

Official Opening of the Animal Bioscience Building

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5th September 2012





Welcome to the Official Opening of Teagasc's Animal Bioscience Building

The building is part of the Teagasc Vision Programme to build centres of excellence in key sciences underpinning the Irish Agri-Food industry. The total area of the building is 2330 m² and this includes 852 m² of laboratories. There are two large molecular biology laboratories, a dark room, and a series of laboratories for DNA/RNA preparation, immunology, biochemistry, microbiology, cell culture and flow cytometry. The building also includes a new canteen and Conference Room.

Alongside the offices and buildings that are being opened today, we recruited seven new researchers to strengthen our capability in molecular and computational biology, animal metabolism and immunology. We have invested in excellent computational biology infrastructure, and will soon start construction of a state-of-the-art animal house close to the Animal Bioscience Building.

Teagasc research is now based on Programmes running across research locations to ensure efficient use of resources and transfer of technologies between areas of science and livestock systems. There are already strong

linkages from the Animal Bioscience laboratories to our dairy and sheep work at Moorepark and Athenry.

This investment in staff and facilities makes Teagasc an even more attractive research partner internationally and new staff have already established strong links with major animal bioscience groups in the US, Canada and New Zealand. External research income has already exceeded the cost of this building.

The subsequent pages of this booklet provide an overview of the main areas of Animal Bioscience research across Teagasc.

Animal Breeding and Genomics

Animal breeding and genetics research, in collaboration with other research departments at Teagasc, is developing tools to more accurately identify the most profitable animal for current and future production systems. National breeding objectives have been developed for dairy cattle, beef cattle and sheep and our primary focus is to continually develop, refine and disseminate the usefulness of these indexes in breeding more profitable animals for the entire Agri-Food industry. We are developing the optimal breeding programmes to maximise genetic gain in the long term. Validation of genetic evaluations and ongoing testing of national breeding objectives is achieved through both controlled experiments with dairy cattle and sheep and also on-farm studies.



Main research activities include:

- Development of multi-breed genetic and genomic evaluations, breeding objectives and breeding programmes for dairy cattle, beef cattle and sheep
- Selection experiments and breed comparisons with dairy cattle and sheep
- Knowledge transfer including the development of decision support tools for farmers and the Agri-Food industry
- Dissection of the molecular and genetic mechanisms underpinning complex traits

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Animal Health and Welfare

This research addresses new and improved management practices and their associated support tools. Our work encompasses the whole production process with, optimal use of inputs, consideration of animal health and welfare in farming systems, product safety and quality. If animal production is to be successful in the future, it has also to respond to the increasing questions about environmental, ethical concerns, address the needs of society and meet consumer requirements.

Specific areas of research activity include:

- Research to verify the welfare advantages experienced by animals in our production systems
- Determining the conditions at pasture which optimise animal welfare
- Investigating housing parameters which improve animal welfare
- Examining novel biotechnological approaches for vaccine delivery to the lung
- Identifying the etiological agent(s) in cases of bovine respiratory disease
- Specifying the mechanisms by which bacterial and viral pathogens affect the immune system.
- Describing the kinetics of the humoral and cellular immune responses with particular emphasis on the pathogenesis and treatment of respiratory diseases
- Determining the distribution of E.coli 0157:H7 in cattle production systems
- Assessing the biological impact of short and long distance transport on the welfare of animals.
- Evaluating calf health and mortality in dairy production systems
- Improving herd health in beef production systems
- Endemic infectious diseases in dairy production systems



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Infection and Disease

Our researchers study mechanisms to control infectious diseases as effective disease control is a critical contributor to the international competitiveness of our agri-food industry. The highly interdisciplinary research focuses on a combination of mechanisms, including enhanced biosecurity and management strategies, improved diagnostics and therapeutics, vaccination, and selection for disease resistant animals.

Researchers aim to understand the molecular and genetic mechanisms of pathogenesis and of the mounted immune response. We aim to identify genes, pathways and biological processes mediating resistance to infectious diseases in cattle and sheep and how these genes interact with pathogens and the environment. Knowledge of the molecular and genetic mechanisms of disease susceptibility has the potential to result in practical applications such as genetic markers, biomarkers, novel diagnostics and therapies.



Main research areas:

- Bovine Tuberculosis
- Intramammary Infection
- Metritis/Uterine health
- Gastrointestinal Nematodes
- Liver fluke

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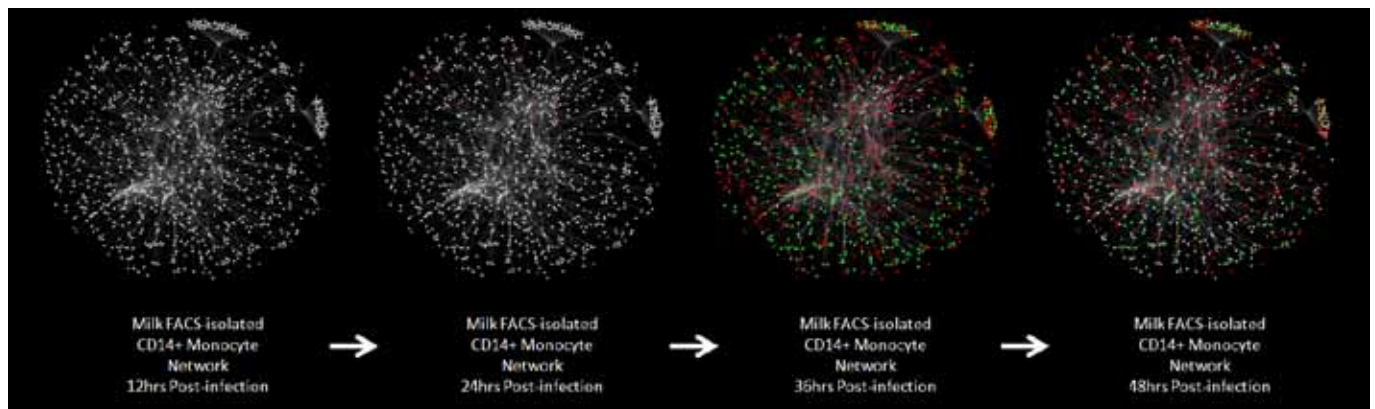
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Computational and Systems Biology

The publication of the bovine genome sequence in 2009 in the journal *Science* along with the bovine HapMap project, an effort to catalogue genetic diversity across the genome in 19 breeds of cattle, has the potential to greatly accelerate animal genomics research and innovation. In this post-genomics era, Animal Bioscience researchers are already utilising genome-wide analyses, including gene and microRNA expression profiling (RNAseq), proteomics, genome sequencing (Illumina & 454), genome-wide association (GWA) studies, epigenomics and metagenomics to investigate important aspects of bovine biology with significant economic impact including traits such as production, nutrition, reproduction, immunity and disease. Such analyses, however, generate vast quantities of data and efficiently analysing such large complex datasets requires advanced computational approaches. Computational biology utilises methods and approaches from bioinformatics, statistics and mathematics along with advanced capabilities for data management to store, analyse and interpret this large-scale data.



Main research activities include:

- Analysis of next-generation sequencing data
- Analysis of metagenomics data
- Pathway and network based analysis (www.innatedb.com)
- Genome-wide association studies
- Systems biology approaches to immunology
- Molecular interaction network analysis and visualisation

For further details please see our article in TRResearch - "Understanding Bioinformatics" - http://www.teagasc.ie/publications/2009/3/3_tresearch200910.pdf

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Fertility and Reproduction

Research is focussed on elucidating the biological causes of reproductive failure with a view to devising management-based strategies to improve reproductive performance of both dairy and beef cows and sheep. The research utilizes conventional endocrine and physiological approaches combined with genomic, proteomic and bioinformatic tools to address the problem of poor reproductive efficiency.



Main research activities include:

- The genetic merit for fertility traits on ovarian follicular development, uterine environment and embryo quality
- Early fetal-maternal interaction and identification of biomarkers of early pregnancy, uterine health and function
- Endocrinology of reproduction and nutrient partitioning
- Use of micronutrients to improve reproductive performance of pasture-based dairy cows
- Automated oestrus detection
- Design & evaluation of synchronisation protocols for seasonal-calving systems, & development of decision-support systems

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Feed Efficiency and Product Quality

Our research activities aim to understand the mechanisms underpinning the efficient conversion of nutrients to quality animal products using a variety of animal models including animals selected for enhanced efficiency (e.g., residual feed intake) and management models of efficiency (e.g., compensatory growth). Multidisciplinary approaches applied include nutrition, physiology; transcriptomics (including RNAseq) and genomics; proteomics; endocrinology and product quality. Data from this work will contribute to the identification of potential molecular biomarkers for the genetic selection of cattle with greater feed efficiency and provide insight into opportunities and consequences of modification of future production systems. Researchers are also applying a suite of molecular technologies including metagenomics to characterise and gain a greater understanding of the rumen microbiome and its role in the efficiency of nutrient utilisation and methane production.

Main research activities include:

- Molecular mechanisms controlling compensatory growth in muscle of cattle
- Examination of the rumen microflora in cattle divergent for residual feed intake
- Investigation of stable isotope and biochemical markers for components of feed efficiency, including rumen methanogenesis
- Enhancing beef quality through modification of diet composition
- Diet and animal effects on feed efficiency and Nitrogen excretion



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Notes

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