EXECUTIVE SUMMARY
Animal Health Research Club (ARC)

The Biotechnology and Biological Sciences Research Council (BBSRC) established the Animal Health Research Club (ARC) in 2012 following consultation with trade associations, levy boards, policy makers and academics, who identified a clear need for engagement between industrial and academic researchers to tackle the costs and risks associated with animal pests and diseases, and to improve animal welfare.

The club is a partnership between BBSRC, the Scottish Government and a consortium of eight leading companies from the animal breeding, pharmaceutical and production industry sectors. Approximately £10M has been awarded to support high quality research in UK universities and research institutes. The research supports the continuing success of the sector by generating new knowledge which will inform industrial research programmes and product development.

With research projects soon ending, the outputs of ARC are beginning to emerge. BBSRC will monitor and communicate the impacts of ARC research and engagement, and facilitate future collaborations, and continuation of the ARC community.

The livestock industry is a significant contributor to the UK economy and delivers produce with an annual retail value of more than £23Bn each year[1]. The sector farms a diverse range of animals, including cattle, sheep, pigs, poultry and fish, all of which are susceptible to pests and diseases. The UK market for animal health products is over £600M per year[2]; these products are necessary to prevent diseases that can cause major losses like the 2001 foot-and-mouth outbreak, which cost the UK economy up to £8Bn[3].

ARC is a BBSRC led investment programme, with 10% of funds coming from our industry members. To date £10M has been invested in 15 research projects (Appendix 1), and training for 5 PhD students. ARC is facilitating increased engagement between industry and academia, de-risking industrial investment in research and development, and enabling greater access to funds for academic labs working within the ARC remit. This increased investment in pre-competitive research is supporting industry innovation in tackling endemic and emerging pest and disease problems by generating new knowledge to inform industrial research programmes that underpin product development, livestock breeding, control strategies, and improved animal welfare.

ARC Research Challenges

Four research challenges were identified through discussions with the industrial membership:

- Understanding the basis of resistance/resilience to pests and diseases in farmed animals
- Developing novel tools for defining disease biomarkers and phenotypes to inform breeding strategies for subclinical diseases and increased disease resistance
- Understanding variation in vaccine responsiveness, immuno-competence at different developmental stages and disease outcomes

  Determining the effects of selection for production traits on immune function

ARC is managed by BBSRC in conjunction with an external coordinator and a steering group formed of industry and academic representatives.

Benefits of Interacting with BBSRC and the Research Community

BBSRC has a strong record in managing collaborative research programmes, including the Research Industry Club mechanism. Companies report a range of significant benefits from their involvement with BBSRC:

- Capacity to influence research in important strategic areas
- Knowledge on the progress of relevant research projects and early access to results
- Opportunity to work with leading researchers and to build strong relationships with them
- Opportunity to identify the best potential industry recruits
- Guidance on other Research Council activities and funding opportunities
- Promotion of companies through relevant activities, objectives and outputs

Delivering Industrial Impact

ARC is delivering new capabilities relevant to the industry. Research projects have been active since 2013, and will end by late 2018, the outputs of which will help to address significant challenges in animal health.

Projects have already generated useful outputs which are of benefit to the member companies, for example:

- A validated approach to engineering resistance to Porcine Reproductive and Respiratory Syndrome Virus
- Understanding of the relation between microbiome and mammary gland health in dairy cows
- New genetic markers for breeding dairy cows with resistance to bovine tuberculosis
- Understanding the ability of trans-membrane proteins to protect against (or hasten) infection of chickens by avian influenza
- New knowledge of the fundamental biology of Avian Infectious bronchitis virus (IBV), to produce consistently effective vaccines for poultry
- A number of insights into the genetic determinants of pest and disease resistance and establishment of associated biomarkers that will inform resistance breeding and/or effective control strategies

For further information please visit the ARC web pages at: www.bbsrc.ac.uk/arc

1. Office for National Statistics, (2016). Total Income from Farming in the United Kingdom First estimate for 2016. United Kingdom.
2. National Office for Animal Health, (2016). Annual Report 2015/2016. United Kingdom.
3. National Audit Office, (2002). The 2001 Outbreak of Foot and Mouth Disease. United Kingdom.

ARC RESEARCH PORTFOLIO

15 research projects were funded through two rounds in 2013 and 2014. The projects are expected to remain active until late 2018.

Detailed project information can be found online by using the BBSRC reference numbers to search:

- RCUK Gateway to Research: http://gtr.rcuk.ac.uk/
- BBSRC Portfolio Analyser: www.bbsrc.ac.uk/research/grants-search/quicksearch/

Cattle

Ref No.	Principal Investigator	Research Organisation	Project Title
BB/L004062/1	Kevin Purdy	University of Warwick	Are microbiomes important to mammary gland health in dairy cows?
BB/L004054/1	Liz Glass	The Roslin Institute	Genomic Selection for Bovine Tuberculosis Resistance in Dairy Cows
BB/M012751/1	Elisabeth Innes	Moredun Research Institute	Host factors in determining resistance to cryptosporidiosis in cattle

Chicken

Ref No.	Principal Investigator	Research Organisation	Project Title
BB/L004003/1	David Hume	The Roslin Institute	Understanding resistance and differential vaccine responses to Eimeria in the chicken - novel biomarkers and genetic control.
BB/L003988/1	Paul Britton	The Pirbright Institute	Selection Versus Mutation: Reducing the Risk of Vaccine Reversion
BB/L003996/1	Mark Fife	The Pirbright Institute	Restriction of avian viruses by host interferon-inducible transmembrane proteins (IFITMs).
BB/M011925/1	David Hume	The Roslin Institute	Macrophage Biology and Disease Susceptibility in Poultry
BB/M012069/1	Lonneke Vervelde	The Roslin Institute	Towards control of Infectious bronchitis virus; understanding cross-protection and the genetic plasticity of IBV

Pigs

Ref No.	Principal Investigator	Research Organisation	Project Title
BB/L004143/1	Alan Archibald	The Roslin Institute	Engineering resistance to Porcine Reproductive and Respiratory Syndrome Virus (PRRSV)
BB/M012891/1	Alan Archibald	The Roslin Institute	Genetics of host responses to Porcine Reproductive and Respiratory Syndrome virus (PRRSV)

Salmon

Ref No.	Principal Investigator	Research Organisation	Project Title
BB/M013022/1	Chris Secombes	University of Aberdeen	Development of novel oral vaccination strategies for Atlantic salmon

Sheep

Ref No.	Principal Investigator	Research Organisation	Project Title
BB/L004070/1	Michael Stear	University of Glasgow	The influence of selective breeding on MHC diversity.
BB/M012980/1	Laura Green	University of Warwick	Is multistrain infection by Dichelobacter nodosus important in the severity of footrot and in the management of disease?
BB/M012085/1	Sabine Tötemeyer	University of Nottingham	Understanding inflammatory processes in ovine footrot to inform rational vaccine design
BB/M011968/1	Jacqueline Matthews	Moredun Research Institute	Dissecting variation in host responsiveness to a recombinant vaccine designed to control teladorsagiosis in sheep