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Review of the Animal Welfare Research Programme 2005-2010

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Section A: Introduction

Introduction

Defra is a major funder of research and the budget for evidence in 2009/10 was £213m, of which £119m was classified as research spend. The research commissioned supports Defra in meeting its overarching aim and strategic priorities (see section 2). Approximately £32.5 million of the 2009/10 budget was spent on animal health and welfare research, and of this £2.9 million was spent on Animal Welfare research. This research also serves to support the goals of the Animal Health and Welfare Strategy for Great Britain, and the Animal Welfare Delivery Strategy for England (see section 3). The results generated from research are used to ensure existing Defra policies are based on sound evidence, to identify the need for new policy development, and to support Defra's regulatory roles.
The Animal Welfare research programme consists of seven sub-programmes; on-farm poultry, on-farm pigs, on-farm ruminants, on-farm fish, companion animals & game birds, transport & markets, and slaughter.

Defra research programmes are subject to a formal review process every three to five years, with an assessment of the delivery of the research toward the overall objectives of the programme being a key aim. Unlike previous reviews of Defra Animal Welfare research, which have focused on specific research sub-programmes, this review will evaluate the full programme of research between 2005 and 2010. This approach will better enable the balance of the Animal Welfare research programme to be assessed, and ensure future funds are prioritised appropriately across sub-programmes.

In consideration of resource management it is important to recognise opportunities for working in partnership (an underpinning element of the Animal Health and Welfare Strategy) and identifying areas where cost and responsibility sharing with stakeholders are appropriate.

In broadening the scope and mechanisms of the research programme it is also necessary to reflect on research and evidence that may be needed on top of the current portfolio. Studies, for example, that better inform the Department and stakeholders on economic, social sciences and behaviour change may be included by such a process.

Defra's Aim and Strategic Priorities

At the time this review was undertaken, Defra's overarching aim was "to secure a healthy environment in which we and future generations can prosper". In order to achieve this aim the Department had set out nine strategic objectives. The Departmental Strategic Objective (DSO) to which the Animal Welfare programme contributed was:

"*A thriving farming and food sector, with farming making a net positive environmental contribution", with one of the intermediate outcomes of this objective being to "Improve the welfare of kept animals".*

The Animal Health and Welfare Strategy for Great Britain, and the Animal Welfare Delivery Strategy

The Animal Health and Welfare Strategy for Great Britain, was published in 2004 by the previous government, with the overall aim of:

'*developing a new partnership to make a lasting and continuous improvement in the health and welfare of kept animals, while protecting society, the economy, and the environment from the effect of animal diseases*'.

To bring about this aim, the following strategic outcomes were identified:

1. Working in partnership
2. Promoting the benefits of animal health and welfare, particularly emphasising prevention is better than cure
3. Ensuring a clearer understanding of the costs and benefits of animal health and welfare practices
4. Understanding and accepting roles and responsibilities
5. Delivering and enforcing animal health and welfare standards effectively.

Following publication of the Animal Health and Welfare Strategy, requests were made from stakeholders for further detail on what this strategy meant for animal welfare. The Animal Welfare Delivery Strategy, published by the previous government in 2007, was prepared to address this need in England and aimed to:

'*ensure that all those who care for or are responsible for animals understand, accept and meet their duty to ensure good standards of welfare for them. It also seeks to ensure they have the necessary skills and knowledge to manage and minimise risks of harm, and to recognise and deal with other problems as they arise.*'

The following strategic goals were laid out to set a framework for successful delivery:

1. Those who care for or have contact with animals have the necessary skills and knowledge to ensure appropriate standards of animal welfare.
2. Animal welfare policy is based on sound scientific research, practical experience and other relevant evidence
3. Economic markets function effectively and transparently allowing customers to make informed choices based on animal welfare standards
4. Compliance with welfare rules, underpinned by efficient enforcement, using risk-based assessments which avoid placing unnecessary burdens on animal keepers
5. Globally accepted animal welfare standards are embedded in international legislation and agreements and, are enforced to the same standards.

The Delivery Strategy also outlines the actions required to achieve each strategic goal. The actions required to ensure '*animal welfare policy is based on sound scientific research, practical experience and other relevant evidence'* are:

1. Develop robust indicators to allow measurement of changes in overall standards of animal welfare

2. Increase stakeholder involvement in the identification of research priorities, selection of project proposals and the provision of funding in some areas
3. Broaden the research to include social and economic research and other sources of information relevant to the measurement of animal welfare standards
4. Ensure evidence takes account of action at EU level e.g. plans to develop standardised European welfare indicators.

The Animal Welfare Research Programme

To ensure the welfare of farm animals, Defra relies on both scientific evidence and practical experience. The Animal Welfare research programme contributes to this evidence base, which enables decisions to be taken with an evidential basis rather than subjective or emotional considerations.

The Animal Welfare research programme forms part of a wider body of research on animal health and welfare. This research portfolio is managed on behalf of the Chief Veterinary Officer and is closely associated with the policy divisions to which it provides a substantial part of the evidence base. From the current Animal Health and Welfare research portfolio, approximately 9% of the budget is allocated to the Animal Welfare research programme (Figure 1).

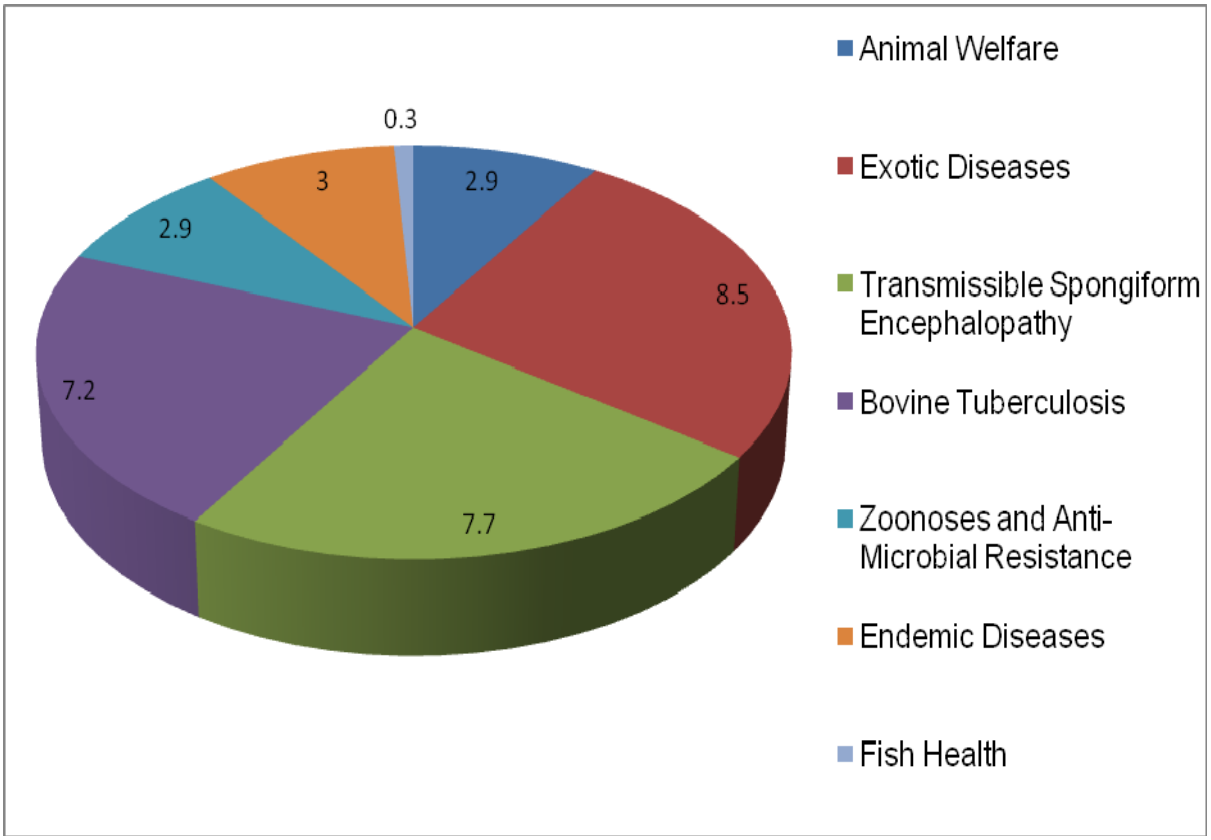

Figure 1: Distribution of the £32.5 million spend between Animal Health and Welfare research programmes during 2009/10.

To note: In 2009/10 a further £2.0 million was used to fund research projects from other Defra budgets. These funds are sourced directly from policy programmes, including £1.5 million for the TB spend and £0.5 million for the VTRI spend.

The overall objectives of the animal welfare research programme are to:

- Improve the welfare of animals reared for food in currently used production and husbandry systems
- Develop and promote alternatives to existing systems where proven to be necessary
- Improve welfare in transport and slaughter systems
- Provide the evidence base to support regulatory policies to improve standards of animal welfare in the UK and across the EU
- Consider how breeding and selection may be applied to improve the welfare of animals while ensuring that new developments do not compromise animal welfare
- Determine and refine methods relevant to assessing animal welfare, establish how methods inter-relate and can be translated into practice
- Improve the welfare of companion and performing animals, and game birds, in line with Departmental responsibilities.

The rationale for funding research into Animal Welfare is set out in a series of SID1 / ROAME statements, covering each of the sub-programmes of research (see Annex 1). The policy and scientific objectives of the research are also defined here.

ROAME is a management system, which stands for ‘Rationale, Objectives, Appraisal, Monitoring and Evaluation’. As such, the rationale and objectives of the research programme must be defined at the outset. Subsequently, research proposals are appraised and the resulting contracts monitored. All projects are then subject to an evaluation.

In line with this system, current and completed Animal Welfare research projects from 2005 to 2010 will be evaluated as part of the review (see list of projects under review in Annex 2). The existing SID1 documents for sub-programmes will be appraised and a new single strategic document will be produced to cover the whole Animal Welfare R&D programme.

Costs of Animal Welfare Research

Total Defra funding for research into animal welfare in 2009/10 was £2.95 million, and was allocated as shown in Figure 2. The current predicted spend for 2010/11 is £2.50 million.

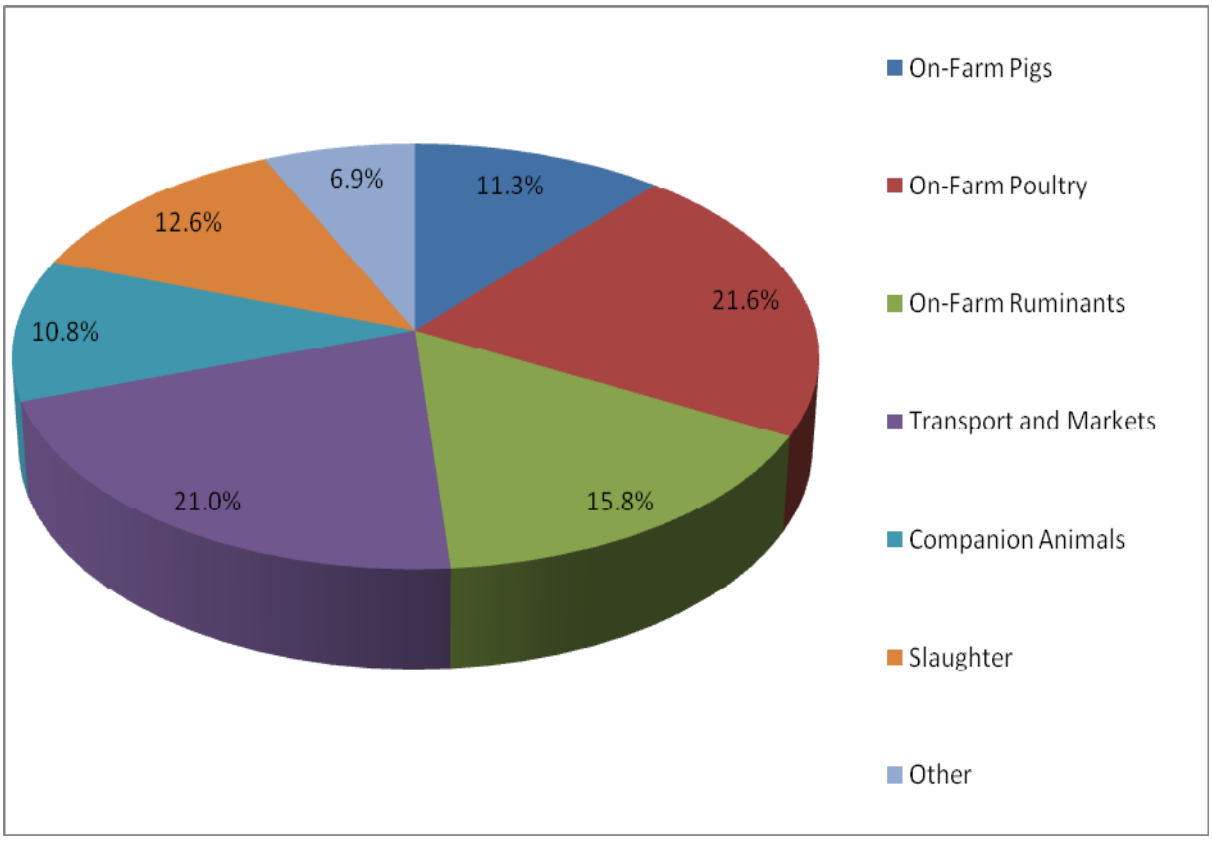

Figure 2: Distribution of the £2.95 million spend across the animal welfare sub-programmes during 2009/10.

Aims of the Animal Welfare Research Review

The Animal Welfare research programme was reviewed by a panel consisting of external referees and Defra officials and the aims were:

- to evaluate completed and current research projects in relation to:
    - their scientific quality
    - their usefulness to policy and contribution to the evidence base
    - delivery of the overall objectives of the Animal Welfare research programme
- to assess the size, scope and balance of the current Animal Welfare research programme in relation to current policy needs
- to consider the future direction of the Animal Welfare research programme and identify future priorities, taking into account the size, scope and balance of the current research programme, as well as research funded in the field by other sponsors.

Section B: Research Review Summary

On-Farm Poultry Research Summary

Success of research in providing value to Defra

About 800 million broiler chickens are slaughtered each year in the UK and roughly 30 million laying hens produce in the region of nine million eggs per year. Defra is committed to improving standards of welfare of all kept animals and Defra commissions R&D to ensure that policy initiatives are soundly based, and to support the UK's position in Community negotiations and in the Council of Europe. Reviewers commented that the research presented was consistently excellent and was well within the scope of what Government should fund, given that it was unlikely other stakeholders would have done so.

Broilers

The priorities identified for broilers were to improve leg heath and assess the affect of various feeding regimes and environment on broiler welfare. An early project identified that the estimated values placed on improved broiler welfare by the general public were substantial and demonstrate a continuing rationale for Defra to seek continual improvements in farm animal welfare. Research relating to leg health suggests that both gait scoring and force-plates, which are proxy measures of walking style, do not predict specific pathologies well. Further work by this research group is looking at the subjective experience of broilers with different gait scores. Early results indicate that a small proportion of birds with Gait Score 3 have potentially painful pathologies, but those with tibial dyschondroplasia did improve their walking style after administration of the analgesic meloxicam. Ongoing research is improving our understanding of food pad dermatitis and hock burn, and interim results suggest that ammoniated litter may be a key causal factor. Research is recently in place to quantify the subjective state of feed restricted broiler breeders, but no results have yet been reported.

Laying Hens

The priorities identified for Laying Hens included improving bone quality, investigating injurious behaviour such as feather pecking, improving design of cages to meet behavioural and welfare requirements, and developing an alternative to beak trimming. Research in this area has provided a comprehensive review of the effect of housing and management strategies on the prevalence of keel fractures, further identifying when keel damage accumulates throughout the life of a laying hen. Encouraging evidence of a potential nutritional basis for providing some protection against keel fracture has also been identified. Ongoing work has begun to assess the impact of keel fractures on the welfare of laying hens. Interim results are indicating that usage of pop holes by birds with fractures is much higher than expected, and suggests that the presence of old fractures does not affect birds' ability to access the range.

Several projects have looked at various aspects of housing of laying hens and have provided an excellent evidence base for policy decisions. Work early in the period covered by this review reported that welfare of laying hens is best in furnished cages, although it was noted that very high variation of hen welfare in both barn and free-range systems indicates that there is considerable scope for improvement within these systems. Further research into enriched colony cages, has shown that bird strain is of critical importance and that smaller colony sizes are preferable. This work

also suggested that careful consideration should be given to the ban on beak trimming since there is bound to be an initial increase in bird losses should a ban be implemented without time to build experience of management techniques to mitigate pecking losses in non-trimmed hens. Injurious pecking is the biggest problem currently facing the egg industry and has major economic and welfare implications. One project reported that colonies that were on the same farm for both rear and lay experience feather damage at a much later stage than those that move. Furthermore, this project showed that with inexpensive video equipment and apparently poor quality images, automated analysis was possible and preliminary evidence indicates that optical flows are predictive of feather pecking behaviour, which might enable intervention in a timely manner.

Two projects looked at ways of controlling Red Mites in laying hen housing systems. One of these evaluated the efficacy of plant-based extracts and concluded that thyme essential oil consistently performed well, whereas the other developed a vaccine, and demonstrated increased mortality of mites in-vivo. Both showed promising results and it would now be most appropriate for industry to take them forward.

Turkeys

Priorities were identified for Turkeys, but these were successfully addressed in projects that were not within the temporal scope of this review. However, one project was funded relating to ducks, which has made a very significant impact in industry and has led to improved welfare of millions of birds. This project demonstrated the importance of open water for the welfare of ducks and also that duck welfare can be maintained by overhead showers without access to ponds, indicating a hygienic and economical way forward for the industry to provide for the welfare of ducks.

Issues and areas of concern relating to this research

The objectives of this sub-programme were met by the research presented at the review and overall the scientific quality was good.

1. Some reviewers were concerned by the lack of academic publications that were produced from research projects. It was acknowledged that although publication in peer-reviewed journals lends significant strength to the research and increases the potency of the evidence in international negotiations, dissemination to and within industry is also vital. It was suggested that industry should also take some responsibility for dissemination.
2. It was noted that an even more joined up approach would be useful and offer value for money. Co-funding opportunities should continue to be investigated with BBSRC, the Scottish Government, industry and other funders of animal welfare research.
3. In only a small number of cases, reviewers felt that the context of the research and environmental variables measured could have been more appropriate and relevant. This should be considered during the selection process.

Research gaps and future priorities

The use of enriched and large colony cages has been adopted by the UK poultry industry but there is a dearth of information on how effectively these systems are functioning. It was suggested that research should be put in place to provide

evidence that will inform approaches to the forthcoming Laying Hen Directive, expected in 2015.

Procedures to improve the welfare of on-farm poultry are well documented but the uptake of these measures has been slow. Research into the barriers that prevent uptake should be considered. This kind of work will increasingly involve sociological and economic research. Although the animal welfare research programme has already started to make use of these approaches, they should become a larger component in the future.

The introduction of the EU Broiler Directive (CD 2007/43) and the Animal Welfare Act (2006) were expected to raise the general level of on-farm poultry welfare. Research to establish the extent to which welfare has improved was considered to be valuable, particularly in light of the forthcoming review of the Animal Welfare Act.

Several lines of evidence, including research into the welfare benefits of using infra-red beak trimming, have identified a range of management procedures to reduce feather pecking. A study could be undertaken to establish how effective these measures are, to identify the barriers that prevent farmer uptake, and to report emerging research gaps in this area.

It was suggested that lines of evidence should be built up with regards to turkey genetics and leg health.

The increasing policy importance of reducing the environmental impact of food production suggests that a systems level study should be conducted to look at the interaction between poultry welfare, management for environmental sustainability and the needs of consumers.

Balance of funding

Within this sub-programme reviewers were content with the balance of projects between poultry sectors and that the priority areas had been addressed. There is a need to invest in projects that investigate how best to disseminate findings and ensure best practice is adopted on-farm. Given that Animal Welfare policy is to a large extent driven by European legislation, this sub-programme should address those issues as they arise to ensure the UK is in a position to implement and monitor efficacy. It will also be important to strengthen links with other funders of animal welfare research and seek opportunities for co-funding.

On-Farm Pigs Research Summary

Success of research in providing value to Defra

Within the UK there are currently about 2 million growing/finishing pigs at any one time, kept in a variety of different management systems. In 2009 UK pig meat production was ~650,000 tonnes, which equates to a 35% reduction from the 1998 peak of 1.14 million tonnes. The industry has invested in high welfare production systems, but there are still some areas that require further research and development to improve the lives of pigs farmed in the UK.

Aggression and other vices

Defra identified several priorities in relation to pig welfare, one of which was to investigate the nature and causes of aggression and other vices in pigs and develop methods to reduce their incidence. Two related projects aimed to identify the genetic

causes of sow aggression towards their offspring and search for allelic variants associated with increased risk of maternal aggression. This research delivered a genetic evidence base for identifying gilts/sows likely to display aggression towards their newborn offspring. It helped to identify key genes and regions of the genome associated with this specific type of aggressive behaviour. A different approach that looked at selecting families that express high genetic merit for piglet survival demonstrated heritability of survival traits at birth, during the nursing period and birth weight. This suggests that there is substantial potential for genetic improvement of survival traits and birth weight.

Farrowing

Two approaches were taken to understanding and addressing pre-weaning mortality since another priority was to develop possible alternatives to the farrowing crate which would allow a greater level of freedom for the sow without compromising the welfare of piglets. One was in the form of an epidemiological study of risk factors and the other is re-designing the farrowing environment from first principles to optimise animal welfare and economic performance. The first approach did not pick up significant differences in pre-weaning mortality levels across the three farrowing systems studied, suggesting that systems in which the sow is not closely confined can be managed without significantly increasing pre-weaning mortality. Indeed farrowing management and stockperson characteristics and behaviour were reported to be most influential on pre-weaning mortality. The second is ongoing research, but has so far produced a review of the basic biological needs of the sow and piglets and an economic optimisation model based on pen design, pig performance and costs. A non-crate system has been formulated and built and at the time of this review more than 100 sows had farrowed in the prototypes.

Housing and Enrichment

Investigation of factors necessary in the environment to enhance welfare was also identified as a priority. Again several approaches were taken, including a review of environmental enrichment for pigs, an assessment of the impact of flooring types and an investigation of different management systems. It was reported that straw can significantly reduce undesirable pig-directed behaviours, such as tail biting, but that it is important the straw is not chopped. Enrichment objects should sustain the interest of pigs and as such should be ‘ingestible’, ‘odorous’, ‘chewable’, ‘deformable’ and ‘destructible’. Research into management systems suggested that no particular housing or feeding system provided a clear health or welfare advantage. However, different risks were identified in each system, providing evidence on which to base improvements. Further work to look specifically at floor types reported associations between floor and bedding type, and foot and limb lesions. In general the results indicate that soil and straw surfaces were protective of lesions, but that they were also associated with erosion of the toe.

Pig Welfare Assessment

Research into Qualitative Behavioural Assessment (QBA) demonstrated that lay and expert observers identify meaningful elements of animal body language. Experimental studies that were performed on-farm consistently resulted in significant relationships between qualitative behaviour and quantitative behavioural and physiological indicators. This work has subsequently been used extensively by the research community for welfare assessments and farm assurance schemes have considered adopting the methodology.

Issues and areas of concern relating to this research

1. It was suggested that one or two less applied research projects could have been co-funded with BBSRC.
2. When commissioning literature reviews, Defra should consider the systematic review approach, which provides a synthesis of available research and should give the best possible estimate of any true effect.

Research gaps and future priorities

It was noted that FAWC are working on an Opinion on mutilations of growing pigs, which will help to identify areas of policy importance to Defra that require further research. However, there was clear agreement that further research is required in relation to mutilations, including teeth clipping, tail docking and castration. There is existing research supported by the Tubney Trust, BPEX and Bristol University reviewing current knowledge on tail biting mitigation methods, while BBSRC funded research is studying the use of infra-red for tail docking. This demonstrates clearly how working in collaboration with other animal welfare research funders and ensuring research is complementary can achieve maximum value for money.

The relationship between health and welfare was also highlighted as one that needs a greater evidence base, particularly with reference to endemic diseases. FAWC are also working on a major study looking at disease and farm animal welfare, and this publication will be beneficial for identifying priority research gaps that it is appropriate for Defra to fund.

Although there is ongoing work investigating farrowing crates, the panel did identify this as an area that continues to need research and development.

It was agreed that there is a good line of evidence that has developed and that, as with other animal welfare sub-programmes, there should be research put in place to identify the barriers of implementation on-farm. Universal application of best practice as identified through the research programme would contribute to a meaningful improvement of welfare for a very significant number of animals.

Balance of funding

There were no concerns raised about the balance of funding for this area.

Companion Animals, Game Birds and Other Projects Research Summary

Success of research in providing value to Defra

Companion Animals

Defra began to develop a small programme in companion animal research in 2007 and those projects that this programme comprises are ongoing. The research into the welfare implications of pet training aids on dogs is still in its early stages, but has already delivered useful information relating to the physical characteristics of training devices, and has developed practical methods of behavioural and psychological measurement of the emotional state of dogs. Research is also in place to investigate risk factors for aggressive dog-human interactions. An extensive review of both academic and grey literature has been performed, and this research is ongoing.

The study of how to promote a duty of care to animals in young people has already delivered an excellent review of our understanding of children's knowledge of, attitudes towards and relationships with animals. The project is ongoing and results are expected to be applicable to the Animal Welfare Act policy, the Department of Children, Schools and Families, and also to the UN World Health Organisation child care program.

Game Birds
The research project on the use of bits and spectacles in game birds provided valuable information for policy makers and this has fed into the code of practice.

Other Research
Research looking at early environmental effects on animal welfare, health and productivity started only weeks before the review, whereas a study looking at whether membership of a Farm Assurance Scheme affects compliance with Animal Welfare Legislation and Codes has reported preliminary results. In all species and countries, there was a pattern of reduced risk of non-compliance in certified enterprises compared with enterprises not known to be certified. This information and the odds ratios attained could be used in the inspection selection process.

Issues and areas of concern relating to this research

1. Where projects are considered sensitive and so presentation of preliminary results is not appropriate in a public forum, reviewers suggested that the presentation could be made to only those involved with appraising the project.
2. There was some concern voiced over the use of post-graduate students in Defra-funded research projects. PhDs are more akin to training programmes and so it is not appropriate to enforce a schedule of deliverables at this level.
3. It was noted that there are international standards for conducting meta-analyses and Defra might be advised to request that these standards are adhered to.

Research gaps and future priorities

With respect to companion animals, hereditary diseases were identified as an area that requires further research, particularly in relation to hips, legs and locomotion, and eyes.

With 40 million game birds in the UK, their welfare needs to be considered within the Welfare Act and evidence is needed to help shape the Game Bird Code.

Non-governmental organisations are concerned with pet welfare but Defra has a role in facilitating this and monitoring their progress. That monitoring should include surveillance of emerging welfare problem in companion animals.

Balance of funding

The welfare of companion animals and game birds entered the Defra R&D programme following the introduction of the Animal Welfare Act in 2006. Reviewers felt that it was a positive move for Defra to commission some research in the area of companion animals. However, it was recognised that whereas 10 million dogs are kept in the UK, there are 800 million broilers and so this should not become a significant part of the programme. Some further research into game bird welfare should also be introduced to the programme.

On-Farm Fish Research Summary

Success of research in providing value to Defra

Four projects were funded on fish welfare in the period covered by this review, but all four of scored impressively both for policy relevance and scientific quality. Aquaculture is an industry that continues to grow and the number of animals involved is similar to the number of animals farmed in other major livestock industries. Fish welfare is a subject about which both FAWC and EFSA have published scientific opinions, identifying areas where further clarity is required.

Fin damage is often considered a “classic” welfare issues which is likely to be caused by the farming environment and it has been suggested that it is the fish equivalent of cattle lameness, pig tail-biting or poultry feather-pecking. Research into fin erosion in Trout has developed methods to assess fin damage, baseline evidence of the severity and prevalence of fin damage within the UK industry and some information identifying key stages of growth and development when fish are most at risk of sustaining fin damage. Further work on trout assessed the interaction between water quality and welfare, confirming that poor water quality can have a negative effect on their health and welfare. This research provided baseline information showing that trout farmers generally do monitor water quality and that on farms the quality rarely deteriorates to levels which would have a negative effect on the welfare of fish. The key water quality parameters that require monitoring and controlling are dissolved oxygen, ammonia, pH and temperature. An excellent output of this project was a stakeholder meeting which achieved consensus between all major stakeholders and provided a prioritised list of actions for the welfare of farmed fish.

More general research looked at trout health and welfare in sustainable aquaculture and moved towards developing a simple non-invasive stress assay. Several useful but counter-intuitive facts were ascertained, highlighting the need for evidence in the field of welfare, rather than relying on subjective and often anthropocentric views. Stress levels after transfer from stock to experimental tanks lasted several days, demonstrating that acclimation is in itself a long-lasting stressor; in relation to stocking density, it was shown that stress levels are higher when at a lower density; and it was shown that food deprivation of one to three days can have a marked effect on physiological indicators. The use of measured concentration of cortisol in water was investigated as a non-invasive stress assay for fish. It was reported that concentration depends not only upon cortisol levels in fish, but also upon number and size of fish, and the dilution by inflowing water. In order for this to be used in commercial fish farms, it must therefore be possible to obtain accurate measures of fish biomass and water inflow rate. Research that sought to develop welfare indices for cod produced a fin erosion key, scoring scheme for monitoring ventilation depth, a condition index and demonstrated that a simple hand-held lactate meter can be used to provide a rapid index of aerobic status.

Issues and areas of concern relating to this research

Reviewers agreed that a great deal had been learnt from the excellent research presented at this review. A couple of concerns were raised.

One reservation that reviewers voiced was that publishing of research outcomes in peer-reviewed papers had in some cases been significantly delayed. It was

acknowledged, however, that there had been considerable emphasis on knowledge transfer to the fish farming industry.

It was noted that fish farming is regional and that novel species are being farmed, and so some concern was noted with respect to selecting the species that research is aimed at.

Research gaps and future priorities

This research reviewed highlighted several significant areas where further clarity is required. Some of these are quite specific and are more suited to either co-funding or should be led by industry, for example the development of a water cortisol 'dip-stick' for use by stockmen. Other areas have much greater scope and are suitable for government funding, for example, it was generally agreed that there is a need to map behaviours to physiological responses in order to better understand the welfare of fish.

In relation to fin damage, a good baseline of knowledge has been gained, but further research is required to ascertain precise developmental times in the life of fish when damage begins to occur, and where interventions might have the greatest impact. Specifically, the investigation of interventions could focus on the relationship between fin damage and feeding/nutrition. It is also important to understand the impact of fin damage on fish behaviour.

It was noted that food deprivation is widely used by the aquaculture industry. Research has reported that food deprivation can lead to marked physiological changes and so further work should examine in greater detail the effect of food deprivation on physiological indicators.

Similarly, research appraised in this review reported that movement between tanks and acclimation are significant stressors. There is little understanding of the effect of transport using pumps, transportation of fish between sites, and how welfare in transport should be assessed. Further work should be undertaken to better understand chronic stress in fish, specifically with respect to transport and acclimation.

One issue that was resoundingly supported for further research was that of reconciling the welfare of a school and the welfare of individuals. Providing stockmen with a toolbox that enables them to monitor both the welfare of individuals within a school, and the welfare of the school as a whole would be invaluable. In-cage cameras were demonstrated to be useful for monitoring ventilation patterns and it was suggested that this is an appropriate tool that warrants further development.

Balance of funding

Current research supported by BBSRC is examining whether fish feel pain and this will feed into any further research priorities for Defra. Fish farming in the UK is regional and there needs to be better co-ordination between the fish welfare research programmes of Defra and the devolved authorities. It was agreed that the research in this sub-programme had very successfully delivered high quality applied science, and that further work should continue to be funded by Defra.

Welfare at Slaughter Research Summary

Success of research in providing value to Defra

This sub-programme had several goals relating to pre-slaughter handling, novel systems, monitoring and enforcement and stunning systems. As a result of incidences of foot and mouth disease and avian influenza, however, a focus on emergency slaughter emerged. It is critical for government to maintain strategic goals, but this added focus demonstrates Defra's ability to react rapidly when it is circumstantially necessary.

Slaughter and Killing of Cattle and Sheep

Addressing concerns about the welfare of animals at the time of slaughter or killing and minimising the risk of stress or suffering at this most critical stage must take account of the processes prior to slaughter or killing. A review and survey provided Defra with information relating to stocking densities, ventilation and noise in red meat lairages, and the sensitivities and responses of animals to them. Cattle and sheep are known to fall and sometimes injure themselves when they are unloaded from vehicles, at abattoirs and at markets and research was undertaken to investigate ways of reducing these incidences. Frequency of slipping was found to be particularly high on certain surfaces and objective criteria for evaluating the appropriateness of a surface in terms of engineering specifications were developed. A guidance note was produced and distributed to the industry sector based on the findings. Research was also undertaken to investigate designs and features of holding pens used for group-stunned animals. Modifications to the design and operation of group-stunning systems were shown to have the potential to improve animal welfare and best practice guidelines were published, publicised and are freely available online.

Slaughter and Killing of Poultry

For poultry, shackle stunning is currently the only viable option for small to medium sized abattoirs and both EFSA and FAWC have expressed concerns about certain aspects of these systems. Work was undertaken that identified practical way of avoiding inversion and suspension of birds prior to stunning. Additional research focused on the electrical stun and developed a method of head-only stunning that was shown to enable immediate and long lasting unconsciousness without compromising carcass quality. Work also investigated stunning of Turkeys and resulted in recommendations that will enable production of a portable stunner. This project provided added value since it demonstrated that subjective assessment of stunning carried out by researchers did not correlate with an objective assessment using EEG.

Slaughter and Killing of Pigs

Pigs can be stunned using a controlled atmosphere, which often entails high concentrations of CO_2. Research in this sub-programme assessed the use of alternative gases and reported that the lower the concentration of the CO_2, the lower the aversion of the animal to the gas mixture is. From an animal welfare point of view, 90% Argon or the lowest possible CO_2 concentration is recommended for stunning pigs. In order to kill 100% of pigs with controlled atmosphere, it is necessary to expose them for longer than seven minutes. Following a FAWC recommendation, research was put in place to investigate whether a combination of

controlled atmosphere stunning and induction of cardiac ventricular fibrillation to kill could lead to improved animal welfare at slaughter. This work is ongoing.

Emergency Slaughter and Killing
A number of projects were commissioned to look at novel systems and emergency killing. Two novel approaches to emergency killing of poultry were investigated, namely containerised gas killing systems and anoxic gas filled foam killing. The containerised gas killing systems proved to be capable of achieving the optimum kill rate, as suggested by contingency planning, and standard operating procedures were produced. Research into the use of anoxic gas filled foam demonstrated that this method of killing is humane, based on recognised behavioural, physiological and neuro-physiological parameters. Further development of this conceptual killing method was ongoing at the time of review, but euthanasia of groups of birds had been achieved and development of foam delivery had led to a consistent flow and expansion rate. An alternative rapid, practical, cost-effective and humane method of emergency killing of poultry is whole-house lethal gas administration. In order to test this method of killing, a system for physiological monitoring of chickens in extreme environments was developed. This was subsequently and very successfully deployed to assess the welfare implications of whole house gassing in a commercially relevant situation. This revealed that the method is highly effective and that fears about the use of liquid CO_2 inducing death by hypothermia appear to be unfounded. However, welfare concerns were raised by the induction period, during which birds experienced potentially unpleasant respiratory responses. Other than poultry, research was put in place to examine the use of captive bolt guns, which are used for on-farm killing of sheep when there is a disease outbreak. This work is going, but had ascertained useful information indicating that marksmanship is key, and that higher velocity bolts result in more effective damage to the brain.

Issues and areas of concern relating to this research

1. There were some excellent examples of dissemination to industry, but it was felt that researchers should be encouraged to submit papers to peer-reviewed journals as well.
2. It was felt that some of the research would have benefited from increased partnership work with industry throughout the life of the projects. This is likely to facilitate commercial uptake of the research outputs.
3. When working on specific technical issues, it was felt that in some cases there would have been benefits wrought from including additional expertise in research consortia.

Research gaps and future priorities

There was broad agreement that many of the questions relating to humane slaughter had been addressed. However, there are some specific topics requiring investigation as well as some broader areas of research that need further work.

Some excellent work on gas killing and controlled atmospheres had been undertaken, but this needs to be tied up by the development of standard operating procedures for the use of gas mixtures and anoxic gas-filled foam. In particular, recommendations were made to ensure that the anoxic gas-filled foam killing method is developed to a point that it is field ready so it can be practically deployed in case of disease outbreak.

There was also emphasis put on the fact that further work needs to be undertaken to understand better what unconsciousness is and how to measure it in a practical way. This relates to recommendations to investigate how best to monitor abattoirs.

It was noted that head restraints for cattle requires research, particularly for large cattle over 600kg.

Balance of funding

Reviewers felt that the balance of funding in this sub-programme was appropriate, but that the current level of funding may not be necessary in the future. There was some concern raised over the maintenance of expertise. The UK hosts world class welfare experts and there is a fantastic and very important opportunity to keep research groups going. It was emphasised that once expertise is lost, undue investment is required to realise it again.

On-Farm Ruminants Research Summary

Success of research in providing value to Defra

Husbandry Systems

With respect to husbandry practices, several systems were explored to produce an evidence base that ensures best practice can be identified. The systems included organic dairy, continuously housed dairy and extensive sheep farming. With respect to comparison of organic and non-organic dairy systems, data on the incidence of disease and welfare issues was provided and best practice strategies that some farmers have used to successfully reduce diseases such as lameness and mastisis were identified. The outputs from this project may be included in the next revision of the cattle welfare code. Ongoing work to investigate continuously housed dairy systems reports preliminary results that indicate the use of loafing areas is the same whether they are furnished or not and whether there is a ‘view’ or not. Preliminary results also suggest cows prefer to use fields as a loafing area rather than a similar sized concrete area, and that they use loafing areas more when feed is present. Study of extensively managed sheep flocks reported that labour input was more influential than nutrition or profit when linking these factors to welfare. It also emphasised that the relationships between welfare, profit and resources available are complex, and highlighted the need to avoid simplistic generalisations about the factors associated with good welfare. Additional work on sheep is ongoing and aims to develop indicators of sheep welfare for on-farm assessment.

Lameness

Lameness is considered to be the major welfare issue facing dairy cattle and had been identified as a priority area over the review period. A project looking at alleviation of lameness in heifers developed a coherent strategy for hazard analysis and risk management through identification of critical control points. This strategy has now been extended, by way of the EU Welfare Quality Project, for use in dairy cattle. The outcomes of this research were also incorporated into the European Food Safety Authority reports and recommendations on dairy cow welfare. Another approach taken was to develop an automated system for early detection of lameness in dairy cattle. This work showed that there is a complex effect of lameness on the underlying mechanics of locomotion, but that automated classification systems can successfully learn the patterns of ground reaction forces of lame cows. The baseline

data collected can inform future developments of a commercially viable automated detection system. Another move to improve the welfare of dairy cows aimed to identify and characterise ‘robust’ cows. Approaches were developed to allow traits underlying robustness, such as body energy, to be included in national dairy breeding indices.

Foot Rot
Disease conditions such as foot rot give rise to welfare concerns and are of economic significance for both cattle and sheep. Research in this period focused on footrot, taking both a molecular approach and looking at interventions. The intervention chosen was administration of parenteral antibiotics to individual male sheep with footrot/digital dermatitis, which significantly reduced the prevalence and incidence of lameness. It demonstrated great benefit of the intervention protocol to the health, welfare and economic return in a sheep flock. The molecular work demonstrated an objective method to quantify footrot, which can be used as a tool for welfare surveillance, and as a management and breeding tool for farmers to improve the biological efficiency of their animals. Indeed it will now be included in breeding programmes which should lead to fewer sheep being affected by footrot with every successive generation. Additional data collected as part of this project suggested the possible involvement of nutrition in poor horn development, leading to clinical signs of Shelly Hoof.

Issues and areas of concern relating to this research

1. Reviewers voiced some concern that results from studies focussing on a relatively small samples might have a disproportionate impact on policy. Defra was advised to be aware of this issue and look to larger scale studies where appropriate.
2. There was some concern voiced over the use of post-graduate students in Defra-funded research projects.
3. It was felt that Defra should be aware of the use of subjective terms since they could lead to research that is not focussed in the way it wants.

Research gaps and future priorities

There was a strong feeling that research into understanding the barriers to knowledge application on-farm is a high priority. A good basic evidence base of best practice exists which can be used to improve welfare, but the practices are not universally implemented at a farm level.

Although it was recognised that some high quality research has been undertaken in relation to lameness in dairy cows, this remains the most important welfare concern. Continuing research and support is needed to provide practical solutions for farmers. Promotion of the DairyCo Mobility Score has resulted in an increased awareness of lameness in dairy farmers and this should help to effect uptake on measures aimed at reducing it.

Welfare issues associated with castration in lambs have been identified as high priority and support for research into this should be considered.

Balance of funding

There were no concerns raised regarding the balance of funding in this area and reviewers identified several areas that required continued research effort and

investment. It was noted that future research should, however, aim to take account of and integrate into more global priorities such as food security.

Transport and Markets Research Summary

Success of research in providing value to Defra

The priorities tackled in this sub-programme were standards for Vehicle Design, Vehicle Environment Monitoring Methods, Livestock Monitoring Techniques, Influence of Human Behaviour on Livestock and Impact of Marketing Animals. Several projects that fall outside of the remit of this review were commissioned in order to address these objectives.

Assessing Fatigue and Fitness to Travel
Long distance transport might induce fatigue in animals, but techniques for monitoring fatigue are largely absent. Research aiming to develop methods to assess fatigue in sheep indicated that after five hours of moderate exercise, no significant differences in selected measures were detected and so it is likely that fatigue had not in fact been induced. This is useful information in itself, although it does leave an open policy question regarding sheep fatigue and its relationship to transport. Work to assess fitness of end-of-lay hens to travel and mitigation strategies to transport slightly sick or injured birds is ongoing and progressing well.

Transport of Unbroken Ponies
Two projects were commissioned to look at the transport and handling of unbroken ponies. These provided important information relevant to implementation of Council Regulation EC 1/2005, which pertains to the protection of animals during transport and related operations. In contrast to other equines, unbroken ponies are best loaded in groups and the optimal group size for transport is four since overall cortisol levels and levels of aggression were lowest in this scenario. Additionally, it was reported that for improved animal welfare, unbroken ponies should be provided with water at all times, but that pressure operated drinkers should be avoided.

Welfare Impacts of the Environment and Journey Duration
Recently completed work reported that journeys undertaken in conditions close to or at the limits of temperature prescribed in the current regulation result in some physiological adaptive responses, but that these responses do not constitute a major threat to pig welfare. It was noted that temperature of rearing environment should be taken into account and that humidity might be an important factor when considering thermal stress. Ongoing work is taking an epidemiological approach to identify acceptable maximum pig journey length.
In order to inform the post-implementation review of regulation 1/2005 and feed into the Commission's review process, one project is studying the impact of legislation to improve the welfare of animals during transport. This is ongoing work that is meeting its milestones and has reported on interview outputs with key stakeholders and agency partners.

Issues and areas of concern relating to this research

1. When working on specific technical issues or using specialist research approaches, it was felt that in some cases there would have been benefits wrought from including an analytical specialist in research consortia.

2. It was felt that researchers should be strongly encouraged to submit their work to peer-review journals in a timely manner both during and at the end of the project's life.

Research gaps and future priorities

There has been a belief that a single model for animal transport, whereas it is most likely that different approaches are required for different species, and indeed within species. This is an area where very little evidence exists and should be explored.

This sub-programme has procured some excellent knowledge which leads to recommendations of best practice for industry. However, it was recognised that knowledge transfer is not the same as knowledge application. Research into implementation of best practice, including barriers to uptake, should be undertaken.

There was some emphasis on the haulage of cattle and it was felt this is an area that requires an updated evidence base to address current welfare concerns.

Balance of funding

It was felt that the welfare in transport and markets sub-programme may not need the same level of investment as it has received over the last five years. Although there are clearly areas that require further investigation, it will not require the same level of funding. It was noted that international collaboration in areas of mutual concern will provide excellent value for money and should be explored further.

Section C: Project Abstracts and Review Comments

On-Farm Poultry

Monday 8th March 2010

On-Farm Poultry Agenda

Monday 8th March 2010

The Royal College of Physicians, St Andrew's Place, London

09.00 – 09.30	Registration and coffee

09.30 – 09.50 Welcome and Introductions
Mr. David Pritchard, Defra (Chair)
Ms. Sarah Hendry, Defra

Oral Presentations – Session 1

09:50 – 10:10 **AW1137**: Foot pad dermatitis & hock burn in broilers: risk factors, aetiology & welfare consequences
Dr. Helen Ternent, University of Glasgow

10:10 – 10:30 **AW1138**: Development of a vaccine to control the poultry red mite & improve laying hen welfare.
Dr. John Huntley, Moredun Research Institute

10:30 – 10:50 **AW1135**: Further development of a method for objective & reliable assessment of broiler leg health under commercial conditions
Dr. Alistair McVittie, SAC Commercial Ltd.

10:50 – 11:10 **AW1301**: To study the effects of the application of bits & spectacles in game birds
Dr. Christopher Davies, Game & Wildlife Conservation Trust

11:10 – 11:30	Coffee break

Poster Presentations – Session 1

11:30 – 12:30 **AW1136**: Non-chemical control of Red Mite in laying hen housing systems (MITEeHEN)
Dr. Jonathan Guy, University of Newcastle

AW1139: Chronic neurophysiological and anatomical changes associated with infra-red beak trimming

AW1141: Quantifying the subjective state of feed restricted broiler chickens using behavioural and neurochemical measures
Dr. Richard D'Eath, SAC Commercial Ltd.

AW1142: The impact of keel bone fractures on the welfare of laying hens
Mr. Lindsay Wilkins, University of Bristol

AW1143: Study to assess the subjective experience, including pain, of broiler chickens with different gait scores
Dr. Nicholas Sparks, SAC Commercial Ltd.

12:30 – 13:15 Lunch

Oral Presentations – Session 2

13:15 – 13:35 **AW0233**: Study to assess the welfare of ducks housed in systems currently used in the UK
Dr. Tracey Jones, University of Oxford

13:35 – 13:55 **AW0234**: Detection, causation and potential alleviation of bone damage in laying hens housed in non-cage systems
Dr. John Tarlton, University of Bristol

13:55 – 14:15 **AW1132**: A comparative study to assess the welfare of laying hens in current housing systems
Prof. Christine Nicol, University of Bristol

14:15 – 14:35 **AW1134**: The influence of rearing environment on propensity for injurious pecking in laying hens
Prof. Marian Dawkins, University of Oxford

Poster Presentations – Session 2

14:35 – 15:15 **AW0235**: A study to compare the health and welfare of laying hens in different types of enriched cage
Dr. Victoria Sandilands, SAC Commercial Ltd.

AW0236: Estimating non-market benefits of reduced stocking density and other welfare increasing measures for meat chickens
Dr. Alistair McVittie, SAC Commercial Ltd.

AW1133: Welfare implications of changes in production systems for laying hens - LayWel
Dr. Heleen van de Weerd, ADAS UK Ltd.

15.15 – 15.45 Coffee break

15:45 – 17:45 Closed session for review panel
Dr. Peter Stevenson, Defra (Chair)

On-Farm Poultry Abstracts and Review Comments

Project code:	**AW1137**
Project title:	Foot pad dermatitis and hock burn in broilers: risk factors, aetiology and welfare consequences
Start date (dd/mm/yy):	01/09/06
End date (dd/mm/yy):	30/06/10
Total cost:	£565,807
Project leader:	Dr Dorothy Mckeegan
Affiliation:	Faculty of Veterinary Medicine University of Glasgow
Sub-contractor(s):	N/A

Abstract of research

This project aims to improve our understanding of the risk factors, development and welfare consequences of foot pad dermatitis and hock burn using a multidisciplinary approach.

Progress to date includes:

- development of a new validated scoring system for foot and hock lesions which is designed to clearly relate to 3 point or binary industry scales to provide flexibility for analysis while retaining detail on lesion severity if required
- collection of a significant and unique epidemiological data set which will allow us to identify management risk factors for particular litter characteristics and increased prevalence of foot and hock lesions
- development of a lesion induction protocol which allows us to model lesion development and examine in detail their formation and healing
- completion of an experiment with ammoniated litter which strongly suggests that ammonia is a key causal factor in the development of foot and hock lesions
- Completion of trials in collaboration with industry partner Aviagen which have provided new insights to the involvement of genotype, environment and dietary protein levels in lesion development and prevalence
- Behavioural trials have been completed which are examining the effects of analgesic on motivation to walk in birds with or without lesions

Review comments

Overall the project scored well both in terms of science and particularly with respect to policy. There were questions over the extent to which to interim results had been disseminated and it was noted that knowledge transfer is an important aspect of publically funded research.

Although not yet completed the project has the potential to be of enormous benefit to chicken welfare in terms of monitoring in slaughterhouses and management advice to producers. Defra stated that this approach could be used as a legal instrument.

Project code:	**AW1138**
Project title:	Development of a vaccine to control the Poultry Red Mite and improve laying hen welfare
Start date (dd/mm/yy):	01/10/06
End date (dd/mm/yy):	30/09/09
Total cost:	£526,986
Project leader:	Dr John F. Huntley
Affiliation:	Moredun Research Institute, Pentlands Science Park, Bush Loan, Penicuik, Edinburgh, Scotland, EH26 0PZ
Sub-contractor(s):	Biomathematics and Statistics Scotland (BioSS), BioSS Office, Scottish Agricultural College, Auchincruive. Ayr, KA6 5HW

Abstract of research

The main objectives were as follows:

1. Identification of candidate *D. gallinae* protective antigens, by proteomic and molecular techniques, based on homology with known allergens and protective antigens from other species. Several candidate antigens have been investigated based on collective knowledge from other parasite models. These have included a Bm86-like protein, subolesin, tropomyosin, paramyosin, a protein homologous to the tick histamine releasing factor (HRF), and proteolytic enzymes. Recombinant proteins were expressed and antibodies to all five of these were tested in the in-vitro feeding assay with promising results
2. Native candidate antigens and allergens were extracted from the soluble, membrane-associated, membrane bound and insoluble proteins. Following immunisation, these antibodies were tested in the in-vitro feeding assay. A further fractionation and testing of the active fraction was performed using ion-exchange chromatography
3. Antibodies to native proteins were investigated for their effect on mites in-vitro. Modifications to the mite feeding assay improved the consistency and number of feeding mites, and the most recent test produced an initial mortality of 40%, from the PBS group. The feeding assay was also employed to investigate the effects of antibodies to recombinant proteins described in Objective 1. These experiments have shown that antibodies to these recombinant proteins (HRF, cathepsins D and L, tropomyosin and paramyosin) induced a reduction in mite survival after one blood meal of 10%, 18%, 12%, 28% and 33%, respectively.
4. A red mite cDNA expression library was generated using a technique successfully employed previously at MRI for making mite and tick libraries.
5. An in vivo study was performed where groups of 60 hens were vaccinated with the PBS fraction, or with a cocktail of the recombinant proteins comprising of HRF, cathepsin D and L, tropomyosin and paramyosin. A control group was given the Quil

A adjuvant alone. A good antibody response was obtained in all vaccinated birds. After vaccination each cage was challenged with mites. The study terminated after 7 weeks but the mite counts were very variable and no significant differences in these counts between vaccinated and control animals was observed. The behaviour and health of the birds were monitored, but no differences in the groups were observed and all birds appeared clinically normal throughout the study.
Further funding has been sought, to fractionate further the native proteins to identify the key and most effective vaccine candidates.

Review comments
This project received good scores for both quality of science and appropriateness to Defra. This was intended to be a speculative project and the research team has done well. Reviewers were supportive of Defra for funding this work. While it was recognised that there was an effective proof of concept, the failure to demonstrate bird protection under commercial conditions is disappointing. Practical application under significant and prolonged field challenge should be the next step e.g. effect of vaccine on reducing house infestation, carried over to an on-farm commercial situation.

The level of commitment by Defra to further research in a commercial situation needs to be considered. The reviewers felt that Defra should act as a pump primer for industry to then take forward and develop a vaccine suitable for the open market. Vaccines were noted to be critical to improving bird welfare as part of good management practice.

Project code:	**AW1135**
Project title:	Further development of a method for objective and reliable assessment of broiler leg health under commercial conditions
Start date (dd/mm/yy):	01/05/05
End date (dd/mm/yy):	30/09/07
Total cost:	£194,211
Project leader:	Dr Nicholas Sparks
Affiliation:	SAC
Sub-contractor(s):	Dr Sarah Brocklehurst (BioSS) Mr Dan Pearson (Grampian Country Food Chicken Rearing Ltd) Mr Barry Thorp (Aviagen Ltd) Mr Jim Vaughan (Kistler Instruments Ltd)

Abstract of research
The purpose of this study was to develop a force plate (FP) system that could be used routinely to objectively assess chicken leg health on commercial production units. The system was validated against post mortem (PM) data, and compared to assessments obtained using the Bristol Gait Scoring method (BGS). Comparisons were made on the commercial broiler trials facility between data collected from the

FP, BGS, and PM, using three strains of chickens (strains 1, 2, 3; both males and females, 2 pens of about 90 birds each). Data was collected and compared using FP and BGS from, on average, 76 birds per pen at 3, 4, 5 and 6 weeks of age. PM data (collected from 30% of these birds at 6 weeks of age) was considered the objective assessment of leg health, and the standard against which FP and BGS were assessed. Based on power calculations and together with sensitivity and specificity from our model fits, we estimated the numbers of birds that would need to be tested by FP and BGS to estimate true prevalence of lameness in flocks.
In summary, the FP was better than BGS at identifying birds with leg health problems (as determined by PM), but only marginally so. Both FP and BGS are poor predictors of leg health. It appears that FP and BGS identify similar factors in birds (judged on better Se and Sp between BGS and FP than between PM and FP or BGS), i.e. gait, rather than leg health, which describes something different. Impractically large numbers of birds need to be tested with either FP or BGS methods to get accurate predictions of flock leg health, due to low levels of sensitivity and specificity.

Review comments
This project scored well and quality of science and policy relevance were considered good. The overall score reduced due to the lack of dissemination. It was noted that the mis-match between footplate, gait scoring and post mortem results is important. This result indicates that it has not yet been possible to produce a practical method for assessing leg health in commercial conditions.. Furthermore, it casts doubt on the relevance of gait scoring for welfare assessment, an outcome that needs serious consideration. The practicality of using a foot plate under commercial conditions is in doubt.
Concerns were expressed about the lack of dissemination considering the widespread use of gait scoring across Europe.

Project code:	**AW1301**
Project title:	To study the effects of the application of bits and spectacles in game birds
Start date (dd/mm/yy):	01/06/05
End date (dd/mm/yy):	01/12/07
Total cost:	£341,362
Project leader:	Christopher Davis B V M & S M R C V S
Affiliation:	Game Conservancy Trust
Sub-contractor(s):	N/A

Abstract of research
Data for the bitting and spectacle studies were collected from game farms across England and Wales between 2005 and 2007. In laying hens, spectacles reduced acts of bird on bird pecking but increased incidences of head scratching and shaking. In laying systems where multiple cocks were kept with hens, spectacles reduced feather damage in hens and also incidences of skin damage in both hens and cocks. The Body Mass Index of pheasants in laying pens was not affected by

the fitting of spectacles. Incidences of bill and nostril damage were higher in spectacled than non-spectacled hens. Egg collection, egg weights, feed usage and mortality rates did not differ between spectacled and non-spectacled birds.
Similarly to spectacles, bits reduced acts of bird-on-bird pecking but increased incidences of head shaking and scratching. In all weeks after bitting, the feather condition of non-bitted pheasants was poorer than those fitted with bits. Incidences of skin damage were also more frequent in the non-bitted pens. On some game farms, the feather and skin condition of the non-bitted pheasants rapidly deteriorated during the trials and it was judged to bit these birds to prevent further damage. The Body Mass Index of pheasants in the bitted and non-bitted pens did not differ in any week. Bits caused nostril- inflammation and bill deformities in some birds, particularly after 7 weeks of age. In weeks 4 and 5 after bitting, corticosterone levels were higher in the faeces of non-bitted pheasants than bitted birds. Feed usage and mortality rates did not differ between bitted and non-bitted birds.
The results of this study suggest that bits and spectacles can be used to prevent welfare problems caused by feather pecking and cannibalism. A change in the design of spectacles and the fitting of larger bits to pheasant poults over 7 weeks old may reduce bill and nares damage caused by these anti-feather pecking devices. Factors identified in the poultry industry as being stimuli for feather pecking should be further examined in relation to feather pecking in pheasants.

Review comments

This project scored well for relevance to Defra, meeting the policy objective and providing evidence that was used to directly inform the Code of Practice. No peer-reviewed publications have yet been submitted. Reviewers noted the high cost of the project, however, this was due to the geographical spread of farms and the high level of observation that was requested by Defra. There was some debate about whether the research would have benefited from collaboration with other experts in the field of animal welfare, but the strength of this research group was in bringing industry on-board.

Project code:	**AW1136**
Project title:	Non-chemical control of Red Mite in laying hen housing systems [MITEeHEN]
Start date (dd/mm/yy):	01/09/06
End date (dd/mm/yy):	31/08/08
Total cost:	£250,561
Project leader:	Dr Jonathan Guy
Affiliation:	Newcastle University
Sub-contractor(s):	N/A

Abstract of research

A series of experiments were conducted over a two-year period to i) evaluate the efficacy of a range of plant-derived products to be used as acaricides and/or repellents/attractants against the poultry red mite (*Dermanyssus gallinae*, De Geer) and ii) to transfer this knowledge and technology to the poultry industry. With

changes in legislation and consumer demand, alternatives to synthetics to manage this pest of laying flocks, where mites may cause losses in egg production, as well as anaemia and even death of hens, are increasingly needed.
Of the 50 essential oils originally selected for study, thyme consistently performed well as a plant-derived product with potential in *D. gallinae* management in laboratory tests. In the absence of any negative effect on welfare, egg production or behaviour, thyme essential oil may be considered a suitable candidate for a *D. gallinae* acaricide. The research has found this oil displays high levels of toxicity to *D. gallinae* at different life stages (specifically juveniles and adults), is environmentally stable, is relatively non-toxic to certain non-target species (specifically mealworm beetles) and even displays a degree of repellence and a fumigant mode of action: all factors which could be advantageous in *D. gallinae* control. The findings have highlighted a number of areas which warrant further investigation before an essential oil-based *D. gallinae* acaricide could be recommended for the poultry industry;

- Strategies to improve the consistency in acaricidal activity of essential oils for use against *D. gallinae*.
- Strategies and/or apparatus to deploy essential oils as acaricides for *D. gallinae* within the limitations of commercial poultry housing systems.

Review comments

The score for policy appropriateness was good and quality of science and overall scores were above requirements. The results were inconclusive, with no essential oil emerging as a potential solution. It was suggested that further research could look at fractions of oils. Additional research is needed to find a control for red mite, and it was felt that this approach is promising and could act as a template for assessing other products. This is for industry to take forward.

Project code:	**AW1139**
Project title:	Chronic neurophysiological and anatomical changes associated with infra-red beak trimming
Start date (dd/mm/yy):	01/01/08
End date (dd/mm/yy):	31/03/09
Total cost:	£39,200
Project leader:	Dr Dorothy Mckeegan
Affiliation:	Faculty of Veterinary Medicine University of Glasgow
Sub-contractor(s):	N/A

Abstract of research

This study examined the long term consequences of IR (infra-red) beak treatment by examining changes in beak nerve function (neurophysiology) and anatomy over a range of ages.
In IR treated and control birds (intact beaks) that were 10, 30 or 50 weeks of age, the responses of single sensory nerve fibres were recorded from small nerve bundles of

the intramandibular nerve, which provides sensation to the lower beak. The beaks of the birds (as well as further groups aged day old and 4 weeks of age, both too small for neurophysiological studies) were then subject to post mortem microscopic and radiographic examination.
There was no evidence of a treatment effect on either mechanical or thermal nociceptive thresholds at any age. This indicates that IR beak treatment is not associated with an increased sensitivity to pain (hyperalgesia) nor does it result in a pain response to a normally non-painful stimulus (allodynia) after 10 weeks of age. Beak measurements at day-old demonstrated that application of the IR treatment at day old affected on average 36% of beak area (using area forward of the nostrils as a basis for comparison). Detailed beak measurement data indicated that the IR treatment had resulted in a 44% reduction in overall (upper) beak length when compared with control birds by 4 weeks of age. Microscopic evaluation of beak tip anatomy revealed that by 4 weeks of age there was limited nerve regeneration in IR treated beaks, including repopulation of mechanoreceptors in some birds. There was evidence of beak healing, which included reepithelialisation, fibrovascular hyperplasia and bone remodelling, in all birds.
Collectively, the results suggest that IR beak treatment of day old chicks does not result in chronic adverse consequences for sensory function, nor does it demonstrate evidence of chronic pain associated with the procedure.

Review comments
The overall score was very good with both quality of science score and policy relevance scoring well. This project makes a valuable contribution to our knowledge on the sensory system of the beak of chickens in general, and on the effect of infra-red beak treatment in particular. The findings, that this type of treatment does not produce chronic pain, have been accepted by FAWC and Ministers, and are likely to lead to changes in legislation. Industry are well aware of the research, although no paper has yet been submitted.

Project code:	**AW1141**
Project title:	Quantifying the subjective state of feed restricted broiler chickens using behavioural and neurochemical measures
Start date (dd/mm/yy):	01/07/09
End date (dd/mm/yy):	30/09/12
Total cost:	£706,792
Project leader:	Dr Rick D'eath
Affiliation:	SAC
Sub-contractor(s):	Dr Vicky Sandilands, Dr Bert Tolkamp (SAC), Dr Melissa Bateson, Dr Tom Smulders, Dr Tim Boswell (University of Newcastle); Ian Dunn, (University of Edinburgh; Roslin Institute); Dr Mintu Nath, Dr Sarah Brocklehurst (BioSS).

Abstract of research
Feed restriction during rearing is standard practice in broiler breeder chickens because more generous food allowances can result in health, welfare and production problems. Feed restriction is likely to result in hunger, but the welfare impact of this hunger has not been quantified in terms of its effect on the subjective state of broiler breeders, i.e. how feed restriction makes them feel. Here, complementary behavioural and neurochemical measures of negative subjective states will be used. Behaviour: An animal's preferences and motivation can reveal its subjective state, but measuring feeding motivation by offering food is problematic because it so radically changes the context. We will avoid this by using a technique from pharmacology known as conditioned place preference and aversion (CPP/A), which measures the overall subjective experience of a situation in the absence of rewarding/aversive stimuli. Using CPP/A, the experience of feed restriction will be compared against more generous feed allowances combined with factors that chickens dislike such as social isolation or reduced space allowance. Neurochemistry: Changes associated with negative subjective states (such as anxiety and depression) have been identified which show similarities between humans and animal models of these states including poultry. These markers will be investigated in feed-restricted broiler breeders. Further validation will involve comparing these markers in broody hens which show voluntary restriction of feed intake with non-broody birds undergoing involuntary restriction to the same degree. Cross-validation: The CPP/A approach will generate preference rankings for different combinations of resources, and the neurochemical markers will be measured in birds reared under these different conditions, to determine whether the ranking determined by the two approaches is similar.

Review comments
The score for appropriateness to Defra was very good; overall it was delivering above requirements and quality of science was considered to be excellent. The likelihood of success was considered difficult to assess so early in the project but potentially an excellent project. The ideas and the methodology are excellent and innovative, however, the outcome will be very dependent on the successful application of the conditioned place preference (CPP) and conditioned place avoidance (CPA). Although not yet completed the project has the potential to be of enormous benefit to the development of policy on broiler breeder welfare.

Project code:	**AW1142**
Project title:	The impact of keel fractures on the welfare of laying hens
Start date (dd/mm/yy):	01/04/09
End date (dd/mm/yy):	31/03/12
Total cost:	£431,317
Project leader:	Lindsay Wilkins
Affiliation:	University of Bristol
Sub-contractor(s):	N/A

Abstract of research
A major threat to bird welfare in such systems is the susceptibility of hens to incurring fractures of the keel during the production cycle and, while this problem has been recognised for some time, recent evidence suggests that the situation has considerably worsened and that up to 90% of birds may be affected in some flocks. The project aims to study the impact of fractures of any degree of severity on the ability of individual birds to perform normal activities and behaviours and importantly to evaluate the consequences for subjective experience including pain, frustration and possibly hunger and thirst where mobility is markedly affected.To determine the ability of birds with fractures to access different resources within a commercial laying environment, four flocks have been assessed at placement, 25, 35 and 45 weeks of age. We also have access to 12 other identically housed flocks which are being used to investigate the potential for improving bone health by provision of an omega-3 modified diet. Some variation in fracture rate exists between different pens and the flocks housed towards the ends of the houses appear to have sustained a greater number of fractures. Currently, the assocation betrween fracture rate and flock activity and flightiness is being studied. While the incidence of fractures in all flocks is relatively high, usage of the pop holes by individually identified and palpated birds is much higher than anticipated and at this early stage the presence of old fractures appears not to affect birds ability to access the range.

Review comments
The research is still in its early stages but the overall score so far is very good. It was considered to be a highly important area for research which probably constitutes one of the two most urgent priorities for laying hen welfare research, the other being feather-pecking. It was acknowledged that co-operation of the poultry industry should be commended and will add real robustness to the study.

Project code:	**AW1143**
Project title:	Study to assess the subjective experience, including pain, of broiler chickens with different gait scores
Start date (dd/mm/yy):	01/05/09
End date (dd/mm/yy):	30/04/11
Total cost:	£348,933
Project leader:	Dr Nicholas Sparks
Affiliation:	SAC
Sub-contractor(s):	Dr Sarah Brocklehurst (BioSS) Dr Dorothy McKeegan (University of Glasgow) Mr Dan Pearson (Vion Diagnostics) Dr Barry Thorp (St David's Poultry Team)

Abstract of research
Lameness, commonly referred to as leg health, in the modern broiler chicken is an emotive issue and the debate surrounding this subject is not helped by the lack of agreement as to how leg health should be assessed and what it means to the bird. This project assesses the subjective experience of chickens that walk with Bristol Gait Score GS 3 by studying the interaction of pain relief (analgesics) and walking style as measured using gait scoring, a force plate and by behavioural assessment. All birds are post-mortemed to allow underlying pathologies to be identified.
72 male chickens of gait score GS 1 or GS 3 were selected from commercial farms and tested both with and without analgesic (carprofen or meloxicam, 4 mg/kg injected subcutaneously, or saline control) for walking style (using a force plate and gait score methods). Birds also completed a runway motivation test to reach companion birds before and after administration of analgesic. After completion of the force plate, GS, and motivation tests, all birds were assessed following post mortem for foot pad and hock scores, variations in leg angulation and any leg and spinal pathologies. Results showed that only 14 birds had pathologies that were potentially painful (foot pad scores of 2 or greater and bacterial synovitus) and the results of the study were inconclusive in terms of significant improvements in walking style resulting from administration of analgesic. When all the data were analysed it was only the two birds that were diagnosed with tibial dyschondroplasia (notably not commonly considered to be a painful condition) that improved their walking style after administration of meloxicam.

Review comments
This project is in its early stages but the overall score to date is good. The project is promising, but its success will depend on the impact that an analgesic has on Gait Score 3 birds. That being so, it would benefit from having a veterinary pharmacologist involved. Concern was expressed about the value of working on Bristol Gait Score GS 3 birds, since other research being reviewed has questioned the validity of gait scoring, although it was acknowledged that this was the focus that Defra sought. The sample size was discussed in light of the multi-factorial nature of lameness in flocks.

Project code:	**AW0233**
Project title:	Study to assess the welfare of ducks housed in systems currently used in the UK
Start date (dd/mm/yy):	01/10/04
End date (dd/mm/yy):	30/09/07
Total cost:	£294,027
Project leader:	Professor Marian Dawkins
Affiliation:	Oxford University
Sub-contractor(s):	Food Animal Initiative

Abstract of research
The study investigated the effects of rearing conditions on a wide range of duck health and welfare measures and systematically examined the effect of bathing water provision on duck health and welfare including behaviour and the animals' own preferences. The study was divided into two parts.
Part 1 looked at duck welfare on commercial farms in the UK. Twenty three houses on 7 farms representing 5 systems differing in ventilation, drinking, and brooding systems, were included in the study. Two flocks were studied through each house; one in cold season conditions (winter/spring) and one in warm season conditions (summer/autumn), so that in total 46 flocks (placing 448,011 ducks) were studied. Management, environment and production data were collected from each house and the health and behaviour of live ducks recorded. Ducks were also inspected at slaughter.
The results confirmed the importance of maintaining low ambient temperatures and humidity, dry litter, and low levels of atmospheric ammonia, for duck health and welfare. They also indicate the important role of ventilation and open water to the duck.
Part 2 consisted of two experiments carried out with small groups of ducks in a controlled environment.
Experiment 1 investigated the effect of bathing water on the health and behaviour of ducks and the strength of their motivation to bathe. The results indicate the importance of open water to duck health and welfare, and suggest that open water supplied from a trough or shower can match that supplied by a bath.
Experiment 2 attempted to quantify the motivation of ducks for bathing water by seeing how important bathing was to them compared to feeding. Post feed and bathing water deprivation, ducks increased the time they spent feeding, drinking and bathing (from bath) compared to prior to deprivation, and subsequently spent less time resting and rooting in the straw. There was, however, no trade off in feeding for bathing or bathing for feeding, indicating that both feeding and bathing were important to the ducks following the levels of deprivation experienced.

Review comments
Overall this project was considered to be of a high scientific standard, with conclusions based on sound evidence. The reviewers also noted that the project had led to a good number of publications.The research carried out in this project is relevant and appropriate and leads to clear conclusions within the framework of the questions raised by Defra. The results of this research are being taken forward in the RSPCA's new Higher Duck Welfare Programme, in which both industry and Defra participate.

Project Code:	**AW0234**
Project title:	Detection, causation and potential alleviation of bone damage in laying hens housed in non-cage systems.
Start date (dd/mm/yy):	01/09/04
End date (dd/mm/yy):	31/08/08
Total cost:	£428,542

Project leader:	Lindsay Wilkins
Affiliation:	University of Bristol
Sub-contractor(s):	N/A

Abstract of research

The main aims of the project were to:
(1) provide an accurate assessment of the current levels of old breaks in end-of lay hens housed in a variety of system designs and identify the important risk factors.
(2) determine when damage occurs during the normal laying cycle and identify critical time and control points.
(3) investigate the use of a new non-invasive method of monitoring bone breakage, metabolism and repair without the requirement for euthanasia, dissection or handling of live birds.
4) evaluate intervention aimed at alleviating this welfare problem.
The results demonstrated that both the prevalence and severity of keel damage increased as the complexity of the environment increased. Of particular note was the increased damage (average of over 80% of birds affected) in flocks housed in systems equipped with multi level perches.
To determine when skeletal damage begins to accumulate flocks housed in barn and free range systems, including those equipped with aerial perches, were assessed throughout the production period. In all three systems the onset of skeletal damage occurred at about 30 weeks of age and in the case of flocks housed with aerial perches, levels of damage were already high (30%). Thereafter there was a continuing accumulation of keel fractures.
An additional technique was tested that would permit the detection of levels of damage in individuals with no handling or capture of individual birds. This measured the presence and levels of the collagen cross-link, lysyl-pyridinoline (L-pyr) which is found only in mineralising tissue, principally bone, and its presence in serum and urine of humans is a reliable indicator of bone turnover, repair and resorption. However, in this study, age related changes confounded the interpretation and at present it is not considered a viable assessment method.
Flocks fed a standard ration or one enriched with n-3 PUFA were examined throughout the laying period and a substantial reduction in the numbers of birds fed the n-3 supplemented diet with broken keels was observed in comparison to free range flocks fed a standard ration. This reduction (up to 60% at 50 weeks assessed by dissection) was significant throughout production.

Review comments

The overall score was high, however the reviewers were disappointed by the lack of publications or other dissemination of results. The research carried out is very relevant and appropriate, and leads to clear conclusions within the framework of the questions raised by Defra. The scientific approach and the methods used are sound and the experiments were very well executed.

Project code:	**AW1132**
Project title:	A comparative study to assess the welfare of laying hens in current housing systems.
Start date (dd/mm/yy):	01/09/04
End date (dd/mm/yy):	01/09/07
Total cost:	£262,126
Project leader:	Professor Christine Nicol
Affiliation:	University of Bristol
Sub-contractor(s):	N/A

Abstract of research

The conditions under which laying hens are housed remain a major animal welfare issue for consumers, the egg production industry and legislators. This study examined the costs and benefits of each housing system using measures which are directly comparable between husbandry systems. The aims of the study were to: (1) Assess, in a cost-effective manner, the welfare of hens in a representative range of current UK housing systems. (2) Assess the potential for practical, affordable improvement in areas where welfare is compromised. (3) Develop an open framework, with all assumptions clearly stated, within which the welfare costs and benefits of different systems can be clearly identified.

Comparing twenty six flocks representing conventional cages, furnished cages, barn and free-range systems, the study examined welfare indicators in the different housing systems, body conformation and skeletal injuries post-mortem, temperature and relative humidity in each housing system, and system-independent risk factors including age at placement, hours of light, number of daily inspections and captures, perch width and climatic variables.

Taking all evidence about the physical condition and physiological state of hens into account, we concluded that the welfare of laying hens is currently best in furnished cage systems. We note that behaviour remains somewhat constrained in this system, and that furnished cage systems are relatively new and may be managed at a higher than average standard. However, the very high variation obtained between flocks shows that there is considerable scope for improvement in hen welfare in barn and free-range systems. This improvement needs to be implemented and audited.

A framework setting out the welfare costs and benefits of each housing system has been devised, setting potential current benchmark levels based on current and previous data, highlighting systems that meet these benchmarks, highlighting significant differences between systems, and indicating the extreme variability found between flocks and systems for many welfare indicators.

Review comments

Reviewers considered this to be an excellent project in terms of scientific quality. The project was also highly relevant to Defra and will be very useful in the formulation of policy. The conclusion that a form of intensive housing provides, on balance, the best welfare for laying hens is controversial and probably runs counter to public perception, however, it is consistent with the findings of other studies.

Project code:	**AW1134**
Project title:	The influence of rearing enviironment on propensity for injurious pecking in laying hens
Start date (dd/mm/yy):	01/10/05
End date (dd/mm/yy):	30/09/08
Total cost:	£395,349
Project leader:	Professor Marian Dawkins
Affiliation:	University of Oxford
Sub-contractor(s):	University of Bristol

Abstract of research

The aims of the project were to investigate the role of factors in the early environment of laying hens in the subsequent development of injurious pecking and to predict which flocks were most at risk. In a longitudinal study, over 335,500 birds from 22 free-range laying farms (composed of over 90 colonies) were followed from rearing to lay in an attempt to identify factors in rear that might predispose flocks to develop feather-pecking later on. A wide range of factors (management, environment and the bird themselves) was studied, with a particular emphasis on management practices that could feasibly be changed. Both beak-trimmed and non-beak trimmed flocks were studied. The results showed that colonies that were on the same farm for both rear and lay experience feather damage at a much later stage than those colonies that were on farms that experience the change from rear to lay (log-rank test: p=0.007).

An experimental study was carried out on commercial farms to test the hypothesis that the light environment experienced in rear is a contributory factor to feather-pecking in lay. This was done by experimentally altering the light during rear with UV lights that had a spectral composition close to that of natural daylight. There was no difference in feather pecking or feather damage between birds reared in the two light environments.

In addition, a pilot study was carried out to test the feasibility of using automated video analysis to monitor laying flocks. The results showed that even with inexpensive video equipment and apparently poor quality images, automated analysis was possible. Using data from this source, we now have preliminary evidence that disturbances to optical flow are predictive

Three workshops were held to disseminate the results of this project.

Review comments

This project received a good overall score and was considered to have met its requirements. It addressed a critical area of welfare research for poultry and took an innovative approach to some of the questions posed. This excellent research may be a major step forward to an early warning system for the outbreak of feather pecking.

Project code:	**AW0235**
Project title:	A study to compare the health and welfare of laying hens in different types of enriched cage
Start date (dd/mm/yy):	01/09/05
End date (dd/mm/yy):	31/10/08
Total cost:	£354,288
Project leader:	Dr Victoria Sandilands
Affiliation:	SAC
Sub-contractor(s):	Dr Sarah Brocklehurst (BioSS)

Abstract of research

This study set out to assess the behaviour, health and welfare of brown (Br) and white (W) hens housed in enriched cages that differed in design and colony size. Two flocks of hens were housed at point of lay for one year each in 72 cages (comprised of 2 cage types x 3 colony sizes x 2 bird strains). Cages were purchased from two cage manufactures (referred to as type A and type B). The cage designs differed in cage layout and amount of scratch mat and nest box space, and colony sizes tested were 20-, 40- and 80-bird colonies. Data collected included: body weights, feed intake, egg production, egg quality, behaviour, white blood cell counts, blood titres, tonic immobility, condition of the feathers, combs, claws and feet, bone strength and keel bone damage, and mortality. Data were analysed using Linear Mixed Models and Generalised Linear Mixed Models.

There was no single cage type, colony size or strain that was superior to the others in the factors assessed here. Behaviour was influenced by cage design, strain and colony size.

Overall, W birds were more fearful, had overgrown claws, and used the nest boxes less than Br birds, but W birds used enriched cage furniture more, had better feather cover, and died less from aggression and bullying than Br birds. These results are perhaps counterintuitive, as it may be expected that the more fearful bird would perform less well in this type of system.

The study indicated that bird strain is of critical importance in the use of such systems, and that contrary to what was expected, the more reactive/fearful strain (white birds) performed better overall (in measurements taken here) than the more docile brown strain. Under these challenging conditions (i.e. lack of frequent presentation of fresh feed as a pecking stimulus), smaller colony sizes were preferable.

Review comments

The quality of science and policy relevance scores for this project were good. The experiment was considered to be useful, but there was a lack of refereed publications. As with all systems-based animal studies there is an inherent issue of potentially confounding factors because the system itself is a treatment factor. This also results in physical limitations on the randomisation of study design. However, the information generated informed Defra's policy on a number of issues including

the size of enriched colony cages and strains of birds that are suited to enriched systems.

Project code:	**AW0236**
Project title:	Estimating non-market benefits of reduced stocking density and other welfare increasing measures for meat chickens in England
Start date (dd/mm/yy):	01/04/05
End date (dd/mm/yy):	01/10/05
Total cost:	£72,205
Project leader:	Dr Dominic Moran
Affiliation:	Scottish Agricultural College
Sub-contractor(s):	Biomathematics and Statistics Scotland, Feedback Market Research Ltd

Abstract of research

The main objective of this project is to consider the economic evidence base for a change in a specific livestock management process that affects animal welfare. It does this in relation to a proposed EU reform of chicken stocking density.
As part of a regulatory impact analysis, this project applies stated preference methods to measure the economic value of the EU stocking proposal. After considering the scientific evidence-base for the change, we apply established hypothetical methods (contingent valuation and choice experiments) to measure stated preferences for the change amongst a sample of respondents in England.
The contingent valuation study estimated willingness to pay additional annual taxation for the provision of the proposed Directive in this form. The average willingness to pay was estimated as £7.53 per household per year (95% confidence interval 5.33 – 9.94), which gives an aggregate value for England of £158 million.
The choice experiment explored the preference weights assigned to welfare policy. The method framed the valuation exercise in terms of increased prices for different combinations of welfare attributes. These implicit prices are high relative to current prices of approximately £2/kg for conventional broiler chicken. In view of these issues regarding aggregation of the choice experiment results, we recommend that the contingent valuation estimates be considered as the more reliable indicators of the aggregate benefits of the proposed Directive. The choice experiment is more useful in allowing comparisons of the relative benefits of the different policy attributes.

Review comments

This project was considered to have met its requirements. It is an important area for research since it both answers questions on public perception of poultry welfare and enables Defra to gain an assessment of the likely impact of key welfare policies such as the Broiler Directive. The results of this research informed the benefits section of the Impact Assessment for negotiation and implementation of the EU Broiler Welfare Directive 2007/43.

Project code:	**AW1133**
Project title:	Welfare implications of changes in production systems for laying hens - LayWel.
Start date (dd/mm/yy):	01/01/04
End date (dd/mm/yy):	31/12/05
Total cost:	£35,679
Project leader:	Dr Heleen Van De Weerd
Affiliation:	ADAS UK Ltd. Gleadthorpe Meden Vale, Mansfield Nottingham NG20 9PF
Sub-contractor(s):	N/A

Abstract of research

The objective of the LayWel project was to produce a report on the welfare of laying hens in various housing systems with particular emphasis on enriched cages, and to provide extensive information about these systems and the welfare of laying hens housed in them. The LayWel project had nine scientific partners from seven EU member states. Each partner was responsible for a workpackage (WP) covering a different topic, ADAS was responsible for WP6, productivity and egg quality.

The objectives for WP6 were to collate egg production, egg weight, egg output, bird body weight, egg quality, second quality eggs and feed intake. This was collected from laying hens of a number of breeds and at a range of stocking densities, over full laying cycles and up to commercial flock scale housed in conventional laying cages, furnished and enriched laying cages and non-cage systems such as barn and free range systems. Other objectives were to establish the connection between the production data gathered and the welfare indicators identified in WP1 and to assess whether productivity and egg quality data are relevant to any proposed revisions of Council Directive 1999/74/EC.

The production parameters showed that production is less efficient in non-cage systems (e.g. higher feed conversion ratios). However, the results indicated that the performance of birds in the different types of furnished cages is not worse than that of those in conventional cages. The egg quality parameters such as cracked and dirty eggs showed that egg quality in furnished cages is dependent on cage design, but does not need to be a problem with the right cage design.

The conclusions of WP6 are that the main production parameters (feed and water parameters and egg production parameters) are not suitable as important indicators of welfare, but they should be monitored continuously and used as an indicator that welfare may be or become impaired. Nest box use can be used as an indicator of welfare as laying hens place a very high value on laying eggs in a secluded area.

Review comments

The overall score for this project was good. The study was part of the LayWel programme that yielded useful information. Data were not analysed statistically, which could jeopardize the reliability of the conclusions. However, statistical analysis

was not a part of this project specification, the aim being to simply collect and present data.

Project code:	**LK0660**
Project title:	Effects of nutrition and UV lighting on broiler bone and leg abnormalities (broiler bones)
Start date (dd/mm/yy):	01/04/04
End date (dd/mm/yy):	31/08/07
Total cost:	£986,439 (Defra contribution £216,984)
Project leader:	Colin Whitehead
Affiliation:	Roslin Institute
Sub-contractor(s):	N/A

Abstract of research

Small-scale studies showed that replacing maize oil with 1 to 2 % salmon oil in the diet could improve bone characteristics of broilers at 2 weeks of age. The effect was attributable to the n-3 fatty acid content of salmon oil. Adding 0.75% salmon oil to the diet of broiler breeder hens did not improve reproductive performance of the hens or bone and leg quality of progeny. Increasing dietary vitamin D concentrations above 5000 IU/kg did not improve bone quality but addition of 25-hydroxyvitamin D to the diet increased plasma concentrations of this metabolite. Varying vitamin D within normal dietary levels in breeder diets did not improve bone quality of chicks at 14 days of age but feeding 25-D gave enhanced vitamin D status at hatch. Small scale studies showed that irradiating chicks at day old could give a prolonged boost to vitamin D status and protect the chicks against tibial dyschondroplasia (TD) when fed a TD-inducing diet of imbalanced calcium-to-phosphorus ratio. Growth and behaviour of chicks were unaffected and there was no evidence of injurious effects on the birds' eyes. The method was tested in a commercial broiler house but did not result in any improvement in leg quality in the birds, probably because the Ross broilers in the flock studied did not suffer from any leg problems that would have been responsive to enhance vitamin D status.

Review comments

The quality of science score was good, however the reviewers were disappointed with the lack of publications. The authors appear somewhat hesitant about the likely uptake of their scientific recommendations, and the knowledge transfer element of the project seemed rather modest in the context of the total Defra funding. As a result the reviewers considered the project to be poor value for money. However, refinement or further development of irradiation techniques appears to offer promise for reducing predisposition of birds to skeletal abnormality, particularly in susceptible breeds.

On-Farm Pigs, On-Farm Fish, Companion Animals and Other

Tuesday 9th March 2010

On-Farm Pigs, On-Farm Fish, Companion Animals and Other Agenda

Tuesday 9th March 2010

The Royal College of Physicians, St Andrew's Place, London

09.00 – 09.30	Registration and coffee

09.30 – 09.40 Welcome and Introductions
Dr. Elizabeth Kelly, Defra (Chair)

Oral Presentations: Session 1

09:40 – 10:00 **AW0132:** Qualitative assessment of behaviour as a method for the integration of welfare measurements
Dr. Francoise Wemelsfelder, SAC Commercial Ltd.

10:00 – 10:20 **AW0133**: An epidemiological study of risk factors associated with preweaning mortality on commercial pig farms
Prof. Laura Green, University of Warwick

10:20 – 10:50 **AW0134**: Identifying the genetic causes of sow aggression towards their offspring.
AW0141: A comprehensive search to identify allelic variants & haplotypes associated with increased risk of the maternal aggression phenotype in sows
Drs. Claire Quilter & Carole Sargent, University of Cambridge

10:50 – 11:10 **AW0143:** Re-designing the farrowing environment from first principles to optimise animal welfare and economic performance.
Prof. Sandra Edwards, University of Newcastle

11:10 – 11:30	Coffee break

Poster Presentations – Session 1

11:30 – 12:20 **AW0130:** Welfare of finishing pigs under different management systems.
Prof. Sandra Edwards, University of Newcastle

AW0135: An investigation to assess the impact of flooring types on the welfare and health of pigs
Prof. Laura Green, University of Warwick

AW0137: A Review on Environmental Enrichment for Pigs
Dr. Heleen van de Weerd, ADAS UK Ltd.

LS3103: Genetic selection for improved pre-weaning survival of piglets

Prof. Sandra Edwards, University of Newcastle

12:20 – 13:00 Lunch

Oral Presentations – Session 2

13:00 – 13:20 **AW1204:** Rainbow trout fin erosion - epidemiological analysis of prevalence, development, risk factors and effects on welfare
Dr. Tim Ellis, CEFAS

13:20 – 13:40 **AW1205:** The interaction between water quality and welfare in farmed rainbow trout
Dr. James Turnbull, University of Stirling

13:40 – 14:00 **AW1402:** Studies to assess the effect of pet training aids, specifically remote static pulse systems, on the welfare of domestic dogs
Dr. Jonathan Cooper, University of Lincoln

14:00 – 14:20 **AW1404:** A study to assess how to promote a duty of care to animals in young people
Prof. Alistair Lawrence, SAC Commercial Ltd.

Poster Presentations – Session 2

14:20 – 15:20 **AW1206:** Welfare & health in sustainable aquaculture
Dr. Tim Ellis, CEFAS

AW1208: Development of practical on-farm cod welfare indices
Professor. Anne Smith, Aquatonics Ltd.

AW0509: Early environment effects on animal welfare, health and productivity
Dr. Kenny Rutherford, SAC Commercial Ltd.

AW0510: Study to assess whether membership of a Farm Assurance Scheme affects compliance with animal welfare legislation and code
Dr. Amy Kilbride, University of Warwick

AW1405: Meta analytical study to investigate the risk factors for aggressive dog-human interactions
Dr. Rob Christley, University of Liverpool

15.20 – 15.45 Coffee break

15:45 – 18:00 Closed session for review panel
Mr. Richard Drummond, Defra (Chair)

On-Farm Pigs Abstracts and Review Comments

Project code:	**AW0132**
Project title:	Qualitative assessment of behaviour as a method for the integration of welfare measurements.
Start date (dd/mm/yy):	01/10/01
End date (dd/mm/yy):	30/04/05
Total cost:	£168,034
Project leader:	Dr. Francoise Wemelsfelder
Affiliation:	Scottish Agricultural College
Sub-contractor(s):	N/A

Abstract of research

The overall objective of this project was to develop the potential of Qualitative Behaviour Assessment (QBA) – and FCP/GPA methodology - for integrating different types of biological data relevant to animal welfare. Using a Free-Choice-Profiling (FCP) methodology specifically suited to facilitate qualitative behaviour assessments (QBA), assessors develop their own descriptors of animal body language, based on direct, close-up observation of animal behaviour. In the second instance observers use these personal descriptors to quantitatively score the animals' demeanour. The objective of the present project was to investigate the potential of this novel method to assist in the integration and interpretation of different types of biological data relevant to animal welfare, both in experimental and in on-farm settings. We developed a number of research collaborations to widen the scope of this objective.

In sum, the results support our main guiding hypothesis that qualitative 'whole-animal' descriptors ascribe meaning to quantitative behaviour measures through a process of integrative observation. Our results indicate that human observers, if properly instructed in qualitative behaviour observation, are fully capable of attributing meaning to animal response patterns in a scientifically robust way.

Review comments

The overall score for this project was good. It was noted that the aims of the research were to objectify the subjective and that although stockpersons already judge an animal's welfare from its behaviour, they would be unable to describe this systematically. The research has demonstrated in a scientifically measurable way that non-specialists can identify good welfare and it has drawn attention to the benefits of monitoring stock from a whole animal perspective. Useful results were derived where precise measurements of behaviour and physiology were taken and the techniques developed are now being used widely, including by industry.

Project code:	**AW0133**
Project title:	An epidemiological study of risk factors associated with pre-weaning mortality on commercial pig farms.

Start date (dd/mm/yy):	01/08/02
End date (dd/mm/yy):	30/06/05
Total cost:	£223,415
Project leader:	Prof M. Mendl
Affiliation:	University of Bristol
Sub-contractor(s):	Joint contractor: Prof L. Green, University of Warwick

Abstract of research

The aim of this research was to identify important risk factors, especially those related to housing and husbandry procedures, which are associated with high levels of pre-weaning piglet mortality in farrowing systems (including farrowing crates; indoor loose-housing systems; outdoor systems) on working commercial farms. An observational epidemiological approach was used because this allows assessment of multiple risk factors under real-life commercial conditions.

The project yielded a large on-farm study of risk factors for piglet pre-weaning mortality (including in commercial indoor-loose housed systems) which is a significant addition to the data available in this area. It did not pick up significant differences in pre-weaning mortality levels across the three farrowing systems studied, suggesting that systems that did not closely confine the sow could be managed without a significant increase in liveborn pre-weaning mortality on the farms sampled. It succeeded in demonstrating that key management and housing variables can affect the risk of pre-weaning mortality on pig farms, and also showed that the important variables may differ according to the farrowing system that the farmer operates. Farrowing management and stockperson characteristics and behaviour emerged as a major cluster of variables that appeared to influence pre-weaning mortality on working commercial farms, leading to a number of general and specific recommendations as summarised in the executive summary. The promotion of positive stockperson-pig relations appeared likely to decrease pre-weaning mortality according to the findings of this study. The findings were disseminated in a report to all farmers involved.

Review comments

Overall the reviewers considered this project to be good, with sound methodology and evidence-based conclusions. It was noted that the work confirmed the findings of previous studies in this area, but had been slow to transfer the knowledge to industry or produce peer-reviewed publications. The researchers should look at the level of training in stockmen as this was measured but not analysed.

Project code:	**AW0134**
Project title:	Identifying the Genetic Causes of Sow Aggression Towards Their Offspring
Start date (dd/mm/yy):	01/05/02
End date (dd/mm/yy):	31/03/07

Total cost:	£506,520
Project leader:	Prof Nabeel Affara
Affiliation:	University of Cambridge, Department of Pathology
Sub-contractor(s):	Dr. Coliin Gilbert, Babraham Institute

Abstract of research

There were two main objectives:

1. Identification of Transcriptional Differences in the Hypothalamus

This scientific objective delivered:

(a) a subtracted and a normalised hypothalamus cDNA library.

(b) the production of DNA chips with clones from these libraries.

(c) a transcription profile of the hypothalamus mRNA population in aggressive and non-aggressive sows

2. Identification of Genetic Loci Influencing Aggressive Phenotype

available to this proposal on a collaborative basis from PIC. This scientific objective would deliver:

(a) a delineation of the region(s) of the pig genome contributing to the aggressive phenotype.

(b) new DNA markers that may be used in predictive testing.

Both these approaches identified candidate genes (a) and regions of the genome (b) for further investigation

The resulting data obtained from our expression array study and affected sib pair analysis provided a good preliminary evidence base for identifying animals likely to commit infanticide by identifying key causative genes and regions of the pig genome associated with the aggressive behavioural phenotype

Review comments

This project was considered to be of a high scientific standard, establishing the heritability of maternal savaging in pigs and showing its similarity to human psychosis. The reviewers did not consider the project to be value for money for Defra since the outputs were thought to be of more relevance to human medicine. It was noted that the research group obtained valuable data by liaising with Chinese researchers and that this did represent good value for money. The panel were disappointed by the level of dissemination of the findings. This was an important first phase of a study that continued in Defra project AW0141, which gave more practical approaches to reducing savaging by sows.

Project code:	**AW0141**
Project title:	A comprehensive search to identify allelic variants & halplotypes associated with increased risk of the maternal aggression phenotype in sows
Start date (dd/mm/yy):	01/10/07
End date (dd/mm/yy):	30/09/10
Total cost:	£382,236

Project leader:	Prof Nabeel Affara
Affiliation:	University of Cambridge, Department of Pathology
Sub-contractor(s):	Dr. Emily Clemete, Cambridge Genomic Services and Dr. Sarah Blott, Animal Health Trust

Abstract of research

Our aim is to identify quantitative trait loci (QTL) associated with maternal infanticide, defined by sows attacking and killing their own newborn offspring, within 24 hours of birth. In a previous study (AW0134), an affected sib pair whole genome linkage analysis identified 4 QTL mapping on Sus scrofa chromosomes 2 (SSC2), 10 (SSC10) and two on X (SSCX). Several potential candidate genes lie in these regions in addition to relevant abnormal behavioural QTL, found in humans and rodents. In this study, 1225 porcine SNPs were identified, which either mapped to chromosomes 2, 10, and X or lay within or close to candidate genes from the former expression arrary analysis. Last year a consortium, of which we were a part, developed a 60K commercial SNP chip for the pig (http://www.illumina.com/pages.ilmn?ID=320). Our SNPs were submitted for consideration to be on the chip. For the SNPs that were rejected there will be a likely alternative close by on the chip and there should also be SNPs within or close by to any identified candidate genes. Genotyping from limited populations of carefully phenotyped aggressive and non-aggressive sows (representing the extremes of the phenotypic spectrum) from the Genus nucleus herd for 4 lines was carried out by hybridising approximately 1000 DNA samples to the chip. This has confirmed the previous QTL and also identified additional important potential loci on other chromosomes. Our objective is to determine how many commercial breeds share these QTL and the relative risk associated with each.

Review comments

As with the previous project (AW0134), this follow-on project was of a high scientific standard, but reviewers were again disappointed by the level of dissemination. The relevance to Defra, and therefore value for money to the Department was also questioned, since maternal aggression is now at a low level in UK pigs, perhaps due to its high heritability and the ability of breeding companies to select against it. The view was expressed that this work would have been more suited to Research Council funding.

Project code:	**AW0143**
Project title:	Re-designing the farrowing environment from first principles to optimise animal welfare and economic performance.
Start date (dd/mm/yy):	01/04/08
End date (dd/mm/yy):	31/03/11
Total cost:	£693,286
Project leader:	Prof Sandra Edwards
Affiliation:	Newcastle University

Sub-contractor(s): SAC

Abstract of research

This project seeks to develop and test an alternative to the farrowing crate that can reconcile the behavioural needs of the sow with good piglet survival and farm practicality, including acceptable capital and running cost and ease of daily management. Following extensive review of the scientific and technical literature, economic modelling and consultation with all stakeholder groups, prototype pens for an alternative system have been designed and constructed on two sites. A structured comparison of key pen design features needing further clarification, including space allowance, nest enclosure and floor temperature and level of nesting substate provision, is in progress with detailed measurements being made of behaviour, welfare and performance of the sow and litter. Early results suggest performance to be comparable to commercial benchmarks in farrowing crate systems, and a controlled commercial comparison will take place after optimisation of prototype design. Data from this comparison will be used to carry out a complete impact assessment of the economic, environmental and trade consequences of implementation of the new system in a national and international context.

Review comments

This project scored highly on both scientific quality and policy relevance, and is delivering the work to a high standard. The reviewers did note, however, that the team did not appear to have taken previous work in this area in the UK and overseas fully into consideration. The research is still not complete so it is not possible to judge the ultimate value of the research, but it was noted that the research has already had a major impact and that industry have taken a keen interest.

Project code:	**AW0130**
Project title:	Welfare of finishing pigs under different management systems
Start date (dd/mm/yy):	01/10/01
End date (dd/mm/yy):	30/06/05
Total cost:	£205,134
Project leader:	Prof Sandra Edwards
Affiliation:	Newcastle University
Sub-contractor(s):	MLC University of Glasgow

Abstract of research

The aim of the project was to carry out a multidisciplinary welfare assessment of different housing and feeding systems for finishing pigs. The specific objectives were:

1. To quantify pig health and welfare when fed either dry or liquid diets, and the interaction with housing system
2. To quantify pig health and welfare in slatted or straw based systems

3. To provide objective data on the feeding space requirements for pigs given liquid or dry feed
4. To provide objective data on the role of environmental enrichment in pig welfare, performance and meat quality in relation to housing and feeding system
5. To synthesise recommendations for commercially applicable finishing pig systems which optimise pig health and welfare
The results of the work did not show that any housing or feeding system produced a clear health and welfare advantage across all parameters measured. Instead, it highlighted the different areas of risk to welfare in each system and, consequently, the aspects of design or management which should receive most attention within that system. This information has been disseminated to policy makers, pig producers and their allied industries and the scientific community in presentations to industry and scientific meetings, and in technical reports and scientific papers

Review comments

This project was the forerunner to AW0143 and scored highly on the scientific approaches used and conclusions based on sound evidence. Its relevance to Defra was clear and dissemination of the findings has been good. It was noted that the results were clearly set out, but that a cautious approach was taken in presenting conclusions. For example, where behavioural differences were noted between housing systems, this could have been expanded in relation to practical implementation, and discussed in the context of a wider welfare debate.

Project Code:	**AW0135**
Project Title:	Impact of flooring on the health and welfare of pigs
Start date (dd/mm/yy):	01/07/03
End date (dd/mm/yy):	30/06/06
Total cost:	£492,218
Project leader:	Laura Green
Affiliation:	University of Warwick
Sub-contractor(s):	Pete Ossent, Institute for Veterinary Pathology, University of Zürich, Winterthurerstrasse 268, CH-8057 Zürich, Switzerland

Abstract of research

The aim of the project was to investigate the impact of all commonly used floor types on the health and welfare of pigs of all ages on commercial farms in Britain. To achieve this aim the following objectives were addressed
1. Enrolment of indoor farms and outdoor units recruited from Assured British Pig members
2. Preparation for farm visits by developing scoring systems and data collections tools
3. Visits to a cross sectional sample of farms in England, Wales and Scotland
4. Data entry, management and checking
5. Data analysis to calculate prevalence estimates and investigate risk factors
6. Investigate the pathology of foot and limb lesions

7. Preparation and submission of papers for peer review and conferences
Floor materials, presence of voids and bedding and floor quality do impact on the health and welfare of pigs of all ages. The impact varied by the outcome of interest and was not significant for all outcomes.
This is the first study to examine outdoor farmed pigs. Overall, outdoor systems with soil and deep bedding were associated with lower prevalence of foot and limb lesions in all ages. However, there was no one indoor floor surface that was 'best' for pig foot and limb injuries and even in the same environment the age of pig led to differing disease effects e.g. in pre-weaning piglets vs. lactating sows.

Review comments
The project received a good score and the work was considered justified. It addressed pertinent issues, and was well conducted and reported. However, since it confirmed what was already known, its value was questioned. The project was expensive but has delivered useful results, showing that lameness is prevalent in pigs. Of particular value was the data obtained on injury and posture/gait in relation to flooring. The research group has been active in dissemination of their results.

Project code:	**AW0137**
Project title:	A review of environmental enrichment for pigs
Start date (dd/mm/yy):	01/08/04
End date (dd/mm/yy):	28/02/05
Total cost:	£19,347
Project leader:	Dr Heleen Van De Weerd
Affiliation:	ADAS UK Ltd
Sub-contractor(s):	N/A

Abstract of research
The aim of this review is to provide an overview of the existing literature on enrichment for weaner, grower and finisher pigs in intensive production systems. Intensive production systems are often characterised by barren environments with (slatted) floors and no substrate in which the animals can root. These environments do not allow pigs to perform behaviours such as exploration and foraging which are important for pigs and abnormal social behaviours, such as ear and tail biting, can occur at high frequencies. Providing pigs with challenging environments, incorporating enrichment with which they can interact, should give rise to a wide range of pig-specific behaviour and this can be seen as an integral part of well-being. The review includes 114 papers on enrichment for pigs, including studies on enriched, alternative systems, systems enriched with a straw bed and enrichment with objects only (so-called 'point source enrichment'). Four main topics are covered: behaviour, health and physiology, performance and carcass quality and eat quality. The review revealed that hide areas can be very effective in reducing aggressive interactions after mixing of weaner pigs with beneficial effects on behaviour, health and performance. It might be beneficial to make producers aware of these effects.

There appears to be a need to inform producers that sows and their piglets (after birth and after weaning) also need some form of enrichment as required by law.

Review comments
The quality of science and the policy relevance scores were good. This review was necessary and was well conducted, however, it would have benefited from the more systematic approach which is now being increasingly used. Reviewers also commented that the conclusions and recommendations could have been clearer.

Project code:	**LS3103**
Project title:	Genetic selection for improved pre-weaning survival of piglets
Start date (dd/mm/yy):	01/10/03
End date (dd/mm/yy):	30/09/07
Total cost:	£276,212
Project leader:	Prof Sandra Edwards
Affiliation:	Newcastle University
Sub-contractor(s):	SAC

Abstract of research
The aim of the project was to measure the extent to which genetic selection of pigs for traits of improved piglet survival could reduce mortality in commercial non-crate (outdoor) farrowing systems. The specific objectives were to:
(1) Estimate the genetic parameters (direct and maternal) for different forms of piglet mortality, by analysis of existing database information, and identification of families with genetic variation in piglet survival.
(2) Determine the concordance of genetic parameters for piglet survival derived from two different populations of pigs, and the genetic and phenotypic correlates of piglet mortality with other important production traits.
(3) Determine whether families that express high genetic merit for piglet survival in crates also express improved survival in a commercial outdoor (non-crate) pig system, using a breeding based intervention study to assess the long term success of dams and sires varying in genetic merit for survival, and confirm the applicability of a breeding index for piglet survival traits in non-crate systems.
An aspect of piglet mortality of significant relevance to Defra welfare policy interests, is that the crushing of piglets by sows in non-crate systems is the major constraint to the phasing out of the farrowing crate. To date, attempts to achieve this by modifying design of the farrowing environment have not yielded successful outcomes which can be commercially applied. The complementary approach of selecting animals genetically less predisposed to mortality in unconfined systems has significant potential to facilitate this objective.

Review comments
The project received good scores across the board and was considered to be a very high quality piece of work. The project was considered to be a major contribution towards understanding the extent to which genetic selection of pigs' traits can

contribute to improving piglet welfare and reducing piglet mortality. The close collaboration with industry brought benefits and it is now for the pig breeding industry to take the findings forward.

Project code:	**AW0138**
Project title:	The effects of different weaning ages on the welfare of gilts and their piglets
Start date (dd/mm/yy):	01/06/04
End date (dd/mm/yy):	30/11/05
Total cost:	£98,800
Project leader:	Dr Kate Breuer
Affiliation:	ADAS UK Ltd
Sub-contractor(s):	University of Newcastle

Abstract of research

The aim of this study was to investigate the effect of increasing weaning age on the behaviour, welfare and performance of piglets and sows.
The study had three main objectives:
1. To investigate the effects of three different weaning ages on the behaviour and welfare of piglets.
2. To investigate the effects of three different weaning ages on the behaviour and welfare of gilts.
3. To interpret the results of the current study together with the production and health data records from the concurrent study (IS0212: the effects of different weaning ages on production efficiency and environmental impact in slurry based systems) in relation to piglet and gilt health.

Review comments

The project scored well for policy relevance, but overall was considered not to meet its requirements. There was concern that the data used were not robust and had been misinterpreted, and that the confounding effect of weaning age had not been dealt with. It was recognised that sound conference papers had been produced, but noted that no peer-reviewed journal papers had been submitted. There was caution expressed about how this work should be used by Defra and whether it should be used to determine policy.

On-Farm Fish Abstracts and Review Comments

Project Code:	**AW1204**
Project title:	Rainbow trout fin erosion - epidemiological analysis of prevalence, development, risk factors and effects on welfare
Start date (dd/mm/yy):	01/04/04
End date (dd/mm/yy):	31/10/08
Total cost:	£295,209
Project leader:	Birgit Oidtmann
Affiliation:	Cefas Weymouth, Barrack Road, Weymouth, Dorset, DT4 8UB
Sub-contractor(s):	Sub-contractor: Division of Food Animal Science, Dept of Clinical Veterinary Science, University of Bristol, Langford, Bristol, BS40 5DU Partner: Institute of Aquaculture, University of Stirling, Stirling, FK9 4LA

Abstract of research

This project used two field-sampling programmes to assess fin damage on UK rainbow trout farms to provide Defra and the UK trout farming industry with

• Comprehensive background information on fin damage in farmed fish
• Methodologies to assess fin damage
• Information on the severity and prevalence of fin damage within the industry
• Evidence from risk factor analyses to propose practical methods for managing the condition on fish farms.
• Evidence on whether fin damage is a benign condition, or does represent a significant insult to trout welfare

The project has provided a “baseline” level of fin damage within the UK industry to enable future comparisons. The project has raised awareness of fin damage within the industry, provided valuable experience to the participants, and strengthened the position of the UK as leaders in fish welfare. The work been disseminated in the trade press, at scientific conferences and in peer-reviewed papers

Review comments

This was considered to be an outstanding piece of work that covered an issue about which relatively little was known and which needed to be addressed. It was felt that the team should be congratulated for carrying out this excellent project and for maintaining good relations with industry. Further research should explore how fish perceive fin rot, using the outcome based behavioural methods developed.

Project code:	**AW1205**
Project title:	The interaction between water quality and welfare in farmed rainbow trout

Start date (dd/mm/yy):	01/04/04
End date (dd/mm/yy):	31/03/08
Total cost:	£295,209
Project leader:	Prof. James F Turnbull
Affiliation:	University of Stirling
Sub-contractor(s):	University of Bristol Center for Environment, Fisheries and Aquaculture Science, Weymouth

Abstract of research

The main aim of this project was to investigate the interaction between WQ (water quality) and trout welfare and provide the scientific information necessary to incorporate WQ into a system for monitoring and auditing fish welfare on trout farms.

1 A literature review of information relating to water quality and welfare.

A detailed review of this complex and contradictory body of literature will be conducted and related to current trout farming practice in the UK.

2 Description of current status of water quality monitoring and control on farms.

3 Focus groups to discuss potential indicators of welfare.

A series of focus groups will be held to explore the criteria that are used to evaluate welfare by stakeholders in trout farming.

4 A tank based study to examine the effects of deteriorating water quality on various indicators of welfare.

Replicated cascades (series of experimental tanks), will provide robust data on the effect of deteriorating water quality, on specific welfare indicators independent of other influences on welfare.

5 Farm based epidemiological studies of relationship between water quality and indicators of welfare

Review comments

This project scored highly across the board. The research established the importance of water quality as the major factor in the welfare of farmed fish by utilising a wide range of parameters and using both experimental and field studies. It was considered to be valuable as it was able to quantify the issue and had a good degree of practical application. The results have given Government robust evidence on which to base legislation. This project was also used to provide a basis of evidence showing that water quality *per se* is the major factor in fish welfare and this was incorporated into the Council of Europe recommendation on the protection of farmed fish (2006).

Project code:	**AW1206**
Project title:	Fish welfare and health in sustainable aquaculture
Start date (dd/mm/yy):	01/10/05
End date (dd/mm/yy):	30/09/08
Total cost:	£194,528

Project leader:	Formerly Alex P. Scott; Latterly Tim Ellis
Affiliation:	Cefas Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset, DT4 8UB
Sub-contractor(s):	N/A

Abstract of research

The scientific aims were to:

• Complete the validation of the measurement of cortisol and melatonin in seawater, thereby providing a non-invasive assay for seawater species

• Examine the potential of two candidate “normalisers” for cortisol (i.e. melatonin and creatinine) in controlled tank experiments with freshwater rainbow trout, with a view to enabling transfer of the method from the laboratory to the field.

• Sample disease challenge experiments at Cefas Weymouth to assess the potential for water cortisol to provide an early warning of disease outbreaks.

• Examine the possibility of developing a “dip-stick” test for cortisol which would enable simple, real-time assessment of cortisol as an indicator of stress and disease status.

This project has demonstrated the potential that measuring excreted metabolites holds as a non-invasive means of monitoring the physiological state, health and welfare of farmed fish, as well as illustrating potential methodological and interpretational pitfalls of the approach. We foresee that, with further research, development and novel thinking, the measurement of metabolites in the water will become more commonplace for assessing the health and welfare of farmed fish.

Review comments

This project was given good scores across the board and although it was noted that there have been publications, little knowledge transfer was undertaken. Overall the project collected a large amount of very high quality data that will be extremely valuable in taking forward the aim of developing non-invasive methods for measuring cortisol in farmed fish. It was noted that the methodology is valuable for measuring cortisol of fish in tanks, but that it may not be possible to apply this to cage systems due to the unknown water flow rates. The findings were used in developing the chapter on trout and salmon husbandry in the Council of Europe recommendation for protection of farmed fish.

Project code:	**AW1208**
Project title:	Development of practical on-farm cod welfare indices
Start date (dd/mm/yy):	01/03/06
End date (dd/mm/yy):	02/07/09 (not continuous)
Total cost:	£40,000 (Defra contribution; additional funding received from SARF, and 'in-kind' support from No Catch Ltd and Aquatonics Ltd)
Project leader:	Professor JA Smith (during novation from December 2008

Affiliation:	Aquatonics Ltd (NoCatch joint contractors)
Sub-contractor(s):	Alan Bourhill; Justin Watson; Dr Dave Hodgson (University of Exeter)

Abstract of research

The key objectives were to:

1. Undertake a pilot study of a current crowding and pre-harvest handling procedure to investigate an initial set of welfare indicators and establish the variability in key physiological, morphological and behavioural parameters, so that subsequent experiments take account of this.
2. Appraise the findings of the pilot studies, in a workshop, to determine the indicators for further investigation and revise sampling procedures as required.
3. To run trials during commercial harvests to further develop and investigate the most promising welfare indicators that had most value for the industry and recommend pre-harvest protocols to the industry.
4. Produce publications and a report of practical cod welfare indices to contribute to codes of best practice for on-growing cod and EU/Scottish/UK legislation.

Review comments

The project scored well. The findings are highly relevant to the difficulties of handling, crowding and killing fish such as cod, which are very different to salmonid fish. Although the industry was strong when the project was awarded, there is very little cod farming left in the UK now so other countries would receive most of the benefit from the research. The welfare indicators and hand held lactate measuring kit were likely to be relevant to other fish species and it was suggested that further research could look at using static cameras to measure respiration rate.

Companion Animal Abstracts and Review Comments

Project code:	**AW1402**
Project title:	Studies to assess the effect of pet training aids, specifically remote static pulse systems, on the welfare of domestic dogs
Start date (dd/mm/yy):	01/09/07
End date (dd/mm/yy):	28/02/10
Total cost:	£469,000
Project leader:	Jonathan Cooper
Affiliation:	University of Lincoln
Sub-contractor(s):	University of Bristol, Food and Environment Agency, Silsoe Livestock Systems, Axiom Laboratories

Abstract of research

Remote static electric collars (e-collars) allow dog owners and trainers to apply electric stimuli to dogs at a distance and may be a valuable tool in dog training. These devices have been banned in several countries and their status in UK is under review. This project has collected data on resistive properties of dogs in order to construct artificial dog models, that can then be used to assess the outputs of such devices when used in training. The project has also been collecting data on long term consequences of having been trained using e-collars. Following pilot studies to validate methods and sample sizes for field trials, 80 dogs with prior experience of training with e-collars will be compared with a matched control population without such training. The dogs' behavioural and physiological responses (eg corticosteroids) to being placed in training context will be compared. In addition dogs' psychological state will be assessed from metabolites of neuro-transmitters expressed in urine (seretonin, dopamine, nor-adrenalin) and tests of cognitive bias. Finally the project assess the immediate effects of use of e-collars on dogs in training. For this we use short term behavioural and physiological measures of emotional response and compare dogs trained with e-collars with dogs referred with similar behavioural problems, but trained without use of e-collars.

Review comments

This project was considered to meet Defra’s policy requirements and to have a sound approach. Due to the politically sensitive nature of the work the project leader provided little detail on some aspects of the work so far. Given that reviewers received a paucity of evidence on which to assess factors such as rate of progress and probability of success, the overall rating for this project was reduced. It was suggested that in the future Defra could consider presentation of sensitive projects to reviewers only, thereby enabling a full assessment. Reviewers commented on the complexity of the subject being studied and that it incorporates ambitious elements. This had been flagged in the original risk register and has led to delays, thereby pushing the project behind schedule. The work has contributed information about the

physical characteristics of training collars and has developed practical methods of behavioural and psychological measurement of emotional state of dogs.

Project code:	**AW 1404**
Project title:	**A study to assess how to promote a duty of care to animals in young people**
Start date (dd/mm/yy):	01/10/08
End date (dd/mm/yy):	30/09/11
Total cost:	£309,206
Project leader:	Professor Alistair Lawrence
Affiliation:	SAC
Sub-contractor(s):	Dr Janine Muldoon, Dr Jo Williams, Professor Candace Currie, University of Edinburgh

Abstract of research

Within the Animal Welfare Act (2006), the concept of a 'duty of care' towards animals has been extended to all vertebrates managed, used and cared for by humans. The importance of promoting positive animal welfare and not just the prevention of cruelty is also emphasised. As a greater proportion of people in the UK are now affected by this legislation as owners of companion animals, it is important to consider how the DOC concept can be effectively promoted to the general population.

Previous research suggests that experiences we have early in life can have long-lasting effects on our attitudes and behaviour towards animals; therefore children are important targets. At present, there is insufficient research to help guide promotion of a DOC towards animals amongst children and young people (defined here as <18 years of age) either within UK education policy or contemporary society. In particular, relatively little research has accessed children's perspectives on animal welfare which is an important omission.

This project addresses these gaps in the knowledge base by: (a) integrating evidence from a number of scientific areas including human-animal studies, developmental psychology and sociology, and (b) applying social science techniques to reveal children's perspectives on animal welfare and teachers' attitudes to potential interventions to promote a DOC in schools. These social science methods will be integrated with materials and approaches developed by stakeholder groups and within animal welfare science. Together, these project activities will help to identify the most effective interventions for use with children in a school setting.

Review comments

Reviewers agreed that the science was of a very high quality. One concern expressed by reviewers was that the researchers had focussed on primary school children whereas the original application was to look at those up to the age of 18. It was noted that the resource didn't allow this and it was agreed with Defra to focus on primary age children. Further work can focus on the adolescent age group. The work showed that different age groups needed different styles of communication and that attitudes varied towards different groups of animal depending on prior experience. The findings are feeding into Defra policy.

Project code:	**AW1405**
Project title:	Meta analytical study to investigate the risk factors for aggressive dog-human interactions
Start date (dd/mm/yy):	01/07/09
End date (dd/mm/yy):	30/11/10
Total cost:	£76,279
Project leader:	Robert Christley
Affiliation:	University of Liverpool
Sub-contractor(s):	N/A

Abstract of research

The specific aims of this project are:

1. A systematic review to identify relevant international literature relating to risk factors for aggressive dog-human interaction. This includes assessing the evidence for a number of potential risk factors likely to include: age of the victim; relationship of victim to dog; age of the owner; breed, age, gender and neutered status of dog; location of bite incident; interactions prior to attack; welfare status and the behavioural history of the dog; previous dog-directed dog aggression.
2. Investigation of risk factors for human-directed dog aggression using meta-analysis. Many published studies may fail to identify the effect of potentially important risk factors because of small sample sizes. Meta-analysis can combine numerous such studies into the equivalent of a single larger study and calculate the summary relative risk across studies. Meta-analysis is only possible where there are two or more appropriate studies with comparable research questions.

This work will form the basis of a comprehensive report which will address each research question describing direction of risk and the strength of the evidence. In addition it will:

- Identify knowledge gaps and highlight areas where evidence is weak or contradictory, thus indicating areas where further research is needed.
- Identify areas where there is strong evidence for risk factors upon which preventive measures can be developed.
- Identify additional sources of data and their potential usefulness relating to human-directed dog aggression which may be used in future research and surveillance.

The results from this study will be widely disseminated in the peer reviewed and scientific press, through a dedicated, searchable web site and through CPD events.

Review comments

The project was considered to meet Defra's policy requirements and scored highly for quality of science. The work itself was considered well thought out and showing a promising start, but it was too soon to be able to judge the final value.

Other Abstracts and Review Comments

Project code:	**AW0509**
Project title:	Early environment effects on animal welfare, health and productivity
Start date (dd/mm/yy):	01/10/09
End date (dd/mm/yy):	30/09/12
Total cost:	£465,005
Project leader:	Dr Kenny Rutherford
Affiliation:	SAC
Sub-contractor(s):	University of Stirling Biomathematics & Statistics Scotland (BioSS)

Abstract of research

A number of experimental studies in farm animals have clearly shown that early life experiences can have a substantial impact on outcomes of great relevance to later health, welfare and productivity. In particular, stress or under-nutrition experienced by the mother during pregnancy has been shown to have wide-ranging and important effects on how her offspring cope with their social, physical and infectious environment. Early life studies have been undertaken in pigs, sheep, cattle, poultry and fish and have shown that significant differences in health and welfare outcomes may occur due to maternal conditions as early as the peri-conception period. The aim of this project is to review all of the relevant scientific literature and combine this knowledge base with detailed data gathered from UK farms on exposure to possible early life risk factors. This information will be used to provide an overall risk assessment regarding the housing and management of gestating animals (and egg incubation conditions for fish and poultry) and suggest circumstances under which they may impair offspring health, welfare and productivity within UK commercial conditions.

Review comments

This project was considered to meet Defra's policy requirements and to be of a high scientific quality. However, reviewers agreed that it was too early in the project to comment further. While the science was interesting, this work might have been funded by BBSRC. The issue being investigated was relevant to practical concerns and the outputs from this research are likely to support existing policy.

Project code:	**AW0510**
Project title:	Does membership of a Farm Assurance Scheme affect compliance with Animal Welfare Legislation and Codes
Start date (dd/mm/yy):	17/04/09
End date (dd/mm/yy):	12/07/09
Total cost:	£55,547

Project leader: Laura Green

Affiliation: University of Warwick

Sub-contractor(s): N/A

Abstract of research

The aim of the project was to establish whether membership of Farm Assurance Schemes (FAS) was associated with greater or lesser compliance with animal welfare legislation or codes as identified by Animal Health (AH) inspectors. To achieve this aim the following objectives were addressed

1. Gain access to data from FAS
2. Match AH records with FAS records
3. Develop simple and multivariable models
4. Present final report and prepare peer reviewed publication

Multivariable multilevel binomial models were built comparing inspections where the enterprise was compliant with animal welfare legislation (AH code A or B) with inspections of non compliant enterprises (AH code C or D). Random effects were included to account for the repeated measures of inspection, enterprise, location (CHP numbers) and county. The models included the year of inspection, the reason for the visit, the number of animals inspected and the type of enterprise. Where sufficient data were available separate models were built for cattle, sheep, pigs and poultry in England, Wales and Scotland.

In all species and countries there was a pattern of reduced risk of code C/D in certified enterprises compared with enterprises not known to be certified. We conclude that certified enterprises could be placed in a category that is at a lower risk of selection for inspection by AH.

Review comments

This project was considered policy relevant and the quality of science scored well. Reviewers were also impressed by the quantity of data produced within such a short time frame. The brief study showed that, in general, members of Farm Assurance Schemes are more likely to receive a score reflecting compliance with legislation. However, the study was limited on the issue of causality i.e. whether membership of a FAS increases likelihood of receiving a score that reflects compliance, or whether farmers who are more likely to receive a score reflecting compliance are also more likely to become members of FASs.

Welfare at Slaughter

Wednesday 10th March 2010

Welfare at Slaughter Agenda

Wednesday 10th March 2010

The Royal College of Physicians, St Andrew's Place, London

09.00 – 09.30	Registration and coffee

09.30 – 09.40 Welcome and Introductions
Mr. David Pritchard, Defra (Chair)

Oral Presentations: Session 1

09:40 – 10:00 **MH0128:** Novel and humane gaseous killing methods for pigs
Dr. Mohan Raj, University of Bristol

10:00 – 10:20 **MH0140:** Studies to examine the use of CBGs as a killing method for horned and un-horned sheep over 6 months of age
Dr. Troy Gibson, Royal Veterinary College

10:20 – 10:50 **MH0143:** Development of a humane method to kill poultry using gas filled foam
MH0144: Further study to develop a humane method to kill poultry using gas filled foam
Dr. Julian Sparrey, Livetec

10:50 – 11:10	Coffee break

Poster Presentations – Session 1

11:10 – 12:00 **MH0134:** The development of a portable electrical stunner for turkeys
Dr. Steve Wotton, University of Bristol

MH0135: Containability & aversiveness of different gas mixtures used for the stunning of slaughter weight pigs
Dr. Antoni Dalmau, Centre de Tecnologia de la Carn, Spain

MH0136: Emergency killing of poultry on-farm using gas mixtures.
Dr. Mohan Raj, University of Bristol

12:00 – 12:45	Lunch

Oral Presentations – Session 2

12:45 – 13:05 **MH0138:** Reducing bird stress & discomfort on the poultry shackle line
Mr Jeff Lines, Silsoe Livestock Systems Ltd.

13:05 – 13:35 **MH0141:** Physiological monitoring of chickens during emergency killing (Phase I)
MH0142: Physiological monitoring of chickens during emergency killing (Phase II)
Dr. Victoria Sandilands, SAC Commercial Ltd.

Poster Presentations – Session 2

13:35 – 14:30 **LK0684:** Avoiding the welfare/quality compromise: head only electrical stunning of poultry
Dr. Jeff Lines, Silsoe Livestock Systems Ltd.

MH0133: A study to design a holding pen for group stunned animals
Dr. Brian Merrell, ADAS UK Ltd.

MH0131: Metal surfaces for sheep and cattle
Prof. Neville Gregory, Royal Veterinary College

MH0132: Literature review & survey of conditions relevant to farm animal welfare in lairage
Dr. Claire Weeks, University of Bristol

14.30 – 15.00 Coffee break

15:00 – 17:00 Closed session for review panel
Dr. Alex Morrow, Defra (Chair)

Welfare at Slaughter Abstracts and Review Comments

Project code:	**MH0128**
Project title:	Novel and humane gaseous killing methods for pigs
Start date (dd/mm/yy):	01/05/05
End date (dd/mm/yy):	30/04/10
Total cost:	£677,182
Project leader:	Dr. Mohan Raj
Affiliation:	University of Bristol
Sub-contractor(s):	N/A

Abstract of research

The overall aim is to induce unconsciousness in pigs by exposing them to a mixture of 85% nitrogen and 15% carbon dioxide and then kill them by inducing CVF (cardiac ventricular fibrillation) with an electric current.
The specific objectives are:
1. Evaluation of gas delivery system;
2. Evaluation of sub-dermal electrodes for recording electroencephalograms (EEGs);
3. CVF electrode design, construction and evaluation;
4. Determination of trans-thoracic impedance;
5. Effect of duration of exposure on duration of unconsciousness (isoelectric EEGs);
6. Minimum current necessary to induce CVF;
7. Time to onset of brain death after CVF; and
8. Estimation of permissible interval between end of exposure to gas and induction of CVF

Review comments

The project scored well, particularly in relation to policy relevance, sound evidence-based conclusions, and value for money. However, there has been a lack of publications to date. There is no clear view on how to proceed further or where the work can be applied. Doubts were expressed about whether the industry would take up the solution suggested by the work.

Project code:	**MH 0140**
Project title:	Studies to examine the use of captive bolt guns as a killing method for horned and un-horned sheep over six months of age
Start date (dd/mm/yy):	15/10/08
End date (dd/mm/yy):	30/09/11
Total cost:	£571,111

Project leader:	N Gregory
Affiliation:	Royal Veterinary College
Sub-contractor(s):	Humane Slaughter Association

Abstract of research

The aim is to determine the captive bolt gun-cartridge combination that will ensure death in sheep, without the need for sticking or pithing. The gun-cartridge combination will be assessed in terms of the peak velocity of the bolt, and the types of sheep that have to be killed (horned, unhorned, rams, ewes). From this work recommendations will be issued for when there is a disease outbreak that requires on-farm killing of sheep.

Review comments

The project received high scores and was considered to be delivering quality science. The project is primarily of importance in informing the practical aspects of on-farm disease control involving red meat species. The lack of attention to haemorrhages was raised as a concern. The findings will help establish best practice necessary to avoid compromising welfare.

Project code:	**MH0143**
Project title:	Welfare assessment of anoxic gas-foam as an agent for the emergency killing of poultry
Start date (dd/mm/yy):	01/11/07
End date (dd/mm/yy):	31/07/08
Total cost:	£102,279
Project leader:	Dr Dorothy McKeegan
Affiliation:	Faculty of Veterinary Medicine University of Glasgow
Sub-contractor(s):	Animal Welfare Group Royal Veterinary College Julian Sparrey, Livetech LST International BV, the Netherlands

Abstract of research

The objectives of this project were:

1. Develop a system to deliver gas-foam to a small to medium group of poultry with similar specifications to that which would be used in the operational disease control situation. Issues that will need to be considered include expansion ratios, surfactant type, temperature of delivery, speed of delivery, method of gas delivery, bubble diameter and bubble composition. Develop, test and build sensors used for objectives 1 and 2
2. Monitor the physiology and behaviour of poultry during exposure to air filled foam and to anoxic gas (nitrogen) filled foam in the laboratory
3. Develop a system to deliver anoxic gas (nitrogen) filled foam into large poultry sheds considering the parameters that influence the distribution of a gas filled foam

and its efficacy of being used as a practicable method for the humane killing of poultry within a shed
4. Disseminate and report the findings of this project to the Government and the British poultry industry.

Review comments
The project scored highly in nearly all categories, with one slight weakness noted with respect to dissemination of findings. This is a key piece of work to provide an alternative method for mass killing in an emergency. The work was well executed and delivery was as expected. This project has played an important role in helping determine policy on killing poultry for disease control purposes. It has provided proof of concept and has informed UK policy on the development of the new EU regulation on welfare at slaughter or killing.

Project code:	**MH0144**
Project title:	Further study to develop a humane method to kill poultry using gas filled foam
Start date (dd/mm/yy):	01/08/09
End date (dd/mm/yy):	31/01/10
Total cost:	£75,049
Project leader:	Dr Dorothy Mckeegan
Affiliation:	Faculty of Veterinary Medicine University of Glasgow
Sub-contractor(s):	Julian Sparrey, Livetec (co-contractor) Dr M Gerritzen, Animal Science Group, WUR, the Netherlands LST International BV, the Netherlands

Abstract of research
The aim of this project is to determine the depth and flow rate of foam that needs to be delivered over birds at commercial stocking densities to ensure that they die rapidly and are not re-exposed to atmospheric air. The first part of the work was to measure the flow characteristics of the foam in an area representative of a poultry shed, in the absence of birds. The second part evaluated the physiological effects of the foam on a subset of birds within a large group of broilers, held at commercial stocking densities. We also measured the breakdown of the foam caused by wing flapping.
The objectives were:
1. Using different forward speeds and depths of foam bow wave, determine the depth of foam required at the point the birds start flapping, how much foam is destroyed and how this is affected by stocking density.
2. Determine how the factors in objective 1 impact on the likelihood of birds regaining consciousness (measured by EEG), allowing clear recommendations about foam delivery to be made.
3. Develop a field method to evaluate the quality and suitability of a sample of foam to kill birds quickly, safely and reliably.

4. Contribute to practical recommendations for design including an operational protocol.

Review comments

The project scored well and was considered to meet its requirements. It was noted that the team would have benefited from a foam chemist. There is no outcome for objective 4 to date, but the research is expected to demonstrate whether proof of concept can be scaled up for on-farm use. This will have a key bearing on the development of policy on disease control options in the longer term.

Project code:	**MH0134**
Project title:	The development of a portable electrical stunner for turkeys.
Start date (dd/mm/yy):	01/09/05
End date (dd/mm/yy):	31/07/09
Total cost:	£238,491
Project leader:	Steve Wotton
Affiliation:	University of Bristol Department of Clinical Veterinary Science Langford Bristol BS40 5DUl
Sub-contractor(s):	Gerry Lewcock AGL Consultancy Ltd. Maple House 50A Canada Road Cobham Surrey, KT11 2BA

Abstract of research

This project aims to develop a portable battery-powered control unit and hand-held applicator from those that are commercially available or by developing an innovative design. The objectives were:
1. A prototype mains-powered generator will be designed and built.
2. The commercial availability of an appropriate hand-held applicator for use with turkeys will be researched, through contact with the poultry industry.
3. In the event of nothing suitable being commercially available for use with turkeys, a prototype hand-held applicator will be designed, constructed and evaluated using the outputs from objectives 1 and 2.
4. The minimum voltage necessary to break down the inherent high resistance in turkeys will be determined with AC and pulsed DC.
5. Subjective assessment will be made of the physical response of turkeys to AC and DC waveforms produced by the generator and applied using the hand-held applicator developed under objective 2.
6. Neurophysiological evaluation will be made of the effectiveness of the waveforms to produce a stunned state in turkeys.

7. Results from the previous objectives will be made available to enable the design of a commercial portable electrical stunner for turkeys to be achieved

Review comments

The project was considered to meet Defra's policy requirements, producing conclusions based on sound evidence. However, reviewers were disappointed by the lack of dissemination of the findings. A useful by-product of this work is the delivery of some interesting new information on the effectiveness of electrical stunning of poultry. This will be helpful in informing future policy consideration of electrical stunning methods more generally.

Project code:	**MH0135**
Project title:	Containability and aversiveness of different gas mixtures used for the stunning of slaughter weight pigs
Start date (dd/mm/yy):	01/06/05
End date (dd/mm/yy):	30/11/05
Total cost:	£35,658
Project leader:	Dr. Antonio Velarde
Affiliation:	IRTA
Sub-contractor(s):	N/A

Abstract of research

The aims of the study was firstly to assess the stability and uniformity of gas mixtures with nitrogen and carbon dioxide in a commercial dip-lift stunning system either when the cradle is static at the bottom of the pit or when it ascends and descends in the pit. The second aim was to ascertain whether these gas mixtures were aversive to slaughter weight pigs by means of the study of aversion learning tests and the behaviour of pigs in the pit .
The specific objectives of the project were:
1. To assess the containability of 98% nitrogen by volume in atmospheric air into a commercial dip-lift stunning system.
2. To assess the containability and homogeneity of a mixture of 70% nitrogen and 30% carbon dioxide by volume in atmospheric air in a commercial dip-lift stunning system.
3. To assess the containability and homogeneity of a mixture of 85% nitrogen and 15% carbon dioxide by volume in atmospheric air in a commercial dip-lift stunning system.
4. To assess the containability and homogeneity of a mixture of 92% nitrogen and 8% carbon dioxide by volume in atmospheric air in a commercial dip-lift stunning system.
5. To ascertain whether 90% argon by volume in atmospheric air is aversive to slaughter weight pigs.
6. To ascertain whether a mixture of 92% nitrogen and 8% carbon dioxide by volume in atmospheric air is aversive to slaughter weight pigs.

7. To ascertain whether a mixture of 85% nitrogen and 15% carbon dioxide by volume in atmospheric air is aversive to slaughter weight pigs.
8. To ascertain whether a mixture of 70% nitrogen and 30% carbon dioxide by volume in atmospheric air is aversive to slaughter weight pigs.

Review comments
The project scored highly across the board. The study was based on sound hypotheses, was well designed, was carried out using appropriate methodology and concluded clearly and soundly. It was, however, difficult to draw out key conclusions from the report provided. This project is helpful in considering the practical application of alternative gas mixtures.

Project code:	**MH0136**
Project title:	Emergency KIlling of Poultry on-farm using gas mixtures
Start date (dd/mm/yy):	01/02/05
End date (dd/mm/yy):	31/12/05
Total cost:	£59,875
Project leader:	Dr. Mohan Raj
Affiliation:	University of Bristol
Sub-contractor(s):	N/A

Abstract of research
The overall aim of this project was to evaluate the feasibility of killing poultry on-farm using gas mixtures contained in wheelie bins and other containers, and to produce a generic operating procedure.
This project involved six objectives:
1. Modify an existing wheelie bin
2. Design and develop a prototype lid for the wheelie bin
3. Evaluate gas delivery and containment in the wheelie bin
4. Evaluate the modified wheelie bin under a typical chicken cull operation
5. Evaluate the efficacy of gas mixtures for other species of poultry
6. Produce specific operating procedure (SOPs) and health and safety guidelines

Review comments
The research was considered to meet its requirements with a good overall score. It provided a useful development of a practical method to kill poultry on-farm in some emergencies, although the early involvement of a gas engineer would have been helpful. This project was of key importance in helping determine both a policy and practical response to Avian Influenza outbreaks.

Project code:	**MH0138**
Project title:	Reducing bird stress & discomfort on the poultry shackle line.
Start date (dd/mm/yy):	01/09/06
End date (dd/mm/yy):	31/03/09
Total cost:	£197,245
Project leader:	Paddy Schofield
Affiliation:	Silsoe Livestock Systems Ltd
Sub-contractor(s):	Paul Berry Technical Ltd The Food Animal Initiative

Abstract of research

The overall aim was to improve poultry welfare at slaughter by developing and evaluating approaches which reduce the stress and discomfort caused by leg compression during shackling, suspending birds upside down by their legs in the shackle and pre-stun shocks on entry into the stun bath.
The objectives were to investigate practical modifications to the shackle line which can be applied to existing equipment. The specific objectives were:
1. Reduce leg compression during shackling
2. Avoid inverting and suspending the birds
3. Improve entry into the stun bath avoiding pre-stun shocks
4. Identify reliable methods to assess bird welfare
5. Assess the functionality and welfare aspects of the developments
6. Assess systems when used by processing staff
7. Initiate technology transfer

Review comments

This project scored well in terms of policy relevance and quality of science. No papers had been submitted to peer-reviewed journals yet, although there had been communication with industry and policy makers. Reviewers questioned whether the work will be taken up commercially because of the capital cost involved, although those abattoirs that have installed the system are reported to be pleased and plan to continue using it. The work is relevant to and will help to inform the ongoing policy debate on the continuing use of water bath stunning equipment for poultry.

Project code:	**MH0141**
Project title:	Physiological monitoring of chickens during emergency killing (Phase 1)
Start date (dd/mm/yy):	01/04/07
End date (dd/mm/yy):	01/09/07
Total cost:	£30,329
Project leader:	Dr Dorothy Mckeegan

Affiliation:	Faculty of Veterinary Medicine University of Glasgow
Sub-contractor(s):	Animal Welfare Group Royal Veterinary College

Abstract of research

This project aimed to develop modern data acquisition techniques to record key physiological parameters (ECG, EEG, respiration, and body and skin temperatures) of fowl during emergency killing, such that subsequent analysis could allow inferences to be drawn about time to loss of consciousness, time to non-recovery, and potential welfare insults experienced by the birds during the euthanasia process. The objective of the project was to design, construct, test, and calibrate a physiological monitoring system for chickens that will operate in the extreme environments pertaining during emergency killing.

Review comments

This project was considered to have delivered quality science using sound scientific approaches. The development and testing of a simple data-logger is of great value for future research.

Project code:	**MH0142**
Project title:	Physiological monitoring of chickens during emergency killing (Phase 2)
Start date (dd/mm/yy):	01/07/07
End date (dd/mm/yy):	31/12/07
Total cost:	£46,779
Project leader:	Dr Dorothy Mckeegan
Affiliation:	Faculty of Veterinary Medicine University of Glasgow
Sub-contractor(s):	Animal Welfare Group Royal Veterinary College Avian Science Research Centre, SAC (co-contractors)

Abstract of research

This project utilises recently developed techniques to monitor and evaluate key physiological parameters of chickens during emergency killing with carbon dioxide. It represents a second phase, following on from a previous project (MH0141) which involved the construction of appropriate telemetry/logging equipment. Analysis of the physiological parameters recorded by these devices during emergency killing allowed inferences to be drawn about time to loss of consciousness, time to non-recovery, cause of death and potential welfare insults experienced by the birds during the euthanasia process. The specific objectives of this project were to
1. Test a physiological monitoring system for chickens with live birds in relation to risk factors likely to influence the success of physiological monitoring during whole house gassing;

2. Monitor and analyse physiological signals (EEG, ECG, body temperature and/or respiration) in chickens in an emergency killing trial

Review comments

This short project was considered to be very good value for money for Defra. The quality of the research was high, particularly with respect to physiological measurements. The work was useful in gaining acceptance of the methods used for mass killing. This project was important in addressing potential welfare concerns about the use of on-farm whole house gassing of poultry for disease control purposes and has helped inform policy on killing methods for disease control.

Project code:	**LK0684**
Project title:	Avoiding the welfare/quality compromise: Head only electrical stunning of poultry
Start date (dd/mm/yy):	01/06/08
End date (dd/mm/yy):	30/09/09
Total cost:	£142,454 (Defra contribution £77,624)
Project leader:	Dr Jeff Lines
Affiliation:	Silsoe Livestock Systems
Sub-contractor(s):	University of Bristol Cargill Meats Humane Slaughter Association Paul Berry Technical

Abstract of research

The project aim was to identify and demonstrate a practical approach to electrical stunning of poultry which achieves simultaneously a high standard of stun (ie immediate and long lasting insensibility for a high proportion of the birds) and also low levels of carcass damage. Such an approach, together with measures to avoid suspending birds by their legs (developed in MH 0138) and to avoid crushing legs in shackles will enable the commercial electrical stunning shackle line to be modified to provide acceptable standards of welfare at slaughter for poultry.
The specific objectives of this project were:
1. Investigate the measurement of bird EEGs using external electrodes
2. Identify the electrical parameters needed to achieve immediate and long lasting unconsciousness using a head only electrical waterbath stun
3. Identify a way to prevent involuntary wing flapping when the bird looses consciousness
4. Assess the carcass quality consequences of this approach to electrical stunning.

Review comments

This project was considered to be policy relevant and good value for money. It was noted that this may have solved a fifty year problem and had the potential to revolutionise the killing of birds by allowing the voltage in stunning to be increased without a risk to meat quality. However, one reviewer did voice a concern that it may not be able to consistently achieve an effective stun in dirty water. This project will be

useful in informing the Commission report on electrical waterbath stunning methodologies, which is required under Regulation 1099 / 2009 by December 2013.

Project code:	**MH0133**
Project title:	A study to design a holding pen for group-stunned animals
Start date (dd/mm/yy):	01/06/05
End date (dd/mm/yy):	30/11/07
Total cost:	£195,073
Project leader:	Lindsay Heasman (Brian Merrell)
Affiliation:	ADAS UK Limited (ADAS)
Sub-contractor(s):	Humane Slaughter Association (HSA) and Industrial Agricultural Engineers (IAE)

Abstract of research

The primary objective of this collaborative research project was to determine the optimal design and operational criteria to maximise animal welfare in a group stun system, for sheep, calves and goats. Specifically the project had three main scientific and technical objectives:-

1. A review of current practice;
2. Identify options for improving animal welfare in group stun systems; and
3. Dissemination of information to the industry.

Review comments

The project was considered to have met the policy requirements, however the reviewers did not rate the approaches used highly. It was accepted that this was not high science, but that it provided good practical solutions for group stunning. The work does improve our knowledge of handling prior to slaughter and has been used and disseminated by the Human Slaughter Association.

Project code:	**MH0131**
Project title:	METAL SURFACES FOR SHEEP AND CATTLE
Start date (dd/mm/yy):	01/10/05
End date (dd/mm/yy):	30/09/09
Total cost:	£345,461
Project leader:	N Gregory
Affiliation:	Royal Veterinary College
Sub-contractor(s):	N/A

Abstract of research

This project aimed at reducing falls and injuries in stock by evaluating different surfaces used in cattle and sheep facilities and equipment, and promoting the better alternatives, without influencing or favouring any sector of the manufacturing industry. The project examined slippery floors in livestock vehicles, abattoirs and markets. It identified where problems can arise in practice and it looked for some simple solutions. Floor slipperiness was assessed in two ways; from the frequency of slips and falls in cattle and sheep, and from objective measurements using a skid resistance value (SRV) tester. The focus was on areas where problems were likely to occur. This included cattle stunning pens, raceways leading up to the stunning pen, corridors in abattoirs and markets, weigh platforms and crushes, unloading bays and ramps in vehicles.

Review comments

This project was considered to have addressed an important issue in a methodical way and had delivered quality science. The project gave a comprehensive view on problems relating to slipping and falling of cattle and sheep. It investigated ease of cleaning but not disinfecting, and gave lots of solutions for improving raceways and stunning pens. The results should now be used for monitoring and consulting the responsible staff at cattle and sheep handling facilities. A leaflet on the subject has been produced.

Project code:	**MH0132**
Project title:	Literature review and survey of conditions relevant to farm animal welfare in lairages
Start date (dd/mm/yy):	01/06/06
End date (dd/mm/yy):	31/05/06
Total cost:	£51,083
Project leader:	S.N.Brown
Affiliation:	University of Bristol
Sub-contractor(s):	ADAS

Abstract of research

The purpose of the study was to review the information currently available on stocking densities, ventilation and noise in red meat lairages and the sensitivities and responses of animals to them. Because the amount of information specific to lairages was very limited, the relevant literature relating to these factors in normal housing systems was included where it could inform the more specific case of lairages.

In order to supplement this review of the literature, a small survey was carried out in which up to 36 lairages were visited and measurements made of stocking rates, air quality and ventilation characteristics and noise levels

Review comments

There were differences of opinion between the reviewers on the soundness and appropriateness of the scientific approaches and methods, which reduced the overall score of this project. It was noted that some variables had been overlooked throughout the work. The project was, however, considered to be relevant for Defra funding. The conclusions and observations made by the researchers are interesting and the work does improve our knowledge of lairage conditions. This could be incorporated into best practice guidance that might be produced.

On-Farm Ruminants and Transport and Markets

Thursday 11th March 2010

On-Farm Ruminants and Transport and Markets Agenda

Thursday 11th March 2010

The Royal College of Physicians, St Andrew's Place, London

09.00 – 09.30	Registration and coffee

09.30 – 09.40 Welcome and Introductions
Dr. Elizabeth Kelly, Defra (Chair)

Oral Presentations: Session 1

09:40 – 10:00 **AW1013:** Alleviation of lameness in dairy heifers: development of a lameness control plan
Prof. John Webster, University of Bristol

10:00 – 10:20 **AW1020:** The welfare of dairy cows in organic milk production systems
Prof. Alistair Lawrence, SAC Commercial Ltd.

10:20 – 10:40 **AW1021:** An intervention study to minimise footrot in sheep
Prof. Laura Green, University of Warwick

10:40 – 11:00 **AW1024:** A further study to assess the interaction between economics, husbandry and animal welfare in large, extensively managed sheep flocks
Dr. Alistair Stott, SAC Commercial Ltd.

11:00 – 11:20	Coffee break

Poster Presentations – Session 1

11:20 – 12:30 **AW1023:** Automated early lameness detection in dairy cattle
Dr. Alan Wilson, Royal Veterinary College

AW1025: The development of indicators of sheep welfare for farm assessment
Dr. Jennifer Duncan, University of Liverpool

AW1026: A study to investigate the management and welfare of continuously housed dairy cows
Dr. David Roberts, SAC Commercial Ltd.

LK0657: Identifying and characterising robust dairy cows
Prof. Alistair Lawrence, SAC Commercial Ltd.

LK0668: A molecular approach to breeding for resistance to footrot
Dr. Joanne Conington, University of Bristol

12:30 – 13:15 Lunch

Oral Presentations – Session 2

13:15 – 13:35 **AW0820:** Transcontinental road transport of breeder pigs - effects of hot climates
Mr. Peter Kettlewell, ADAS UK Ltd.

13:35 – 13:55 **AW0938:** A study to assess the effects of handling and transport on unbroken ponies
Dr. Toby Knowles, University of Bristol

13:55 – 14:15 **AW0940:** Epidemiological study to identify acceptable maximum journey lengths for pigs whilst maintaining welfare
Dr. Janet Talling, Fera

Poster Presentations – Session 2

14:15 – 15:00 **AW0934:** Effects of handling & transport on unbroken ponies
Dr. Heleen van de Weerd, ADAS UK Ltd.

AW0941: Study on end-of-lay hens to develop a method for assessment of fitness to travel and mitigation strategies to transport slightly sick or injured birds
Dr. Claire Weeks, University of Bristol

AW0942: Study to assess the impact of legislation to improve the welfare of animals during transport
Dr. Stephen Webster, Delta Innovation

15:00 – 15.30 Coffee break

15:30 – 17:30 Closed session for review panel
Mrs. Sue Ellis, Defra (Chair)

On-Farm Ruminants Abstracts and Review Comments

Project code:	**AW1013**
Project title:	Alleviation of lameness in heifers: development of a lameness control plan.
Start date (dd/mm/yy):	01/04/02
End date (dd/mm/yy):	30/04/07
Total cost:	£492,732
Project leader:	A.J.F.Webster, D.C.J.Main
Affiliation:	Dept. Clinical Veterinary Science, Univeristy of Bristol
Sub-contractor(s):	N/A

Abstract of research

The aim of the project was to develop and test a Decision Support System (The Lameness Control Programme, LCP) based on HACCP principles (Hazard analysis and critical control point programme) and designed to protect dairy heifers from developing crippling foot lameness at the outset of their first lactation.
The specific objectives were as follows:
1. Identification and characterisation of hazards, risks and critical control points according to HACCP principles
2. Development and testing the lameness control plan LCP through a case-control study involving 58 dairy farms with a known lameness problem.
3. Analysis of the associations between putative risks and outcomes (lameness and lesions) on all farms (intervention and control).
4. Development and refinement of the LCP as a decision-support programme for use by farmers and veterinary surgeons.

Review comments

The project was scored highly by all reviewers. The intervention study did not achieve a measurable reduction in lameness due to farmers not implementing all the measures. However, the study provided a comprehensive understanding of the causes of lameness and the researchers should be commended for their dissemination of these findings to the industry. The research also fed into a 2008 awareness campaign, 'Cattle Lameness and Herd Mobility Scoring', which ADAS ran on Defra's behalf for cattle producers.

Project code:	**AW1020**
Project title:	The welfare of dairy cows in organic milk production systems
Start date (dd/mm/yy):	01/10/03
End date (dd/mm/yy):	30/10/06
Total cost:	£299,999

Project leader:	Prof Alistair Lawrence
Affiliation:	SAC
Sub-contractor(s):	N/A

Abstract of research

In this project, five key questions were proposed that encapsulated the prevailing concerns over cow welfare in organic dairy production systems:
1. What is the relative risk of different disease states for cows managed in organic and non-organic systems?
2. Is there a difference between organic and non-organic systems in the recovery rate from disease?
3. Is there evidence of some organic disease treatments being more effective in treatment of disease than others?
4. Is there evidence that modern dairy cows are metabolically less well adapted to organic than non-organic dairy systems?
5. Is there evidence that improved husbandry conditions are being applied to cows in organic systems and that these conditions impose less 'environmental (behavioural) stress' on cows?
The aim of the study was therefore to provide data that would allow these questions to be answered. This information could also be used to establish best practice for cow health and welfare across the dairy industry. These aims were translated into the objectives of the study:
1. Recruitment of organic farms, organisation of the farmer Consortium, refinement of experimental protocols
2. Data collection from farms
3. Analysis of data and feedback to farmers

Review comments

This project scored well. It was a professional piece of research, well formulated, implemented and interpreted. In addition to the organic versus non-organic results it provided some useful pointers with respect to how management can improve animal welfare in all herds. Some of the best practice identified could be included in the next revision of the cattle welfare code.

Project code:	**AW1021**
Project title:	An intervention study to minimise footrot in sheep
Start date (dd/mm/yy):	01/04/05
End date (dd/mm/yy):	30/09/07
Total cost:	£340,735
Project leader:	Professor Laura Green

Affiliation:	Biological Sciences University of Warwick Coventry CV4 7AL
Sub-contractor(s):	Department Clinical Veterinary Science Division of Farm Animal Science, Langford House LANGFORD BRISTOL BS40 5DU

Abstract of research

If the prevalence (number of existing cases) of footrot and interdigital dermatitis and the period of infectiousness can be reduced, by treating individual lame sheep, the incidence will be reduced. To test this hypothesis, the following approach and objectives were used:

1. Set up an intervention study
2. Record and run the study for one year to test the hypothesis that immediate and rigorous treatment of footrot and interdigital dermatitis reduce the incidence of these diseases.
3. Collect samples for study of *Dichelobacter nodosus* serotypes, virulence and antibiotic sensitivity to test the hypothesis that these characteristics of *D. nodosus* may change with the intervention
4. Consider impact of intervention over first year and estimate the success of the hypothesis in objective 2.
5. Run the intervention study for a second year, with any minor adjustments following the interim report and steering group meeting where these might improve farmer uptake
6. Analysis and report findings to DEFRA, scientific community and farmers

Review comments

Reviewers considered this to be a good project with clear policy relevance. The research was well thought out and has delivered good results. Treatments chosen for interventions groups led to reduction in the prevalence of lameness and subsequent maintenance of low levels, resulting in increases in productivity and cost:benefit. However, to extrapolate to national flocks would be premature and it would be essential to first roll out the interventions on a larger sample of farms. This further work could establish some of the results and elucidate infectious mechanisms for the organisms involved. It was noted that this project produced an excellent set of publications, including some papers that were published before the project began.

Project code:	**AW1024**
Project title:	A further study to assess the interaction between economics, husbandry and animal welfare in large, extensively managed sheep flocks
Start date (dd/mm/yy):	01/06/06
End date (dd/mm/yy):	30/08/09

Total cost:	£685,814
Project leader:	Dr. Alistair W.Stott
Affiliation:	SAC
Sub-contractor(s):	ADAS, MLURI

Abstract of research

This project's aim was to explore the relationships between economics, farm management and animal welfare of extensive hill sheep enterprises in depth under the different CAP reform strategies that have been implemented in Scotland, England and Wales. By doing this, farmers and policy makers will be better able to ensure that the prosperity and acceptability of farming in Britain's hills continues to improve to the benefit of the local economy, the environment and animal welfare. There were 4 objectives as follows:

1. Develop indicators of sheep welfare in a representative range of extensive sheep farming systems in Great Britain from the animal's perspective.
2. Establish the main farm management strategies open to extensive sheep farmers that are likely to have impacts on animal welfare in Great Britain following CAP reform.
3. Provide a model of the relationship between the quality/availability of labour and animal welfare under extensive sheep farming systems in Great Britain.
4. Quantify the relative impact of alternative farm management strategies (identified in objective 2) on-farm profitability and animal welfare under the regional range of conditions in extensive sheep farming regions in Great Britain, and hence explore the interactions between economics and animal welfare.

Review comments

The approaches used in this project were novel and complex but entirely appropriate for the study. The project has produced sound evidence-based conclusions and has contributed to the evidence base on the relationship between economics, husbandry and animal welfare in extensive sheep farming systems. The outcomes inform not only Defra's animal welfare policy, but also policies on rural communities, economics, employment and the environment. It was noted that there had been Knowledge Transfer to sheep farmers with a significant proportion of these farmers changing their practices as a result.

Project code:	**AW1023**
Project title:	Automated Early Lameness Detection in Dairy Cattle
Start date (dd/mm/yy):	01/04/06
End date (dd/mm/yy):	30/03/09 with no cost extension to 31/12/09
Total cost:	£586,352
Project leader:	Professor Alan Wilson
Affiliation:	The Royal Veterinary College, University of London

Sub-contractor(s): N/A

Abstract of research

The aim of this project was to develop an automated system for early detection of lameness in dairy cattle, using force plate gait analysis and pattern recognition techniques to identify changes in gait which indicate the onset of lameness. The research focused on natural onset of lameness in a farm environment. It was proposed that the system could be programmed to record every cow at every milking. This would generate sufficient data to allow temporal changes in the data to form a major part of the analysis.
The key objectives in the development of the system were:
1. Installation of an automated gait analysis system
A system consisting of five purpose-built force plates, computer, video monitoring, and data collection and archiving facilities was developed and installed in the RVC dairy barn to record gait data at each milking. A second identical 'mobile' system was taken to two additional farms to test the robustness of the data collection in different farm environments.
2. Collection of a primary data set consisting of force plate data for 500,000 foot strikes, built up from recordings at three farms.
3. Development of an automated lameness detection system. From analysis of footstrike data, receiver operating curves (percentage correctly detected versus false alarms) were calculated for various classification systems to identify the most powerful classification system. In addition, simulations of less complex systems, eg with a reduced number of force plates, or single axis or dual axis load cells will be produced to show the tradeoff between system complexity (cost) and discriminative power.
4. Specification of an automated lameness detection system, defining the hardware, software, classification system (model parameters, gait features and algorithms) and set-up.

Review comments

The overall score of satisfactory was the average of high and low scores given by different reviewers. There was concern that the system did not register until cows were already moderately lame, but a lot of potential was seen for future developments. The research would have benefited from gathering more data on lame cattle but the study is an important first step in delivering an automated system for lameness detection.

Project code:	**AW1025**
Project title:	The Development of Indicators of Sheep Welfare for on-farm Assessment
Start date (dd/mm/yy):	01/10/07
End date (dd/mm/yy):	30/09/10
Total cost:	£333,944
Project leader:	Dr JS Duncan
Affiliation:	University of Liverpool

Sub-contractor(s):	N/A

Abstract of research

The aim of this project is to develop valid, repeatable and feasible indicators of sheep welfare for use in on-farm assessment/ monitoring of sheep welfare.
It had 5 principle objectives:
Objective 1. Identification of valid indicators of sheep welfare from examination of the scientific literature and consultaion with a panel of sheep experts.
Objective 2. Develop the assessment methods for each individual animal level indicator to provide accurate, reliable and practical scoring systems for on-farm observational assessment of the selected individual animal level indicators of sheep welfare. The indicators were examined for their between and within observer repeatbility, feasibility and an examination made of sources of between farm variation in test scores.
Objective 3. The development of individual level animal indicators into group level indicators which can be applied on a flock basis.
Objective 4. Establish a longitudinal study of the effects of seasonality and management on group level indicators over a 1 year period.
Objective 5. Development of standard operating procedures for each indicator to provide guidance on preliminary intervention levels for on-farm use by future welfare inspectors.

Review comments

Reviewers expressed concerns about the rate of progress and variations to the agreed experimental plan. It was accepted, however, that the research is ongoing, that a lot of data has been collected but not yet analysed, and that as a result it is difficult to assess the project at this stage. It was also noted that developing indicators of poor welfare is a complex and difficult task, and that this project does have potential to deliver.

Project code:	**AW1026**
Project title:	A study to investigate the management and welfare of continuously housed dairy cows
Start date (dd/mm/yy):	01/07/08
End date (dd/mm/yy):	30/06/11
Total cost:	£650,392
Project leader:	Dr David Roberts
Affiliation:	SAC
Sub-contractor(s):	Assured Dairy Farmers (ADF); BioSS

Abstract of research

The number of farmers housing their cows, or some portion of their herd, throughout the year appears to be increasing due to the need to feed cows a high concentrate ration, the use of robotic milkers and the need to control pollution. However, there are welfare concerns about housing cows continuously.

To address these issues, the aims of this project are:
1. To assess the prevalence of continuous housing systems in Britain, and to determine the main reasons farmers have for converting;
2. To assess the effect of continuous housing on dairy cow health, and to determine whether the provision of a loafing area can improve welfare;
3. To investigate aspects of loafing area design such that they meet the needs of dairy cows;
4. To assess the effect of the type of indoor lying and standing areas on the use of loafing areas, and the strength of the motivation to use loafing areas;
5. To transfer this knowledge to farmers and other groups involved in dairy cows welfare and housing.

Review comments

This research project scored well and was considered to be of particular policy relevance considering the increasing intensification of dairy farming in the U.K. The study is ongoing and is progressing according to schedule. Some concern was expressed about the emphasis on loafing, since the dairy cow spends approximately 50% of the time lying down. It was noted, however, that the focus on loafing had been at Defra's request since the project was working towards a better understanding of issues facing continuously housed cows in particular.

Project code:	**LK0657**
Project title:	Identifying and Characterising 'robust' dairy cows
Start date (dd/mm/yy):	01/02/04
End date (dd/mm/yy):	31/01/07
Total cost:	£1,305,931 (Defra contribution £622,751)
Project leader:	Prof. Alistair Lawrence
Affiliation:	SAC
Sub-contractor(s):	Roslin Institute (Edinburgh)

Abstract of research

The aims of this project were to:

a) Investigate two factors that might improve health and fertility. These were body condition score (body fatness) and the maturity of the heifer at her first calving
b) Determine whether the daughters of some sires are more suited to particular environments than others.
c) Determine whether the use of a new selection index would adversely affect animal behaviour.

Objectives to achieve this were:
1. To develop tests to characterise biological traits underlying robustness e.g. lifetime energy balance (LEB), degree of maturity, temperament traits, conformation. (1b) To calculate a breeding index of robustness for sires using available traits such as fertility, locomotion, lifespan, somatic cell count (SCC) and LEB.

2. To define environments according to geographical, physical and management features that are likely to affect robustness.
3. To compare the expression of traits of robustness in bulls' daughters of high and low robustness both within and between environmental classes.
4. To explore the relationship between an index of robustness and its component traits, and to evaluate the need for inclusion of environmental sensitivity in a robustness index.
5. To assess the feasibility and desirability of selecting for robust cows.

Review comments

This project was considered to have delivered quality science with good dissemination of the findings. It was noted that 'robust' is a subjective descriptor and the research has not provided an objective definition. This project contributed to Defra's evidence base and traits underlying robustness are now included in national breeding indices which will improve the welfare of dairy cows.

Project code:	**LK0668**
Project title:	Breeding for resistance to footrot: Combining molecular and phenotypic approaches
Start date (dd/mm/yy):	01/08/05
End date (dd/mm/yy):	31/10/08
Total cost:	£530,547 (Defra contribution £136,524)
Project leader:	Joanne Conington and Lutz Bunger
Affiliation:	SAC
Sub-contractor(s):	Roslin Institute, ADAS Rosemaund, QMS, Eblex, HCC, British Texel Sheep Society Ltd., Blackface Elite, Innovis, University of Wales Aberystwyth, Lincoln University, Lincoln NZ Univeristy of Melbourne, Australia

Abstract of research

Footrot is a major welfare problem in sheep and is reported to be the most common cause of lameness. Footrot-affected sheep are often in pain and have reduced mobility that affects their ability to forage, lactate and reproduce effectively. The aim of this project was to develop robust procedures to identify individuals and family groups differing in their genetic resistance to footrot that can be selectively bred as parents of the next generation. Using information from Blackface, Texel and Mule sheep, the project used both molecular techniques and conventional animal breeding strategies to investigate the links between genetic susceptibility and phenotypic expression of footrot.

Specific objectives were:

1. To test and further develop a robust phenotypic scoring procedure to enable studies of the genetic control of footrot resistance to be undertaken.
2. To investigate associations between footrot resistance and (a) polymorphisms at the DQA2 gene (the 'New Zealand footrot genetic test') and (b) other genetic markers within and close to the MHC region on Chr 20.

3. To estimate genetic parameters for footrot resistance and explore the genetic relationships of footrot resistance with other traits of economic importance such as lamb weights and maternal characteristics
4. To predict the genetic, epidemiological and total financial benefits from breeding for footrot resistance

Review comments

The sound scientific approaches and evidence-based conclusions led to a good overall score for this project. Together with the bolt-on project LK0669, which investigated Shelly Hoof in sheep, the research will help to improve the welfare of sheep and reduce the incidence of footrot, since it will now be included in breeding programmes. The added benefit will be a reduction in antibiotic and chemical foot bathing, and ancillary treatment necessary for the national flock, with the concomitant reduction in the potential for environmental contamination.

Project code:	**LK0669 (BOLT ON TO LK0668)**
Project title:	Breeding for resistance to footrot: Combining molecular and phenotypic approaches – Bolt-on project – Genetic and nutritional aspects of Shelly Hoof .
Start date (dd/mm/yy):	01/01/09
End date (dd/mm/yy):	31/03/09
Total cost:	£20,548 (Defra contribution £10,274)
Project leader:	Joanne Conington
Affiliation:	SAC
Sub-contractor(s):	Roslin Institute, ADAS Rosemaund, QMS, Eblex, HCC, British Texel Sheep Society Ltd., Blackface Elite, Innovis, University of Wales Aberystwyth, Lincoln University, Lincoln NZ, University of Melbourne, Australia

Abstract of research

The possible involvement of nutrition in poor horn development leading to clinical signs of shelly hoof has been shown in this preliminary study. In the samples studied there was no evidence of the degenerative effects of over-nutrition, which has previously been implicated in equine horn problems. The evidence for poor horn development was seen in all samples from affected ewes. Some evidence of poor horn development was also detected in samples with no clinical signs of shelly hoof from sheep which had other hooves that were affected. It is likely that it is the extent of the degeneration of the horn that leads to clinical signs of shelly hoof. The three distinctive physical features of shelly hoof seen using TEM technology include
a) irregular edges of the dorsal horn with micro-fissures that penetrate deeper into the laminar corum,
b) separation (‘un-zipping’) and disintegration of cell membranes creating gaps between the cells, and

c) poor keratinisation of the cells and their weak attachment to the cell membranes. These defects undoubtedly contribute to the degradation and ‘flaky’ appearance of the hoof that is characteristic of shelly hoof in sheep

Review comments

See project LK0668 ‘Breeding for resistance to footrot: Combining molecular and phenotypic approaches’ for comments.

Transport and Markets Abstracts and Review Comments

Project code:	**AW0820**
Project title:	Transcontinental road transport of breeder pigs - effects of hot climates
Start date (dd/mm/yy):	01/02/06
End date (dd/mm/yy):	01/06/09
Total cost:	£1,444,383
Project leader:	Peter Kettlewell And Malcolm Mitchell
Affiliation:	ADAS and SAC respectively
Sub-contractor(s):	Eddie Harper, MBE, Independent Livestock Transport Consultant Professor Morris Villarroel, Universidad Politecnica de Madrid

Abstract of research

Scientific objectives

1. To determine the range of thermal conditions that breeder pigs encounter during trans-continental transport by road.
2. To characterise the physiological and potential welfare consequences of these conditions and journeys.
3. To define the acceptable ranges and limits for thermal conditions for breeder pigs during transcontinental road transport.
4. To provide the sound scientific basis for negotiation and development of future welfare legislation and codes of practice relating to the transportation of pigs.

Review comments

The project scored well, and despite being derailed by a disease outbreak, a significant volume of useful data was collected on the final phase. The high cost of the research was noted, but taking the cost of conducting such research into consideration, the project was deemed to be good value for money. The researchers have been active in disseminating their findings in conferences and meetings, but if the data are to influence colleagues in other countries, the work needs to be submitted to peer-reviewed journals.

Project code:	**AW0938**
Project title:	A study to assess the effects of handling and transport on ‘unbroken’ ponies.
Start date (dd/mm/yy):	01/08/05
End date (dd/mm/yy):	01/08/08
Total cost:	£209,311
Project leader:	Dr Toby Knowles

Affiliation:	University of Bristol
Sub-contractor(s):	N/A

Abstract of research

This study was instigated to scientifically examine the effects of group size and space allowance during transport on unbroken (i.e. not halter trained or used to handling) pony behaviour and welfare. In addition, the study aimed to examine aggression between ponies and the prediction of aggressive behaviour during transport. Until now there has been no scientific work on the transport of unbroken ponies, so that recommendations and legislation have been based on information relating to horses and ponies accustomed to handling, as well as on anecdotal information.
Study Objectives
By means of controlled study and survey to:-
1. Identify a range of group sizes for unbroken ponies for which transport is acceptable (to include an investigation into the acceptability of individual transport).
2. Identify acceptable space allowances for unbroken ponies transported in different sized groups.
3. Provide a protocol for identifying aggressive ponies to enable their separation prior to group transport.

Review comments

The project was scored as very good. This was a fairly comprehensive piece of research with excellent data collected on stocking rates. However, the results of this project and project AW0934 should now be brought together so that outcomes can be used in any guidelines on the development of best practice for the handling and transport of unbroken ponies. All data will feed into the review of the welfare in transport regulation (EC) 1/2005. A further benefit of this project and project AW0934 was that stakeholder relationships were significantly developed.

Project code:	**AW0940**
Project title:	Epidemiological study to identify acceptable maximum journey lengths for pigs whilst maintaining welfare
Start date (dd/mm/yy):	01/06/08
End date (dd/mm/yy):	30/06/11
Total cost:	£686,606
Project leader:	Katja van Driel
Affiliation:	Food and Environment Research Agency
Sub-contractor(s):	ADAS (joint contractor) Scottish Agricultural College (joint contractor)

Abstract of research

This project assesses the risk factors related to journey durations and welfare outcomes by following a large number of long and short distance transports of pigs. Its objectives are:

1. To collect animal-based measurements of pig welfare during and after long-distance journeys of both breeder pigs and slaughter pigs (where possible) - phase 1.
2. To collect information on a range of journey factors, such as space allowance and vehicle characteristics, associated with long-distance transport of pigs.
3. To categorize journeys into categories based on journey length (first) and temperature (second) - phase 2.
4. To statistically compare categories and draw conclusions about the effect of journey length in association with temperature.
5. To model data collected in phase 1 to examine whether and if so what associations exist between journey factors and pig welfare, using cohorts of pigs.
6. Present the results via a workshop to Defra, industry representatives, participating hauliers and other interested stakeholders.

Review comments

This project, which is ongoing, was considered highly relevant to Defra and the quality of science considered to be high. There were differences of opinion between the reviewers on the soundness of the approach and the ability of the data being gathered to support the model. It was suggested that an epidemiologist should be consulted.

Project code:	**AW0934**
Project title:	A study to assess the effects of handling and transport on 'unbroken' ponies
Start date (dd/mm/yy):	01/06/05
End date (dd/mm/yy):	31/08/08
Total cost:	£244,405
Project leader:	Dr Heleen Van De Weerd
Affiliation:	ADAS UK Ltd. ADAS Gleadthorpe Meden Vale Mansfield N20 9PF
Sub-contractor(s):	Universtiy of Edinburgh (joint contractor) Macauley institute (sub-contractor) Universtiy of Cambrige (sub-contractor)

Abstract of research

This study had 5 objectives:
1. An Industry survey to gather information on transport factors such as stocking rates, journey lengths.
2. Assess the effects of various components of the market experience that may affect the ability of unbroken ponies to cope with the transportation process.
3. Assess the welfare of ponies during the loading process.
4. Assess the welfare of ponies under different handling regimes for transportation.
5. Produce guidelines on the transportation of unbroken ponies.

Review comments
This project had clear policy relevance, appropriate scientific methods were used and the conclusions were based on sound evidence. It was noted the conclusions are useful and have an obvious practical value. No refereed papers have been published yet but a valuable stakeholder workshop was held. Overlap with project AW0938 should be reconciled as stated in comments for that project.

Project code:	**AW0941**
Project title:	Study on end-of-lay hens to develop a method for assessment of fitness to travel and mitigation strategies to transport slightly sick or injured birds.
Start date (dd/mm/yy):	01/04/09
End date (dd/mm/yy):	31/03/12
Total cost:	£423,394
Project leader:	Dr Claire Weeks
Affiliation:	University of Bristol
Sub-contractor(s):	N/A

Abstract of research
Council Regulation (EC) No. 1/2005 on the protection of animals during transport acknowledges that sick or injured animals may be considered fit for transport if, amongst other reasons, slightly injured or ill and transport would not cause additional suffering. Guidance needs to be developed to assess fitness to travel of end-of-lay hens, the improved transport conditions needed to transport animals that are slightly injured or ill and the cut off point where it would be unacceptable to transport end-of-lay hens and thus utilise on-farm methods of killing.
These points are being addressed by the following objectives:
1. To undertake a survey of principal causes of hens dead on arrival (DOA) at the slaughterhouse and to link these with flock health and husbandry with the aim of identifying risk factors on-farm and risk factors for individual hens.
2. To develop methodology for assessing individual hens for fitness to travel.
3. To work with industry to devise mitigation strategies which maximise welfare during transit, including holding a workshop for stakeholders to discuss results and agree practical ways forward.
4. To compare practicality and effectiveness in the commercial environment of implementation of methods of assessment of fitness to travel and selected mitigation strategies in improving end of lay hen welfare during transit.
5. To provide a final report for Defra that will include guidelines for methods to assess the fitness to travel and potential mitigation strategies which meet specific needs during transport.

Review comments
This project is employing sound scientific approaches to a subject that is of relevance to Defra. It was noted that the project is ongoing so the final value could not be assessed at this stage. The research addresses an important area and there

is no doubt that ways can be developed of identifying those flocks that are at greater welfare risk. There was some discussion about how the findings will be used.

Project code:	**AW0942**
Project title:	Study to assess the impact of legislation to improve the welfare of animals during transport
Start date (dd/mm/yy):	01/04/09
End date (dd/mm/yy):	31/03/10
Total cost:	£112,965
Project leader:	Dr Steve Webster
Affiliation:	Delta-innovation Ltd
Sub-contractor(s):	Livestock Management Systems Ltd

Abstract of research

This project is assessing what impact legislation (specifically Council Regulation (EC) No. 1/2005) on the protection of animals (pigs, sheep, cows, horses, ponies, layer hens and broilers) during transport has had on the welfare of animals transported.

To achieve this the project is:

a) Mapping animal transport to current and potential indicators of welfare, and to legislative and other controls, and examining the possibilities and likelihood of unintended consequences arising from this legislation.

b) Collecting and analysing primary data including: (i) structured interviews with monitoring bodies, industry organisations and assurance schemes, and (ii) telephone surveys of abattoirs, markets, hauliers and farmers. Data is being collected from across farm and farm species types.

c) Examining other (non-legislative) means by which animal welfare in transport may be further improved.

Review comments

The project is ongoing and so it is difficult to judge the outcome, but this project was considered to be policy relevant and overall was meeting its requirements. Given that this is a retrospective study, it is not assessing the welfare of animals but stakeholders' opinions of the welfare of animals. That being so, it would have benefited from having a social scientist involved. The results so far are interesting but the methodology will need to be robust if policy is to be based on the findings.

Project code:	**AW0937**
Project title:	The development of methods to assess fatigue in sheep
Start date (dd/mm/yy):	01/06/05
End date (dd/mm/yy):	31/01/08

Total cost:	£179,062
Project leader:	Dr M.S. Cockram
Affiliation:	Previously University of Edinburgh
Sub-contractor(s):	Scottish Agricultural College

Abstract of research

This project aims to develop a protocol for inducing fatigue in sheep so that the methods could be evaluated. It was considered that fatigue could be identified by either the sheep voluntarily stopping exercise or showing other signs of reduced performance.

The objectives of the research were:

1. To identify the minimum severity of exercise required to produce a decrease in performance of sheep walked on a treadmill
2. To examine the extent of any changes in blood chemistry indicative of muscle metabolism, stress and hydration state in sheep with a decreased performance during exercise.
3. To examine the potential of a range of methods to identify fatigue in sheep, by testing the hypotheses that a decreased performance in an exercising sheep is associated with one or more of the following:

(a) a decrease in the frequency of the electromyogram
(b) a quantitative increase in post-exercise lying behaviour
(c) qualitative changes in behaviour as determined by subjective whole animal appraisal by a panel of observers
(d) a shift in motivational status, as determined by increased motivation to rest at the expense of motivation to feed.

Review comments

There were concerns voiced about delayed delivery and dissemination of the findings from this project. The study addresses a very important topic of high relevance for animal welfare during transport. So far, however, the project has not produced any papers or abstracts and some of the results are yet to be analysed. It is not clear if the experimental approach (use of a treadmill) is comparable to the fatigue that animals may experience after standing for a long time in a vehicle. This project was conducted under Home Office licence which placed some constraints on the experimental design.

Annex 1: SID 1 / ROAME Statements

N.B. As part of the review process a new strategic document to cover the whole Animal Welfare R&D programme will be produced.

On-Farm Poultry Welfare SID1

General enquiries on this form should be made to:
Defra, Science Directorate, Management Support and Finance Team
Telephone No. 020 7238 1612

SID 1 ROAME Statement

General notes

1. The first stage of the ROAME (Rationale, Objectives, Appraisal, Monitoring, Evaluation) process requires a clear and succinct statement of the commissioning organisation's rationale for funding research. The SID 1 provides the customer's reasons for requiring research in a particular policy area and the policy and scientific objectives of that research. It forms the basis for all research proposals and is vital to ensure overall direction and ultimate evaluation of the research programme.
2. The level at which the SID 1 statement is set is for the policy customer to decide. Each Programme should focus on one or more related policy objectives and the related scientific objective(s). However, policy customers may wish to set SID 1 statements at a higher level, e.g. where a large research programme addresses similar policy and scientific objectives.
3. **The SID 1 is an important working document, which stems from and supports Defra's Evidence and Innovation Strategy. All SID 1s will be published and used to inform contractors and other funders of research of the rationale and key policy drivers underpinning Defra's research programmes.**
4. A SID 1 **must** be produced for each research programme. It should be **approved at Director level, or at a lower level only through formal delegation of authority.** Science Units within Defra are responsible for ensuring that all research is commissioned and contracted under a SID 1 which complies with this guidance. A SID 1 should typically be no more than 5-6 pages long, although this can vary depending on the complexity and size of the programmes covered.
5. SID 1s should be reviewed every 3-5 years. If new or revised forms are produced (for example, following a review), these should annex the original form to provide a historical record of programme change. Please refer to the Science Handbook for further guidance.
6. This form is in Word format and the boxes may be expanded, or reduced, as appropriate.

1. Area of Policy/Research

Please state the title of the proposed research programme – including FPS Programme Code Assessment Unit or Sub-Programme Code.

On-farm Poultry Welfare R&D Programme (PI: 030 AW02 & AW11)

2. RATIONALE for Defra Funding

(a) Describe the policy problems to be addressed by this research.

Ministers are committed to improving standards of animal welfare on-farm, during transport, at markets, and at slaughter, wherever possible on a European Community basis.

Defra commissions R&D in support of this aim to ensure that policy initiatives are soundly based and to support the UK's position in Community negotiations and in the Council of Europe. This commitment is embodied in the Defra aims and objectives. One of these objectives is 'to protect the public's interest in relation to environment impacts and health, including in relation to diseases which can be transmitted through food, water and animals and to ensure high standards of animal health and welfare'.

The Farm Animal Welfare Council (FAWC) - the independent body advising Ministers on farm animal welfare issues - have made a number of recommendations for research to improve the welfare of poultry. These are detailed in the FAWC Reports on the Welfare of Turkeys (1995), Laying Hens (1997), Broiler Breeders (1998) and their subsequent annual reports.

(b) Explain how the research will support Defra Strategic Priorities, PSA targets and Evidence and Innovation Strategy.

This R&D programme will directly support the departmental Strategic Outcome, “Sustainable farming and food, including animal health and welfare,” and will directly contribute to the delivery of PSA9, “To improve the health and welfare of kept animals and protect society from the impact of animal diseases, through sharing management of risk with the industry.”

(c) Explain how this research will be co-ordinated with other Defra science and policy activity. This should cover co-ordination with other Defra research programmes, including economic, social science and the Horizon Scanning Programme and other Defra science activity, e.g. monitoring and surveillance programmes.

The On-farm Poultry Welfare R&D Programme will be co-ordinated across other Defra policy areas where there are direct contributions to that particular area eg Sustainable Food and Farming, Environment.

(d) Explain how the proposed programme will align with the work of other Departments and funders of research. This should cover UK funders and, where possible or appropriate, funders in other countries or international bodies; whether co-ordination is needed or foreseen and, if so, how and when such co-ordination or collaboration should take place.

The On-farm Poultry Welfare R&D Programme will be co-ordinated with other funders of R&D in this area to ensure complementary research is undertaken that does not duplicate effort eg the BBSRC, SEERAD.

(e) Provide a brief summary as to why Defra should fund the proposed research. You are required to justify the use of Defra resources for the proposed project. In your justification you should clearly set out that no other existing or current research or body of information meets the policy needs; why R&D is the most suitable method to provide evidence; and the intended outcome of the programme.

Given the nature of the issues under consideration, there do not appear to be any alternative methods of addressing the policy objectives. Policy may also be informed by the output of projects in relevant research programmes of SEERAD and DARDNI.

There are options for achieving improvements in the welfare of poultry (eg legislation, codes of recommendation and advice - such as ADAS campaigns). These are complimentary to the R&D programme which is needed to provide the underpinning basis for decisions on the use of these instruments. New research is only commissioned where knowledge is lacking to provide the best solutions to the problems and enable welfare to be obtained in such a way.

Output from the EU and global research is maintained by Defra and its research contractors. This is used to inform policy objectives wherever it is appropriate. Research contractors are encouraged to seek EU funding in relevant areas but the time-frame for the availability of results is considered in relation to policy needs.

The Government is committed to improving standards of farm animal welfare. However, improvements to husbandry systems or practises may entail extra costs for producers, without any corresponding benefit such as an increase in productivity. There is a need to ensure that welfare is assessed independently of commercial influences. Farm animal welfare research is therefore considered to be suitable for public funding, although industry participation is encouraged where there are obvious benefits to the industry and the independence and objectivity of the research can be assured.

3. OBJECTIVES

(a) State policy objectives which should be:

- achievable;
- testable (i.e. in a form capable of verification, preferably in a quantitative fashion); and
- time-bound (i.e. to be reached at a pre-determined date).

The policy objective is to improve the welfare of poultry. Policy priorities are:

<u>Meat chickens</u>

- To improve leg health; and
- To assess the affect of various feeding regimes and environment on broiler welfare.

<u>Laying Hens</u>

- To improve bone quality;
- To investigate behaviour (particularly feather pecking and dust-bathing);
- To address depopulation issues;
- To improve the design of cages to meet behavioural and welfare requirements, such as cage height, stocking density, and enrichment (including provision of a dust-bath); and
- To develop an alternative to beak trimming;

<u>Turkeys</u>

- To investigate group size, including stocking density, light intensity and enrichment; and
- To improve skeletal and tendon strength.

3. OBJECTIVES continued

(b) State scientific objectives which must be achievable, verifiable and timebound. Science staff must decide where research can contribute to the achievement of policy objectives and agree with Policy DGs scientific objectives appropriate to meet the policy need. **They should also cover the key deliverables against which the success of the programme will be judged at review**:

- anticipated contribution to Defra policy development (i.e. to inform change of policy);
- other outputs, such as new or refined industry practices/standards;
- planned processes for Knowledge Transfer and Innovation and communication to the public.

Meat chickens

Leg health

- The development of reliable, quantifiable and objective measures of broiler leg health that allows the differentiation of gait changes due to leg disorders and conformation.
- To determine effective control strategies for infectious and non-infectious causes of poor leg health.

Feeding regimes

- The affect of various feeding regimes on the welfare of broiler breeders eg restricted fed vs skip a day feeding vs reduced restricted feeding regimes.
- The effect of stocking density on the ability to gain access to, and competition for, resources.
- To identify the biological and motivational basis of hunger (broiler breeders).
- To investigate the environmental factors affecting broiler health and welfare.
- To identify the causes and aetiology of contact dermatitis in broiler chickens.
- To assess the health, welfare and parasite status of birds in extensive systems.

Laying hens

Bone quality

- Further development of markers for bone quality and bone strength.

Feather pecking, other behaviours and management

- The assessment of alternative methods to control feather pecking and cannibalism.
- The effect, and use, of lighting regimes/levels on, or for, the management and control of feather pecking, cannibalism, and other behavioural patterns.
- To identify ways of controlling red mite numbers in poultry housing systems.
- Broilers chickens& other poultry

Other poultry - Turkeys

- To investigate the affect of group size and stocking density, plus light intensity, on the welfare of turkeys.
- To identify ways of providing environmental enrichment to turkeys to prevent and redirect adverse pecking.
- Methods to improve skeletal strength.

4. APPRAISAL

Explain your plans to ensure that you obtain fit for purpose research under this programme and value for money for the taxpayer. In particular, how will you ensure expert external input and challenge (e.g, through advice from expert groups/committees; peer review of project proposals; and level of competitively let contracts) are taken into account.

To ensure fit for purpose research, that provides value for money, R&D will be subject to external peer review both at the commissioning stage of the research procurement process and when projects are completed.

5. MONITORING

Please explain how you plan to monitor progress against programme and project objectives, in particular any key programme review points.

Progress will be monitored on an annual basis via the appraisal of annual reports and through attendance at individual project monitoring visits.

6. EVALUATION

Please specify how you intend to evaluate the outputs of the programme against its objectives, ensuring appropriate external input and challenge. This should also include an assessment of the future of the programme.

The whole On-farm Poultry Welfare R&D Programme will be reviewed on a four to five year basis where the purpose will be:

i. To examine progress to date against Defra's stated policy and scientific objectives;
ii. To place the poultry welfare research programme in the context of the whole of Defra's welfare research programme;
iii. To evaluate the role of the Defra programme in the context of research programmes of other sponsors, within and outside of Government; and
iv. To determine the direction and priorities for future research.

This research programme will be reviewed by (insert year) 2010

Approved by | Date

Name | Unit

On-Farm Welfare of Pigs SID1

General enquiries on this form should be made to:
Defra, Science Directorate, Management Support and Finance Team
Telephone No. 020 7238 1612

SID 1 ROAME Statement

General notes

1. The first stage of the ROAME (Rationale, Objectives, Appraisal, Monitoring, Evaluation) process requires a clear and succinct statement of the commissioning organisation's rationale for funding research. The SID 1 provides the customer's reasons for requiring research in a particular policy area and the policy and scientific objectives of that research. It forms the basis for all research proposals and is vital to ensure overall direction and ultimate evaluation of the research programme.
2. The level at which the SID 1 statement is set is for the policy customer to decide. Each Programme should focus on one or more related policy objectives and the related scientific objective(s). However, policy customers may wish to set SID 1 statements at a higher level, e.g. where a large research programme addresses similar policy and scientific objectives.
3. **The SID 1 is an important working document, which stems from and supports Defra's Evidence and Innovation Strategy. All SID 1s will be published and used to inform contractors and other funders of research of the rationale and key policy drivers underpinning Defra's research programmes.**
4. A SID 1 **must** be produced for each research programme. It should be **approved at Director level, or at a lower level only through formal delegation of authority.** Science Units within Defra are responsible for ensuring that all research is commissioned and contracted under a SID 1 which complies with this guidance. A SID 1 should typically be no more than 5-6 pages long, although this can vary depending on the complexity and size of the programmes covered.
5. SID 1s should be reviewed every 3-5 years. If new or revised forms are produced (for example, following a review), these should annex the original form to provide a historical record of programme change. Please refer to the Science Handbook for further guidance.
6. This form is in Word format and the boxes may be expanded, or reduced, as appropriate.

1. Area of Policy/Research

Please state the title of the proposed research programme – including FPS Programme Code Assessment Unit or Sub-Programme Code.

On-farm Welfare of Pigs R&D Programme (PI: 030 AW01)

2. RATIONALE for Defra Funding

(a) Describe the policy problems to be addressed by this research.

The Government is committed to improving standards of animal welfare on-farm, during transport, at markets and at slaughter in the UK and the EU, and where possible at an international level.

Defra's R&D programme aims to ensure decisions about policy initiatives, changes to farm animal welfare legislation and welfare Codes of Recommendation have a sound scientific basis. This is particularly relevant in relation to the welfare of pigs on-farm, where there is EU legislation in the form of Council Directive 91/630/EEC, which is under continuous review. Although it has been amended by two further Directives, Council Directive 2001/88/EC and Commission Directive 2001/93/EC in 2001, there are two further reviews scheduled, one to look at space allowances for fattening pigs and a subsequent full review, for both of which our policy must be informed by research.

In its Report on Animal Welfare R&D, published in 1993, the Farm Animal Welfare Council (FAWC) – the independent body advising Ministers on farm animal welfare issues – made a number of recommendations for research to improve the welfare of pigs. The Government has accepted these recommendations. Further recommendations have been made in the FAWC report on the Welfare of Pigs Kept Outdoors (1996) and subsequent annual reports from the Committee.

(b) Explain how the research will support Defra Strategic Priorities, PSA targets and Evidence and Innovation Strategy.

This R&D programme will directly support the departmental Strategic Outcome, "Sustainable farming and food, including animal health and welfare," and will directly contribute to the delivery of PSA9, "To improve the health and welfare of kept animals and protect society from the impact of animal diseases, through sharing management of risk with the industry."

(c) Explain how this research will be co-ordinated with other Defra science and policy activity. This should cover co-ordination with other Defra research programmes, including economic, social science and the Horizon Scanning Programme and other Defra science activity, e.g. monitoring and surveillance programmes.

The On-farm Pig Welfare R&D Programme will be co-ordinated across other Defra policy areas where there are direct contributions to that particular area eg Sustainable Food and Farming, Environment.

(d) Explain how the proposed programme will align with the work of other Departments and funders of research. This should cover UK funders and, where possible or appropriate, funders in other countries or international bodies; whether co-ordination is needed or foreseen and, if so, how and when such co-ordination or collaboration should take place.

The On-farm Pig Welfare R&D Programme will be co-ordinated with other funders of R&D in this area to ensure complementary research is undertaken that does not duplicate effort eg the BBSRC, SEERAD.

(e) Provide a brief summary as to why Defra should fund the proposed research. You are

required to justify the use of Defra resources for the proposed project. In your justification you should clearly set out that no other existing or current research or body of information meets the policy needs; why R&D is the most suitable method to provide evidence; and the intended outcome of the programme.

Given the nature of the issues under consideration, there do not appear to be any alternative methods of addressing the policy objectives. Policy may also be informed by outputs from the research programmes of other organisations such as BBSRC which fund more fundamental R&D in this area.

Other options for achieving improvements in the welfare of pigs are used, such as legislation, codes of recommendations and advice to farmers, through, for example, ADAS campaigns. These are complimentary to the R&D programme, which is needed to provide the underpinning basis for decisions on the use of these instruments. ADAS campaigns also provide one of several routes by which we acquire stockmanship knowledge that can inform policy decisions. New research is only commissioned where knowledge is lacking to provide the best solutions to welfare problems.

Work carried out in other countries is taken into account when available and appropriate. In the case of EU countries, a wide-ranging review of research is summarised in a Scientific Veterinary Committee report on the Welfare of Intensively Kept Pigs, which was adopted on 30 September 1997. This is used to inform policy objectives wherever it is appropriate. Research contractors are also encouraged to seek EU funding in relevant areas but the time-frame for the availability of results is considered in relation to policy needs.

Participation by industry and other interested parties is encouraged and where appropriate research may also be funded by e.g. SEERAD and BBSRC, but there remains a need for Defra to research the welfare needs of farm animals and ways in which these can be met in commercially viable systems.

3. OBJECTIVES

(a) State policy objectives which should be:

- achievable;
- testable (i.e. in a form capable of verification, preferably in a quantitative fashion); and
- time-bound (i.e. to be reached at a pre-determined date).

The general policy objective is to improve the welfare of pigs on-farm. Specifically the main policy objectives to be addressed by the current research programme are:

1. Investigate the nature and causes of aggression and other vices in pigs and develop methods to reduce their incidence;
2. Continue research to develop possible alternatives to the farrowing crate which would allow a greater level of freedom for the sow without compromising the welfare of piglets;
3. Further investigation of the factors necessary in the environment of growing pigs to enhance welfare; and
4. Develop a greater understanding of the causes of welfare issues in pigs with a view to reducing their occurrence in the UK pig herd.

3. OBJECTIVES continued

(b) State scientific objectives which must be achievable, verifiable and timebound. Science staff must decide where research can contribute to the achievement of policy objectives and agree with Policy DGs scientific objectives appropriate to meet the policy need. **They should also cover the key deliverables against which the success of the programme will be judged at review**:

- anticipated contribution to Defra policy development (i.e. to inform change of policy);
- other outputs, such as new or refined industry practices/standards;

Planned processes for Knowledge Transfer and Innovation and communication to the public.

1. Aggressive and injurious behaviour
   - To investigate ways of manipulating their environment to reduce aggression in newly weaned sows in mixing pens; and
   - To study why some animals express harmful social behaviours whereas others, in the same environment, do not.

2. The farrowing environment:
   - To examine the social dynamics of free farrowing/community lactation systems; and
   - To identify environmental enrichment methods for the farrowing environment.

3. Housing systems for growing pigs
   - To assess and evaluate ways in which young and subordinate pigs obtain access to resources including environmental enrichment;
   - To examine the effect of very large group sizes (greater than 100) on pig behaviour and welfare in both fattening and breeding pigs, including the effects of limiting resources on behaviour and welfare in large groups (e.g. feed and water, enrichment) in the different systems used; and
   - To identify a hierarchy of preferred characteristics of long term and short term enrichment devices for pigs, and to investigate the mechanisms responsible for the modification of behaviour towards such devices.

4. General pig welfare
- To assess limb conformation in relation to the presence and severity of leg pathologies;
- To identify whether tail docking results in chronic pain; and
- To ascertain the extent to which mutilations continue to be carried out in the UK since the introduction of the Welfare of Farmed Animals (England) Regulations 2003 and the revised Code of Recommendations for the Welfare of Livestock: Pigs. To assess the measures taken to reduce or remove the need for such mutilations to be carried out.

4. APPRAISAL

Explain your plans to ensure that you obtain fit for purpose research under this programme and value for money for the taxpayer. In particular, how will you ensure expert external input and challenge (e.g, through advice from expert groups/committees; peer review of project proposals; and level of competitively let contracts) are taken into account.

To ensure fit for purpose research, that provides value for money, R&D will be subject to external peer review both at the commissioning stage of the research procurement process and when projects are completed.

5. MONITORING

Please explain how you plan to monitor progress against programme and project objectives, in particular any key programme review points.

Progress will be monitored on an annual basis via the appraisal of annual reports and through attendance at individual project monitoring visits.

6. EVALUATION

Please specify how you intend to evaluate the outputs of the programme against its objectives, ensuring appropriate external input and challenge. This should also include an assessment of the future of the programme.

The whole On-farm Pig Welfare R&D Programme will be reviewed on a four to five year basis where the purpose will be:

v. To examine progress to date against Defra's stated policy and scientific objectives;
vi. To place the pig welfare research programme in the context of the whole of Defra's welfare research programme;
vii. To evaluate the role of the Defra programme in the context of research programmes of other sponsors, within and outside of Government; and
viii. To determine the direction and priorities for future research.

This research programme will be reviewed by (insert year) 2008

Approved by | Date

Name | Unit

Animal Welfare at Slaughter SID1

General enquiries on this form should be made to:
Defra, Science Directorate, Management Support and Finance Team
Telephone No. 020 7238 1612

SID 1 ROAME Statement

General notes

1. **The first stage of the ROAME (Rationale, Objectives, Appraisal, Monitoring, Evaluation) process requires a clear and succinct statement of the commissioning organisation's rationale for funding research. The SID 1 provides the customer's reasons for requiring research in a particular policy area and the policy and scientific objectives of that research. It forms the basis for all research proposals and is vital to ensure overall direction and ultimate evaluation of the research programme.**
2. The level at which the SID 1 statement is set is for the policy customer to decide. Each Programme should focus on one or more related policy objectives and the related scientific objective(s). However, policy customers may wish to set SID 1 statements at a higher level, e.g. where a large research programme addresses similar policy and scientific objectives.
3. The SID 1 is an important working document, which stems from and supports Defra's Evidence and Innovation Strategy. All SID 1s will be published and used to inform contractors and other funders of research of the rationale and key policy drivers underpinning Defra's research programmes.
4. A SID 1 **must** be produced for each research programme. It should be **approved at Director level, or at a lower level only through formal delegation of authority.** Science Units within Defra are responsible for ensuring that all research is commissioned and contracted under a SID 1 which complies with this guidance. A SID 1 should typically be no more than 5-6 pages long, although this can vary depending on the complexity and size of the programmes covered.
5. **SID 1s should be reviewed every 3-5 years. If new or revised forms are produced (for example, following a review), these should annex the original form to provide a historical record of programme change. Please refer to the Science Handbook for further guidance.**
6. **This form is in Word format and the boxes may be expanded, or reduced, as appropriate.**

1. Area of Policy/Research

Please state the title of the proposed research programme – including FPS Programme Code Assessment Unit or Sub-Programme Code.

Animal Welfare at Slaughter (PI: 030 MH01)

2. RATIONALE for Defra Funding

(a) Describe the policy problems to be addressed by this research.

Ministers are committed to encouraging high standards of animal welfare on-farm, in markets, during transport and at slaughter, wherever possible on a EU basis. This requires a sound scientific basis to support negotiation and implementation of EU legislation and subsequent enforcement, guidance and education. This programme seeks to address concerns about the welfare of animals at the time of slaughter or killing and to minimise the risk of stress or suffering.

The main objective is to provide a sound scientific base for negotiation of changes in EU Directive 93/119/EC on the welfare of animals at the time of slaughter or killing, implement these changes in national legislation and issue statutory codes of practice and other guidance.

(b) Explain how the research will support Defra Strategic Priorities, PSA targets and Evidence and Innovation Strategy.

This R&D programme will directly support the departmental Strategic Outcome, "Sustainable farming and food, including animal health and welfare," and will directly contribute to the delivery of PSA9, "To improve the health and welfare of kept animals and protect society from the impact of animal diseases, through sharing management of risk with the industry."

(c) Explain how this research will be co-ordinated with other Defra science and policy activity. This should cover co-ordination with other Defra research programmes, including economic, social science and the Horizon Scanning Programme and other Defra science activity, e.g. monitoring and surveillance programmes.

The Animal Welfare at Slaughter R&D Programme will be co-ordinated across other Defra policy areas where there are direct contributions to that particular area e.g. Sustainable Food and Farming.

(d) Explain how the proposed programme will align with the work of other Departments and funders of research. This should cover UK funders and, where possible or appropriate, funders in other countries or international bodies; whether co-ordination is needed or foreseen and, if so, how and when such co-ordination or collaboration should take place.

The Animal Welfare at Slaughter R&D Programme will be co-ordinated with other funders of R&D in this area to ensure complementary research is undertaken that does not duplicate effort e.g. the BBSRC, SEERAD, FSA and HSA.

(e) Provide a brief summary as to why Defra should fund the proposed research. You are required to justify the use of Defra resources for the proposed project. In your justification you should clearly set out that no other existing or current research or body of information meets the policy needs; why R&D is the most suitable method to provide evidence; and the intended outcome of the programme.

Given the nature of the issues under consideration, and the Department's need for up to date and relevant information, there do not appear to be any alternative methods of achieving these objectives.

Other options for achieving improvements in the welfare of animals at slaughter are currently being used, such as legislation, codes of practice and advice to abattoirs. These are complimentary to the R&D programme; which is needed to provide the underpinning basis for decisions on the use of these instruments.

Work carried out in other countries is taken into account when available and appropriate. Research contractors are also encouraged to seek EU funding in relevant areas but the time-frame for the availability of results is considered in relation to policy needs.

Since there is little profit to be had in animal welfare research there is little concerted R&D effort within the industry, particularly the red meat sector, and the outputs from this work is usually commercially confidential and mainly linked to meat quality. As a result little data is published. That said however, participation by industry and other interested parties is encouraged. Animal welfare organisations support a limited amount of research each year.

3. OBJECTIVES

(a) State policy objectives which should be:

- achievable;
- testable (i.e. in a form capable of verification, preferably in a quantitative fashion); and
- time-bound (i.e. to be reached at a pre-determined date).

The main objective is to provide a sound scientific base to assist with negotiations on the welfare of animals at the time of slaughter or killing, implement these changes in national legislation and issue statutory codes of practice and other guidance.

(a) Pre-slaughter handling
Handling systems should make use, as far as possible, of animals' natural behaviour to minimise stress in lairage, races and conveyors. This is particularly important in controlled atmosphere systems where a constant input of animals is required and in other systems where animals are presented in groups for stunning**.**

(b) Novel or alternative systems
Novel or alternative systems are required which improve welfare and reduce the potential for stress. Development of predictive tools might help to assess new systems.

(c) Monitoring and enforcement
Equipment design and efficacy should be regularly assessed. Abattoir practices should be surveyed. Consideration should be given to enforcement tools.

(d) Stunning systems
Further work is needed to establish a scientific basis for the optimum parameters for electrical stunning, and alternative stunning systems, in all species.

3. OBJECTIVES continued

(b) State scientific objectives which must be achievable, verifiable and timebound.
Science staff must decide where research can contribute to the achievement of policy objectives and agree with Policy DGs scientific objectives appropriate to meet the policy need. **They should also cover the key deliverables against which the success of the programme will be judged at review**:

- anticipated contribution to Defra policy development (i.e. to inform change of policy);
- other outputs, such as new or refined industry practices/standards;
- planned processes for Knowledge Transfer and Innovation and communication to the public.

(a) Pre-slaughter handling

- To determine the affect of pre-slaughter handling on stun efficacy.
- To investigate alternative methods of presenting and handling live birds in a slaughter line.
- To investigate whether the sight of the slaughter of a conspecific is distressing to an animal species where this information is currently absent eg horses.
- To assess whether automatic conveyors are stressful to pigs or sheep.

(b) Novel or alternative systems

- To develop alternative stun and/or stun-kill systems for different farm animal species eg electrical stun-kill systems for cattle, novel gaseous systems for pigs and poultry.
- To develop novel methods for the casualty and/or emergency slaughter of poultry.
- To develop methods to stun-kill very young (red meat) animals.

(c) Monitoring & enforcement

- To develop rigorous, robust and validated indicators of animal welfare to allow the determination of the point of insensibility.
- To translate research tools into rigorous, robust and validated indicators of animal welfare that may be applied at the slaughterhouse.

(d) Stunning

- To investigate the physiological basis for electrical stunning in turkeys; examining the development of insensibility and the affect of current, waveform and frequency.

4. APPRAISAL

Explain your plans to ensure that you obtain fit for purpose research under this programme and value for money for the taxpayer. In particular, how will you ensure expert external input and challenge (e.g, through advice from expert groups/committees; peer review of project proposals; and level of competitively let contracts) are taken into account.

To ensure fit for purpose research that provides value for money, R&D will be subject to external peer review both at the commissioning stage of the research procurement process and when projects are completed.

5. MONITORING

Please explain how you plan to monitor progress against programme and project objectives, in particular any key programme review points.

Progress will be monitored on an annual basis via the appraisal of annual reports and through attendance at individual project monitoring visits.

6. EVALUATION

Please specify how you intend to evaluate the outputs of the programme against its objectives, ensuring appropriate external input and challenge. This should also include an assessment of the future of the programme.

The whole Animal Welfare at Slaughter R&D Programme will be reviewed on a four to five year basis where the purpose will be:

- To examine progress to date against Defra's stated policy and scientific objectives;
- To place the pig welfare research programme in the context of the whole of Defra's welfare research programme;
- To evaluate the role of the Defra programme in the context of research programmes of other sponsors, within and outside of Government; and
- To determine the direction and priorities for future research.

This research programme will be reviewed by (insert year)	2009

Approved by		Date	
Name		Unit	

On-Farm Ruminant Welfare SID1

General enquiries on this form should be made to:

Defra, Science Directorate, Management Support and Finance Team
Telephone No. 020 7238 1612

Department for Environment Food and Rural Affairs

SID 1 ROAME Statement

General notes

1. **The first stage of the ROAME (Rationale, Objectives, Appraisal, Monitoring, Evaluation) process requires a clear and succinct statement of the commissioning organisation's rationale for funding research. The SID 1 provides the customer's reasons for requiring research in a particular policy area and the policy and scientific objectives of that research. It forms the basis for all research proposals and is vital to ensure overall direction and ultimate evaluation of the research programme.**
2. The level at which the SID 1 statement is set is for the policy customer to decide. Each Programme should focus on one or more related policy objectives and the related scientific objective(s). However, policy customers may wish to set SID 1 statements at a higher level, e.g. where a large research programme addresses similar policy and scientific objectives.
3. The SID 1 is an important working document, which stems from and supports Defra's Evidence and Innovation Strategy. All SID 1s will be published and used to inform contractors and other funders of research of the rationale and key policy drivers underpinning Defra's research programmes.
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5. **SID 1s should be reviewed every 3-5 years. If new or revised forms are produced (for example, following a review), these should annex the original form to provide a historical record of programme change. Please refer to the Science Handbook for further guidance.**
6. **This form is in Word format and the boxes may be expanded, or reduced, as appropriate.**

1. Area of Policy/Research

Please state the title of the proposed research programme – including FPS Programme Code Assessment Unit or Sub-Programme Code.

On-farm Ruminant Welfare R&D Programme (PI: 030 AW10)

2. RATIONALE for Defra Funding

(a) Describe the policy problems to be addressed by this research.

Ministers are committed to improving standards of animal welfare on-farm, during transport, at markets, and at slaughter in the UK and wherever possible, on a European Community basis. Defra commissions R&D in support of this aim to ensure that policy initiatives, changes to welfare legislation and welfare codes are soundly based and to support the UK's position in Community negotiations.

In its Report on Animal Welfare R&D, published in 1993, the Farm Animal Welfare Council (FAWC) made a number of recommendations for research to improve the welfare of cattle and sheep. The Government has accepted these recommendations. Further recommendations have been made in the FAWC Report on the Welfare of Sheep (1994), the FAWC Report on the Welfare of Dairy Cattle (1997), and subsequent annual reports from the Committee.

(b) Explain how the research will support Defra Strategic Priorities, PSA targets and Evidence and Innovation Strategy.

This R&D programme will directly support the departmental Strategic Outcome, "Sustainable farming and food, including animal health and welfare," and will directly contribute to the delivery of PSA9, "To improve the health and welfare of kept animals and protect society from the impact of animal diseases, through sharing management of risk with the industry."

(c) Explain how this research will be co-ordinated with other Defra science and policy activity. This should cover co-ordination with other Defra research programmes, including economic, social science and the Horizon Scanning Programme and other Defra science activity, e.g. monitoring and surveillance programmes.

The On-farm Ruminant Welfare R&D Programme will be co-ordinated across other Defra policy areas where there are direct contributions to that particular area e.g. Sustainable Food and Farming, Environment.

(d) Explain how the proposed programme will align with the work of other Departments and funders of research. This should cover UK funders and, where possible or appropriate, funders in other countries or international bodies; whether co-ordination is needed or foreseen and, if so, how and when such co-ordination or collaboration should take place.

The On-farm Ruminant Welfare R&D Programme will be co-ordinated with other funders of R&D in this area to ensure complementary research is undertaken that does not duplicate effort eg the BBSRC, SEERAD, MDC.

(e) Provide a brief summary as to why Defra should fund the proposed research. You are required to justify the use of Defra resources for the proposed project. In your justification you should clearly set out that no other existing or current research or body of information meets the policy needs; why R&D is the most suitable method to provide evidence; and the intended outcome of the programme.

Given the nature of the issues under consideration, there do not appear to be any alternative methods for addressing the policy objectives. Policy may also be informed by the output of projects in relevant research programmes of the BBSRC, SEERAD and MDC.

Other options for achieving improvements in the welfare of ruminants are used, such as legislation, codes of recommendations and advice to farmers, through for example, ADAS campaigns. These are complimentary to the R&D programme, which is needed to provide the underpinning basis for decisions on the use of these instruments. New research is only commissioned where knowledge is lacking to provide the best solutions to welfare problems.

Output from the EU and global research is maintained both by Defra and its research contractors. This is used wherever it is appropriate to inform policy objectives. Research contractors are encouraged to seek EU funding in relevant areas but the time-frame for the availability of results is considered in relation to policy needs.

3. OBJECTIVES

(a) State policy objectives which should be:

- achievable;
- testable (i.e. in a form capable of verification, preferably in a quantitative fashion); and
- time-bound (i.e. to be reached at a pre-determined date).

The policy objective is to improve the on-farm welfare of ruminants. Priorities are to:

1. Ensure that husbandry practices (e.g. cattle housing) and interventions (e.g. castration, disbudding) are consistent with best available knowledge on welfare requirements for the species;
2. Reduce the incidence of lameness in dairy cattle (including digital dermatitis) and sheep; and
3. Reduce the incidence of disease conditions (including endemic disease) which give rise to welfare concerns and are of economic significance in sheep and cattle (e.g. foot rot and Contagious Ovine Digital Dermatitis (CODD) in sheep).

3. OBJECTIVES continued

(b) State scientific objectives which must be achievable, verifiable and timebound. Science staff must decide where research can contribute to the achievement of policy objectives and agree with Policy DGs scientific objectives appropriate to meet the policy need. **They should also cover the key deliverables against which the success of the programme will be judged at review**:

- anticipated contribution to Defra policy development (i.e. to inform change of policy);
- other outputs, such as new or refined industry practices/standards;
- planned processes for Knowledge Transfer and Innovation and communication to the public.

1. Husbandry practices
   - Studies to investigate the welfare of dairy cows in high versus low production systems.
   - Studies to investigate the effects of social structure on the welfare of dairy cows kept in different production systems.
   - Studies that examine the interaction between genetics, environment, health, welfare and productivity of the farmed dairy cow.
   - Studies that explore the sustainability of different breeds of cattle in organic dairy systems.
   - Studies that examine the control of parasites of dairy cattle kept in organic systems.
   - The relationship between energy balance, life-time production and longevity of the modern dairy cow.

2. Lameness in dairy cattle
   - Studies to investigate the pathogenesis, modes of transmission and methods of controlling digital dermatitis.
   - Studies to reliably and repeatably measure lameness, whilst preferably being able to identify its cause.
   - Studies that identify genetic markers of disease in cattle.

3.Disease conditions
   - Studies that investigate the economic cost of sheep lameness.
   - Studies to investigate the causes and control methods of sheep lameness e.g. the relationship between foot rot, inter-digital dermatitis and CODD.
   - Studies to assess the interaction between economics, husbandry and animal welfare in large, extensively managed sheep flocks, following CAP reform.

4. APPRAISAL

Explain your plans to ensure that you obtain fit for purpose research under this programme and value for money for the taxpayer. In particular, how will you ensure expert external input and challenge (e.g. through advice from expert groups/committees; peer review of project proposals; and level of competitively let contracts) are taken into account.

To ensure fit for purpose research, that provides value for money, R&D will be subject to external peer review both at the commissioning stage of the research procurement process and when projects are completed.

5. MONITORING

Please explain how you plan to monitor progress against programme and project objectives, in particular any key programme review points.

Progress will be monitored on an annual basis via the appraisal of annual reports and through attendance at individual project monitoring visits.

6. EVALUATION

Please specify how you intend to evaluate the outputs of the programme against its objectives, ensuring appropriate external input and challenge. This should also include an assessment of the future of the programme.

The whole On-farm Ruminant Welfare R&D Programme will be reviewed on a four to five year basis where the purpose will be:

- To examine progress to date against Defra's stated policy and scientific objectives;
- To place the pig welfare research programme in the context of the whole of Defra's welfare research programme;
- To evaluate the role of the Defra programme in the context of research programmes of other sponsors, within and outside of Government; and
- To determine the direction and priorities for future research.

This research programme will be reviewed by (insert year)	2010		
Approved by		Date	
Name		Unit	

Welfare of Animals During Handling and Transport ROAME

ROAME 2000 - 2004
Welfare of Animals during Handling and Transport

A.1 Summarise the policy problems to be addressed

Ministers are committed to improving standards of animal welfare on-farm, at slaughter, and during transport and at markets, wherever possible on a European Community basis. The transport and markets programme seeks improvements to ensure that the level of stress and physical damage to animals is minimised at all stages of handling between point of collection on the farm and the point of slaughter. A sound scientific base is required to underpin future policy and to facilitate future negotiations within the European Community, the Council of Europe and other international fora.

A.2 What are the policy objective(s) for which you are considering commissioning research?

Within the time-scale of the programme the objective is to generate sound scientific data to address the following areas relevant to Defra policy on welfare on handling and transport of animals by:

- informing negotiation and amendment of legislation; and
- providing practical advice to be used by transporters and enforcers of animal welfare legislation.

(a) Standards for Vehicle Design

To establish which factors influence the micro-climate within animal transport vehicles. The programme must establish methods of controlling these factors in order to maintain an acceptable micro-climate within the vehicle from the time when the first animal is loaded until the last animal is unloaded.

(b) Vehicle Environment Monitoring Methods

To develop methods for the remote monitoring of the micro-climate of animal transport vehicles. This will provide more convenient and practical alternatives to existing manual routine checking on vehicles.

(c) Livestock Monitoring Techniques

To establish non-invasive techniques for monitoring the physiological responses of livestock so moving away from the use of invasive methods.

(d) Space Allowances for Animals on Vehicles

To further examine the effects of differing space allowances on livestock. A method of assessing space allowances in a practical situation must be established.

(e) Influence of Human Behaviour on Livestock

To assess the effect of human behaviour, driving events and handling on animals in transit and while loading and unloading.

(f) Impact of Marketing Animals

To identify the impact of the whole process of transport from farm, time in markets and onward travel. This must identify the impact of individual stages of the marketing process and their cumulative effect.

A.3 What are the scientific objectives of the proposed research programme?

The scientific objectives are:

- To maintain an up-to-date knowledge of the work carried out in the animal transport sector, particularly in Europe, in order to ensure that work commissioned is complementary to work already in the public domain.

- To ensure, wherever possible, that technology transfer of applied science takes place so that the welfare of animals in transport is improved.

Objectives in specific areas are:

(a) Standards for Vehicle Design

- To establish the effect of long distance road transport in hot weather on livestock. To incorporate the data obtained from such studies into a mathematical model to enable predictive guidance on ventilation requirements for livestock on such journeys.

- To develop and apply physiological stress modelling to determine the acceptable ranges and limits for individual stresses, and their combinations, during the transport process. This will allow the definition of the optimum transport environment for each species and consequently inform on ways in which to alleviate these stressors.

- To understand and alleviate the stressors associated with animal transport in small passively ventilated vehicles.

(b) Vehicle Environment Monitoring Methods

- To validate the use of remote surface temperature measurement, as an alternative to direct air temperature measurement, on stationary livestock vehicles to facilitate the routine checking of pen temperatures on vehicles.

(c) Livestock Monitoring Techniques

- To examine the relationships between skin temperature and deep body temperature over a wide range of thermal loads in order to create predictive models which could be used in conjunction with a remote non-invasive monitoring system.

- To develop, and apply, telemetry devices that allow the continuous and remote measurement of key physiological parameters associated with animal stress.

(d) Space Allowances for Animals on Vehicles

- To study the effect of space allowance on livestock and provide a portfolio of 'standard' photographs demonstrating the range of commercial stocking densities for each of the main livestock species.

- To evaluate a number of possible methods of estimating space allowance of livestock in terms of accuracy, consistency and ease of use, in order to identify a technique which could be used in the field to visually assess the stocking density of sheep whilst on board a transport vehicle.

- To examine the relationship between vehicle design, space allowance and head room of animals in transport vehicles.

(e) Influence of Human Behaviour on Livestock

- To determine the relationship between driver behaviour: the postural stability of sheep; orientation of the animal in relation to the direction of travel; and animal-animal interactions.

- To assess and quantify the occupational stressors that livestock haulage drivers are subject to when driving, loading and unloading animals.

(f) Impact of Marketing Animals

- To identify points of potential stress in the marketing process that animals encounter in order to identify ways to alleviate these stressors.

A.4 Describe any alternative research means of fulfilling the Department's policy objective(s). Have these alternatives been rejected and, if so, why?

Given the nature of the issues under consideration, there do not appear to be any alternative methods of addressing the policy objectives.

A.5 Are there non-research ways of achieving these objectives? If so, why is R&D considered necessary?

No. Any guidance needs to have a sound scientific basis. Scientific knowledge of the precise nature of the problem is required to enable welfare improvements.

A.6 It may be possible to get the research result(s) by buying in the information from other countries or by participating in internationally funded and organised research. Have these alternatives been considered, have they been rejected and, if so, why?

There is limited information available from work conducted in other countries. This is being reviewed however, and we are assisting one of our contractors in a collaborative research project at a Spanish Institute. Defra's development of an EU Animal Welfare web-based forum will improve our awareness of other on-going work, including collaborative work.

A.7 Why should DEFRA fund the research rather than private industry or other public bodies?

Defra cannot fulfil its policy objectives without the increased knowledge which this research will provide. Research also enables Defra to provide training aids for end users such as a training video for drivers and information fact sheets for livestock hauliers.

Industry participation in the research will be encouraged wherever possible. However, it is unlikely that sufficient funding could be made available from the many small businesses that form the major part of the livestock transport industry.

Annex 2: Index of Projects Under Review

On-Farm Poultry Welfare Project List

Project Code	Title	Start date	End date	Contractor(s)	Cost (£)
AW1137	Foot pad dermatitis & hock burn in broilers: risk factors, aetiology & welfare consequences	01/09/06	28/02/10	University of Glasgow	565,806
AW1138	Development of a vaccine to control the poultry red mite & improve laying hen welfare.	01/10/06	30/09/09	Moredun Research Institute & SAC Commercial Ltd	526,986
AW1135	Further development of a method for objective & reliable assessment of broiler leg health under commercial conditions.	01/05/05	01/09/07	SAC Commercial Ltd	194,211
AW1301	To study the effects of the application of bits & spectacles in game birds.	01/06/05	30/11/07	GWCT	341,362
AW1136	Non-chemical control of Red Mite in laying hen housing systems (MITEeHEN)	01/09/06	31/08/08	University of Newcastle Upon Tyne	250,561
AW1139	Chronic neurophysiological and anatomical changes associated with infra-red beak treatment	01/04/08	31/03/09	University of Glasgow	39,200
AW1141	Quantifying the subjective state of feed restricted broiler chickens using behavioural and neurochemical measures	01/07/09	30/09/12	Roslin Institute, Edinburgh (BBSRC), SAC Commercial Ltd, and University of Newcastle Upon Tyne	706,792
AW1142	The impact of keel bone fractures on the welfare of laying hens.	01/04/09	31/03/12	University of Bristol	431,317
AW1143	Study to assess the subjective experience, including pain, of broiler chickens with different gait scores	01/04/09	31/03/11	SAC Commercial Ltd	348,933
AW0233	Study to assess the welfare of ducks housed in systems currently used in the UK.	01/10/04	30/09/07	University of Oxford	294,027
AW0234	Detection, causation and potential alleviation of bone damage in laying	01/09/04	31/08/08	University of Bristol	435,592

	hens housed in non-cage systems.				
AW1132	A comparative study to assess the welfare of laying hens in current housing systems.	01/09/04	30/11/07	University of Bristol	295,265
AW1134	The influence of rearing environment on propensity for injurious pecking in laying hens.	01/10/05	30/09/08	University of Oxford	395,349
AW0235	A study to compare the health and welfare of laying hens in different types of enriched cage.	01/05/05	30/09/08	SAC Commercial Ltd.	346,171
AW0236	Estimating non-market benefits of reduced stocking density and other welfare increasing measures for meat chickens.	01/06/05	30/09/05	SAC Commercial Ltd.	61,460
AW1133	Welfare implications of changes in production systems for laying hens - LayWel.	01/01/04	31/12/05	ADAS UK Ltd	35,679
LK0660	Effects of nutrition and UV lighting on broiler bone and leg abnormalities (broiler bones)	01/04/04	31/08/07	Roslin Institute	986,439

On-Farm Pig Welfare Project List

Project Code	Title	Start date	End date	Contractor (s)	Cost (£)
AW0132	Qualitative assessment of behaviour as a method for the integration of welfare measurements.	01/10/01	30/04/05	SAC	168,034
AW0133	An epidemiological study of risk factors associated with pre-weaning mortality on commercial pig farms	01/08/02	30/06/05	University of Bristol	223,415
AW0134	Identifying the Genetic Causes of Sow Aggression Towards Their Offspring	01/05/02	31/03/07	University of Cambridge	506,520
AW0141	A comprehensive search to identify allelic variants & halplotypes associated with increased risk of the maternal aggression phenotype in sows	01/10/07	30/09/10	University of Cambridge	382,236
AW0143	Re-designing the farrowing environment from first principles to optimise animal welfare and economic performance.	01/04/08	31/03/11	University of Newcastle	693,206

AW0130	Welfare of finishing pigs under different management systems	01/10/01	30/06/05	University of Newcastle	205,134
AW0135	Impact of flooring on the health and welfare of pigs	01/07/03	30/06/06	University of Warwick	492,218
AW0137	A review of environmental enrichment for pigs health and welfare of pigs	01/08/04	28/02/05	ADAS UK Ltd	19,347
LS3103	Genetic selection for improved pre-weaning survival of piglets	01/10/03	30/09/07	University of Newcastle & SAC	276,212
AW0138	The effects of different weaning ages on the welfare of gilts and their piglets	01/06/04	30/11/05	ADAS	98,000

On-Farm Fish Welfare Project List

Project Code	Title	Start date	End date	Contractor(s)	Cost (£)
AW1204	Rainbow trout fin erosion - epidemiological analysis of prevalence, development, risk factors and effects on welfare	01/04/04	31/10/08	CEFAS	298,721
AW1205	The interaction between water quality and welfare in farmed rainbow trout	01/04/04	31/03/08	Universities of Stirling & Bristol	295,209
AW1206	Fish welfare & health in sustainable aquaculture	01/10/05	30/09/08	CEFAS	194,528
AW1208	Development of practical on-farm Cod welfare indices	01/03/06	02/07/09	Aquatonics	40,000 from Defra

Other Welfare Project List

Project Code	Title	Start date	End date	Contractor(s)	Cost (£)
AW0509	Early environment effects on animal welfare, health and productivity	01/10/09	30/09/12	SAC	456,005
AW0510	Does membership of a Farm Assurance Scheme affect compliance with Animal Welfare Legislation and Codes	17/04/09	12/07/09	University of Warwick	55,547

Companion Animal Welfare Project List

Project Code	Title	Start date	End date	Contractor(s)	Cost (£)
AW1402	Studies to assess the effect of pet training aids, specifically remote static pulse systems, on the welfare of domestic dogs	01/09/07	28/02/10	University of Lincoln	469,000
AW1404	A study to assess how to promote a duty of care to animals in young people	01/10/08	30/09/11	SAC	309,206
AW1405	Meta analytical study to investigate the risk factors for aggressive dog-human interactions	01/07/09	30/11/10	University of Liverpool	76,279

Welfare at Slaughter Project List

Project Code	Title	Start date	End date	Contractor(s)	Cost (£)
MH0128	Novel and Humane gaseous killing methods for pigs	01/05/05	30/04/10	University of Bristol	677,182
MH0140	Studies to examine the use of CBG's as a killing method for horned and unhorned sheep over 6 months of age	15/10/08	30/09/11	Royal Veterinary College	571,111
MH0143	Development of a humane method to kill poultry using gas	01/11/07	31/07/08	University of Glasgow	102,279
MH0144	Further study to develop a humane method to kill poultry using gas filled foam	01/08/09	31/01/10	University of Glasgow	75,049
MH0134	The development of a portable electrical stunner for turkeys	01/09/05	31/07/09	University of Bristol	238,491
MH0135	Containability & aversiveness of different gas mixtures used for the stunning of slaughter weight pigs	01/06/05	30/11/05	IRTA	35,658
MH0138	Reducing bird stress & discomfort on the poultry shackle line	01/09/06	31/03/09	Silsoe Livestock Systems Ltd	197,245
MH0141	Physiological monitoring of chickens during emergency killing	01/04/07	01/09/07	University of Glasgow	30,329

	(phase 1)				
MH0142	Physiological monitoring of chickens during emergency killing (phase 2)	01/07/07	31/12/07	University of Glasgow	46,779
LK0684	Avoiding the welfare/quality compromise : head only electrical stunning of poultry	01/06/2008	30/09/2009	Silsoe Livestock Systems	142,454
MH0133	A study to design a holding pen for group stunned animals	01/06/2005	30/11/2007	ADAS UK Ltd	195,073
MH0131	Metal surfaces for sheep and cattle	01/10/2005	30/09/2009	Royal Veterinary College	345,461
MH0132	Literature review & survey of conditions relevant to farm animal welfare in lairage	01/06/2006	31/05/2006	University of Bristol	51,083

On-Farm Ruminant Welfare Project List

Project Code	Title	Start date	End date	Contractor (s)	Cost (£)
AW1013	Alleviation of lameness in heifers: development of a lameness control plan	01/04/02	30/04/07	University of Bristol	492,732
AW1020	The welfare of dairy cows in organic milk production systems	01/10/03	30/10/06	SAC	299,999
AW1021	An intervention study to minimise footrot in sheep	01/04/05	30/09/07	University of Warwick	340,735
AW1024	A further study to assess the interaction between economics, husbandry and animal welfare in large, extensively managed sheep flocks	01/06/06	30/08/09	SAC	685,814
AW1023	Automated Early Lameness Detection in Dairy Cattle	01/04/06	31/12/09	Royal Veterinary College	586,352
AW1025	The development of Indicators of Sheep Welfare for an on-farm assessment	01/10/07	30/09/10	University of Liverpool	333,944
AW1026	A study to investigate the management and welfare of continuously housed dairy cows	01/07/08	30/06/11	SAC	650,392
LK0657	Identifying and Characterising ‘robust’ dairy cows	01/02/04	31/01/07	SAC	1,310,000

LK0668	Breeding for resistance to footrot : Combining molecular and phenotypic approaches	01/08/05	31/10/08	SAC	504,181

Welfare in Transport and Markets Project List

Project Code	Title	Start date	End date	Contractor(s)	Cost (£)
AW0820	Transcontinental road transport of breeder pigs – effects of hot climates	01/02/06	01/06/09	ADAS UK Ltd. & SAC	1,444,383
AW0938	A study to assess the effects of handling and transport on 'unbroken' ponies	01/08/05	01/08/08	University of Bristol	209,311
AW0940	Epidemiological study to identify acceptable maximum journey lengths for pigs whilst maintaining welfare	01/06/08	30/06/11	FERA	686,606
AW0934	A study to assess the effects of handling and transport on unbroken ponies	01/06/05	31/08/08	ADAS UK Ltd	244,405
AW0941	Study on end-of-lay hens to develop a method for assessment of fitness to travel and mitigation strategies to transport slightly sick or injured birds	01/04/09	31/03/12	University of Bristol	423,394
AW0942	Study to assess the impact of legislation to improve the welfare of animals during transport	01/04/09	31/03/10	Delta-innovation Ltd	112,965
AW0937	The development of methods to assess fatigue in sheep	01/06/05	31/01/08	University of Edinburgh	179,062

Annex 3: Welfare Research Funded by Other Organisations

Animal Welfare Research Funded by the Scottish Government (2005-2010).

Commission Reference	Project Title	Date Project Start	Date Project End	Contractor organisation	Total funding (£)	Summary
ADA00706	Improved venison quality for sustainable deer farming	01/04/2006	31/05/2009	ADAS	45500	The aim of this project is to identify suitable parameters for assessing venison quality and to investigate consumer perceptions and the effects of packaging and slaughter conditions on quality. This will provide robust guidelines for producing consistent high quality venison without compromising animal welfare and lead to a more sustainable future for deer farming.
ADA00806	Humane slaughter of water buffalo	01/12/2006	31/12/2007	ADAS	65000	Anecdotal evidence suggests that the use of a captive bolt gun in the poll position (with the correct charge) may be an acceptable method for stunning water buffalo but this method has not been evaluated in the UK. The aim of this project is to gather information from a variety of sources in order to inform SEERAD on the potential for using poll position captive bolt stunning as a humane method for the slaughter of water buffalo.
KTW02705	Health and welfare systems from research: KT co-ordination Scottish pig strategy manager	01/09/2005	31/08/2008	Quality Meat Scotland	60000	1. Maintain membership of Wholesome Pigs (Scotland) above 90% of Scottish herd and explore feasibility of linking with farm recording software and business benchmarking systems to provide producers with a single comprehensive Scottish Pig Industry Database. 2. Visit farms and liaise with unit vets in order to improve productivity. 3. Preparation and delivery of project to expand abattoir monitoring to identify reproductive and mycotoxin problems. 4. Develop protocols for the cost-effective monitoring and diagnosis of enteric disease and pig welfare on-farm. 5. Ensure smooth operation of ZAP Salmonella scheme in Scotland. 6. Review existing scientific papers on areas of specific interest and report findings to industry. 7. Manage contract with environmental consultants appointed to provide IPPC support to large producers. 8. Manage the QMS Pig Forum including preparation of agendas minutes proposals for approval project updates and liaison with

						Chairman and members. 9. Liaison with Scottish research institutes SEERADABRG and other funding organisations for pig research. 10. Organise on-going programme of communication with the pig sector in Scotland
MLU71600	Matching animal genotype to extensive production systems: implications for nutrition welfare and product quality.	01/04/2000	31/03/2006	Macaulay Land Use Research Institute	770000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
MLU93604	Effects of nutrient supply and composition during early development on appetite learning ability and dietary preferences of ruminants and associated underlying physiological mechanisms.	01/04/2004	31/03/2006	Macaulay Land Use Research Institute	380000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
MRI07602	Comparative studies of parapoxviruses that infect animals and man.	01/04/2002	31/03/2006	Moredun Research Institute	997000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
MRI84001	Diagnosis and control of caseous lymphadenitis in sheep.	01/01/2002	31/08/2006	Moredun Research Institute	285000	The findings suggest that the current use of autogenous vaccines in the UK may be of therapeutic use but that the use of foreign vaccines may be of limited use against CLA in the UK.
QDD00104	FAPRI - UK Partnership: model-based agricultural policy analysis for Northern Ireland England Scotland & Wales	01/07/2004	31/03/2007	Department of Agriculture and Rural Development, NI	82800	
QRV00107	Tail injury in dogs and its association with docking of tails in the UK	01/10/2007	01/10/2008	Royal Veterinary College	10000	

ROS00504	Effects of nutrition and UV lighting on broiler bone and leg abnormalities (broiler bones)	01/04/2004	31/03/2007	Roslin Institute	217000	
SAC29701	Qualitative assessment of behaviour as a method for the integration of welfare measurements.	01/04/2001	31/03/2006	Scottish Agricultural College	494000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC33102	Investigation of genetic and management strategies influencing lameness in dairy cattle.	01/04/2002	31/03/2006	Scottish Agricultural College	495000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC33202	Decision support tools to enhance farm animal health wellbeing and biosecurity.	01/04/2002	31/03/2006	Scottish Agricultural College	677000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC33402	The development of aggressiveness in pigs: Consistency and the effect of litter composition.	01/04/2002	31/03/2006	Scottish Agricultural College	590000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC34603	Meeting sustainability targets for hill sheep in integrated land use systems.	01/03/2003	31/03/2006	Scottish Agricultural College	206000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC34903	Development of methods to optimise design of woodchip corrals to minimise the pollution risk relative to other methods of overwintering livestock.	01/04/2003	31/03/2006	Scottish Agricultural College	212000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed

SAC35303	Genotype by system interactions for health and welfare related traits in dairy cattle.	01/04/2002	31/03/2006	Scottish Agricultural College	520000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC38704	Influence of prenatal nutrition on neonatal behavioural development.	01/04/2004	31/03/2006	Scottish Agricultural College	360000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC38804	Breeding for behavioural adaptation to sustainable systems of production.	01/04/2004	31/03/2006	Scottish Agricultural College	388000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC38904	Resource use in dairy cattle systems.	01/04/2004	31/03/2006	Scottish Agricultural College	445000	http://www.scotland.gov.uk/Topics/Research/projects/environment-biology-agri/completed
SAC39305	A molecular approach to breeding for resistance to footrot.	01/04/2005	31/10/2008	Scottish Agricultural College	120000	
SAC39405	Development of nutritional regimes for rearing organic laying stock	01/04/2005	31/03/2008	Scottish Agricultural College	72000	
SAC39507	Development of an acute phase protein index as an objective indicator of sub-clinic disease status in live pigs.	01/10/2007	01/11/2009	Scottish Agricultural College	129000	
SCL00404	Humane killing of poultry for disease control purposes: evaluation and development of whole-house methods.	17/01/2005	17/07/2006	SAC Commercial Ltd	155000	

SCL00705	Animal health & welfare management programme pilot evaluation of benchmarking options	01/11/2005	31/10/2008	SAC Commercial Ltd	47000
SCL00905	Endemic disease control in ruminants: decision making on costs and benefits to livestock business.	01/02/2006	30/06/2008	SAC Commercial Ltd	164000
SLS00105	Passive monitoring of sea lice	01/11/2005	30/04/2007	Silsoe Livestock Systems Ltd	63000
SLS00208	Avoiding the welfare-quality compromise: Head only electrical stunning of poultry	01/04/2008	30/06/2009	Silsoe Livestock Systems Ltd	26000
SRI00200	IPPC compliance in the UK poultry industry	01/10/2000	31/01/2005	Silsoe Research Institute	35250
UNC00103	Genetic selection for improved pre-weaning survival of piglets	01/10/2003	31/01/2008	University of Newcastle	146000
USA00607	Entanglement of minke whales in Scottish waters: an investigation into occurrence causes and mitigation	31/10/2007	31/07/2009	University of St Andrews	84000
Current Projects					
MLU95907	Developing methodology for measuring deer health and welfare.	01/01/2008	31/03/2010	Macaulay Land Use Research Institute	200000

MLU02406	Work package 2.4 - Livestock welfare	01/04/2006	31/03/2011	Macaulay Land Use Research Institute	213000	http://www.scotland.gov.uk/Topics/Research/About/EBAR/research-strategy/programmes/animals
SAC02406	Work package 2.4 - Livestock welfare	01/04/2006	31/03/2011	Scottish Agricultural College	5500000	http://www.scotland.gov.uk/Topics/Research/About/EBAR/research-strategy/programmes/animals
SAC39608	Improving welfare health and sustainability in dairy cows by expanding the selection objectives to include calving ease udder health and longevity (expanding indices)	01/04/2008	31/03/2011	Scottish Agricultural College	153000	

Animal Welfare Research Funded by the BBSRC (2005-2010).

Reference Number	Title	Award-holding Institute	Start Date	End Date	Total Value of Award
BB/E01870X/1	A molecular epidemiological approach to combating footrot, an endemic disease of sheep	University of Warwick	20070901	20110831	£916,100
BB/E017959/1	A molecular epidemiological approach to combating footrot, an endemic disease of sheep.	University of Bristol	20071001	20110930	£470,536
BB/G018553/1	A multivalent vaccine and single platform diagnostic for bacterial respiratory diseases of pigs	Imperial College London	20091106	20151105	£1,532,291
BB/G019274/1	A multivalent vaccine and single platform diagnostic for bacterial respiratory diseases of pigs	University of Cambridge	20091106	20151105	£2,303,325
BB/F019742/1	A tissue engineered corneal epithelium replacement for animal testing using human stem cells	University of Reading	20081001	20110930	£332,531
BB/G012717/1	Active and passive coping strategies: the periaqueductal grey to cerebellar link	University of Bristol	20090301	20130228	£822,592
BB/C518949/1	Advancing animal welfare science: welfare assessment and early life programming	University of Bristol	20051001	20100930	£1,904,537
BB/C518930/1	Advancing animal welfare science:welfare assessment and early life programming	Royal Veterinary College	20060103	20110102	£606,184
BB/F014147/1	Aggression in social animals: Effects of group size, resource holding potential and costs of fighting on the outcome of battles	University of Plymouth	20080501	20110430	£225,264
BBS/E/S/00000495	An experimental and mechanistic modelling study of spatial vision in the domestic fowl		20040401	20050531	
BBS/E/I/00001160	Animal susceptibility to infection and disease: do husbandry and welfare drive microbial colonisation and immune development?		20040601	20090531	
BBS/E/F/00042154	Animal susceptibility to infection and disease: do husbandry systems and welfare drive microbial colonisation and immune development		20050101	20090531	

S15950	Assessment of muscle nocicepter (pain) activity in myopathy susceptible fast-growing meat-type chickens	Roslin Institute (RI)	20020301	20050831	£195,528
S16054	Assessment of muscle nociceptor (pain) activity in myopathy susceptible fast-growing meat-type chickens	Keele University	20030201	20060131	£22,968
REI18478	Automatic monitoring and control of small mammals in large and complex spaces	University of Liverpool	20030722	20060421	£58,312
S13354	Behavioural and neural assessments of the use of mental imagery by sheep	Babraham Institute (BI)	20010102	20040301	£274,096
BB/C510559/1	Cognitive bases of competitive behaviour and information transfer in domestic pigs	University of St Andrews	20050701	20090228	£85,466
BB/C510316/1	Cognitive bases of competitive behaviour and information transfer in domestic pigs.	University of Bristol	20050701	20090131	£236,690
BB/H002782/1	Comparative biomechanics and pathology of mammalian feet	Royal Veterinary College	20091123	20121122	£433,077
BBS/E/F/00041826	Defra Studentship: Animal susceptibility to infection and disease: do husbandry systems and welfare drive microbial colonisation and immune development		20050101	20080930	
E17208	Development of a non-invasive technique of measuring nitric oxide bioactivity in large arteries in vivo	University of Reading	20021209	20041008	£108,427
E17208/2	Development of a non-invasive technique of measuring nitric oxide bioactivity in large arteries in vivo	Imperial College London	20041001	20070930	£226,281
BB/F01970X/1	Does pre-operative affective state influence the severity and duration of post-op pain in rats?	Newcastle University	20080701	20110630	£307,177
BBS/E/S/00000497	Effect of urine and chemical fixatives on the physical properties of hoof keratin		20040401	20050331	
BB/G000921/1	Evaluation of pain experience in domestic fowl: associations between clinical symptoms, biochemical markers and bird self-selection of analgesics	University of Bristol	20090601	20120531	£544,659
BB/G002630/1	Evaluation of pain experience in domestic fowl: associations between clinical symptoms, biochemical markers and bird self-selection of analgesics	University of Glasgow	20090601	20120531	£17,955

BBS/E/I/00000958	Foot-and-mouth disease virus: the molecular basis of tissue tropism and persistence		20020901	20050831	
S14400	Genetic markers for osteoporosis in laying hens	Roslin Institute (RI)	20010401	20040531	£289,432
BBS/E/R/00000660	Genetics of a behavioural vice: feather pecking and cannibalism in poultry		20010401	20050331	
BBS/E/D/05191132	Genetics of Complex Traits		20080801	20090731	
BB/H00114X/1	Honeybee population dynamics: Integrating the effects of factors within the hive and in the landscape	Rothamsted Research (RR)	20091101	20121031	£765,592
BB/D012708/1	Host acute stress responses and the regulation of C. jejuni virulence in the avian gut	University of Leicester	20061101	20081031	£134,052
BB/D013135/1	Host acute stress responses and the regulation of C. jejuni virulence in the avian gut	Institute of Food Research (IFR)	20070108	20100107	£142,087
BB/D013798/1	Host acute stress responses and the regulation of C. jejuni virulence in the avian gut	University of Bristol	20061101	20091031	£176,527
BBS/E/F/00042159	Host acute stress responses and the regulation of C. jejuni virulence in the avian gut		20070108	20100107	
BB/F009186/1	Identifying epitopes that induce antibody mediated protection against foot-and-mouth disease using reverse genetics	Institute for Animal Health (IAH)	20091207	20121206	£455,377
BBS/E/I/00001104	Improvement of FMD control by ethically acceptable methods based on scientifically validated assays and new knowledge on FMD vaccines and their impact		20040101	20081231	
BBS/E/I/00001195	Influence of neuroendocrine stress hormones on the carriage and virulence of zoonotic bacterial pathogens in farm animals		20050401	20100531	
BB/C518022/1	Influence of the neuroendocrine stress hormones on the carriage and virulence of zoonotic bacterial pathogens in farm animals	Institute for Animal Health (IAH)	20050401	20101031	£438,214
BB/C506272/1	Laboratory welfare of Xenopus	University of Bristol	20050201	20080131	£249,382

D16045	Metabolic and pathogenic mechanisms of loss in supportive capacity of bovine hooves at calving leading to lameness	University of Bristol	20020101	20050531	£282,148
BB/C503970/1	MUP knockout mice: implications for chemical communication and a generic research tool	Cardiff University	20050401	20080831	£292,558
S19811	Nociception in fish: electrophysiological and behaviour analysis	The University of Manchester	20040501	20060731	£19,095
S19809	Nociception in fish: electrophysiological and behavioural analysis	University of Liverpool	20040501	20060731	£95,761
BB/F015631/1	Opioid self-administration in the assessment of post-operative pain in rats	Newcastle University	20080901	20110228	£345,656
BB/C518957/1	Perinatal programming of stress response and nociceptive mechanisms and the welfare consequences	University of Edinburgh	20060101	20101231	£1,113,567
BB/C518965/1	Perinatal programming of stress response and nociceptive mechanisms and the welfare consequences	University of Glasgow	20060101	20101231	£419,966
BB/C518973/1	Perinatal programming of stress response and nociceptive mechanisms and the welfare consequences	Scottish Agricultural College	20060105	20110504	£1,025,169
BBS/E/R/00000692	Poultry Genetics		20050401	20090331	
BB/G012709/1	Production of welfare friendly" eggs - improving bone health and reducing bone breakage in laying hens using an omega-3 modified diet"	University of Bristol	20090601	20120531	£611,391
BB/F015623/1	Stereotypy and perseveration in captive European starlings: consequences for decision-making	Newcastle University	20080401	20110331	£366,905
S15384	The development of a composite objective validated scale for assessing pain in dairy cows	University of Glasgow	20020301	20051130	£257,908
BB/F020627/1	The European Xenopus Stock Centre: a bioinformatically integrated molecular and animal resource	University of Warwick	20081021	20111020	£407,763
D13812	The vision control of movement between perches in domestic fowl: assessment of factors affecting risk of injury	Heriot-Watt University	20010401	20040401	£177,244

BB/G00613X/1	To call or not to call: mechanisms underlying vocal production in chimpanzees	University of York	20090701	20120630	£293,943
BBS/E/R/00000336	Welfare assessment of gaseous stunning in poultry		20011201	20050630	
BB/C518922/1	Welfare of farm animals: environmental perception, cognition, interaction and management	Royal Veterinary College	20051001	20100930	£2,792,964

Animal Welfare Relevant Research Funded by the EC.

All research projects have to comply with current legislation on animal welfare. The two main directives are:

- Council Directive 86/609/EC on the approximation of laws, regulations and administrative provisions of the Member States regarding the
  protection of animals used for experimental and other scientific purposes
- Council Directive 98/58/EC concerning the protection of animals kept for farming purposes.

There is, of course, some species specific legislation which will be applicable in specific circumstances.

For a review of past projects, refer to the review of projects carried out in 2002 (*http://europa.eu.int/comm/research/quality-of-life/animalwelfare/seminars/index_en.html*).

Below, are listed projects since that review. Basically they fall into two categories:

- Projects with a specific welfare objective
- Projects with some other health objective but that are likely to have a significant impact in animal welfare.

In addition, most animal health projects (the full list being available as the list supplied to AHAW in EFSA) will have some welfare implications.

"Animal welfare" is referred to in the specific programme text of the 5th Thematic Priority (Food Quality and Safety) and also in area 1.4 of Scientific Support to Policy (*"New and more environment friendly production methods to improve animal health and welfare including research on animal diseases such as foot and mouth disease, swine fever and development of marker vaccines"*).

The three major specific welfare projects under FP6 are all coordinated through the Netherlands.

FP7

2 topics are published in the fourth call (FP7-KBBE-2010-4) of the work programme of Theme 2 "*Food, Agriculture and Fisheries, and Biotechnology". Deadline for applications is 14 January 2010.*

KBBE.2010.1.3-03: Development and integration of animal based welfare indicators in livestock species The project will aim at further developing, and refining existing results and assessment models and optimise ways to integrate them in the production chain. Moreover, the project will aim at extending and adapting the indicators and the strategies developed to other commercially

interesting species, at least in small ruminants (sheep and goats), in poultry species not covered yet (turkeys, ducks and geese) and in horses. Other terrestrial species like rabbits maybe considered. The project will ensure integration by linking together a wide range of stakeholders and stimulate science-society dialogue on welfare issues in farming through educational initiatives. Collaboration with the stakeholders' animal welfare platform being currently developed is encouraged.
.
Funding scheme: Collaborative Project (large scale integrating project).
Expected impact: Development of instruments supporting science-based legislation on animal welfare for different commercially interesting
species.

KBBE.2010.1.3-04: Improving integration in farm animal welfare research in an enlarged Europe The purpose of the project is to strengthen partnership between actors/institutions in the enlarged EU and Candidate countries. An improved integration is characterised by an increased level of collaboration and by a stronger European dimension in the proposed research. In particular the project will raise awareness of animal scientists, veterinarians, producers, and consumers about farm animal welfare and will identify the institutions dealing with welfare related problems, in order to include them in the "European Network of Reference Centres for the protection and welfare of animals", which could be possibly established in the future. The project will facilitate farm animal welfare research in an enlarged EU and Candidate countries, by establishing working contacts between animal welfare researchers including medium-term researcher exchanges, by supporting the exchange of information and by facilitating the involvement of scientists from the enlarged EU and Candidate countries in Community funded research on animal welfare. The project will identify critical gaps in implementation of the legislation and incorporation of animal welfare in educational programmes
Funding scheme: Coordination and Support Action (coordinating action)
Expected impact: The European added value lies in reinforcing collaboration and better exploiting research synergies across the enlarged EU and Candidate countries. By strengthening partnership and widening the participation through joint research in the area of animal welfare, full profit from the complementary expertises will be achieved This will strengthen the ERA and provide opportunities for capacity building and knowledge transfer between European research actors and increase transnational collaboration, while supporting EU and national policies.

Project Acronym	Project number	Title	Brief description
Projects concerned directly with Animal welfare (Framework Programme7)			
ECONWELFARE	KBBE-213095	Good animal welfare in a socioeconomic context: Project to promote insight on the impact for the animal, the production chain and society of upgrading animal welfare standards	Overall objective of the project is related to the policy instruments needed to achieve the aims of the Action Plan on Animal Welfare. At the end of the project we want to say what policy instruments are effective in the route towards higher animal welfare representing the concerns of civil society and in which competitiveness of the livestock industry is guaranteed. EAWP KBBE-212326 European Animal Welfare platform: adding welfare quality to food The present proposal contributes to
EAWP	KBBE-212326	European Animal Welfare platform: adding welfare quality to food	The present proposal contributes to the European Knowledge Based Bio-Economy (KBBE) by bringing together industry, research and other stakeholders to exploit new opportunities that address social and economic challenges. The proposed European Animal Welfare Platform (EAWP) will provide a forum for key stakeholders who are committed to taking up these challenges and striving to incorporate high welfare standards into their product chain. The stakeholders include key industrial partners, animal welfare organisations, and research institutions.

Project Acronym	Project number	Title	Brief Description
Projects concerned directly with animal welfare (Framework Programme 7)			
Animal welfare	ERA-NET 2003-SSA-510193	Towards sustainable integration of animal welfare in food production	This is a specific support action funded to help the development of an ERANET – i.e. a project to help funding bodies to coordinate their funding strategy. It aims to “bring national research strategies under a single umbrella”. http://cordis.europa.eu/coordination/projects.htm
Code-efabar	FOOD-CT-2003-506506	Code of good practice for farm animal breeding and reproduction	This is a specific support action developing a voluntary code of good practice for European livestock breeders (poultry, pigs, cattle and fish). Welfare is specifically considered within the (draft) code. www.sefabar.info/code-efabar/
Cloning in public	FOOD-CT-2004-514059	Farm animal cloning and the public – A project to facilitate a European public debate and to make recommendations on regulation and on	This specific support action aims to stimulate informed, public debate across Europe on farm animal cloning (somatic cell nuclear transfer) and to make recommendations on European regulation and on guidelines covering research on farm animal cloning and its subsequent applications. It considers cattle, sheep, goats, pigs, poultry and fish. www.sl.kvl.dk/cloninginpublic/

		guidelines for research and applications of farm animal cloning	

Project concerned significantly, but indirectly, with Animal Welfare (Framework Programme 6)			
PCVD	FOOD-CT-2005-513928	Studies on the epidemiology, early pathogenesis and control of Porcine Circovirus Diseases (PCVDs)	A new specific targeted research project examining the epidemiology and control of post-weaning multi-systemic wasting syndrome, which has significant welfare implications www.pcvd.org
SABRE	FOOD-CT-2006-016250	Cutting Edge Genomics for Sustainable Animal Breeding	Work Package 8 - Animal Well-Being Objectives - Determine gene expression responses to stress in pigs and poultry - Detect polymorphisms in candidate genes associated with stress responses http://www.sabre-eu.eu/
PIGCAS	SSPE-CT-2006-043969	Attitudes, practices and state of the art regarding piglet castration in Europe	Overall objective: To provide information on pig castration that will support EU policy. Specific objectives: - to collect information on the attitudes of relevant stakeholders; - to collect information on the practice of pig castration; - to evaluate research work and other information, in order to examine the various alternatives to surgical castration without anaesthesia and derive research priorities; - to integrate the collected information and evaluation in a report providing support for EU policy. http://w3.rennes.inra.fr/pigcas/participantsAL/participants.htm
DIALREL	SSPE-CT-2006-043075	Religious slaughter: improving knowledge and expertise through dialogue and debate on issue of welfare, legislation and socioeconomic aspects	The principle aims of the DIALREL project will be to explore the conditions for promoting the dialogue between interested parties and stakeholders and facilitating the adoption of good religious slaughter practices. The additional aim will be to review and propose a mechanism for implementation and monitoring of good practices. http://www.dialrel.eu

Projects Animal Welfare (Framework Programme 5)			
Lamecow	QLK5-CT-2002-00969	A multidisciplinary approach to the reduction in lameness and improvement in dairy cow welfare in the European Community	This is a shared cost research project, and it aims to reduce the incidence lameness in dairy cows through the analysis of 'best practice' in dairy enterprises in member states of the EU and through research on the biological mechanisms by which lameness is caused and may be minimised www.abdn.ac.uk/lamecow/
Turkey gait disorders	QLK5-CT-1999-01549	The roles of selection and husbandry in the development of locomotory dysfunction in turkeys	This is a shared cost research project, investigating the role of genetic selection for production traits on turkey gait and the musculoskeletal system. It relates clinical lameness to gait parameters and determine the existence, prevalence, severity and consequences of tibial dyschondroplasia in unselected turkey lines. It also evaluates the impact of various factors on the development of the condition. www.turkey-gait.ri.bbsrc.ac.uk/
SAFO	QLK5-CT-2002-02541	Sustaining Animal Health and Food Safety in Organic Farming	This is a concerted action on organic livestock production, though not specifically targeted at welfare, aims to identify important food quality characteristics linked to organic livestock products, and improve food quality, including food safety with regard to zoonoses, drug residues and the development of anti-microbial resistance in the food chain and includes aspects of food processing quality with regard to animal health and welfare in organic livestock production systems. www.safonetwork.org/
Mastitis resistance	QLK5-CT-2002-01186	New breeding tools for improving mastitis resistance in European dairy cattle	A shared cost research project, Mastitis resistance is fine mapping quantitative trait loci for mastitis resistance. Although not specifically welfare related, any improvement in the control of mastitis is likely to impact on dairy cattle health. http://portal.mtt.fi/portal/page?_pageid=38,115219&_dad=portal30&_schema=PORTAL30
BBP	QLK5-CT-2001-01732	Broiler breeding production – solving a paradox	A shared cost research project, adjusting, *inter alia*, feed regimes to the broiler chickens' needs, thus improving welfare. http://www.tours.inra.fr/sra/internet/resultats/actuels/broiler%20breeder%20paradox.htm
Quality pork genes	QLK5-CT-2001-01888	New gene tools to improve pig welfare and quality of pork	www.qualityporkgenes.com/
CATRA	QLK5-CT-1999-01507	Minimising stress inducing factors on cattle during handling and transport to	www.bt.slu.se/catra/

		improve animal welfare and meat quality	
SEFABAR	QLG7-CT-2000-01368	Sustainable European Farm Animal Reproduction and Selection	www.sefabar.org

Projects concerned Animal Welfare (Framework Programme 4)			
	FAIR-CT-1995-00075	Genetic solutions to health and welfare problems in poultry caused by painful skeletal disorders	http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=1918601&CFID=3815492&CFTOKEN=11547116
	FAIR-CCT-1997-03576	Feather pecking: solutions through understanding	See: http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=3937815&CFID=3815492&CFTOKEN=11547116
	FAIR-CT-1996-02049	Chain management of veal calf welfare	See: http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=2429202&CFID=3815492&CFTOKEN=11547116
	FAIR-CT-1998-03678	Consumer concerns about animal welfare	See: http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=3424558&CFID=3815492&CFTOKEN=11547116
	FAIR-CT-1998-04405	Network for animal health and welfare in organic agriculture	www.veeru.reading.ac.uk/organic/
	FAIR-CT-1998-04339	Embryonic origin of health and welfare: a new concept for understanding the susceptibility to diseases	See: http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=3939646&CFID=3815492&CFTOKEN=11547116
	BIO4-CT-1998-00055	The future developments in farm animal breeding and reproduction and their ethical, legal and consumer implications	See: http://dbs.cordis.lu/cordiscgi/srchidadb?ACTION=D&SESSION=3992003-3-19&DOC=1&TBL=EN_PROJ&RCN=EP_RCN:45601&CALLER=EISIMPLE_EN_PROJ

ELSA -P?CHE	FAIR-CT-1998-03821	Ethical, Legal and Social Aspects of Fisheries Management in Europe	http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=3424555&CFID=3828777&CFTOKEN=61001008
	FAIR-CT-1998-03372	Organic salmon production and consumption: ethics, consumer perceptions and regulation	http://ica.cordis.lu/search/index.cfm?fuseaction=proj.simpledocument&PJ_RCN=3424545&CFID=3828777&CFTOKEN=61001008

Annex 4: Review Panel and Attendees

Members of the Independent External Expert Review Panel

On-Farm Poultry Welfare

Professor Michael Appleby, World Society for the Protection of Animals

Professor Jörg Hartung, University of Veterinary Medicine, Hanover, GERMANY

Mr Stephen Lister, Crowshall Veterinary Services

Professor Werner Bessei, Unviersity of Hohenheim, Stuttgart, GERMANY

Mr Andrew Walker, ADAS

On-Farm Pig Welfare

Professor Colin Whittemore, University of Edinburgh

Mr Derek Armstrong, BPEX

Dr Dinand Ekkel, Professional Agricultural University, Dronten, THE NETHERLANDS

Mr Mike Varley, BPEX

Professor Don Broom, University of Cambridge

Professor Henry Buller, University of Exeter

On-Farm Fish Welfare

Professor Felicity Huntingford, University of Glasgow

Mr Tony Wall, Fish Vet Group

Companion Animals, Game Birds and Other Welfare

Dr Stephen Wickens, Universities Federation for Animal Welfare

Professor Henry Buller, University of Exeter

Dr Vicki Adams, Veterinary Epidemiologist

Welfare at Slaughter

Dr Bert Lambooij, University of Wageningen,THE NETHERLANDS

Professor Bo Algers, Swedish University of Agricultural Sciences, SWEDEN

Dr Marien Gerritzen, University of Wageningen, THE NETHERLANDS

Dr Martin von Wenzlawowicz, Beratungs- und Schulungs Institut, Schwarzenbek, GERMANY

On-Farm Ruminant Welfare

Dr Jon Huxley, University of Nottingham

Dr Phil Scott, The Royal (Dick) School of Veterinary Studies

Professor David Leaver, Professor Emeritus of the Royal Agricultural College

Professor Martin Upton, University of Reading

Mr Paul Roger, Veterinary Consultancy Services

Welfare at Transport and Markets

Mr Eddie Harper MBE, Road Haulage Association

Miriam Parker, Livestockwise Ltd.

Xavier Manteca, Universitat Autònoma de Barcelona, Barcelona, SPAIN

Defra Personnel

Food and Farming Group

Ms Sarah Hendry, Director

Threat Detection and Assessment

Mr Richard Drummond
Dr Peter Stevenson
Dr Alex Morrow
Dr Andrea Patterson
Mr John Tayleur

Animal Welfare Core Function

Mrs Sue Ellis
Dr Liz Kelly
Mr David Pritchard
Mr Phil Alder
Mr Mark Benneworth
Mrs Serena Cooke
Mr Andy Cooke
Mr Alan Dell
Dr Rebeca Garcia
Mr Alastair George
Mr Henry Hoppe
Mrs Terri Jeffs
Dr Emma Jones
Mrs Alison Maydom
Mr Rob Peters
Mr Andy Patnelli
Dr Sophia Rizvi
Mr Geoff Webdale

Represented Stakeholder and Research Organisations

ADAS UK Ltd
Animal Health
Aquatronics Ltd
Association of Independent Meat Suppliers
Aviagen
Biomathematics and Statistics Scotland Research Institution
Biotechnology and Biological Sciences Research Council
British Equine Veterinary Association
British Pig Executive
British Veterinary Poultry Association
Cargill Meats
Cattle and the Sheep Health and Welfare Sector Groups
Centre de Tecnologia de la Carn, SPAIN
Centre for Environment, Fisheries & Aquaculture Science
Compassion in World Farming
Delta Innovation Ltd
Department of Agriculture and Rural Development, NORTHERN IRELAND
Dogs Trust
English Beef & Lamb Executive
Euro Quality Lambs Ltd
GLW Feeds Ltd.
Hy-Line UK
Institiute of Aquaculture, University of Stirling
Livetech
Meat & Livestock Commission
Meat Hygiene Service
Ministry of Agriculture (FVST), DENMARK
Moredun Research Institute
National Pig Association
Poultry Xperience Ltd
Scottish Agricultural College
Silsoe Livestock Systems
Swiss Federal Veterinary Office
The British Egg Industry Council
The British Horse Society
The British Meat Processors Association
The British Pig Association
The British Poultry Council
The British Trout Association
The Electronic Collar Manufacturers' Association
The European Commission
The Farm Animal Welfare Council

The Federation of European Aquaculture Producers
The Food and Environment Research Agency
The Game and Wildlife Conservation Trust
The Horse Trust
The Humane Slaughter Association
The Kennel Club
The Macaulay Land Use Research Institute
The Muslim Council of Britain
The National Beef Association
The National Council of Shechita Boards
The National Farmers Union
The National Sheep Association
The Pig Veterinary Society
The Royal Association of British Dairy Farmers
The Royal College of Veterinary Surgeons
The Royal Society for the Prevention of Cruelty to Animals
The Royal Veterinary College
The Scottish Government
The Universities Federation for Animal Welfare
The Veterinary Public Health Association
The Welsh Assembly Government
University of Bristol
University of Cambridge
University of Glasgow
University of Lincoln
University of Liverpool
University of Newcastle
University of Oxford
University of Southampton
University of Warwick
World Horse Welfare
World Society for the Protection of Animals

Annex 5: Background Information

Terms of Reference for External Referees

On the basis of project information provided prior to the review meeting, as well as presentations and discussions at the review meeting, the terms of reference are:

- To consider the relevance and appropriateness of the research for funding by Defra
- To consider the soundness and appropriateness of the scientific approaches used and if they are being taken forward competently
- To examine the progress being made towards the objectives and the likelihood of success
- To consider if the findings from the research are based on sound evidence
- To consider the value for money of the research
- To consider for future scientific direction of the work
- To prepare a written report (i.e. assessment form for external referees) on the research area and to comment verbally at the review meeting in March 2010
- To confirm that any views expressed are entirely objective

External Referee Assessment Form

Review of Defra's Animal Welfare Research Programme, 8 – 11 March 2010

PROJECT CODE:	
APPRAISED BY:	
DATE:	

The scores and comments you provide will be used for a range of purposes, including (1) to inform Defra personnel; (2) for feed back to the project leader(s); and (3) for possible inclusion in the review output document (which will be published on the Defra website). Please note that while a list of the review panel members will be publicly available, with reference to points (2) and (3), the scores and comments provided by each referee will not be directly attributed to them, but rather referees will be referred to anonymously, i.e. Referee 1, Referee 2 etc. However, you should be aware that Departmental correspondence, including peer review processes, fall within the remit of regulations that permit greater access to information, including Freedom of Information, Environmental Information Regulations and the code of practise on access to government information. In the event that peer review information (such as the names of referees and the comments they made) should become the subject of such a request, the Department will seek to protect the interests of referees in the light of legal requirements.

Instructions:
Please assign a score and provide written comments where necessary. Scores should be based on a 1-5 scale, where:
1 = Unsatisfactory
2 = below requirements in some respects
3 = meets requirements
4 = above requirements
5 = Outstanding

1.	Relevance and appropriateness for R&D funding by Defra	
2.	Soundness and appropriateness of the scientific approaches and methods	
3.	Appropriateness of the contractors, sub-contractors and collaborators (i.e. personnel and facilities)	
4.	Rate of progress to date in achieving the aims and objectives of the research	
5.	Probability of success (if the research is ongoing)	

6.	Conclusions based on sound evidence	
7.	Dissemination of findings	
8.	Quality of science	
9.	Value for money	
10.	Overall rating **(it is important to provide a score here)**	

11. Overall opinions on the research area (including your overall views, as well as any comments you have on questions 1-10)*

12. Has the research raised further questions that need addressing with Defra R&D funding?
YES/NO

If yes, please provide details*

13. Are the areas within the current research addressing topics of highest priority?
YES/NO

If not, which topics would you identify as high?*

*Please expand boxes as required

Policy Assessment Form

Review of Defra's Animal Welfare Research Programme, 8 – 11 March 2010

PROJECT CODE:	
APPRAISED BY:	
DATE:	

Instructions:
Please assign a score and provide written comments where necessary. Scores should be based on a 1-5 scale, where:

1 = Unsatisfactory
2 = below requirements in some respects
3 = meets requirements
4 = above requirements
5 = Outstanding

1. How useful has the research been to Policy?

(This may include helping to answer an urgent policy question, informing the formulation of a policy, contributing to the evidence base, maintaining scientific expertise, development of improved methods etc.)

Score

Comments

3. Has the research raised further questions that need addressing with Defra R&D funding?

Yes / No

If yes, please provide details