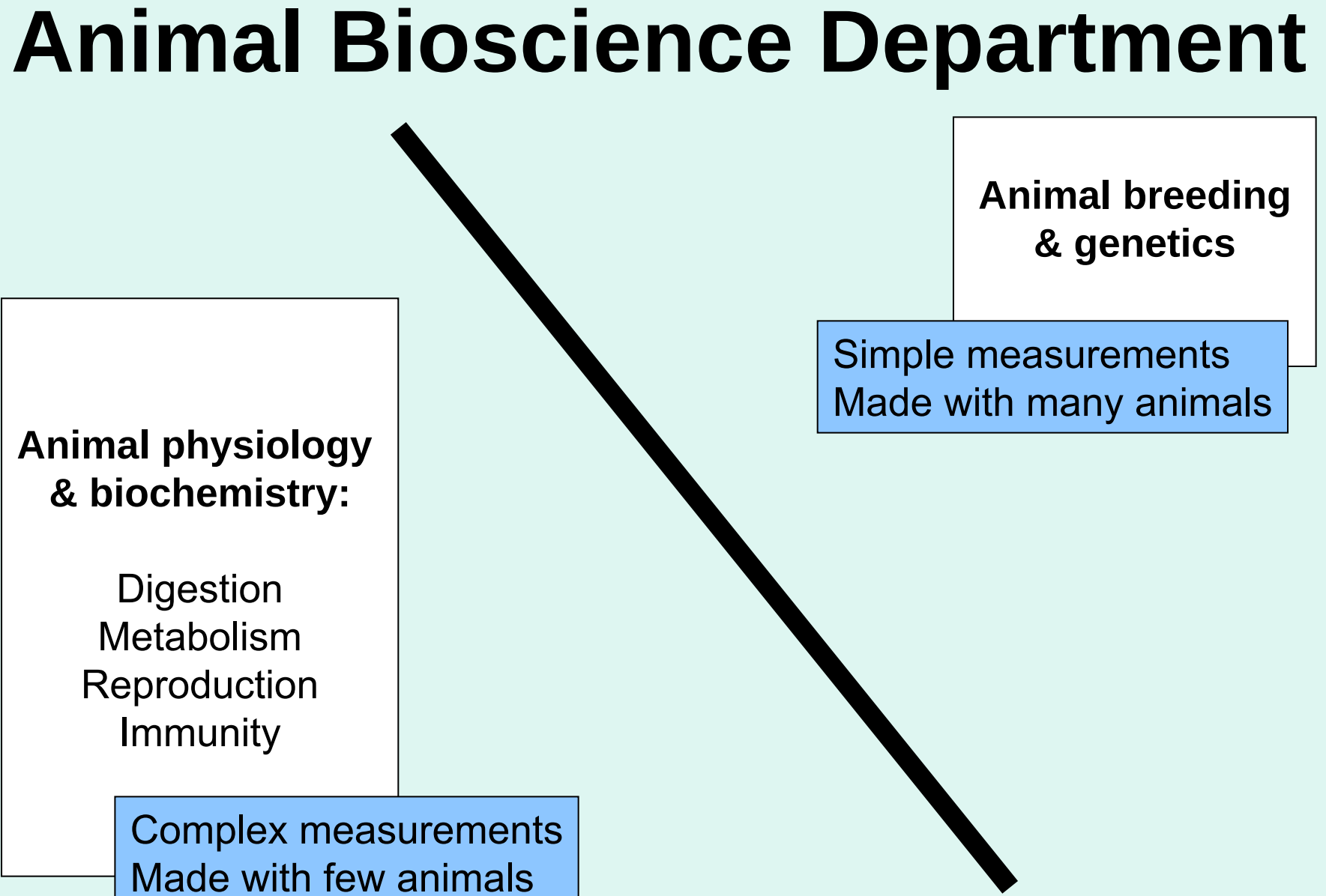


Overview of the Animal Bioscience Department

Dr. Richard Dewhurst
Animal Bioscience Centre

Animal Bioscience Department



Animal physiology & biochemistry:

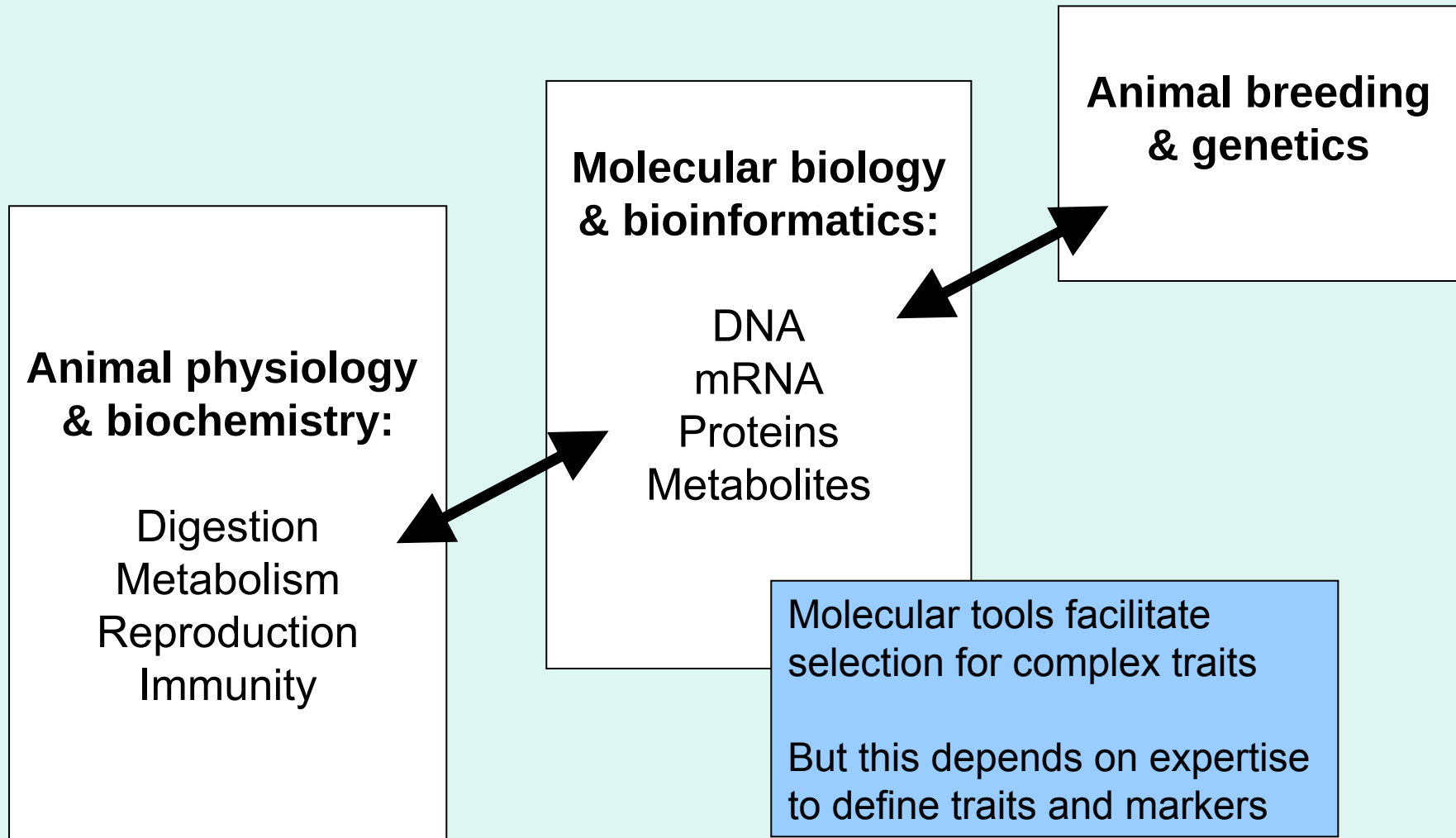
Digestion
Metabolism
Reproduction
Immunity

Complex measurements
Made with few animals

Animal breeding & genetics

Simple measurements
Made with many animals

Animal Bioscience Department



FERTILITY

Michael Mullen

QUALITY

Aidan Moloney

Richard
Dewhurst

EFFICIENCY

Sinead Waters

Orla Keane

Kieran Meade

HEALTH

Bernadette
Earley

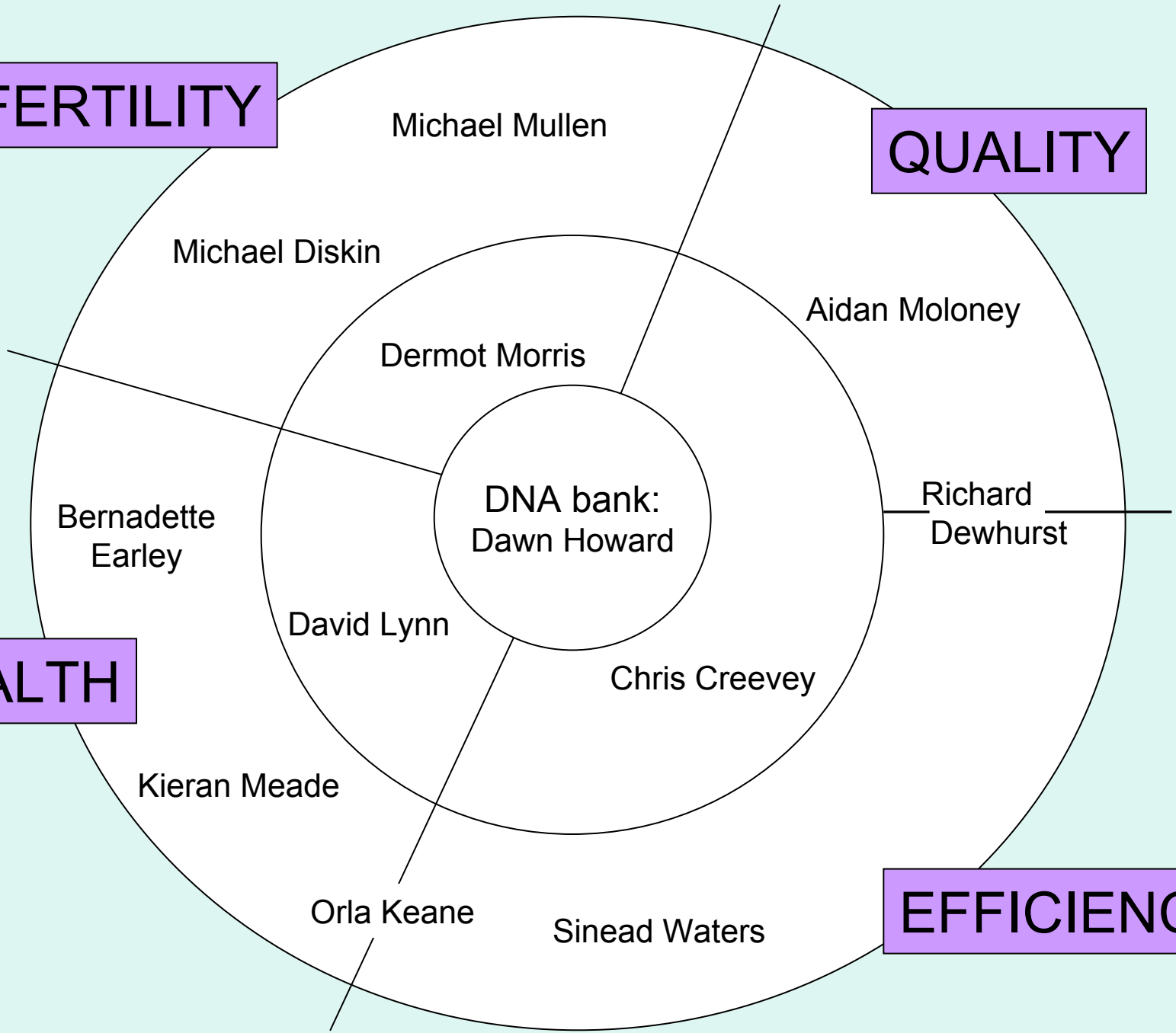
David Lynn

Chris Creevey

Dermot Morris

Michael Diskin

DNA bank:
Dawn Howard



Core technologies:

- DNA bank
- Bioinformatics

Fertility:

- High/low fertility lines
- Negative energy balance
- Dietary fatty acids
- Uterine proteomics

Core technologies:

- DNA bank
- Bioinformatics

Fertility:

- High/low fertility lines
 - Negative energy balance
 - Dietary fatty acids
- Uterine proteomics

Core technologies:

- DNA bank
- Bioinformatics

Health:

- Weaning/transport
 - Respiratory disease
 - Mastitis, metritis, IL8
 - Dietary fatty acids
- Nanoparticle vaccines

Fertility:

- High/low fertility lines
- Negative energy balance
- Dietary fatty acids

• Uterine proteomics

Quality:

- Dietary fatty acids
- Traceability
- Safety

Core technologies:

- DNA bank
- Bioinformatics

Health:

- Weaning/transport
 - Respiratory disease
 - Mastitis, metritis, IL8
 - Dietary fatty acids
- Nanoparticle vaccines

Fertility:

- High/low fertility lines
- Negative energy balance
- Dietary fatty acids

• Uterine proteomics

Quality:

- Dietary fatty acids
- Traceability
- Safety

Core technologies:

- DNA bank
- Bioinformatics

Health:

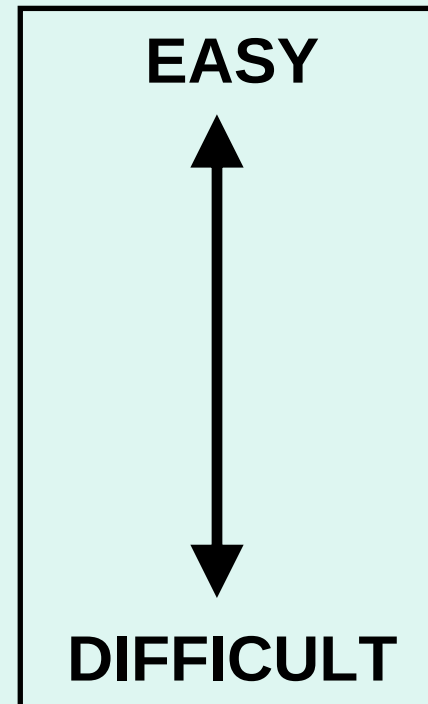
- Weaning/transport
 - Respiratory disease
 - Mastitis, metritis, IL8
 - Dietary fatty acids
- Nanoparticle vaccines

Efficiency:

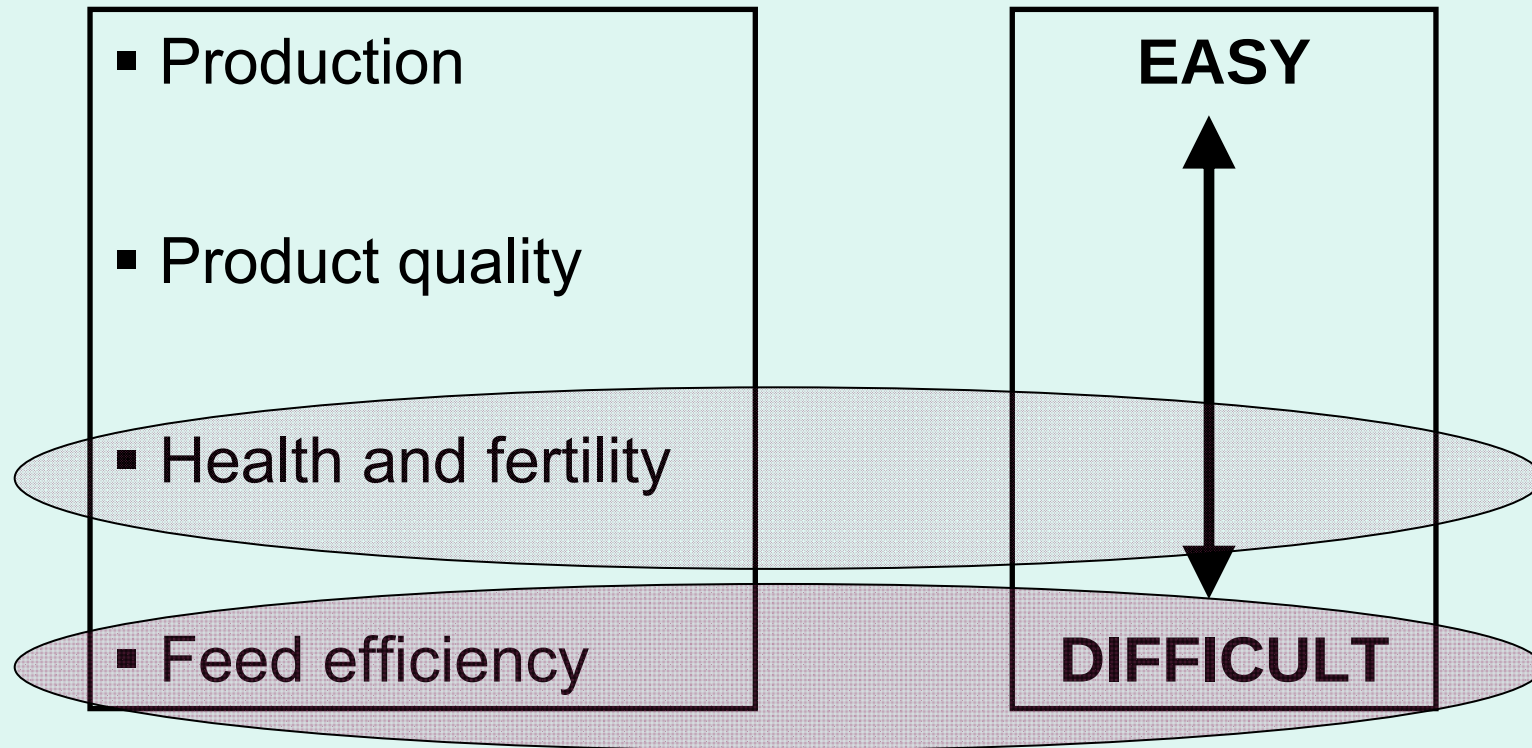
- High/low growth potential
 - Compensatory growth
 - Feed efficiency
- Rumen metagenomics

Ease of defining/measuring traits

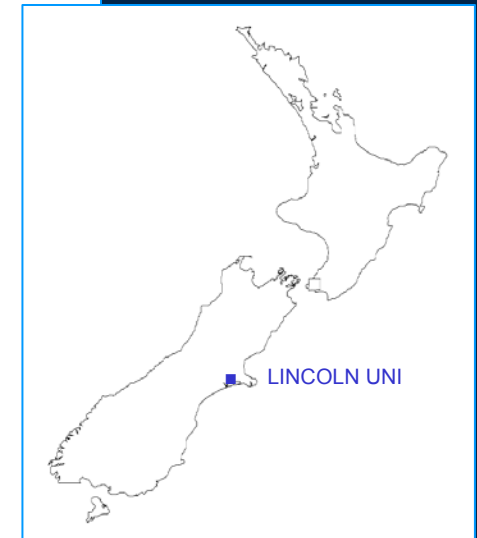
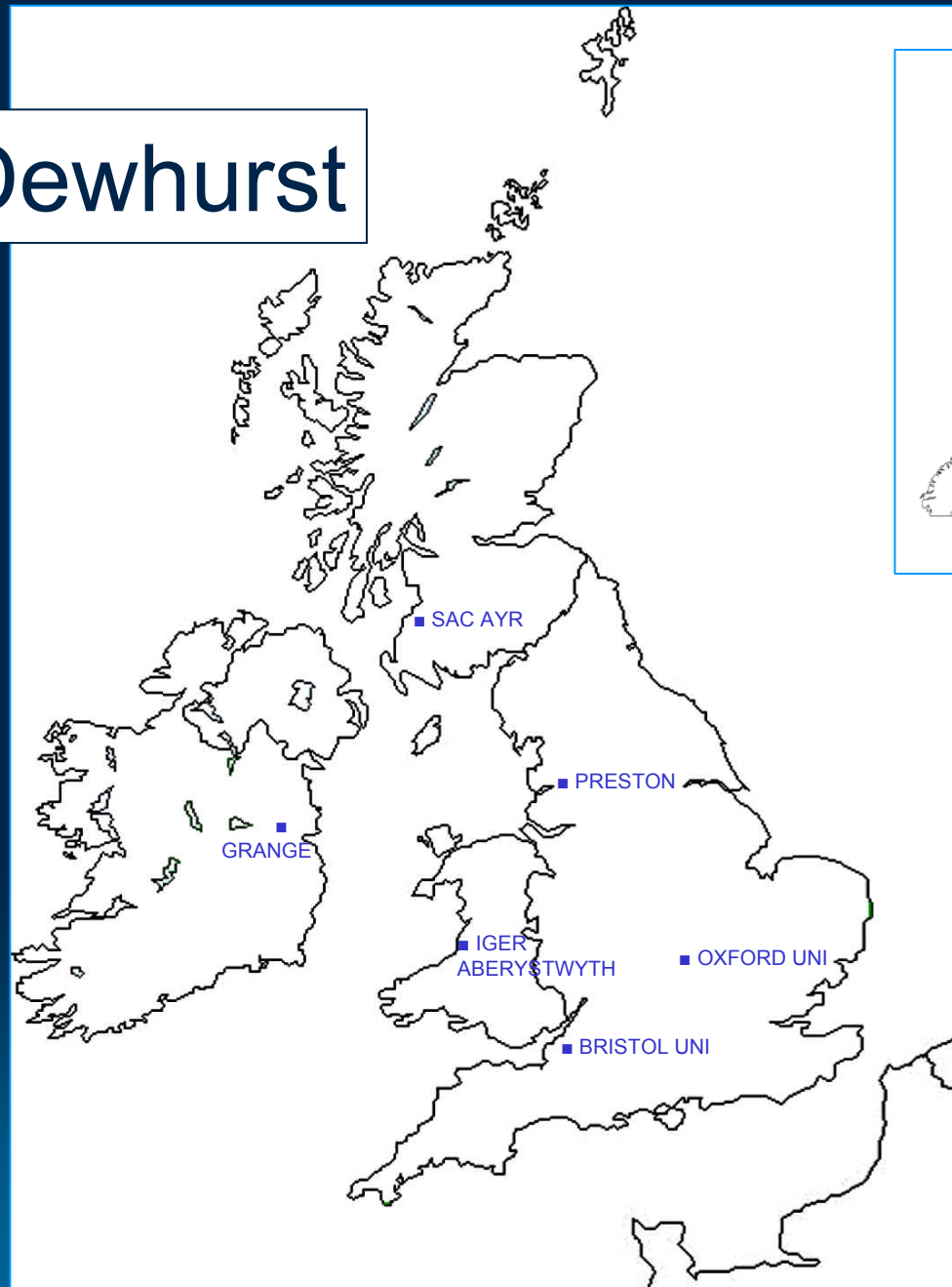
- Production
- Product quality
- Health and fertility
- Feed efficiency



Ease of defining/measuring traits



Richard Dewhurst



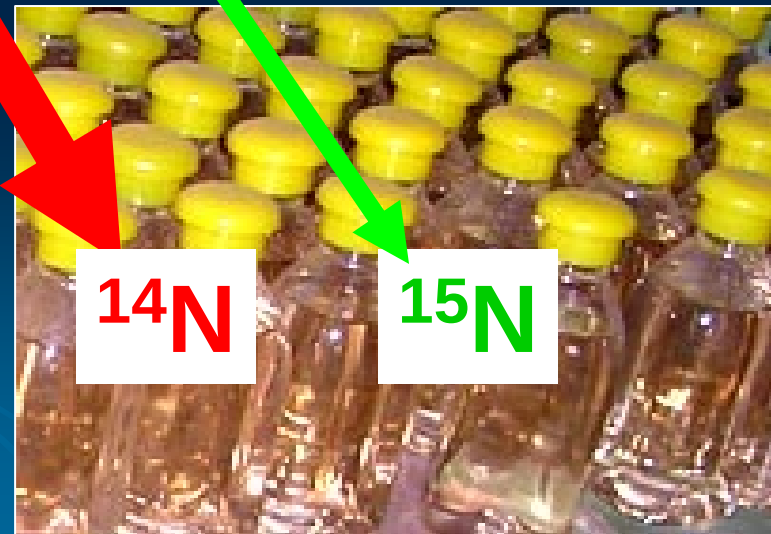
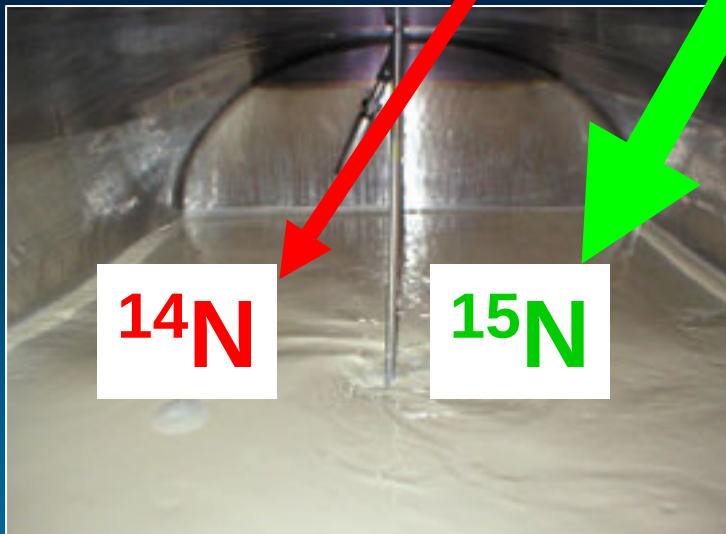
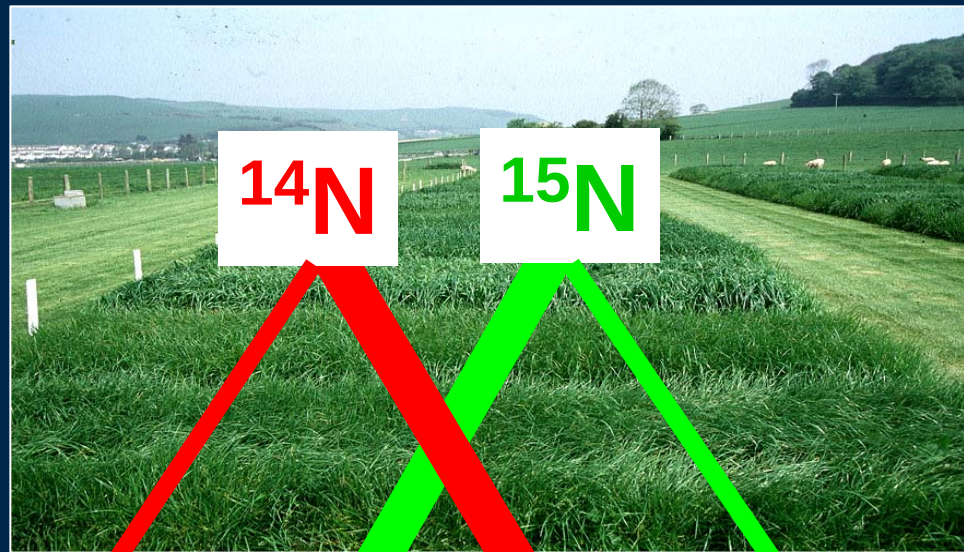
Feed efficiency markers

- N-use efficiency: ^{15}N in milk protein
- Methane – archaeol in faeces

Nitrogen partitioning



Nitrogen partitioning



Methane marker

	High silage	High concentrate	SED	Sig.
Methane (g/kg DM intake)	37.4	15.0	6.09	**
Faecal archaeol (mg/kg DM)	30.6	51	5.42	***

Gill et al., in preparation

Orla Keane

- Molecular Biology/Genetics
- Genetics of Animal Health
- Host resistance to disease
- Genetic Improvement of livestock



Background

- BA(mod) Microbiology, TCD
- PhD Microbial Genetics, TCD
- Animal Genomics, AgResearch NZ
- Evolutionary Genetics and Bioinformatics, TCD



Ovine HapMap Project

- ISGC developed ovine 50k SNP chip
- Almost 3,000 animals genotyped from 60 breeds
 - Evolutionary history
 - Genome structure
 - Selection sweeps
- Identify genes associated with traits under selection

Ovine SNP chips

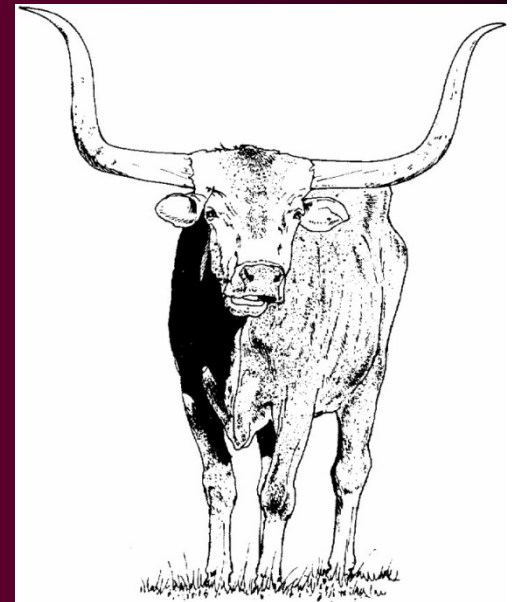
- Use 50k ovine SNP chip to find genes associated with traits of economic importance
 - Number of lambs born
 - Parasite resistance
 - Foot rot resistance
 - Production traits

Genomics and Animal Health

Dr. Kieran Meade

Mission:

- Identifying the genes that control the immune response
- Selecting animals with superior immunocompetance



My background

Degree in Animal Science UCD

Structural and population genetics of candidate genes (GH/GHR)
- Teagasc Walsh Fellowship

PhD in Molecular Genetics in UCD

MSU

ILRI - Kenya

Postdoctoral Scientist

St. Vincent's University Hospital (EI)

Trinity College Dublin (FIRM & RSF)

Skill set

International Livestock Research Institute, Africa

Trypanosomiasis – Understanding natural
mechanisms of Tolerance

- Molecular genetics
- Functional genomics
- Immunology



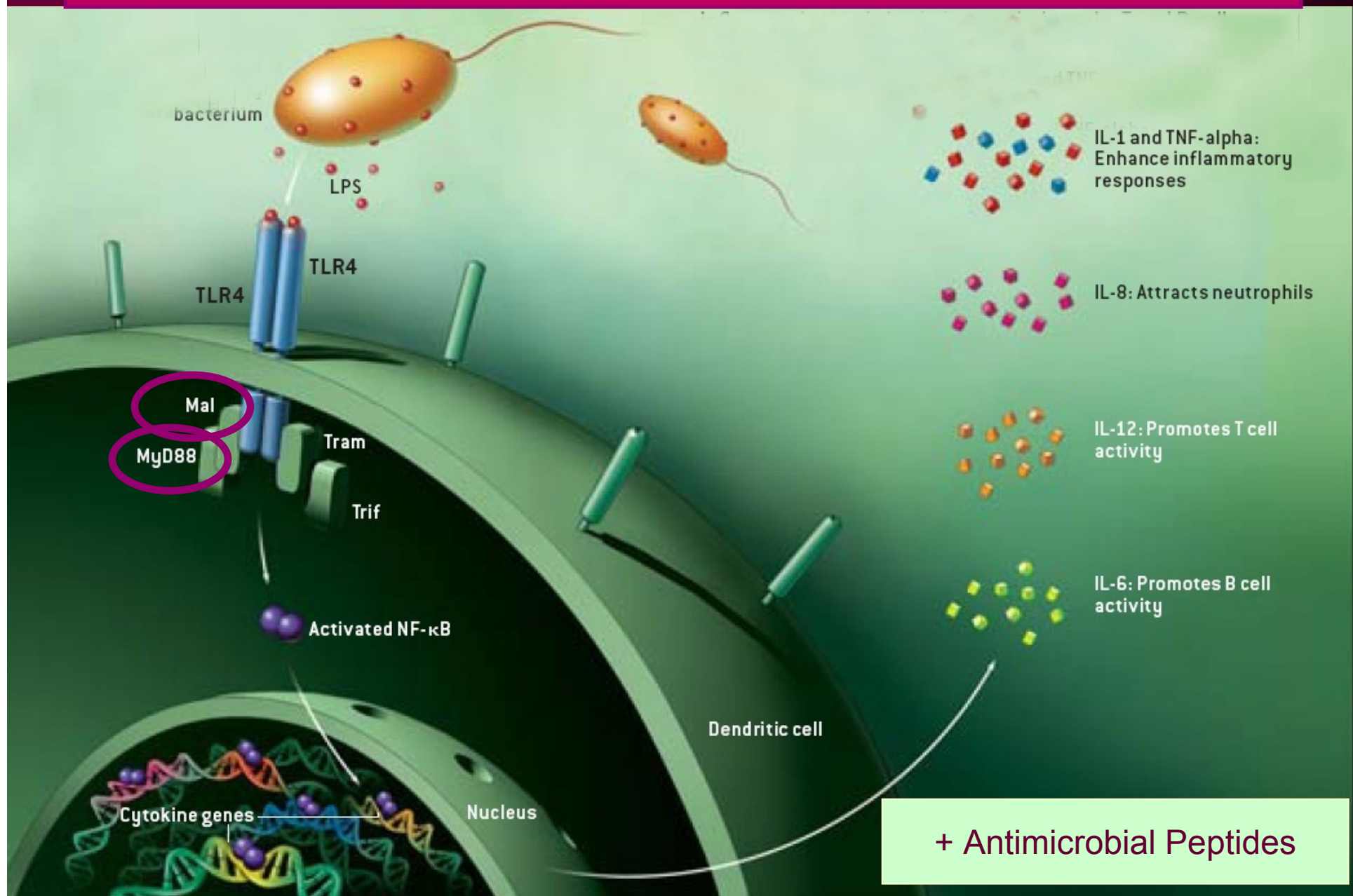
Animal Health

More, S 2007 – Shaping our future (IVJ)
Ireland not meeting international best practice

EU Animal Health Strategy 2007-2013 “Prevention is better than cure”

- o Infectious diseases costs to the livestock industries have been estimated for the developed world at 17% of turnover (Bishop et al., 2002). Mastitis costs €25b worldwide (Pareek et al., 2005).
- o Reducing the burden of disease at source is the best method for controlling transboundary, zoonotic infectious agents.
- o Discovery of novel genes involved, and regulating the immune response will ultimately lead to the development of novel diagnostics, and molecular targets for animal improvement schemes

Innate immunity (O' Neill 2005)



Health Phenotypes

The lack of reliable health-related phenotypes limits the rate of genetic gain attainable from genome-wide association studies (GWAS).

Health-related phenotypes can be used both for both GWAS and for the estimation of trait heritabilities.

Aims:

1. To assess baseline immune parameters and in response to disease in the national herd in order to identify animals with traits associated with superior disease resistance
2. To develop a panel of reliable informative immune phenotypes
3. Assess the change in immune parameters in response to disease (systemic, local, natural, experimental).

Teagasc and ICBF

Sample type	Test	Method
Health screen	Viral bacterial Antibody screen	Swab, culture
Data recording	SCC	
Blood sampling	1. Immune titres (antibody level) 2. Innate proteins (AMPs, APPs, cytokines) 3. Cell numbers and functionality	BVD, BRD, IBR. ELISA, Molecular Flow cytometry, Functional assays.

Animal cohorts selected – calves, bulls, experimental herds, national herd?

Chris Creevey M.Sc. Ph.D.

- B.Sc. Science NUI Maynooth (Biology & computer science)
- M.Sc. Ecology (Coford and NUIM) 
- Ph.D. Bioinformatics 
- Postdoc UCC/NUIM 
- Postdoc European Molecular Biology Laboratory (Heidelberg, Germany) 
- Current position: SFI Stokes Lecturer 



Background:

Previous research areas:

- Evolutionary genetics,
- Comparative genomics,
- Bioinformatics.

Current Research Areas:

- Genetic basis of traits of economic importance
- Rumen Microbial metagenomics

4 Walsh Fellowships investigating:

- Milk production
 - Fertility
 - Muscle growth and development
 - Immunity (mastitis)
-
- In conjunction with Dr. David Lynn
 - Primarily bioinformatics driven projects
 - Using a systems biology approach

Systems Biology Approach to understand traits of interest

Available data:

Literature
SNP association studies
Candidate gene studies
Genotyped animals
Phenotypic records
Whole Genomes

Areas of study:

Chromosomal regions
Gene families
Biochemical pathways
Protein-protein interactions
Protein-chemical interactions
Predicted functional partners
Regulatory elements

Predicted outcomes:

Overall picture of the mechanics of the system
Identification of central genes/regulatory elements involved
Understanding of how genetic changes affect the phenotype
More directed animal breeding programs, supported by genetic screening