

Understanding animals, improving welfare

Modern animal welfare research is adding to our ability to really understand and improve the welfare of farmed and laboratory animals, sometimes with surprising results.

From the early human attempts at domestication many thousands of years ago, people have bred animals for specific purposes: for companionship, food, clothing, labour, hunting, protection, transportation and, more recently, for laboratory research. With this relationship comes a responsibility for ensuring animal well being.

What constitutes good animal welfare and how can we measure it? How do we know when an animal experiences suffering and what the effects of that suffering are? How can we work to improve the welfare of farmed and laboratory animals?

BBSRC supports research involving the use of animals that adheres to the UK's stringent regulations and is, through its own ethical monitoring process, committed to ensuring that high standards of animal welfare are maintained in this research. In 2005 we launched a five-year, £8M programme* to provide core funding for fundamental research to underpin animal welfare in farmed, laboratory and companion animals. The programme also aimed to ensure that this research could be translated into practical solutions to welfare problems. As the projects move through their final year, key results and clear impacts are emerging, some of which are explored here.

Welfare assessment on the farm

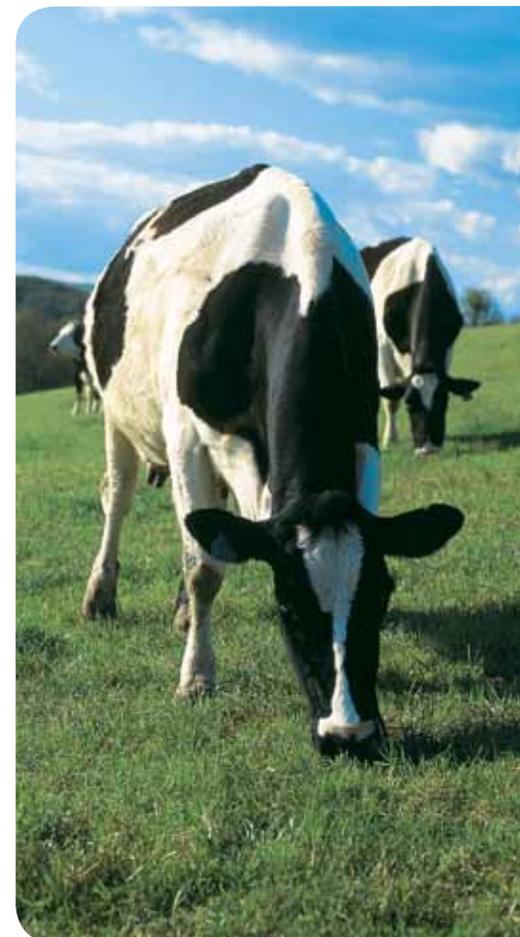
In commercial broiler chicken farming, major problems can arise as a result of the intense selection for rapid weight gain. This leaves chickens at risk of a range of health problems as the circulatory and skeletal systems struggle to support the additional body mass.

Gait scoring, whereby chickens are scored on a rank scale for how well they are able to walk, is one of the main methods used to measure welfare in live chickens. But this relies on a subjective measurement, is labour intensive and provides only a snapshot of welfare at a particular point in time.

Researchers at the University of Oxford have developed an automated system which uses web cams or CCTV to monitor welfare across an entire flock. Specifically, the system measures how quickly chickens move across the camera's field of vision. It then applies a number of statistical measures to build up a picture of the movement patterns of a normal flock.

Changes from 'the norm' correlate well with measurements made by conventional gait scoring, indicating that this system can be used to detect when welfare has been compromised¹. As measurements can be taken more regularly than with conventional methods, it could also enable more rapid detection and mitigation of any problems that arise.

The researchers have already carried out a number of commercial trials of the new system with one of the largest broiler breeding companies in the world, Cobb (Europe). Their next step is to build up a database of normal recordings of birds of different ages, sexes and breeds in order to increase the value of this tool.



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*The Animal Welfare Programme was overseen by a Steering Group, chaired by Professor Jane Hurst from the University of Liverpool



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Joined up approach to welfare assessment

Broadly speaking, there are two approaches to welfare assessment. The first uses welfare indicators, such as coat or plumage condition or time spent exhibiting natural behaviours. However, it can be difficult to define a good baseline for certain welfare indicators and results can be difficult to interpret when the scores from different indicators conflict. The second looks at motivational priorities: if an animal has experienced two different environments, and is then given a choice between them, it will be motivated to choose the one that is better for its welfare. However, this assumes that an animal can assess all the variables and that it then makes a definite choice.

Researchers at the University of Bristol are seeking to understand how the two approaches inter-relate. This will help to validate both methods for measuring welfare and will facilitate a better understanding of how to modify animals' environments to maximise their welfare. Some of their findings were, perhaps, a little unexpected.

Over several weeks, chickens were placed in combinations of three different environments whilst a raft of physical, physiological and behavioural welfare indicators was measured. The birds were then allowed to choose between the different environments: one with a bare wire floor; the second, a solid floor covered by wood shavings; the third, a solid floor covered with wood shavings and peat (PPN, this environment also had a perch and a nest box). The researchers were able to show that chickens made definite choices and had clear preferences between the different environments.

We might expect birds to prefer what we perceive as the 'enriched' PPN environment but the team found that no one environment was preferred by all the birds. Even in groups of genetically similar animals, individual responses and preferences were not the same. Instead the birds could be classified into different 'types' based on their behavioural and physiological profiles and birds that preferred the same environment tended to be of the same type.

Individual chickens were consistent and rational in their choices – if they preferred environment A to B, and environment B to C, they also preferred environment A to C (a property called transitivity²).

Regardless of the specific environments chosen by individual birds, the chickens chose those environments in which, when they had experienced them previously, their body temperatures and blood glucose levels had been lower and where they had experienced reduced reactions to novel stimuli³. Not only do chickens choose environments consistently, but their choices are guided by their prior responses to those environments, and can be linked to their scores for a sub-set of welfare indicators.

What these experiments highlight are that the decisions we make in order to try to improve animals' housing conditions and welfare, are made on the basis of human experiences and perceptions, which may not reflect the experiences and perceptions of the animals themselves. The ultimate goal would be to be able to use information about how animals respond to different environments to predict in advance what they will prefer and so which changes might be beneficial for their welfare.

At a glance

BBSRC spent **£4M** on animal welfare research in 2008/09

Rodents and fish account for **94%** of research animals

850 million chickens are produced for the table each year in the UK

At any one time there are **five million** pigs kept on UK farms

The UK sheep farming industry is the **largest in Europe**

Up to **90%** of British adults in a 2008 survey could conditionally accept animal experimentation⁶

(See report for definition of conditional acceptance)

There were **3.7 million** scientific procedures using animals in the UK in 2008

Challenging accepted practices

Researchers at the Royal Veterinary College (RVC) are also trying to understand more about how the conditions in which an animal is kept affect its welfare.

At any one time there are five million pigs kept on UK farms. Pigs reared indoors often experience high levels of mechanical noise and ammonia, thought to be stressors for the animals. Furthermore, the buildings that house these animals are often poorly lit. The RVC team has been working to accurately measure the impact of these factors on pig welfare.

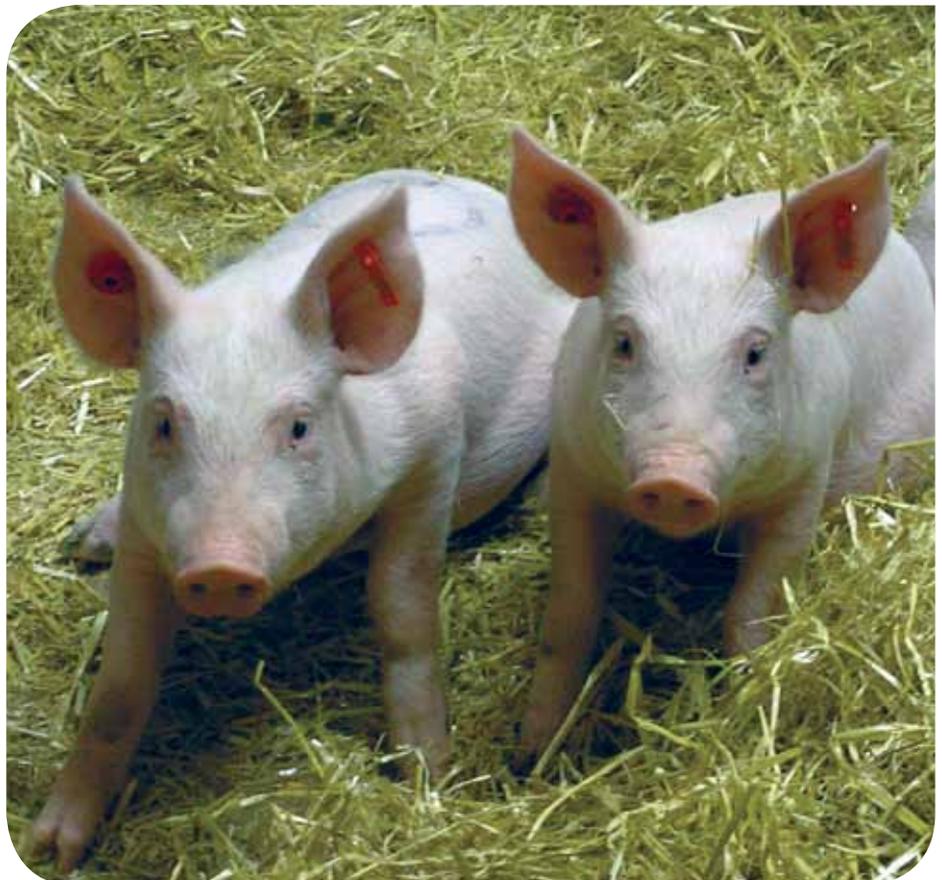
They have shown that, if all other factors are kept close to optimal, neither low light, high noise levels nor high ammonia have an effect on the productivity of pigs. Yet, despite the lack of effect on productivity, other welfare indicators are affected.

When kept in an environment with high ammonia concentrations, levels of salivary cortisol were lower, which can indicate chronic

stress. Pigs also showed less group cohesion, were more aggressive and showed decreased play behaviour in this environment. Disrupted social factors such as these are likely to contribute to increased stress, which may be caused by the masking of the odour cues that pigs would normally use to communicate.

High noise levels alone did not affect any of the welfare indicators measured in these experiments. But pigs exposed to high levels of background noise in conjunction with high ammonia were less submissive when encountering aggression, suggesting that the impact of high ammonia levels on pig welfare is exacerbated if other conditions also fall below optimum.

Regulations state that 'gas concentrations shall be kept within limits which are not harmful to animals'. Given that the ammonia levels used in these experiments had adverse effects on the pigs concerned it seems that ammonia levels in pig housing should be kept as low as possible and certainly below those used in this experiment, 20 parts per million.



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Interestingly, low light levels also led to an increase in aggression. If corroborated, this may suggest that the belief held by some, that dim lighting reduces aggression, is incorrect.

Making observations of animals under different conditions and measuring the effects on the welfare of those animals can lead to results which are surprising when compared to accepted practice. Challenging accepted practice however, and looking for and testing new ideas to improve living conditions for farm and laboratory animals, should lead to improved animal welfare in the long run.

Early-life experiences

Measuring short-term effects of changes in the environment of farmed or laboratory animals is difficult, we have already seen that different factors can act in combination to different effect and that an animal's motivational priorities and the indicators that we use to measure welfare do not always match up. What then, if we try to measure longer term effects of stressful situations on animals, or the effects on animals that have been exposed to stressful situations at key times during early-life?

Broadly comparable research has been undertaken on rats, pigs and sheep at the Universities of Edinburgh, Glasgow and Bristol and at the Scottish Agricultural College (SAC), to look at the effects of exposing animals to stress whilst still in the womb or soon after birth, and of the effects of tail docking in newborn farm animals.

Researchers in Edinburgh found that female prenatally stressed rats weigh less at birth and reach puberty sooner than unstressed rats. Male prenatally stressed rats go on to display an anxious phenotype in adulthood⁴.

In pigs, prenatal stress also results in a more anxious phenotype; they are less aggressive at three months-old and females become more fearful mothers which are more likely to savage or crush their piglets when they farrow. Similarly, sheep that have experienced early-life stress (from a mild immune challenge in the first few days of life) have been observed to be more nervous when they are older. For example, in the field they spend more time looking around for potential threats than their unstressed counterparts.

Prenatally stressed pigs and rats are also physiologically more reactive to stressful situations once they are born. When exposed to a 'postnatal stressor', these rats show a greater increase in stress hormone levels than those born to unstressed mothers. In pigs this can be seen in their reaction to normal farm practices such as tail docking or weaning, where they show more behavioural indicators of pain⁵ and an increased growth check post weaning, respectively.

To dock or not to dock?

In pigs, tail-docking represents another common early-life challenge which may have long-term implications for welfare.

Recently, researchers at Glasgow and SAC found that, in pigs, tail docking alone does not lead to long term changes for the animal, either in sensitivity to pain in the tail region, or on factors such as growth or immune function. Their finding offers some reassurance that tail docking does not have major long term negative effects on healthy, unstressed pigs. Nonetheless, further studies at SAC have shown that tail-docking is acutely painful for piglets so the practice itself still represents a welfare concern. This supports



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the current legislation where docking is only allowed on farms where there is a demonstrable risk of tail-biting. Thus, an assessment is made to determine whether docking or not docking an animal's tail represents a greater welfare concern.

These studies in farm animals and in rodents have clearly shown that early-life experiences can have a substantial impact on outcomes of great relevance to later health, welfare and productivity. However, there are difficulties associated with trying to understand the effects on welfare of particular practices or conditions, given that they will occur in combination with a whole range of other variables. Ultimately these and other experiments could be used to tease apart the factors that should be most carefully controlled, and at which points during an animal's life, to ensure its welfare.

Applying research to real life

The next step for much of this research will be to explore how experimental findings relate to real life situations on the farm and in the lab. The UK already has rigorous standards of farm animal welfare but, by working together, researchers and industry will ensure that these standards continue to improve. For example, we know that mixing pigs during pregnancy is highly stressful for sows and detrimental to the later welfare of their developing offspring. What is unclear is the extent to which mixing occurs on commercial

pig farms at those crucial times during pregnancy that researchers have identified as causing negative outcomes in offspring.

A recent Defra grant, which builds on work carried out under the BBSRC Animal Welfare Programme, has been awarded to SAC to review current literature on prenatal stress in farm animal species and then gather information from farms to assess the degree to which early-life experiences could be placing welfare at risk.

Working towards ensuring excellent animal welfare across the board is clearly a noble endeavour but it presents challenges. The work discussed here demonstrates that there are a myriad of different factors that interact (not always predictably!) to affect an animal's welfare, both in the long- and short-term. It also highlights the difficulties that are associated with accurately measuring welfare in animals we cannot communicate with. On the other hand, the same research is adding, piece by piece, to our knowledge and at the same time is gradually adding to our ability to really understand, and therefore to improve, the welfare of farm and laboratory animals.

BBSRC intends to disseminate the results of these research projects widely, to ensure that the work funded through this programme has maximum impact on animal welfare.

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Welfare and the law

The Animals (Scientific Procedures) Act 1986 regulates the use of animals in research in the UK in order to limit unnecessary suffering and ensure the welfare of animals used in scientific procedures. Any researcher planning to use animals in their research must first show why there is no alternative and what will be done to minimise numbers and suffering.

The Home Office issues licences for procedures covered by the Act and together with Local Ethical Committees they make sure that the Act is adhered to. Similarly strict regulations exist relating to the welfare of farm animals. For example, the Welfare of Farmed Animals (England) Regulations 2007 apply in England with corresponding legislation in place in devolved administrations.

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View details of the Programme at www.bbsrc.ac.uk/welfare