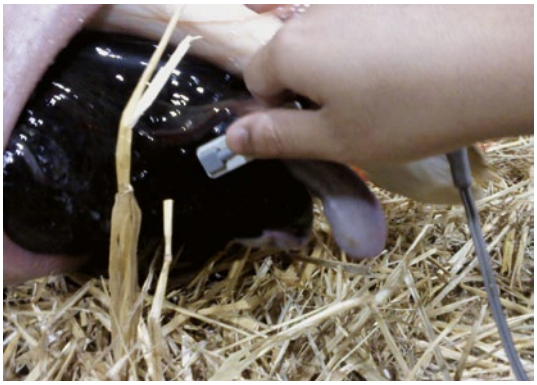
Impact of dystocia on newborn calf vigor

Ken E. Leslie and Christine Murray
Department of Population Medicine, University of Guelph, Guelph, ON, Canada

Introduction

The process of parturition can be a traumatic and hazardous event in the life of a calf. The process is initiated by a rise in fetal cortisol, followed by a surge of endocrine events in the dam that lead to myometrial contractions, dilation of the cervix, delivery of the fetus, and ending with expulsion of the placenta (Senger, 1999). Many different factors can disrupt the fetal or maternal systems involved with parturition, which may result in dystocia (Breazile et al., 1988). Dystocia is defined as a difficult or abnormal calving due to a prolonged unassisted parturition process, or due to a prolonged or severe assisted calf removal (Mee, 2008).

The prevalence of dystocia in dairy cattle has increased over time as breeding programs have focused largely on production traits, and have incidentally resulted in cows producing calves that are relatively larger compared to their dams (Mee, 2008). The most common cause of dystocia is excessively large calf birth weight and a resulting mismatch of fetal-maternal size, especially in primiparous dams (Lombard et al., 2007). Statistical models constructed by Johanson and Berger (2003) showed that calf birth weight was a better predictor of calving difficulty than calf gender alone. It was determined that for every one kilogram increase in birth weight, there is a 13% increased probability of dystocia (Johanson and Berger, 2003). A curvilinear relationship exists between birth weight and dystocia. This relationship is dependent upon the parity, breed and pelvic size of the dam. Holstein cows have the highest incidence of dystocia of any dairy breed, averaging a 40% incidence rate. Holsteins have the highest ratio of calf birth weight to dam body weight,



averaging 7.1%, but it is often over 10% (Holland et al., 1992). The threshold for calf bodyweight in Holsteins lies between 42 and 45 kg. If calf weight increases above 45 kg, the rate of dystocia increases significantly (Johanson and Berger, 2003).

Stress effects on the newborn calf, as a result of dystocia, greatly increases the risks of both neonatal morbidity and mortality. Lombard et al. (2007) reported that dystocia and subsequent health effects account for almost 50% of all calf mortality. The most comprehensive study to document calf losses in North America has reported that 15.9% of calves die before weaning (USDA 2007). The first losses (8.1%) result from events that occur during calving and in the initial 48 hours after birth. These losses are classified as stillbirths. The remaining mortalities (7.8%) are associated with health problems caused by pathogens acquired after birth, most commonly manifested as diarrhea and respiratory problems leading to calf death. As such, calves experiencing trauma due to dystocia at birth often have reduced newborn viability resulting in detrimental effects on the adaptation to life outside the uterus.

Reduced Viability in the Newborn Associated with Dystocia

Management of dystocia on modern dairy herds in North America is largely aimed at maintaining a healthy and fertile cow, partly because methods for determining the vitality of the fetus during parturition are very limited. In dams carrying valuable calves, or when dystocia is suspected, there is the risk of intervening too soon, which is the main cause of trauma and asphyxia in the calf (Bleul and Kähn, 2008). A large number of stillbirth deaths are attributed to trauma, suggesting either an inappropriate timing of assistance or excessive force during delivery. Excessive trauma is commonly found (25%) in calves delivered using normal traction. When excessive force is applied during the delivery process, trauma inflicted can affect several body systems (Schuijt, 1990). For example, rib and vertebral fractures are a common sequelae following dystocia. In addition, hemorrhage in and around the kidneys, adrenal glands and musculature is a consistent necropsy finding and is a useful indicator that a thoraco-lumbar fracture is present (Schuh and Killeen, 1988). Other frequent results of birth trauma in calves include mandibular fractures (Ferguson, 1985), meningeal hemorrhages and congestion, liver rupture leading to abdominal hemorrhage (Haughey, 1975), long bone fractures, myeolma-


lacia, spinal cord compression or severed spinal cord (Schuh and Killeen, 1988). Calf deaths from these problems may not occur for 12 to 24 hours, or often days later. A large percentage of traumatic injuries sustained during extraction remain undetected (Kelly and Rowan, 1993).

Another consequence of forced extraction of the fetus is the premature rupture of umbilical vessels. With early umbilical cord rupture, calves have an inability to regulate respiration leading to a diminishing oxygen supply and the rapid development of asphyxia and respiratory acidosis (Szenci, 1982). This results from the lack of the ability to breathe after termination of blood oxygenation from the placenta, intense and prolonged labor contractions, and trauma during forced extraction. The development of a severe acid-base imbalance and prolonged hypoxia becomes present (Breazile et al., 1988; Grove-White, 2000). If the hypoxia is severe enough, fetal tissues will derive energy from anaerobic glycolysis, which results in the production of lactic acid and leads to metabolic acidosis. Severe respiratory and metabolic acidosis resulting from hypoxia may compromise survival in the newborn calf (Bleul et al., 2007; Grove-White, 2000). Mulling (1976) found that the largest losses associated with dystocia are caused by hypoxia due to intrauterine asphyxia. Asphyxia can cause death, edema, bleeding, liver damage, and if amniotic fluid is in the lungs, it can also cause pneumonia (Mulling, 1976).

During the fetal to neonatal transition, the newborn calf experiences severe thermolysis, which often results from the evaporation of fetal fluids and severe weather conditions. Maintenance of thermoregulation during the neonatal period is derived by both shivering thermogenesis in muscle tissue, and by non-shivering thermogenesis in brown adipose tissue (Carstens, 1994).

It has been shown that following dystocia, calves have may have an impaired response to environmental stress such as cold temperature conditions. Bellows and Lammoglia (2000) found that following severe dystocia requiring a mechanical calf puller, calves are less able to withstand cold stress compared to calves born without assistance, minor manual assistance or by cesarean section (Bellows and Lammoglia, 2000). Autopsy findings of calves that died later than a few hours, but less than eight days, after birth, showed that typical signs of cold injury and starvation include subcutaneous edema of the distal limbs, extensive catabolism of fat deposits, and focal hemorrhages in the adrenal cortex (Haughtey, 1975). Lower heat production and drop in rectal temperature found in stressed calves may be due to decreased mobilization of body lipids and low levels of plasma thyroid hormone (Vermorel et al., 1983).

It is logical that pain, discomfort and/or inflammation following calving, particularly dystocia, may interfere with the normal physiological and behavioral status of newborn calves, including thermoregulation and the motivation to consume feed. It has been shown that consumption of colostrum in calves with fetal distress is reduced by up to 74% during the first 12 hours after birth (Vermorel, 1989). Studies have indicated that calves that have experienced dystocia have reduced or delayed intake of colostrum at birth. Thus, failure of passive transfer in these calves may result from merely the failure to get up and drink in a timely manner. One study indicated that in severely acidotic calves (defined as venous blood pH <7.15), a 52% decrease in colostrum intake correlated with a 35% decrease in serum IgG concentration (Drewery et al., 1999). In other studies, the increased morbidity resulting from failure of passive transfer may have been associated with reduced IgG

absorption, rather than lower colostrum intake. In particular, studies in calves have shown that dystocia-induced asphyxia is followed by decreased absorption of IgG (Besser et al., 1990; Boyd, 1989).

Methods to Assess the Viability of Newborns

In humans, pre-natal and post-natal care programs have resulted in a very high rate of success for prevention of problems in women and in newborn babies due to a standard requirement for the completion of health and vigor score within minutes of birth. This method of assessment, commonly termed the "APGAR" score was created by Virginia Apgar, M.D., in 1953. It has become the standard procedure since that time. In this assessment system, 5 easily observed signs in newborn babies were selected for use, since these signs could be evaluated without special equipment and could be taught to the delivery room personnel without difficulty. These signs include heart rate, respiratory effort, reflex irritability, muscle tone, and color. In 1962, two pediatricians created an acronym to facilitate teaching the five signs of the APGAR score. The acronym APGAR stands for appearance, pulse, grimace, activity, and respiration. A rating of 2, 1, or 0 was given to each sign at 60 seconds after delivery, and subsequently following a decision-tree on a repeated basis, until the baby is deemed to be healthy and vigorous; the lower the APGAR score, the less vital the infant (Finster et al., 2005). Notably, the APGAR score was not designed for the purpose of making long-term predictions about future health and growth, but rather to guide physicians in providing care to individuals that may be at considerable risk immediately after birth. Studies have demonstrated that the APGAR score is a predictor of mortality in newborns, but it does not generally serve as a reliable predictive index of long-term physical, neurologic or mental impairments (Veronesi et al., 2009).

Dr. Apgar's first study (1952–1956) of more than 15,000 infants established that neonates scoring 8, 9, or 10 are vigorous and usually breathe within seconds after delivery. Mildly depressed infants score 5, 6, or 7, whereas severely depressed infants, scoring 4 or less, are blue and limp and have not established sustained respiration by 1 minute. When scores were analyzed by the type of delivery, APGAR scores of 0–2 occurred in 20% of breach presentations, 12% of cesarean deliveries, and only 3% of vaginal vertex deliveries. Neonatal death occurred in 15% of infants scoring 2 or less, in contrast to 0.13% of infants scoring 8–10 (Apgar et al., 1958).

Tests of newborn vigor have been developed for various species including the pig, horse and dog (Randall, 1971; Veronesi et al., 2005; Veronesi et al., 2009). In each of these studies, a modified APGAR test system was created using the basic rules presented by Virginia Apgar; choosing a few parameters that were easily evaluated without the use of complicated tools. These studies included variables such as heart and respiratory rate, reflexes, motility and mucous colour. With the use of this scoring system, Veronesi et al. (2009) found that there was increased mortality in pups with a low vitality score compared to those with high vitality scores. They also found that those puppies with lower vitality scores were less likely to seek the mammary gland and had weaker suckling/swallowing reflexes (Veronesi et al., 2009). Randall (1971) found that piglets with lower vitality scores were slower to stand, had more difficulty breathing, had slower heart rates, decreased arterial blood pH and increased pCO2, indicating a state of acidemia and hypercapnia (Randall, 1971). Results from these studies, indicating signs of reduced viability correlate well with many studies looking at the varying conditions of calves after a stressful birth.

In Germany, a variation of the APGAR score has been developed and modified to assess its validity in assessing calf vitality at birth (Mulling, 1976). The original calf APGAR score created by Mulling (1976), used signs of asphyxia as the criteria for scoring. This included muscle tone and movement, reflexes, respiration and mucous membrane colour. Schafer and Arbeiter (1995) used the modified APGAR score to assess newborn calf vitality. It was found that when parturition was greater than 2 hours, 71% of calves had low-grade depression. When relating APGAR scores to hormone and blood parameters, vitally depressed calves with lower scores had higher blood concentrations of cortisol and estradiol, larger numbers of granular neutrophils, and less lymphocytes than lively calves (Schafer and Arbeiter, 1995).

Herfen and Bostedt (1999a) also made use of Mulling's modified APGAR score. In a study looking at the correlation between calf vitality and length and type of parturition, it was found that both the length and type of parturition significantly influenced the degree of vitality of the mature neonate. Those delivered by a difficult natural vaginal birth had a much lower state of vitality than those born by cesarean-section. It was also found that clinical examination involving the APGAR score was only marginally correlated with the results of blood-gas analysis. Following the more prolonged calving events, as well as in cesarean sections, the clinically measured vitality of the calf appeared to be more severe than that measured by clinical laboratory parameters, such as blood gas analysis.

In a second study, Herfen and Bostedt (1999b) used the APGAR score to assess vital signs of newborn calves. Based on results from a previous study, it was found that Mulling's APGAR score was not accurate to assess the vitality status of the calf. It was found that calves were more appropriately classified into vitality groups based on acid-base status, rather than by their APGAR score. Vitality groups consisted of vital, vital depressed and life threatened. Those born with the highest level of acidosis, pH of less than 7.0, were classified as life threatened. While those with the highest pH, greater than 7.2, were classified as vital. Regardless of which vitality group calves classified into, by 180 minutes after birth, all experimental calves had pH values in the range of 7.27 to 7.3.

Other methods to assess newborn calf viability relate to a calf's motivation to consume colostrum. According to Schulz et al. (1997), it is physiological for calves to have a frequency of 80 or more intensive suckling movements per minute, and the ability to stand and drink without human assistance within 12 hours post-natum. Using this criteria, it was recommended that suckling behavior be used to assess vitality alone, or as a part of a modified APGAR score. However, it is interesting to note that a few other studies have been performed to assess suckling reflex and time to standing as an objective indicator of fetal stress in calves. Schuijt and Tavern (1994) looked at the time interval from birth to sternal recumbency as an objective measure of newborn calf vitality. This study indicated that calves that were forcefully extracted took significantly longer to achieve sternal recumbency, had more severe acidosis, recovered more slowly from acidosis, had greater mortality and exhibited trauma more frequently than those that were born without assistance, were normally extracted or were born by cesarean section (Schuijt and Taverne, 1994). In other research, time to standing has been found to be associated with a reduced motivation to drink colostrum. It was found that the quantity of colostrum ingested is best predicted by a combination of birth weight, vigor during colostrum feeding, and vigor during the first hour of life. However, suckling reflex was not related to colostrum intake, being pulled or not at calving, or calf vigor (Vasseur et al., 2008).

Summary and Conclusions

The goal of the dairy and beef industry to maintain healthy cattle could benefit from the development, validation and implementation of useful methods for determining the vitality of the calf during parturition. There is virtually no standard, validated protocol for monitoring newborn vigor (Bleul and Kähn, 2008). It has been suggested that intervention should occur when the calf begins to show signs of reduced vigor such as injury, blue mucous membrane colour, reduced responsiveness, poor suckling reflex and prolonged time to standing (Mee, 2004). However, there is currently a lack of published data supporting these observations. More research needs to be performed in order to validate these signs of reduced vigor, and to relate them to the future health and productivity of the animal. Currently, little is known about the effect of birth trauma on future calf health and performance. In addition, there is very little published data on control of pain from dystocia with appropriate therapeutic interventions. Alleviation of this pain and distress following calving may have important benefits for improving the physiological and behavioral status of the calf, total colostrum intake, success of passive transfer and, subsequently, reducing the risk of disease.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Dr. Cathy Dwyer

Cathy was appointed Reader of Behavioural Development and Animal Welfare at SAC in Edinburgh in 2007, and has been employed as a researcher at SAC from 1994. She manages a number of research projects concentrating on parturition, mother-offspring interactions and behavioural development in sheep, cattle and mice, and welfare in extensively managed species. She also teaches on the University of Edinburgh MSc course in Applied Animal Behaviour and Welfare, is currently supervising 3 PhD students and supervises a number of MSc student dissertations each year.

Before moving north of the border to Scotland, Cathy was awarded her PhD from the Royal Veterinary College in London in 1992 for studies in prenatal nutrition and maternal effects on foetal development in pigs. She worked as a postdoctoral research assistant at the Royal Veterinary College and at Massey University, New Zealand, investigating foetal development in guinea pigs and mice. Cathy has a degree in Physiology from the University of Bristol, UK.

Birth difficulty effects on mother-offspring behaviour and offspring development

Cathy M Dwyer
Sustainable Livestock Systems, SAC, Edinburgh, Scotland

Birth is an intrinsically risky process for both mother and young: half of all preweaning mortalities in cattle and sheep, for example, occur within the first day or so life (Hansen et al., 2003; Sawalha et al., 2007), and maternal mortalities and health problems also peak around parturition. Prolonged or difficult deliveries are associated with increased offspring mortality in cattle, sheep and pigs (e.g. cattle: Erikksson et al., 2004; Johanson and Berger, 2003; Meyer et al., 2001; sheep: Haughey, 1993; pigs: Baxter et al., 2008; Alonso-Spilsbury et al., 2005), and also has continuing impacts on offspring development. Thus, optimizing the parturition process can have important impacts on health, welfare and productivity in all farmed species.

Birth difficulty and mother-offspring behavior

Birth triggers an interest in the mother for neonatal cues (e.g. odours associated with neonates) and the expression of behaviour patterns designed to promote offspring survival. In cattle and sheep these are typically licking or grooming of the offspring, an absence of aggression and cooperation or facilitation of the neonate's sucking behavior (e.g. Dwyer, 2008). The offspring also shows a defined series of behaviours that culminate in the young animals standing, reaching the udder and sucking successfully. The survival of the young animal depends crucially on the appropriate expression of behaviours from both partners. For example, maternal grooming dries, cleans and stimulates the calf to seek the udder (Edwards, 1983; Nowak and Poindron, 2006; von Keyserlingk and Weary, 2007), whereas offspring sucking behavior ensures adequate colostrum intake and promotes bonding and recognition between mother and young.

In sheep, prolonged, difficult or assisted deliveries extend the time taken by the ewe to begin to groom her lamb, reduce the amount of grooming attention given to the offspring and increase the expression of aggressive or rejection behaviours,

compared to unassisted ewes (Dwyer et al., 2001). In dairy cattle, however, assisted delivery was not associated with altered maternal care (Barrier et al., 2010), perhaps because maternal care already occurred at a relatively low frequency in this species. In sheep, beef and dairy cattle assisted deliveries are consistently associated with reductions in offspring vigour, with dystocial offspring taking longer to stand, reach the udder and suck (lambs: Dwyer, 2003; Dwyer and Lawrence, 2005; beef calves: Riley et al., 2004; Poppe et al., 2006; dairy calves: Edwards, 1982; Diesch et al., 2004; Barrier et al., 2010).

Birth difficulty and the neonate

Calving difficulty or dystocia is consistently found to be related to high calf mortality occurring within 24 hours of birth, with mortality increasing with the severity of the dystocia (Nix et al., 1998). Nearly half of all calf mortality in first parity heifers, and a quarter of all calf mortalities in cows, are associated with dystocia (Erikkson et al., 2004). Calves are 3-15 times more likely to die if there has been calving difficulty (Johanson and Berger, 2003; Meyer et al., 2001; Chassagne et al., 1999). Singleton lambs, in particular, are also at risk of dying following a difficult delivery (Haughey, 1993), and piglets born late on in the birth order, or with a long cumulative farrowing period, are more likely to be stillborn (Baxter et al., 2008; 2009).

Why does dystocia cause neonatal mortality? Neonates may die during the birth process, as a consequence of asphyxia and/or damage and trauma suffered during delivery. Calf and lamb losses in the first two days after birth can also be related to injuries sustained during the birth process which prevent the newborn from adjusting completely to postnatal life. Birth injury is reported to be present in over 80% of lambs classified as parturient deaths (dying up to 3 h after birth) and up to 57% of lambs dying from starvation, mismothering or exposure (Haughey, 1993). Neonates can suffer a range of injuries, particularly involving haemorrhage around the brain and spinal cord, subcutaneous oedema or rupture of the liver. By extrapolating findings from studies of central nervous system haemorrhages carried out in humans (Moussouttas et al., 2006; Schwedt et al., 2006), neonatal calves or lambs with these injuries are likely to experience severe pain. In addition, calves are at risk of traumatic injury and fracture during assisted delivery, particularly with mechanical calf pullers.

In addition to physical damage, young animals experiencing birth difficulty frequently suffer periods of anoxia or hypoxia which can lead to brain damage. In addition to low vigour, birth-injured lambs and calves surviving the birth process may struggle to regulate their body temperature effectively. Calves experiencing severe dystocia (where a mechanical calf puller or two of more people were required to deliver the calf) have a lower rectal temperature than calves experiencing no birth difficulty, or where the calf was delivered by caesarean section (Bellows and Lammoglia, 2000), and physiological changes suggesting their ability to thermoregulate efficiently has been impaired. These hypoxic neonates will be slow to stand after birth and slow to find the udder and suck, or may not suck without assistance. Whether this low vigour occurs because of the pain and trauma that the animals may be experiencing as a consequence of their difficult delivery is unknown. However, our data suggests that neonatal lambs and calves that have experienced an assisted delivery have elevated plasma cortisol, and high plasma cortisol in the first three days of life is

associated with impaired vigour in lambs (Dwyer and Lawrence, 2002). Low vigour animals are particularly vulnerable to starvation and hypothermia immediately after birth, and may also fail to get sufficient transfer of passive immunity by ingesting only small amounts of colostrum, thus making them susceptible to infection. In a US study of beef calves, calves that have been born with assistance took more than twice as long to stand after birth than calves born from an unassisted delivery, and had lower plasma immunoglobulins. Similar findings have also been seen in lambs (Dwyer, 2003) and dairy calves (Barrier et al., 2011) following assisted deliveries Hypoxic neonates are thus more likely to suffer starvation, hypothermia (exacerbated by the physiological changes described above) and have lowered immunity.

Birth difficulties and later development

Our recent data suggests that assisted heifer calves that survive the neonatal period have a higher probability of mortality than unassisted heifers by weaning, by 120 days of age and by first service (Barrier et al., 2011). Surviving assisted calves had a similar growth rate and fertility to unassisted calves, although this may be due to the mortality of the more badly affected animals.

Practical applications

Difficult deliveries can clearly have long term effects on the health and welfare of the offspring, in addition to impacts on the mother, the need for labour inputs and effects on staff morale of delivering dead neonates. Thus measures to reduce and prevent dystocia will be very beneficial. Management to prevent dystocia, such as attention to maternal nutrition, provision of a quiet, stress-free birth environment and careful sire selection particularly for first-time mothers, are measures that should reduce birth difficulty in the short-term. Genetic selection to reduce birth problems is also underway in cattle and sheep which would provide a longer term solution to preventing difficult deliveries. Finally, the sympathetic management of any cases of dystocia that do arise, by taking care when using traction and providing additional support to the neonate to ensure a good mother-young bond and adequate intakes of colostrum, may reduce the impact of the difficult delivery for mother and young.

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Notes

Prof. Xavier Manteca

Xavier Manteca Vilanova received his BVSc degree from the Autonomous University of Barcelona and a Master's degree in Applied Animal Behaviour and Animal Welfare from the University of Edinburgh. He has a PhD from the Autonomous University of Barcelona. Currently, he is associate professor at the Department of Animal Science, School of Veterinary Science in Barcelona, where he teaches animal behaviour and animal welfare. His main research interests are in the field of farm animal behaviour and welfare, and companion animal behaviour. He has been member of several working groups of the Panel on Animal Health and Animal Welfare of the European Food Safety Authority and has published around 90 papers in international journals.

Farrowing difficulties: a link between sow welfare and piglet welfare?

Xavier Manteca and Eva Mainau
Universitat Autònoma de Barcelona, Spain

Pigs show a high prevalence of neonatal mortality. Data from the UK, for example, indicates that 11.85% of all live-born pigs die within the 72h post-parturition period. Besides constituting an important economic problem, piglet mortality is also becoming an increasingly significant welfare concern. Neonatal mortality in pigs is a complex multi-factorial problem that involves elements related to piglet health status and behaviour, the behaviour of the sow and the characteristics of the physical environment (Baxter et al., 2008). Crushing is the most common and ultimate event preceding live-born death, although hypothermia and starvation are often underlying and important factors resulting in the piglet being more susceptible. The piglet's level of development and physical condition at birth has a major impact on survival. Stillborn mortality is correlated with having a reduced body weight and, more precisely, with having a disproportionately long and thin body shape, abnormal shape proportions, as well as with being born late (Baxter et al., 2008). Live-born mortality is also highly dependent on the vigorousness of the piglet, irrespective of its relation to body weight. Less active individuals face a higher risk of being crushed through a variety of interplaying factors. For example, it takes longer for them to locate the udder and to suck the colostrum, which in turn prevents them from

gaining additional weight and also increases the risk of hypothermia and starvation. Piglets experiencing hypothermia tend to seek closer contact with the sow, thus raising their chances of being crushed. Moreover, less vigorous piglets show reduced mobility and attentiveness which may further increase the risk of crushing (Baxter et al., 2008).

Practical measures to reduce neonatal mortality have been centred around alteration of the farrowing environment based on the different causes of piglet death and the implementation of strategies to reduce hypothermia and

starvation should decrease mortality. When the piglet is born and makes the transition from the thermoneutral intrauterine environment to the extrauterine environment, it is exposed to a 15-20˚C drop (Herpin et al., 2002). Providing additional heat sources at the birth site during farrowing can decrease mortality. Additional management strategies designed to decrease mortality include supervision and intervention at the time of farrowing to assist the birth process and thereby limit the incidence of stillbirths and to help weak piglets find the teat and suckle colostrum (White et al. 1996). In addition, many aspects of piglet survival are heritable and there is sufficient genetic variance to allow economically viable selection for welfare-friendly characteristics (Roehe et al., 2010).

Farrowing is one of the most critical phases in pig production and has an enormous impact on neonatal pig survival. For example, the percentage of stillborns ranges from 3 to 12% and accounts for 30-40% of the total neonatal mortality; farrowing difficulties are generally thought to increase the percentage of stillborns. In order to study the relationship between farrowing difficulty and piglet survival, an "ease of farrowing score" (EFS) was constructed using the total duration of farrowing, the birth interval, the total time standing or sitting and the number of position changes during the day before and the day of farrowing, the sow posture at farrowing and the viability and position of piglets at birth (Mainau et al., 2010). Position changes were recorded using a previously developed automatic system (Mainau et al., 2009). A common factor analysis yielded five factors that accounted for 75.05% of the total variability between sows in EFS. Primiparous sows had higher values for factor 3 ("sow activity") than multiparous sows (p=0.02), and sows without stillborn or mummified foetuses had higher values of EFS than sows with at least one stillborn or mummified foetus (p=0.06 and 0.01 respectively). The EFS appears to be a good behavioural scale to measure farrowing difficulties and their affect on piglet survival.

Farrowing difficulties are likely to increase pain and the use of analgesics may have positive effects on the welfare of sows and piglets. For example, sows treated with the NSAID meloxicam spent significantly less time lying on day 2 and 3 after farrowing than control sows, suggesting a faster recovery from farrowing. Additionally, piglets of low birth weight born (defined as percentile 15: BW<1180g) to multiparous sows treated with meloxicam had an average daily gain higher than that of piglets of low birth weight born to non-treated multiparous sows. In summary, then, improving the welfare of sows at farrowing may have welfare benefits for the piglets and increase production.

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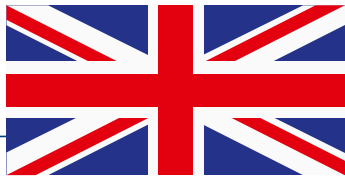
Notes

Dr. Helen (Becky) Whay

Becky was awarded her PhD from Bristol University in 1998 following work to improve methods of pain relief for UK dairy cattle, a field in which she continues to work. She is currently Head of the University of Bristol, Animal Welfare and Behaviour Research Group which comprises 65 researchers. She also leads her own research team within the Animal Welfare and Behaviour Group which focuses on methods of animal welfare assessment and improvement. Recently her work has included conducting welfare assessments of cattle, laying hens and pigs for the RSPCA and initiating projects such as a dairy cattle lameness initiative to provide targeted welfare improvement. She has researched, published and presented papers extensively in the arena of animal welfare assessment and improvement both within the UK and at international forums. She has also been working in collaboration with the Brooke Hospital for Animals, the World Society for the Protection of Animals (WSPA) and Send a Cow on a number of projects aimed at facilitating welfare improvement among working equines and production animals in developing countries.



Is the cost of animal welfare improvement the key limiting factor for farmers? The example of lameness in dairy cattle

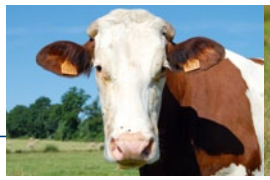
Helen R Whay, Katharine A Leach, Zoe E Barker & David C J Main
University of Bristol, School of Veterinary Sciences, UK

Farms operate as small businesses or in some cases quite substantial businesses, so it would seem to make intuitive sense that providing information about the financial cost of animal health and welfare problems, and the consequent economic gains of ameliorating these problems, would lead farmers to take rapid steps to control such problems. Unfortunately this does not appear to be the case, or certainly not universally so. For example, mastitis is regularly reported by dairy farmers to be one of the most consistently and frequently seen cattle diseases they face, as well as being one of the most costly (Halasa et al 2007). There is also a body of evidence suggesting that many of the recommended mastitis management practices are effective and cost efficient (e.g. Miller et al 1993). Despite this, farmer implementation of recommended, cost efficient mastitis control measures is low. A similar picture emerges for dairy cattle lameness; Clarkson et al (1996) reported a UK lameness prevalence of 21% based on observations made in the late 1980's, this was followed some ten years later by a reported lameness prevalence of 22% (Whay et al 2003) indicating little change in the national lameness prevalence. Then in 2010 Barker et al (2010) reported a mean lameness prevalence of 36% across 227 farms visited during the winter of 2006/2007, while Haskell et al (2006) reported a lameness prevalence of 15% in grazing herds and 39% in zero-grazing herds. These figures demonstrate that the problem of lameness in UK dairy cattle has been persistently high for at least the last 20 years. Accompanying, and partly in response to this recognition of the magnitude of the lameness problem there has been a substantial body of widely disseminated information about the financial cost of lameness; much of it packaged in "farmer friendly" formats. Figure 1 is an example of a leaflet provided to farmers as part of a lameness intervention project run by the University of Bristol.

It appears that making the case for the financial benefit of disease management is not sufficient to stimulate many dairy farmers to implement adjustments or changes to their management practices to reduce even the most common diseases seen among their herds. To understand more about why this should be and what it is that does in fact stimulate farmers to implement changes to their disease management and preventive practices a number of threads of information need to be drawn together.

Farmers themselves don't fit into a single generic mould; they have many different motivations for farming. In a 2008 report Defra (Pike, 2008) considered why farmers farm and segmented them in to five subgroups; custodians (23%), lifestyle

Figure 1. Poster highlighting the financial losses associated with lameness (compiled from various sources by Dr Zoe Barker, cartoons by Steve Long).




choice (6%), pragmatists (22%), modern family business (41%) and challenged enterprises (7%). If we take this as a reflection of the diversity of motivations for being in farming it is clear that not all farmers are primarily driven by a financial imperative. Leach et al (2010b) reported a survey of farmers' motivations to reduce lameness in dairy cattle. Two hundred and twenty two UK dairy farmers were asked to describe the factors which motivated them to control lameness in their own herds; the most commonly reported and highest scored response was "pride in a healthy herd" followed by "feeling sorry for lame cows". "Feeling guilty about lame cows", the view that "lame cows lose money" and desire for a "good public image" all scored similarly but at a lower level than "pride in a healthy herd". Here we see a range of motivators with job satisfaction and external appearance ranked more highly than an economic consideration. In addition, the financial concern, when it was expressed, was framed as a concern about losing money rather than about making money.

As well as motivations for reducing a problem it is also relevant to consider barriers to implementing new practices. Whay et al (2002) reported that dairy farmers were, on average, only aware of one in four lame cows in their herds. This pattern has continued, with Leach et al (2010a) reporting that 90% of 222 farmers interviewed did not perceive lameness to be a major problem despite an average herd prevalence of 36%. Lack of awareness is a critical limiting factor for implementation of new management practices. Without awareness of a problem there is little possibility of remedial action being taken and, bearing in mind that individual farmers have differing characteristics, there are some for who raising awareness of a problem will be sufficient to trigger change.

However, raising awareness alone is widely considered to be insufficient to stimulate mass implementation of change. This has been demonstrated in a lameness context by Bell et al (2009) as well as in other disciplines where change is required such as human health (Kerr et al, 2005) and environmentally sustainable behaviours (McKenzie-Mohr & Smith, 1999). In addition to a lack of awareness / concern about lameness, Leach et al (2010a) reported that the most commonly reported constraints to implementing lameness control activities were "lack of time" and "lack of labour". While both of these constraints clearly have economic components to them only 30% of farmers made explicit reference to financial constraints preventing them from implementing lameness control activities.

The reports of motivations and barriers for implementing lameness control measures are helpful for gaining insight into where cost influences farmers' decision making. However, these results are based on attitudinal reports and do not relate to a specific, "real life" lameness control situation. Barker et al (2011) describes an exploration of the financial costs of changes made on dairy farms during a three year intervention study. Of 198 farmers involved in the study, 151 provided information about costs, but were only able to do so for 34% of the changes implemented. A similar finding was reported by Sorge et al (2010) in relation to a Johnes disease control programme. Farmers were also more likely to be able to attribute a cost to "one off type changes" than to changes in routine. Interestingly, farmers were willing to incur considerable costs to reduce lameness on their farms, for example, the mean "one off" cost per cow reported by farmers who made changes directed at improving lying time was £208/cow with a range between £2 and £3111/cow.

Financial considerations in relation to implementing health and welfare improvement strategies are clearly taken into account by farmers when considering what action they might take. This is not surprising as they are indeed running businesses. What is perhaps more counterintuitive is that cost does not appear to be either the key motivator or the key barrier to implementing change. Farmers appear to have only limited awareness of how much making changes actually costs but demonstrate in practice that they are willing to make considerable investments per cow to reduce lameness depending on circumstances.

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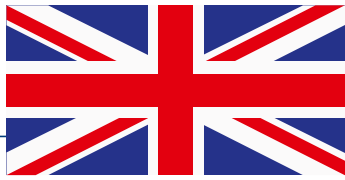
Notes

Dr. Donncha Hanna

Donncha Hanna received his BSc (1st Class Hons) Psychology degree and subsequent PhD 'The influence of the attitudes, personality and behaviour of stockpeople on the behaviour and productivity of dairy cows' from Queens University of Belfast. Currently he is a lecturer in Psychology at Queens University of Belfast where he teaches individual differences, psychometrics and statistics.

He is actively involved in a range of research projects, post-graduate supervision and professional committees. His research interests' focus on utilising applied individual differences, psychometrics and multivariate statistical techniques to diverse real world problems including stockpersonship, teaching in higher education and adult metal health.



The relationship between the stockperson's attitudes and the productivity of dairy cows

Dr. Donncha Hanna
Queen's University Belfast, UK

Introduction

Stockpersonship had been defined as the human element "necessary in optimising health, welfare, husbandry, management and thereby both physical and financial performance in animal production" (Beynon, 1991) and there exists a growing body of research which offers empirical evidence supporting this role (Hemsworth & Coleman, 1998). Given that stockpeople can improve welfare and output it would be advantageous if it was possible to predict the extent of this influence through psychometric methods (that is, psychological testing). If we could effectively relate psychological measures to successful stockpersonship it may prove possible to select employees with more appropriate psychological attributes or select those existing employees who would benefit most from training.

Attitudes are evaluative predispositions, externally directed towards objects, which are useful in predicting behaviours (Fishbein & Ajzen, 1974). There is existing literature highlighting the importance of attitudes held by stockpeople in relation to their subsequent behaviour towards the animals they work with. For example, there is evidence to suggest that stockpeople who report more negative attitudes towards animals perform more negative behaviours when working with pigs (Coleman et al., 1998; Hemsworth et al., 1989) and veal calves (Lensink et al., 2000). There have also been attempts to measure the attitudes relevant to dairy stockpeople's behaviour (Hemsworth et al., 2000; 2002).

The psychological correlates of attitudes may be theoretically important for predicting the behaviour of the stockperson and, perhaps more importantly, output measures (for example, milk yield). As such, they may also be used to discriminate between more and less effective candidates to work with animals. Therefore the aim of this study was to discover if the attitudes of the stockperson could be related to the milk yields they obtain.

Method

Materials and method

This study employed a postal questionnaire design. The names and addresses of Northern Ireland farmers that were (or had recently been) registered pedigree dairy cow breeders were obtained from the Department of Agriculture and Rural Development. In total 834 addresses were obtained resulting in a final in a sample of 311.

The Stockperson attitudes questionnaire

It was necessary to construct a questionnaire to assess attitudes toward working with dairy cows. Students on agricultural courses were chosen instead in order to obtain large numbers of people who had experience working with cows. Although students did differ from the Northern Ireland Dairy farmers on the variables of age and educational level, these variables were not related to the attitudinal factors that were eventually extracted.

Forty-two items were created, aiming for high correspondence between the target (Dairy cows) and action elements (physical force, verbal force, empathic feeling, etc) that had been identified in the literature (Ajzen & Fishbein, 1977). The format used with a number of these items was based on existing research, for example, Coleman et al. (1988) and Beveridge (1996). Principal axis extraction and oblique rotation revealed a four-factor structure and the factors were labelled *empathy, negative beliefs, job satisfaction* and *patience*.

Statistics

When examining the relationships between milk yields and attitudes partial correlation were utilised to remove the effect of any potential confounding variables in the relationships. Three factors which strongly correlated with milk yield include amount of concentrate fed to the cows (r = 0.792), the number of cows in a herd (r = 0.378) and the number of people involved in the milking (r = 0.318); these variables also correlated with the attitude factors. Partial correlations were therefore run examining the relationships but controlling for the influence of concentrate, number of cows and number of workers.

Results

Farm demographics

The number of cows on each farm ranged from a minimum herd size of 27 to a maximum of 450 cows. The mean number of cows per farm across the 311 replies was 111 with a standard deviation of 59.35. Most (72%) of the farms had at least one additional full time worker to help look after the dairy herd with a cow to staff ratio of one stockperson per 52 cows on average. The mean amount of concentrate fed was 1.67 tonnes per cow per year with a standard deviation of 0.59.

Attitudes and Milk Yield

The milk yield (mean = 7424 litres per cow per year, standard deviation = 1367) was correlated with the four attitude scales and three significant (but weak) correlations were obtained. *Empathy* had a significant positive correlation with milk yield (r_p=0.235, df=308; $p<0.01$). This suggested that higher *empathy* scores were related to higher milk yield. Attitude 2, *negative beliefs*,

had a significant negative correlation with milk yield (rp=-0.192, df=308; p<0.01). This suggested that the tendency to hold few negative beliefs about dairy cows was related to a high milk yield. *Job satisfaction* had a significant postive correlation with milk yield (rp=0.223, df=308; p<0.01). This suggested that a high score on this factor (indicating that the individual found the experience of working with cows rewarding) was related to high milk yield. *Patience* was not significantly correlated with milk yield.

Discussion

English (1991) has suggested that empathy is an important component of the 'art of stockpersonship', although this is not universally appreciated within agriculture. English (1991) also postulated several theories relating to empathy that have been consistent with regards to the factor that has been labelled *empathy* in the present study; namely, that it is influenced by personality type and leads to improvements in productivity. One of the main reasons empathy may be important in stockpersonship is that empathy is thought to be important in inhibiting aggressive behaviour (Enderson & Olwes, 2001: Pagani, 2001). Conversely, higher levels of *negative beliefs* were related to lower milk yields.

It should be acknowledged that the correlations between attitudes and milk yield are not very high. However, it is hypothesized that the attitudes held influence the stockperson's behaviours, which in turn will lead to physiological responses in the cow that affects milk let down (Hemsworth et al., 2000). Simultaneously, many other important variables (for example, amount of food consumed, genetic merit, stockperson's knowledge & skill, hygiene etc.) will explain a large proportion of the variance in milk yield. The results of the present study concur with the integrative model of work attitudes, motivation and performance proposed by Katzell and Thompson (1990) which does not predict strong direct causal connections between attitudes and production, but indirect paths. This therefore accounts for the positive, although weak, correlations often found between attitudes and production across a range of industries.

Conclusion

This study, in conjunction with previous research, suggests attitudes of the stockperson may be related to the subsequent milk yield they obtain. Partial correlation revealed that higher levels of *empathy* and *enjoy working with cows* were related to higher milk yields. Conversely, higher levels of *negative beliefs* were related to lower milk yields. The total amount of variance in the milk yield accounted for by the attitudes was estimated to be approximately 7%. One application from these findings would be to use attitudes to select employees into the dairy industry and also for identify those individuals that may benefit from training. Making individuals aware of their own attitudes and personality may allow them insights to address weaknesses in their own stockpersonship.

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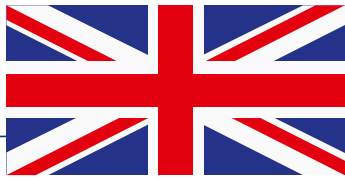
Notes

Prof. Alistair Lawrence

I was born into a farming family in Perthshire, Scotland and studied Zoology at St Andrews University. As a postgraduate I moved to the University of Edinburgh initially to take a one year diploma in animal science, and then to study for a PhD under Professor David Wood-Gush one of the pioneers of farm animal welfare research. Following this I was employed as Research Assistant to then The Principal of the School of Agriculture (Professor Peter Wilson), before becoming responsible for behaviour and welfare research at SAC.

I currently head the Animal Welfare Team at SAC and am also Acting Head for the Sustainable Livestock Systems Group. SAC's welfare research aims to improve targeted animal welfare problems, develop scientific approaches for assessing animal welfare and integrate the biology of animal welfare with economics. I also have an interest in developing wider public understanding of animal welfare particularly in young people. I currently hold a joint position with the University of Edinburgh Veterinary School where I help oversee delivery of welfare teaching to Undergraduate Veterinary and Masters students. I recently finished a 9 year spell as a member of the UK Farm Animal Welfare Council and have been appointed to the council of the Universities Foundation for Animal Welfare.



Economics & animal welfare: can combining these 'dismal' sciences help improve animals' lives?

Prof. Alistair Lawrence and Prof. Alistair Stott
Scottish Agricultural College, Edinburgh, UK

Animal welfare is a high profile ethical concern for the physical and mental health of animals under our care. From its earliest inception in the 18th century this concern has mainly been focused on the negative aspects of animals' lives such as pain, stress and fear, although more recently there has been a growing interest in positive animal welfare. Economics is the study of the choices we, as individuals and as a society, have to make to reconcile our 'human demands' with the fact that scarcity of resources means that we cannot possibly satisfy everyone's wants. Economics is sometimes referred to as the 'dismal science' usually in reference to the infamous prediction of Thomas Malthus (1798) that human population growth would outstrip the growth in food production necessary to sustain it. In that sense there is a connection to the potentially uncomfortable nature of many animal welfare issues and a link with renewed concerns over food security and the sacrifices that may be needed to address it.

Combining the sciences of animal welfare and economics is not a new idea (see [1]). Most frequently economics has been applied in the field of animal welfare to address the costs and benefits of producing food to higher welfare standards (e.g. [2]). However, we would argue that economics has a broader role to play in addressing animal welfare issues[3]. Firstly economics is built upon its own very extensive body of theory which, just as with theories from animal welfare science, can help provide us with new insights and solutions for problems. Secondly, economics is more than a simple accounting approach, and can be used to identify the 'hidden' or 'external' costs (e.g. animal welfare) associated with market transactions. Thirdly, as economics is primarily concerned with the choices we are required to make in using valuable resources, then it is inevitable that economists have put much thought into understanding the interactions and trade-offs between our competing wants. In this paper we aim to demonstrate how these attributes of economics can be usefully applied to improve animal welfare by looking at three key questions.

Can we increase consumer demand for animal welfare?

Prior to 2000, legislation had been the main pillar of government policy to improve welfare (e.g. UK legislation phasing out the use of sow stalls in 1999). There are sound economic reasons for using legislation to impose minimum animal welfare standards, if animal welfare as an issue is likely to be subject to 'market failure' (i.e. where

the costs to animals of our farming practices are undervalued in the free market). However, UK government policy took a shift in 2004 with the publishing of the GB Animal Health & Welfare Strategy[4], which emphasised the wider roles and responsibilities of all stakeholders (including consumers) in improving animal welfare. In a similar vein the EU published its animal welfare action plan (2006-2010) which aimed to increase dissemination of best practice and information to consumers to allow them to make informed choices[5]. This shift coincided with the growth of farm assurance schemes which opened up the possibility that the food chain could help regulate and improve on-farm welfare through standards developed by industry based farm assurance schemes.

A number of studies have demonstrated that the public are in principle 'willing to pay' for welfare improvements[6]. Yet the values generated in such willingness to pay studies are usually greater than those seen in real life consumer behaviour. One reason put forward for this 'mismatch' is the relative invisibility of animal welfare attributes in products and hence the difficulty consumers' face in making informed choices about products varying in their welfare attributes. For this reason increasing emphasis is being placed on better integration of animal welfare into the food chain, for example through labelling linked to the use of scientifically robust methods for assessing welfare on farms[7]. At SAC we have developed an approach to assessing welfare on farms (qualitative behavioural assessment) which is showing considerable promise as a scientifically sound yet practical approach, which addresses public concerns and has at its basis skills in observation of animal behaviour[8].

However, animal welfare science cannot provide all the information we need to solve this question. For example, it is clear that we still have a rather poor idea of consumer attitudes and behaviours towards animal welfare products. Going back to the issue of animal welfare attributes there is evidence that the public are not aware of what appear to be well publicised animal welfare issues, and in fact may not wish to be made aware (e.g. [9]). Consumers maybe resting on the assumption that retailers (and governments) will ensure appropriate standards of animal welfare, or they may be using labelling as a proxy assurance that the animal product they are buying was humanely produced. We have some evidence for this in some recent work where we have demonstrated that animal welfare products (especially the Freedom Food brand) show greater resilience to price increases relative to regular products[10]. The complexity of consumer attitudes to animal welfare appears to be understood by retailers who prefer to communicate on welfare in general rather than on specific issues; for example they see that attempting to explain the need for tail docking could be counter productive to demand for pork products in general[10]. Finally in understanding how to promote the market for animal welfare products we need to analyse the 'supply chain' of each product. Supply chains can present barriers to promoting animal welfare products especially if not all 'actors' are convinced to participate (e.g. [11]) or if segments of the chain has excessive 'power'. Failure to implement a complete supply chain approach of course can also erode consumer confidence in the animal welfare claims being made of the final products (e.g. [12]).

Can we persuade farmers to supply more animal welfare?

We believe that in improving on-farm welfare it is also important to consider the capacity for

farmers to supply more welfare. In this context we are interested in the extent to which welfare and business interests can be matched-up, but also in estimating any potential losses incurred in improving welfare, as this information helps to pinpoint where consumers' 'willingness to pay', most needs to be directed. We believe there are some important issues that are brought into focus when we consider the supply of welfare; for example the relationship between farming 'intensity' and animal welfare. Scientific evidence from welfare studies suggests that we should be cautious about drawing simple conclusions, as the relationship between intensive production systems and animal welfare is usually complex, and that animals' day to day experiences are key to animal welfare; as far as the animal is concerned the 'devil is in the detail' not the headline[3].

Another important issue which underlies the supply of welfare is the extent to which welfare is really a cost. There are a number of examples of 'system components' where improvements to welfare and farmers' interests are matched including improving animal health and neonatal survival, and reducing impacts of animal temperament on welfare and production[3]. At a higher level of complexity we can consider how to optimise welfare within a production system. We have been working on this sort of problem using combinations of resource economics and animal science. Our work initially considered welfare in extensive sheep production, and has demonstrated the potential for individual sheep farms to choose management options to improve welfare at little or no additional cost[13]. We have extended the approach to the issue of the farrowing crate which has long been an unresolved area of welfare concern, given the dilemma between protecting piglets and humans versus allowing the farrowing sow greater behavioural freedom. Our most recent results indicate that a pen designed to accommodate the needs of the sow, piglets and farmer has potential to achieve higher levels of welfare, again at little cost or even with a financial benefit[14].

Can we understand the relationships between animal welfare and other societal demands?

The recent past has seen animal welfare increasingly become just one of a number of issues or 'drivers' surrounding animal production. In particular climate change and food security have risen in profile and can now be seen as more dominant features of the policy landscape. This raises the importance of understanding the relationships between animal welfare and these other demands that society is making of livestock production. Without such an understanding it would be possible to suggest ways of (say) mitigating against climate change, that are detrimental to animal welfare.

Take as an example dairy production, where there is increasing pressure in northern Europe to house cows for longer indoors partly for efficiency reasons but also to help in controlling environmental pollution from the production system. Economics allows us to analyse and better understand the different options for housing cows in terms of the overall performance of the system for physical, environmental, welfare as well as financial outputs. Understanding these relationships can also be important because they account for hidden benefits or costs of improving welfare; the cost of supplying an input to improve welfare may be offset (partially or wholly) by related benefits. For example in a recent analysis of the economic costs of improving dairy cow welfare in Denmark[15], it was

concluded that improvements to cow housing might be better value for money, than requiring farmers to provide cows with compulsory grazing. However this cost: benefit analysis may not take full account of the interaction of these two strategies with the incidence of cow lameness, an important welfare issue with well known financial costs[16]. The length of time cows spend on grass is well known to have beneficial effects in reducing cow lameness[17]; such 'hidden' benefits need to be accounted for in arriving at the net financial value of providing welfare improvements. Indeed in a more recent analysis we have shown that UK farms with low levels of lameness have superior overall technical efficiencies to farms with higher levels of lameness[18]. Furthermore, although farms with low lameness were technically inefficient in terms of their use of grazing and labour inputs, these inefficiencies were offset by the gain in milk yield, presumably as a 'hidden' benefit of the low lameness levels. We have yet to investigate how these low lameness farms would rank against an environmental measure of efficiency (e.g. GHG emissions).

We have developed another economic approach known as partial equilibrium (PE) modelling, to explore how improvements to animal welfare could affect trade and environmental outputs including green house gas emissions. Using a relatively straightforward welfare issue as a case study (the use of high fibre diets fed to sows in pregnancy to improve piglet survival), the PE modelling found, associated with a reduction in piglet mortality, an improvement in trade volumes and an environmental benefit; in other words the analysis was able to quantify positive effects on multiple sustainability goals (a 'win-win-win' scenario)[19]. We are currently expanding this work to assess the wider impacts of more complex welfare improvements such as a move from farrowing crates to designed farrowing pens.

In conclusion the debate over farm animal welfare is at a cross-road. In the past animal welfare concerns were somewhat disconnected from mainstream livestock farming, mainly concerned with pointing to the welfare problems of intensive farming rather than seeking widely acceptable solutions. Today animal welfare has moved to being one of a number of issues (externalities) that need to be accounted for and resolved when producing meat and other animal products. There are risks in this new situation not least because other externalities (e.g. climate change) may be seen as having a higher priority than animal welfare. There is however also an opportunity to ensure that welfare is more central in decisions made across the food chain with respect to livestock production. The associated research may not only benefit animal welfare, but also provide a lead in the development of future farming systems by pioneering a truly interdisciplinary approach that ensures the increasingly severe, unequal and conflicting demands we place on the world's resources[20] are better reconciled. In this paper we have illustrated the application of a combination of economics and animal science to animal welfare issues. There are significant challenges in this approach, including achieving a better understanding of the market for animal welfare, how to increase the supply of animal welfare from producers and how to analyse the trade-offs between animal welfare and other societal demands including concerns over climate change. However the interaction between the two 'dismal' sciences of economics and animal welfare does provide a rational basis for farmers, retailers and policy makers to better understand the choices they face in improving animal welfare in the real world hopefully leading to better lives for animals in the future.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Boehringer Ingelheim Animal Health GmbH
Binger Straße 173
55216 Ingelheim am Rhein / Germany
www.boehringer-ingelheim.com

Contact
Dr. Laurent Goby
Corporate Marketing
Phone +49 (0) 61 32 77 - 9 04 96
Fax +49 (0) 61 32 77 - 89 48
Mail laurent.goby@boehringer-ingelheim.com

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