

Institution: University of Bristol
Unit of Assessment: 6 - Agriculture, Veterinary and Food Science
<p>a. Context</p> <p>The School of Veterinary Sciences (SVS) has a long-standing reputation for research in <i>Animal Welfare and Behaviour (AWB)</i>, <i>Meat Science and Food Safety</i>, <i>Infection and Immunity (I&I)</i> and <i>Comparative and Clinical Research (C&CR)</i> funded by industry, government and charities. These funders are often interested in solutions to practical problems. Consequently, a culture of celebrating impact has been promoted within the School for many years, and research work undertaken at Bristol has led to measurable changes in <i>Health and Welfare</i> (clinical veterinary practice, clinical medical practice, animal health and welfare), <i>Public Policy</i> (governmental legislation, charity policy), <i>Industry Production and Practice</i>, <i>International Development</i> (animal health and welfare in developing countries) and <i>Society and Culture</i> (public attitudes informed by media activity).</p> <p>The School's impact has reach, significance and diversity in its methodologies and beneficiaries. Beneficiaries include veterinary and medical practitioners, government and charity policy makers and advisory bodies, and the livestock farming industry. Impacts are delivered by influencing a range of policy instruments including; legislation, certification standards, market requirements, charity procedures, post-graduate training and best practice standards. Academic staff from each research group play a direct role in translating findings into practice. Animal Welfare and Food Safety research, in particular, is implemented by participation in government advisory bodies and relevant expert working groups. Active involvement in training programmes has had an important influence, especially in animal welfare at slaughter. In areas such as companion animal behaviour academics have been involved in influencing public attitude and behaviour, particularly through successful public engagement activities. Academics involved in clinical research have informed the development of new therapeutic interventions and pioneered new diagnostics.</p>
<p>b. Approach to impact</p> <p>Research impact has often been achieved through direct interaction with stake-holders, who are often collaborators, throughout the research process, as well as by publication of findings. Impact is seen as an integral part of the School's research, and not as an 'added extra'. This is characteristic of a significant proportion of the School's research portfolio. As an example of promoting excellence in impact, SVS researchers have been recognised by two recent external awards: The Humane Slaughter Association's 'John Ace-Hopkins Award for Significant Advances in Humane Slaughter' (Knowles Wotton, Wilkins, Lines, O'Callaghan, Raj) and the Universities Federation for Animal Welfare Medal for 'Outstanding Contributions to Animal Welfare Science' (Nicol).</p> <p>Impact is promoted within SVS by a number of means (see also section c), which includes the strategic appointment of new staff with industry-relevant knowledge and skills, making translational and applied research central to the School's research strategy, and actively encouraging staff to engage in consultancy and sit on external industry, government and charity committees. Support for promoting impact is provided by the University's Press Office and Centre for Public Engagement and by the Research and Enterprise Development (RED) office which works with academic, student and entrepreneur communities to support commercialization and intellectual property issues. The School pursues a broad range of routes to impact:</p> <p><i>Work with government and charitable bodies adopts a policy-driven approach.</i> Research sponsored by Defra in the area of Animal Health and Welfare has been targeted at developing EU-wide legislation such as the 2009 EU directive on welfare at slaughter (Wotton) and the 2012 EU ban on conventional battery cages for laying hens (Nicol, Weeks). Nicol is advising the Secretary of State for Environment, Food and Rural Affairs with regard to the proposed 2016 ban on beak trimming of laying hens. Charity-funded research (RSPCA, Dogs Trust, Cats Protection) into issues such as separation anxiety in dogs, enrichment provision and the use of electric shock collars (Casey, Blackwell and Bradshaw), has directly influenced the charities' policies. By working with both industry and charities, impacts have also been created in areas of potentially conflicting interests. For example, in 2011 the UK Dairy Levy Board launched its Lameness Knowledge Transfer Programme based on Tubney Charitable Trust support (Main, Whay).</p>

Researchers have strong, long-standing, direct links with the industry. In many studies, an academic's personal involvement ensures that their research has maximum impact for the industry. For example, in 2009 Bradley (now at Nottingham) was directly involved in the adoption of Bristol mastitis research findings by the UK dairy industry. Researchers have also worked directly with retailers (e.g. M&S, Co-op) to guide animal welfare initiatives within their dedicated supply chains (Nicol, Main). Previous work on shelf life, eating quality and fatty acid composition continues to influence practice and policy of retailers, abattoirs and processing plants, even though research in meat science and meat quality has declined in recent years because of staff retirements. For example, Blade Farming and Celtic Pride, major beef producers, have specified minimum levels of vitamin E in cattle diets to extend the shelf life of beef. The breadth of involvement of staff with industry extends to collaborations on food safety (Allen & Corry, both recently retired & Cogan), fish slaughter (Knowles), broiler husbandry (Knowles, Nicol, Butterworth), sheep lameness (Grogono-Thomas), parasite burdens in farm animals (Wall, Morgan), probiotics in pigs and poultry (Cogan, Bailey), injurious pecking in hens (Nicol, Weeks, Main), bone breakage in hens (Wilkins, Tarlton) and tail biting in pigs (Main, Mendl).

Fundamental researchers and clinical veterinarians collaborate closely. Langford Veterinary Services (LVS), a unique business model amongst UK veterinary schools, was established in 2009 and has significantly increased the material for clinical research and teaching. It aims to maximise the commercial potential from clinical services. For example, LVS diagnostic laboratories have promoted the development and marketing of quantitative PCR techniques for detecting infectious and genetic disorders in cats (Tasker) and *Clostridium* in packaged raw meat [Corry].

A long term strategy has been to recruit research-active clinicians who work closely with basic scientists to provide solutions to major clinical challenges in animals and humans ('One Health'). The School's Comparative and Clinical Research (C&CR) Group brings together these staff, emphasising the importance of research on naturally-occurring diseases within the case load. To ensure success of this strategy, critical mass is being built in **Translational Research**, focusing on areas of existing strength in the wider University which includes neuroscience (Granger), cardiology (Chanoit), regenerative medicine (Price, Tarlton) and translational immunology (Woolridge, Bailey). For many years anaesthetists (Waterman, Slingsby and Murrell) have worked with neuroscientists and pharmacologists to improve methods for measuring pain which has led to the licensing of better analgesics for its management. Chanoit is working with the Bristol Heart Institute (Ascione et al) on methods to preserve pulmonary integrity during cardiac bypass and on the development of graft materials using the pig as a pre-clinical model. Fundamental research on the pig immune system (Stokes, Bailey) has led to human laryngeal and tracheal transplants. Bailey is now developing translational models of corneal transplantation with the Bristol Eye Hospital. Pioneering work by Granger has shown that recovery can be achieved using autologous stem cells for the repair of naturally-occurring spinal lesions in dogs. Collaborative work has also led to a tissue engineered cell bandage for cartilage repair (Tarlton) which progressed in 2012 to a Phase I/IIa clinical study. The University is committed to developing Langford as a centre of excellence for translational research and is supporting the development of a pre-clinical research centre (in 2015) that will include a 3Tesla MRI and improved facilities for large animal models.

Staff are encouraged to act as advisors and serve on committees for government, industry and charitable bodies. This is important for gaining a deep understanding of the problems that these bodies seek to tackle and for ensuring that advice and policies informed by the outcomes of research is appropriate. Academics are members of numerous groups including the UK Farm Animal Welfare Committee (Butterworth, Wotton, Main); European Food Safety Authority Working Groups (Corry, Mendl); EU and UK Animal Transport Working Groups (Knowles); Defra Laying Hen Beak-Trimming Action Group (Nicol); Advisory Council on the Welfare Issues of Dog Breeding (Casey); EU Evaluation of Animal Disease Control Programmes (van Klink) and EU WelNet, a pilot for a European Network of Reference Centres (Main, Butterworth, Mendl, Wotton).

Researchers make research products available to the scientific community. Browne co-directs the University's Centre for Multilevel Modelling which produces and supports the widely used statistical software package MLwiN. Of over 10,000 new licences since 2005, more than 750 are for non-academic bodies and institutions including the Departments of Education, Health, Work and Pensions, the Office for National Statistics, Ofsted, AQA, Statistics Canada, Statistics Norway, the Netherlands Bureau of Statistics, UNESCO and WHO. Human infertility technology originally

developed for livestock was successfully evaluated in clinical trials in 2012 (OvuSense, Fertiloscope; Butterworth, Knowles). More than a third of the swine monoclonal antibodies marketed by Bio-Rad AbDSerotec Ltd were produced in SVS (Wilson, Stokes, Bailey) and RED have recently supported the commercialisation of diagnostic tests for campylobacter (Cogan).

Public engagement is facilitated by the University and the School. Staff are encouraged to participate in public engagement projects; e.g. Bradshaw's book 'In Defence of Dogs' (2012) has sold over 100,000 copies and animal welfare research has been included in many television programmes (Country File, The Secret Life of the Cat, Jimmy Doherty's Private Life of Pigs). The ABW group was awarded a BBSRC Public Engagement Grant that supported a range of initiatives and increased public awareness of animal welfare issues has influenced the welfare policies by retailers.

SVS delivers post-graduate education. Veterinary clinicians, working with LVS, offer Continuing Professional Development courses to ensure that clinical research findings and clinical developments are disseminated to the profession. In 2011-12 this included 28 meetings attended by over 800 veterinary professionals. The Animal Welfare Officer (AWO) course, which is delivered widely across the UK and also internationally, includes the latest Bristol-based research on stunning and slaughter. In 2009 EU legislation insisted that all abattoirs employ a trained AWO. In 2010 a certificate level course that grew out of Bristol research in companion animal behaviour was made available to staff working within pet charity re-homing centres.

c. Strategy and Plan

The School's strategy for achieving impact includes:

(i) The appointment of staff whose research has the potential for impact. Since 2008 appointments have been made in C&CR (Chanoit, Granger, Price), AWB (Whay, Held), Food Security (Eisler, Lee) and Public Health (van Klink, Cogan). Lee's appointment is part of the South West Food Security and Land Research Alliance with the Universities of Bath, Cardiff and Exeter and Rothamstead Research and takes advantage of access to the unique North Wyke Farm Platform. **(ii) Ensuring the value of impact is recognised.** Processes for staff review and development and for progression and promotion now recognise the importance of impact. **(iii) Promoting and supporting impact within the School.** The research committee takes a leading role in this activity and an Impact Director (Main) will continue to co-ordinate impact activities after the REF submission. An Impact Prize has been introduced and impact-relevant topics are included within school workshops and seminars. **(iv) Participation in the BBSRC Excellence with Impact initiative.** This includes training programmes for early career researchers, appointment of Academic Business Fellows and winning BBSRC Sparking Impact grants. **(v) Proposed involvement in UK Reference Centre in Animal Welfare.** In collaboration with the Scottish Rural University College, this centre will ensure that national and EU policymakers have access to the latest welfare science. **(vi) Improved use of Faculty and University resources.** The School will continue to work with RED in commercialising research outcomes, establishing consultancies etc. Staff will continue to make use of the University's Enterprise and Impact Development Fund, and enter for the Vice Chancellor's new Impact Prize (the lameness welfare group were runners up in 2012). **(vii) Continuing with existing post-graduate training schemes and developing new ones.** **(viii) Collaborating with LVS to support the commercialisation of diagnostic tests.** **(ix) Continued active involvement of staff in public engagement.**

d. Relationship to Case Studies

Case studies highlight some of the ways in which our approach to impact has been implemented.

1. *Slaughter.* This case demonstrates the impact generated by working with government funders and industry to generate the required information for important EU legislative change. The AWO course, now embedded in EU legislation, is a critical factor for the ongoing success of this impact.
2. *Laying hens.* This work illustrates the importance of welfare science as a basis for European legislation.
3. *Tests for feline infectious disease.* This case demonstrates the value of linking fundamental and clinical research with the commercial activities of LVS.
4. *Dairy Cattle Lameness.* This case demonstrates that continued interest in a topic amongst several academics over several years can result in genuine change within industry.