

Teagasc

Resources and short-term plans

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Teagasc Objective for Today's Workshop(s)

- Identify areas of mutual interest
- Commence dialogue to build future synergies and collaborations
- Commence process of deciding how to best use and exploit new and emerging molecular tools and technologies
- Improve communication between interested parties.

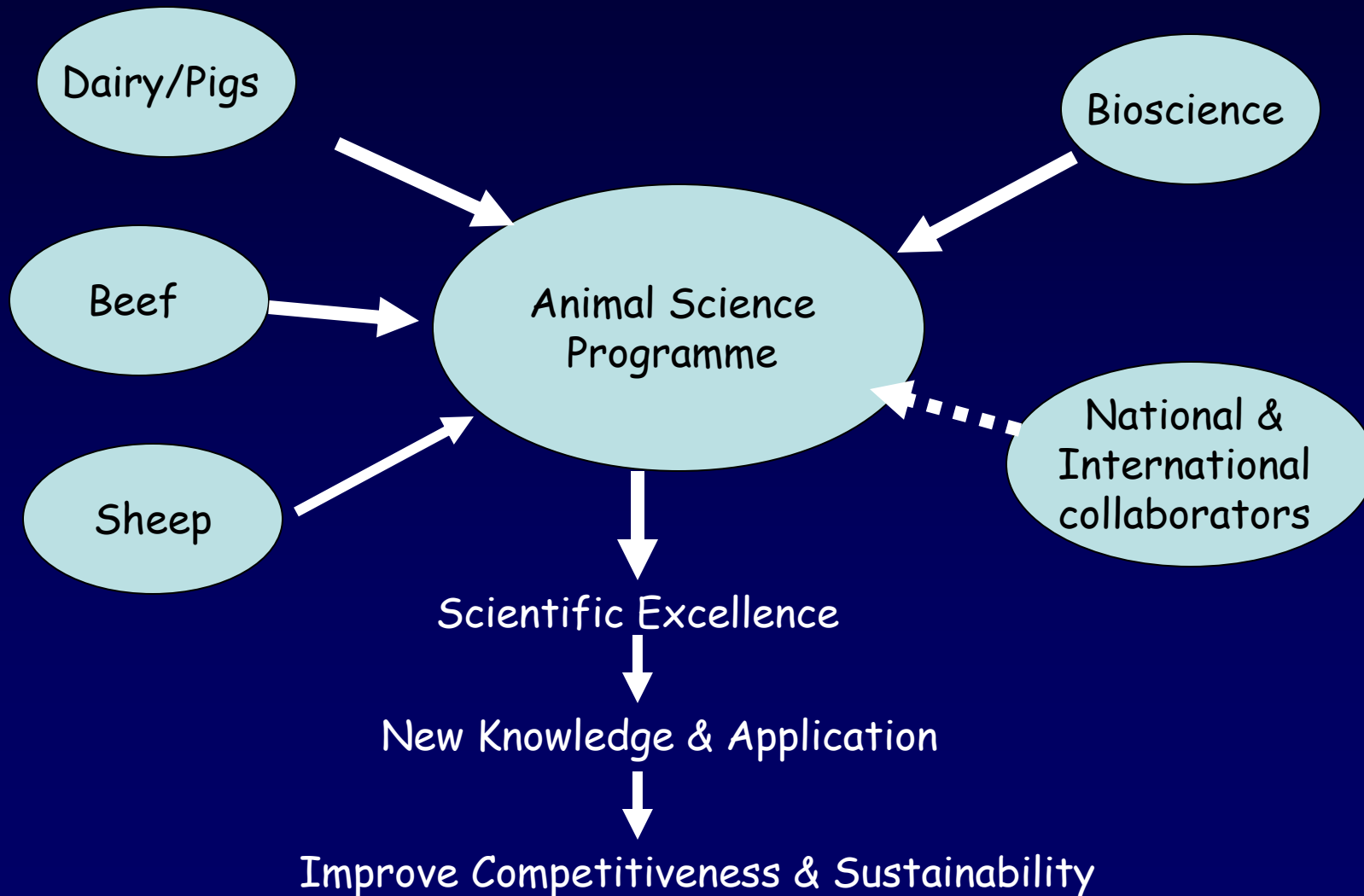
Short term goals

- To develop critical mass in emerging technologies and strengthen other areas in the application of emerging technologies
- Identify biomarkers/SNPs for net feed efficiency, fertility, detection of weanlings at risk of respiratory disease following weaning/transport, and for growth rate
- Investigate nutritional, management, environmental (and epigenetic) factors affecting gene expression and traits of economic importance
- Develop DNA bank resource and implement genomic selection for dairy, beef and sheep

Teagasc Animal Research: Sub-Programmes

- **Genetic Improvement of Animals**
- **Physiology of Reproduction, Growth & Lactation**
- **Animal Health & Well Being**
- **Animal Nutrition & Product Quality**
- **Animal Facilities, Labour, Automation & Energy Efficiency**
- **BETTER (TET) Farms**

Teagasc Animal Science Programme



Critical Mass - Animal BioScience/ Animal Science

	RESEARCH STAFF ALLOCATED
Animal Reproductive Physiology	4
Feed efficiency	3
Growth physiology	1
Nutrition	3
Animal health and welfare:	4
Milk and meat quality	6
 Molecular biologists	 3
Quantitative geneticists	4
Proteomics	2
Bioinformatics	3
Total	33

+ Technical

+ Walsh Fellows

Recent Recruits

- Dr Sinéad Waters – Molecular Biology
- Dr Richard Dewhurst – Nutrition
- Chris Creevey – Computational Biology (SFI Stokes Lecturer)
- David Lynn – Bio-informathician
- Dr Kieran Meade – Immunology
- Dr Orla Keane – Molecular biology
- Dr Sinead McParland - Quantitative Geneticist
- Dr Noreen Begley-Quantitative Geneticist (post Doc)
- Dr Dawn Howard – Molecular Biologist (DNA bank) Post Doc
- Dr Michael Mullen – Proteomics – RBC Cluster with UCD

Further Expertise Required

- Lactation physiology
- Growth biology

Animal models

- Fertility (High & Low Fertility and Short-term NEB models)
- Nutritional e.g., Dietary PUFA supplementation
- Growth rate (beef)
- Feed efficiency (beef)
- Animal welfare (transport/weaning/castration; beef and dairy)
- Dairy: breeds and strains within breeds
- Sheep: Growth rates/reproductive traits/ parasite resistance
- Methane emissions (beef and dairy)

Potential New Animal Models ??

- Animals divergent for health traits
- Facilities to challenge animals with diseases (e.g., Johne's disease)
- Feed efficiency model for dairy cattle
- Lack of genetic information

Equipment/Laboratory/Skills

- **Animal skills & Animal Models**
- **Endocrine and metabolic assays**
- **Data analysis**
- **Nutrition:** Animal & Laboratory
- **Environmental:** Animal & Laboratory
- **Meat quality:** Laboratory

MIDU (Meat Industrial Development Unit, Ashtown)

- **Genomics:** Laboratory
- **Molecular microbiology:** Rumen Biology
- **Proteomics:** Laboratory
- **Bioinformatics:** Platform currently being established
- **DNA Bank:** Dairy Beef and Sheep

Strong Across Centre Collaborative Programmes
Strongly Linked to UCD, NUIM, NUIG and ITs and
International linkages - Universities and Research Organisations

New equipment / skills required

- Calorimeters
- Platform for SNP chip hybridisation and scanning (currently outsourced)
- SNP chip with greater representation, i.e 500,000 SNPs
- Increased computing resources
- Better recording and definition of new traits
 - ❖ Feed efficiency in dairy cows
 - ❖ Phenomics / phenotypic tools
 - ❖ Automatic recording

DNA Bank

- All dairy, beef and sheep research animals
 - ❖ > 4,000 dairy animals
 - ❖ > 800 beef cattle
 - ❖ ~ 130 sheep
 - ❖ Excellent phenotypes
- AI sires
 - ❖ > 2000 dairy bulls
 - ❖ Starting beef bulls

Collaboration in progress

High throughput SNP genotyping
Sequenom

Genotyped 1000 sires and 600 cattle for SNPs in
candidate genes of functional importance

- Cross directorates in Teagasc
and with UCD
- Currently analyses for
genetic associations with
economically important traits



Collaboration in progress

- Purchasing of the Next generation Illumina Genome Analyzer II sequencer with Professor Brendan Loftus, UCD (starting this week)

Uses:

- ❖ Digital Gene Expression
 - ❑ RNA-seq
 - ❑ Tag Profiling
 - ❑ Small RNA Discovery and Analysis
- ❖ Genome sequencing and resequencing
- ❖ ChIP-Seq



Cluster Approach - 2009

- Using a systems biology approach to elucidate differences among animals for a range of pertinent traits
 - ❖ Fertility
 - ❖ Milk production
 - ❖ Growth rate
 - ❖ Health

Cluster Approach - 2009

Title	University	Teagasc	Programme
Enabling systems level analyses of bovine gene expression and whole-genome association study data in the context of the bovine interactome	Prof. Fiona Brinkman (Simon Frazer University)	Dr David Lynn (ABS Grange)	4- year PhD
Investigation of the genetic basis of bovine milk production traits using gene expression and genome-wide association data	Dr David McHugh (UCD)	Drs David Lynn Donagh Berry & Orla Keane (ABC Grange)	4-year PhD
Investigation of the genetic basis of the bovine mammary immune response using transcriptomic and genome-wide association data	Prof Cliona O'Farrelly (TCD)	Dr David Lynn, Bernie Earley & Kieran Meade (ABC, Grange)	4-year PhD

Strengths/weaknesses

➤ Strengths

- ❖ Staff
- ❖ Databases for genomic and phenomic data
- ❖ Animal resources and animal models
- ❖ Good laboratory resources /skills
- ❖ Application of Results

➤ Weaknesses

- ❖ Lack of critical mass in some research areas

Opportunities/Threats

➤ Opportunities:

- ❖ Multidisciplinary Cluster
- ❖ Visiting research fellows
- ❖ Walsh Fellowships
- ❖ DNA Bank

➤ Threats

- ❖ Critical mass
- ❖ Intellectual property issues - Slow down research
- ❖ Funding opportunities
- ❖ Availability of skilled staff to hire

Future priorities

- **Apply Molecular Biology Tools to Important Traits:** Reproduction, health, feed efficiency, milk Production, growth rate & product quality
- Generate **New Knowledge** and exploit this **Nationally**
- Exploit **system biology** tools in animal breeding
- **Genomic selection** - across species
- Expand and Exploit DNA Bank
- Increase scientific output- **Peer Reviewed papers**
- Transfer new knowledge to industry

Future priorities

- Expand Skilled Multidisciplinary Teams
- Equip Laboratories
- Establish and improve national & international collaborations.
- Attract competitive grant funding
- Train more PhD student

Summary – Message

- Focussed Programmes - “Real” Constraints to Efficiency
 - Scientific Excellence & Output
 - Delivery to Industry
- Single Animal Science Programme
- Skilled, Committed & Flexible Staff
- Multidisciplinary Teams (Cluster Approach)
- Well-Equipped Laboratories & Skills Base
- Animal Models
- Databases
- DNA Bank
- Strong National & International Collaborations
- Focus on External Competitive Funding
- Open to new collaborations

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