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Overview of Research Challenges

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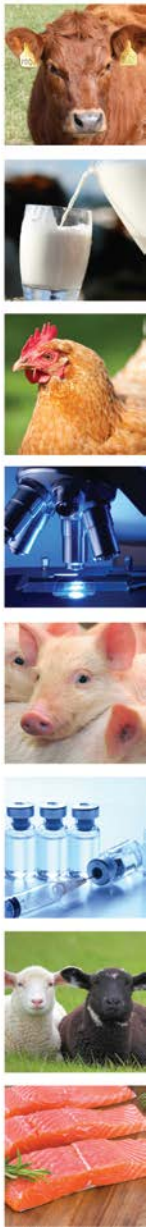

Context and Scope

- Context:
  - Reducing the impact of endemic and emerging pests and diseases a win-win-win (economic, environmental and social)
  - Follows on from CEDFAS
  - Rapid development of research tools
  - Aligned with industry priorities
- Scope:
  - Pre-competitive, innovative, industrially relevant research to underpin the capacity of the sector to tackle endemic and emerging pest and [infectious] disease problems
  - Farmed animal species
    - Cattle (dairy and beef), chickens (broilers), pigs, salmon, sheep
  - Research themes overlap and the call document is not an exhaustive list – if in doubt talk to ARC Industry Members

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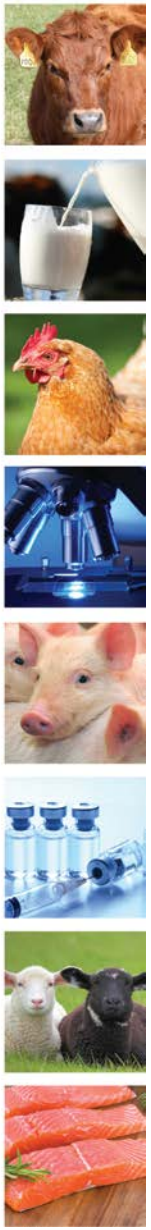

Aims

1. To support high quality, innovative, strategic research ... to improve the resistance of farmed animals to pest and disease organisms
2. To strengthen the research community ...
3. To ensure the exchange of knowledge between the science base and industry through effective networking ...

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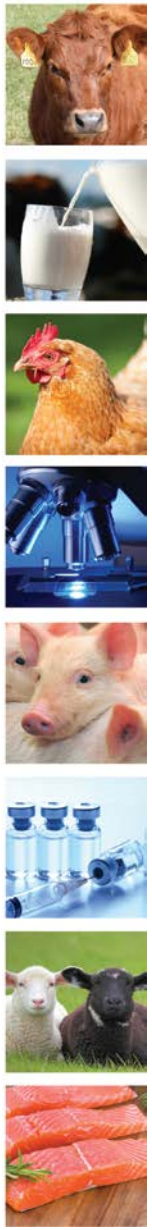

Four Main Themes

- Understanding the basis of resistance/resilience to pest and disease
- Developing novel tools for defining disease biomarkers and phenotypes ...
- Understanding variation in vaccine responsiveness, immuno-competence ... and disease outcomes
- Determining the effects of selection for production traits on immune function

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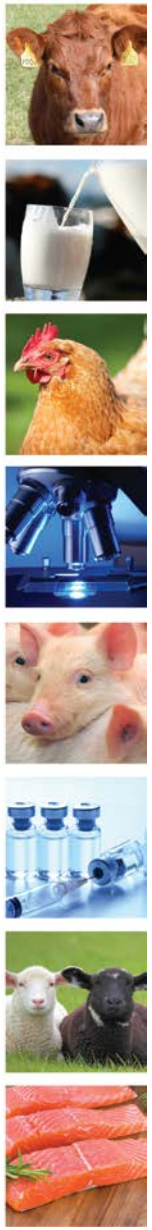

Understanding the basis of resistance/resilience to pest and disease

- Genetic and molecular mechanisms through which innate and adaptive resistance in a population is conveyed
- Dissecting the aetiology/mechanisms of complex disease syndromes
- Informing the design and delivery of novel therapeutics and vaccines
- Pathogen virulence factors, pathogen evolution, strain variation, molecular epidemiology and susceptibility to intervention

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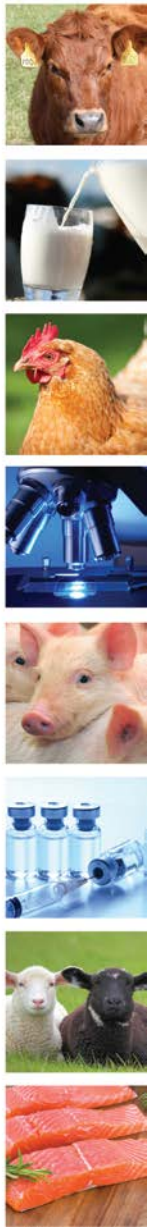

Developing novel tools for defining disease biomarkers and phenotypes to inform breeding strategies for subclinical diseases and increased disease resistance

- Dissecting the aetiology/mechanisms of complex disease syndromes in order to deliver new disease diagnostics or markers for use in selection
- Tools that differentiate exposure, infection and disease progression within individuals and populations
- Development of high-throughput *ex-situ* or *in-vitro* phenotypes
- Novel uses of routine health data
- Novel routes to disease resistance (proof of concept or an experimental tool)

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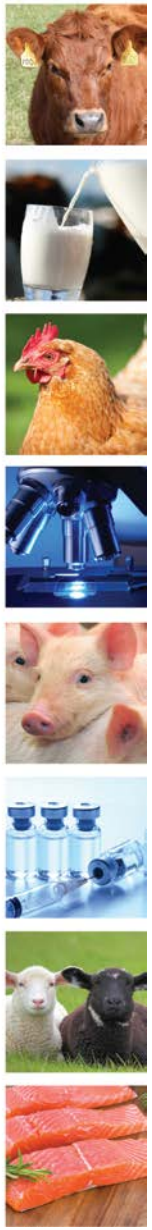

Understanding variation in vaccine responsiveness, immuno-competence at different development stages and disease outcomes

- Exploring genetic variation in responsiveness to vaccines
- Determining the potential for combined selection and vaccination strategies
- Understanding the development of innate and adaptive immunity for improved choices in breeding programmes
- Development of immuno-modulation approaches

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Determining the effects of selection for production traits on immune function

- Has selection for production traits compromised population susceptibility to infectious disease?
- Identification of specific resistance alleles that may be used in selective breeding
- [Improved understanding of best strategies - resistance, tolerance & vaccination/intervention]
- [Development of improved approaches to selection]
- Examining the co-evolution of hosts and pathogens

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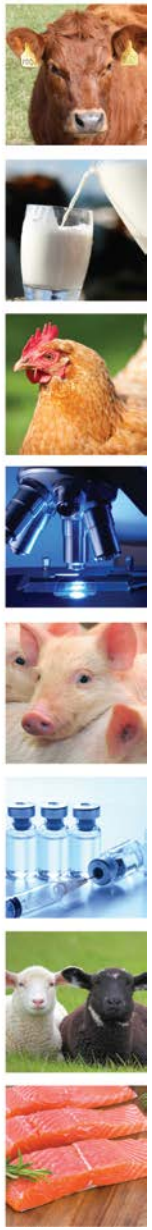

Highlight Areas

- Aquaculture in relation to salmon farming including the development of new methods, disease resistance, novel vaccine candidates, oral vaccination, vaccination responsiveness and the impact of breeding on disease susceptibility and immune responses
- Beef cattle covering the areas of disease biomarkers, resistance to infection and immune responsiveness
- Exploitation of pathogen genome resources in relation to disease outcome and host resistance
- Applications addressing challenge 4

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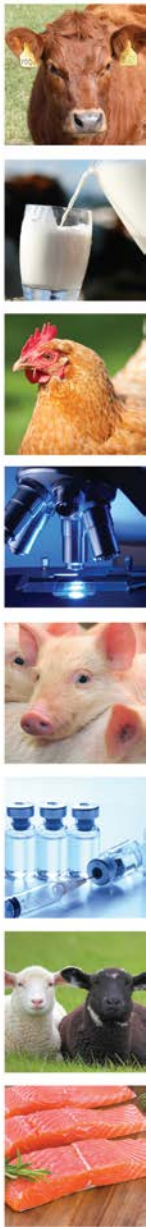
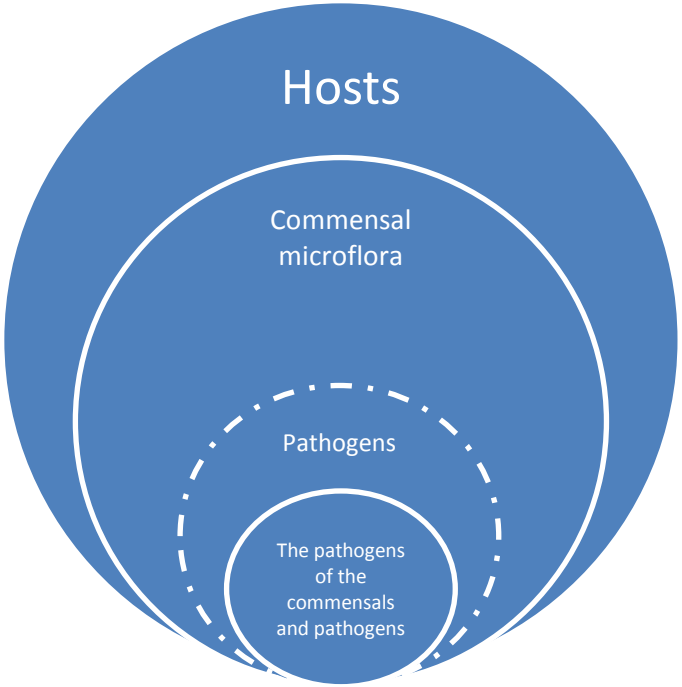


Closing Comments

- Pre-competitive, innovative, industrially relevant research
- To underpin the capacity of the sector to tackle endemic and emerging pest and [infectious] disease problems
- New tools enable new approaches
- Collaborative, interdisciplinary approaches strongly encouraged
- If in doubt ask:
  - Prof. Andy Tait (ARC Co-ordinator)
  - Steering Group members
  - Biosciences KTN
  - BBSRC

Co-evolving Populations



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Thank you for your attention

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