

Institution: Royal Veterinary College
Unit of Assessment: A 6 Agriculture, Veterinary and Food Science
a. Context

RVC undertakes excellent basic biological, biomedical and veterinary applied and clinical research in order to advance science, and enhance human and animal health. Consequently, its impact reaches a broad range of beneficiaries. Major interactions cover organisations and specialist groups both nationally and internationally and include:

- **Industry** – e.g. animal health and nutrition, pharmaceutical, diagnostics, medical devices, biotechnology and robotics businesses.
- Government **policy makers**, veterinary drug registration agencies, non-governmental organisations, e.g. United Nations' Food and Agriculture Organisation and charities involved in public health and infectious disease control.
- All areas of **professional veterinary practice** - companion and production animal and equine practice at first opinion and referral levels, wildlife medicine, government service for public health and food safety and security. Additionally, through translation to human medicine, human health care provision systems.
- **Communities and individuals** - particularly those affected by disease or injury, including organised patient groups; pet owners; and those concerned with animal welfare or food safety e.g. farmers and animal charities, together with all affected by socio-economic consequences of zoonoses.
- **Public** (adults and school-age children) **and media** – engagement has been directed towards fostering greater understanding of and enthusiasm for our science and natural history.

Impacts include those typical for biological research – improvements in health from medical advances, providing social and often economic benefit, and commercial value of products delivering this. In the veterinary field, research leading to evidence-based policy change can drive economic, social and commercial benefit especially in food animal production, in both the developed and developing world. Research-led improvements in companion animal medicine and animal welfare impact upon other beneficiary groups such as pedigree breed clubs.

RVC's holistic approach to research, exemplified by the 'One Health' agenda, encompasses the interplay of the human, animal and natural environment which constitute the ecosystem potentially affected by research outcomes and hence a complex web of interactions, in order to deliver positive impact. (See Environment Template.)

b. Approach to impact

Our approach is informed by the realisation that it is not sufficient to identify a technical solution to a problem: it needs to be practical to implement which may entail social, ethical and/or economical acceptability, in order to deliver positive impact. We have established a culture and infrastructure to achieve this through actively engaging with each of our targeted beneficiary groups (examples below). The Vice Principal Research and Innovation (VP-RI) is responsible for impact, supported by RVC Enterprise (RVCE), funded from HEIF. The Research and Innovation Management Group (RIMG) ensures good communication with others across RVC such as Widening Participation and Community Engagement (WPCE) team, involved in aspects of impact delivery.

Industry Collaboration is fostered through approaches such as: a) training for commercial awareness; b) London BioScience Innovation Centre (LBIC), RVC's on site incubator, as a hub for SME networking; c) proactive marketing of expertise, services and facilities; d) industry showcase events; e) matched proof of concept funding initiatives; and f) professional contract and intellectual property licensing negotiation. This strategy has delivered success with 15.4% of total research income (over 180 projects during REF period) derived from industry partnerships: We currently hold 22 BBSRC CASE and 17 further studentships with companies or other external partners. Industrial Partnership Awards have contributed to grants totaling £4,227,000 (£650,700 industry

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contribution) and 21 further grants have been supplemented by company cash support in the REF impact period. Proof of concept schemes, (BBSRC Follow-on Fund, Heptagon Fund (HEIF2 and LDA funding, 2004-2010) and HEIF 2011-14) have been used to progress research findings towards commercial products and services. [text removed for publication]. In financial years 2008 - 2013, RVC provided consultancy for 28 companies (£331,500) and also received Technology Strategy Board funding in partnership with SME businesses, including RVC's own spin-outs.

Policy Influence RVC encourages participation in regional, national and international bodies making and influencing policy, as well as in schemes to develop political awareness. Joint initiatives with government departments and training courses designed to meet the needs of policy makers and advisors internationally have enhanced connections. In 2008-13, at least 10% RVC academic staff have served on panels including: Parliamentary Advisory Committee on Dangerous Pathogens; National Expert (Foresight) Panel on New and Emerging Infections; Farm Animal Welfare Council (chaining landmark report 2009); Veterinary Products Committee; DEFRA Antimicrobial Resistance Co-ordination Group; DEFRA TB Review Panel; Spongiform Encephalopathies Advisory Committee; European Food Safety Authority Working Groups (Chair and members); Chair of Regulatory Agencies Strategy Board; Scientific Steering Group, Federal Institute of Risk Assessment, Germany; Scientific Committee, Food Safety Agency of the Basque country, Spain; Scientific Advisory Group, EU FMD Commission, Food and Agriculture Organisation of the United Nations (FAO). In addition, RVC has supplied expert advisors and consultants to the Directorate General Agriculture, European Commission; Caribbean Animal Health Network; FAO (from 2012 as an FAO Reference Centre in Veterinary Epidemiology); World Health Organisation; and World Organisation for Animal Health (OIE).

Veterinary Practice and other professionals Engagement with first opinion and specialist veterinary practitioners both ensures research is focused on common clinical issues of concern and provides access to data and case material for research. Relationships with charities (e.g. PDSA, Blue Cross, Battersea Dogs and Cats Home) facilitate substantial projects with unique longitudinal data collection over prolonged periods. To broaden this approach to the private first opinion practice sector, the VetCompass project – involving routine capture of first opinion clinical data via electronic patient records held within Practice Management Systems - enables regional demographic assessments; disease prevalence studies; and risk factor analysis. The database now holds over 500,000 cases and has brought 180 private and charitable practices into partnership in research activity. RVC research is also translated through conventional dissemination routes: its own Continuing Professional Development (CPD) course programme; textbooks; and national and international conference presentation. RVC also engages with agrifood industry bodies and professional animal owners and managers through provision of practical tools and training, derived from research, such as the 2013 Workshop on Calf Health, supported by DairyCo; post-weaning multi-systemic wasting disease severity and economic loss calculators for pig farmers; and the forthcoming 'Chicken of the Future' Symposium.

Community and Public Engagement RVC's WPCE team works closely with researchers to enthuse schools; groups recognised as hard-to-reach for higher education; and other community groups in RVC's research. Groups from across the London region have visited to be introduced to research in locomotion; importance and significance of zebrafish in bioscience research. Evidenced by feedback from teachers, this work has contributed to raising levels of both scientific interest and attainment at primary and secondary level. In the last year, over 400 adults (age range 25 – 75) have been introduced to RVC work in comparative physiology and medicine. A series of research-themed 'RVC Late' public open evenings began in 2012. This work has been recognised by awards to RVC members including: UKRC Woman of Outstanding Achievement (2010); Runner-up BBSRC Social Innovator of the Year (2011); Charles Darwin Lecture, British Science Festival (2012); MBE for Services to Veterinary Science (2012); BBSRC Schools Regional Champion (2012). BBSRC and EPSRC have recognised RVC activities by news features on web pages (e.g. health issues in over-long dog breeds; tracking cheetahs and cats), and in a 2013 Impact Evidence Report, highlighting a public engagement project in chicken welfare.

Media Interactions RVC's Press Office builds relationships between research-active staff and journalists in both specialist and popular media. This has contributed to RVC's leading position, (by article number), amongst the UK veterinary schools, for popular dissemination of its research. A list

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of specialists in areas of likely media interest is provided on the RVC website, and in 2010, around 25% of staff reported approaches from journalists to act as an expert. Since 2008, substantial coverage of RVC research has featured fetal programming; elephant gait; growth and speed of *Tyrannosaurus rex*; and cheetah speed and agility. RVC has also contributed to influential and award-winning TV documentaries and series. In 12 months (2011-12), RVC research news items proactively placed in the media resulted in 176 items in print, broadcast and/or online media, together with 82 enquiries seeking expert comment.

Infrastructure and Environment

Four focus areas are used to maintain and develop an environment that recognises and promotes implementation of impact from research. Where appropriate, this has been codified into organisational policies.

1. Training Personal Development forms part of annual appraisal, with training needs set and reviewed. Training workshops and events, relevant to impact, target researchers at different career stages and include 'Commercial awareness & intellectual property exploitation'; 'Introduction to public and media engagement'; 'Professional media training'; and 'Impact from your research – planning for impact generation'. Support for writing pathways to impact plans for RCUK grant applications is provided by RVCE. We also promote external training opportunities such as the Parliamentary Partnering scheme; Wellcome Trust Public Engagement courses; and BBSRC Media training.

2. Assessment and Benchmarking Tools to monitor effectiveness of impact-generation include monitoring engagement through appraisal; tracking media coverage and HEBCI performance metrics. Commercial awareness was benchmarked in 2007, with a repeat survey in 2010 (awareness of knowledge transfer increased from 12% to 61%). In 2012, RVC published UK comparisons to re-assess its revenue sharing policy for inventors (doi.org/10.5367/ihe.2012.0077). The 2012 appraisal engagement survey (116 of 161 academics) indicated substantial and diverse engagement activities with: general public (40%), industry (58%), charities (47%), media (35%), school visits (27%), veterinary practitioners (47%) and paraprofessionals (32%). RIMG periodically reviews these data and plans proactive measures to enhance engagement accordingly.

3. Competitions and Incentives are used to encourage and highlight value of impact-related activity. Policies for research consultancy and revenue sharing from commercialisation provide personal incentives. RVC has engaged with initiatives such as BBSRC Excellence with Impact (2008 and 2013); BBSRC Sparking Impact; RCUK business plan (finalists 2007/8 and semi-finalists 2009/10); Biotechnology YES (entered annually 2008-13); and BBSRC Innovator of the Year (runner up Social Innovator 2011). RVC also uses £150,000 pa of HEIF for competitive proof-of-concept grants of up to £50,000, requiring company match; and runs competitions for postdoctoral researchers (awarding £2,000 for public engagement activities) and PhD students (smaller cash prizes for impact statements accompanying research posters).

4. Communications and Recognition Impact awareness is systematically reinforced through multiple channels. RVC's Intranet includes resources and a blog supporting public engagement. Homepage 'Messages of the Day' broadcast impact-related events, achievements and media coverage. All research findings are reviewed for both intellectual property protection/commercialisation and PR opportunity prior to disclosure. RVC employs communications specialists to support public and media engagement. Research Strategy Committee (RSC) and Research Programme Awaydays provide vehicles to disseminate impact messages to research-active staff. External communication channels include press releases; media interviews; website (research news updated weekly and news archive); research podcasts; and alumni communications. Each of RVC's 50 podcasts has been downloaded over 3,000 times (150,852 total downloads 2008-13). Membership of One Nucleus and hosting its networking events facilitates showcasing RVC research to the regional (London and Eastern) biotechnology community.

c. Strategy and plans

Research impact strategy is disseminated via the academic RSC and the externally-focused RIMG, ensuring a well-co-ordinated approach to impact, with clear lines of communication to access support and resource. The strategy during the REF Impact Period has been established in alignment with the College's corporate objectives (Corporate Plan 2009-13) and HEIF Institutional Strategy documents (HEIF 4 covering 2008-11 and HEIF 2011-15). Impact implementation,

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integral to the research agenda, has informed development of the Corporate Plan 2014-18, undertaken during the first half of 2013.

Our strategy aligns with the goals of principal funders and is based on: awareness of clinical needs with applied research leading to animal and public health and welfare innovations; participation in policy advice and professional (research and veterinary) governance fora; a history of industry collaboration including commercialisation of products and services (out-licensing and spin-out creation); a well-developed WPCE programme; and an established media relations activity.

Future development To consolidate a strong culture of impact-awareness and supporting infrastructure our main goals lie in maximising impact delivery in economic, social and policy-related domains, through corporate management of the approaches described above, using methods such as the public engagement 'EDGE' tool. The strategy of developing Agricultural Economics as an academic discipline is succeeding and benefiting our impact agenda and so will continue to be supported and extended to include Veterinary Ethics.

Policy Alignment Engagement with Research Council strategy committees and initiatives, DEFRA and EU Government advisory committees, ensures RVC's research and impact strategies are aligned well with government priorities and policies. RVC research is focused in two of the three Key Strategic Research Priorities of the BBSRC: Food security (Livestock Health and Production programme) and Basic Bioscience Underpinning Health (Comparative Physiology and Medicine programme). We also deliver a substantial contribution to 5 of Defra's 29 identified policy areas.

Monitoring 'Pathways to Impact' and equivalent documents; the Research Outcomes System (ROS); and the RVC's internal system for review of manuscripts prepared for publication all provide prompts for stimulating and monitoring impact-related activity. Each system provides an opportunity to identify new intellectual property and commercialisation potential through industry licensing or spin-out creation. We hold 50 active RCUK research and training grants (RCUK research income increased from 18.8% in RAE 2008 to 34.1% of total income), so proactive engagement with ROS is an efficient way to foster impact. Systematic project review of industry collaborations to maximize realisation of impact is a priority from 2014. This includes incorporation of outputs into our CPD programme, where appropriate, to drive evidence-based veterinary practice utilising new products.

Partnerships LBIC, owned and managed by RVC, is now host to 50 client companies and has supported 5 spin-out businesses from RVC itself (Immexis; VetCell Biosciences; SensAthlete; PrioCam; and Tecrea.) Clients offer opportunities for research collaboration, business for RVC contract services; role-models of entrepreneurship; pro-bono contributors to student business courses; and student placements. RVC is now reorganising its industry-facing activities –to further professionalise and integrate the marketing of RVC's industry 'offerings' from invention to product authorisation, whilst sustaining business development resource to support academics in company relationships. Training courses for nascent entrepreneurs, run by LBIC, and the 'RVC Late' events, have provided early opportunities for RVC to engage with the Francis Crick Institute, (400m from Camden campus, opening 2015), to deliver shared impact-related activities.

Professional practice VetCompass will continue to be a major vehicle for partnership with veterinary practices, championed at RVC by Vice Principal support and core funding, including some HEIF commitment. The next stage in the development of this initiative will see private veterinary practitioners use the system to undertake research in collaboration with the RVC to gain professional doctorates. [text removed for publication]. Other routes to engagement with veterinarians include an extensive programme of CPD provision; and management of the WikiVet online veterinary education resource (encompassing 25,000 users worldwide).

RVC is now established as a trusted provider of consultancy and services to national and international bodies including the European Commission; FAO and DEFRA. It is recognised as a registered provider by the European Food Safety Authority and a preferred provider for DEFRA. Strong links with private consultancy organisations provide complementary expertise when required to address specific project proposals. A postgraduate certificate in food safety risk analysis provides a further mechanism for establishing relationships with policy professionals. RVC is also active in national risk surveillance for livestock: hosting an Animal Health and Veterinary Laboratories Agency surveillance unit and active in promotion of control schemes for Bovine Viral Diarrhoea, as well as providing input to Bovine Tuberculosis control strategies. These activities synergise with a new Advanced Training Partnership programme in Intensive Livestock Production

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which provides professional training – at Masters and Professional Doctorate level – for individuals within the agrifood industry. Existing relationships forged through research collaboration with farming levy boards – BPEX, EBLEX and DairyCo – and with poultry organisations such as the British Egg Marketing Board and the Poultry Diseases Group - will assist in addressing and bringing the College closer to this target sector. This initiative will, in turn, enable RVC's applied research on intensive livestock to address the needs of the industry more closely.

Goals RVC has identified a number of goals for impact from research during the forthcoming REF period for which SMART targets and deliverables will be set:

- Seek opportunities for impact from fundamental bioscience research, where there are no obvious immediate beneficiaries
- Increase engagement and dissemination programmes with stakeholders and beneficiaries, engaging more closely in planning and conducting research, including through professional doctorate programmes.
- Routinely embed economic and ethical assessment into applied research to enhance impact and drive change in farming practice
- Roll out VetCompass for further international data capture and research
- Expand collaboration with other organisations, to access interdisciplinary strengths
- Promulgate One Health ethos through formal links with medical institutions, including advancing human medicine through translation from proof of concept in veterinary patients (see Environment Template)

d. Relationship to case studies

Impact has frequently been facilitated by engagement with the anticipated beneficiaries or end-users, during research programmes. Our culture of impact awareness, recognition that most research relates to real-world problems, and our support framework, underpin these results. Case studies delivering changes in professional practice, and new product introductions (e.g. **Feline Chronic Kidney Disease, Canine Heart Disease**) have arisen from engagement of researchers with charity clinics to access primary care cases and follow them longitudinally. The researchers, viewed as key opinion leaders, have collaborated with and consulted for multiple animal health businesses. Interactions with all stakeholders in the production animal sector have also facilitated change leading to economic and other benefits (e.g. **Calf Mortality, Artificial Insemination, Bovine Viral Diarrhoea**).

Relationships built with policy-makers and government agencies and the complex interplay of these partnerships with commercial product development, have contributed to evidence-based policy-making and regulatory approaches, using RVC research findings (e.g. **Avian Influenza, African Swine Fever, Antimicrobial Drug Dosage**).

An entrepreneurial culture and a drive towards collaboration with SME businesses, supported by RVCE and LBIC, has contributed to the success of new company creation at RVC, (e.g. **Tendon Biology**) – leading to the creation of, and on-going relationship with VetCell Biosciences Ltd. The integrated approach to translating research between animal and human medicine is also seen in the arising human applications of stem cell technology.

RVC researchers are enthusiastic to share the wonders of the natural world and well supported by the WPCE team to deliver social impact (e.g. **Giant Animals**). Lastly, a personal commitment to health and welfare (e.g. **Pedigree Dogs**) exemplified in the final words of the Royal College of Veterinary Surgeons oath, has been and will remain a major contributor to impact arising from RVC research: "... my constant endeavour will be to ensure the welfare of the animals committed to my care."