

CORE SCIENCE THEMES

Food Quality, Safety and Innovation

Policy Context: The Going for Growth Strategic Action Plan for the Northern Ireland agri-food industry (Agri-Food Strategy Board, 2013) has identified opportunities to exploit the rising global demand for dairy products from a growing world population and increasing affluence and westernisation of diets in developing countries. It recommends further R&D on nutrition to improve the performance and health of animals and humans, in the context of environmental sustainability. Innovative developments, including extension of shelf-life, are required to fully exploit the opportunities offered by long-distance export markets. As Northern Ireland is a net importer of grain and other animal feed ingredients, the complex international supply chain for these raw materials presents a risk to the safety of the local food chain. AFBI already has an international reputation for the development and application of analytical methods for the detection of hazardous agents in the food chain. It must continue to develop rapid, sensitive and cost-effective methods for the detection of feed chain hazards including chemical and microbiological contaminants. This requirement is especially important in the context of current EU proposals to modernise meat inspection regimes.

Strategy for Food Quality, Safety and Innovation: To assist the local agri-food industry to achieve the targets set out in the Going for Growth Strategic Action Plan (Agri-Food Strategy Board, 2013), and to continue to provide DARD with a robust science base for policy development AFBI will:

- Build on our recognised expertise in food analysis by adapting, developing and applying rapid, sensitive and cost-effective methods for the detection of food chain hazards, including pesticides, veterinary drug residues, adulterants and marine biotoxins. These activities will include multi-class, multi-residue analytical methods based on application of increasingly sensitive instrumentation and increased data processing power.
- It is important here to differentiate between (a) screening methods used to identify new/potential hazards in the food chain and (b) advanced analytical methods needed for confirmation of these hazards and enforcement of legislation. Both areas are equally important.
- Develop novel techniques for the identification of substances associated with nutritional quality and perceived eating characteristics.
- Work with CAFRE's food technologists to develop new methods for extending shelf-life and reducing food spoilage and waste.
- Develop new methods to study consumer food preferences, including the use of home sensory analytical methods that exploit modern electronic communication methods.
- Offer specialist training for the local agri-food industry and international customers.
- Build further expertise in emerging areas of microbiological food safety and investigate new processing and packaging technologies to enhance food safety and quality.
- Maintain scientific expertise in meat and dairy science, including in texture and colour analysis, flavour chemistry, sensory evaluation and nutritional properties.



Sustainable Livestock Production Systems

Policy context: The expansion targets set out in the Going for Growth Strategic Action Plan must be achieved in a sustainable manner. Fundamental and applied research, including the application of advances in genetics and nutrition, is required to increase output, competitiveness, improve the environment and address consumer concerns about food safety, animal welfare and environmental protection.

The competitiveness of the dairy, beef and lamb sectors will continue to depend on maximising the efficiency of utilisation of grass, an area in which Northern Ireland has a competitive advantage. Greenhouse gas emissions in Northern Ireland are subject to a wide range of Northern Ireland, UK and EU policies and legislation and the Northern Ireland Executive's Programme for Government has set a target of a 25% reduction in GHG emissions by 2025 relative to 1990 levels. Strategies to reduce the intensity of greenhouse gas (GHG) emissions from livestock and soils are therefore required to increase environmental sustainability and ensure that the Northern Ireland agri-food industry complies with relevant legislation.

The intensive pig and poultry sectors are highly dependent on imported feed ingredients which represent approximately 80% of the costs of production. Therefore, improved feed efficiency is key to the sustainability of these sectors. These sectors must also comply with EU integrated pollution prevention and control regulations relating to ammonia emissions and odour levels, and also further reduce phosphorus excretion.

Strategy for Sustainable Livestock Production Systems: To provide a robust science base to DARD for policy development and to assist the local agri-food industry to improve the competitiveness and environmental sustainability of livestock production systems while achieving the targets set out in the Going for Growth Strategic Action Plan (Agri-Food Strategy Board, 2013), AFBI will:

Sustainable dairy, beef and sheep systems

- Further develop expertise in nutritional strategies to reduce methane emissions and nutrient losses from livestock systems and to investigate their inter-relationships with animal performance and welfare. A multi-disciplinary approach to the development of precision animal feeding systems will bring together AFBI's specialists in soil and livestock science, in strategic partnership with other research organisations, in the areas of transcriptomics, proteomics and metabolomics.
- Further develop expertise in precision feeding systems to improve "whole farm" feed efficiency on dairy, beef and sheep farms. AFBI will use a holistic approach encompassing rumen function, nutrient partitioning, nutrient losses (nitrogen and phosphorus), GHG emissions (methane and nitrous oxide), milk production and health and fertility parameters. This will involve cross-cutting science, including expertise in endocrinology, and veterinary and livestock science.
- Further develop expertise to exploit the scientific opportunities that arise from the development of integrated industry databases to significantly increase genetic progress in cattle and sheep. AFBI will use a multi-disciplinary approach through cross-divisional working and collaborative partnerships with other research organisations, to provide genetic evaluations, including genomics, and develop online management tools based on data from commercial herds and flocks in Northern Ireland.
- Develop the most up-to-date breeding techniques for forage grass, protein crops, cereals, potatoes, mushrooms and soft fruit, including the use of genomics and phenomics as appropriate
- Continue to support plant breeders and statutory agencies through the provision of independent, accredited trialling of new crop varieties.
- Further develop expertise in plant genomics, agronomy, ecosystem services, and harvesting and utilisation of biomass crops



- Develop further expertise in plant genomics, physiology and fibre technology in order to enhance the quality of, and identify new commercial opportunities for existing and potential new crops to be grown in Northern Ireland
- Maintain expertise in the ecology of grassland, heather moorland and farm woodland to identify and promote management practices which optimise utilisation of resources and increase biodiversity.
- Develop a model to predict grass growth on a regional basis to assist the industry in the efficient production, management and utilisation of grass in the diets of grazing livestock.
- Exploit the scientific opportunities which arise from the development of integrated industry databases, including application of the key performance indicators collated from the BovIS online application to benchmark the competitiveness of the local dairy and beef sectors against international best practice in advance of the abolition of milk quotas in the EU in 2015.
- Develop a cattle DNA bio-bank on which to base future genomic studies, including a range of new phenotypic information e.g. GHG emissions and nutrient utilisation.
- Continue to develop expertise in beef and lamb systems for upland pastures while promoting biodiversity.

Sustainable pig and poultry systems

- Develop enhanced expertise on how to optimise performance and productivity from the NI pig herd through the development of lifetime management and nutritional strategies to increase sow productivity, improve feed use efficiency and reduce nitrogen and phosphorus excretion, ammonia emissions and odour levels from pig and poultry systems.
- Further develop expertise in management and nutritional strategies to optimise pig performance from liquid feed systems since liquid feeding is expected to become the preferred feed system in NI in the future.
- To harness the ability of technology to increase nutrient availability from feed which will improve the precision with which feed can be formulated for pigs and poultry.



Protection of Fisheries and Aquatic Ecosystems

Policy Context: AFBI's freshwater and marine fisheries science and ecosystem science programme underpins a strong local, national and international policy framework. The institute is the key provider and leader in the generation of scientific data for the evaluation of compliance with EU regulations. The institute's marine fisheries programme addresses the core requirement of the EU Common Fisheries Policy regulatory stock assessment by collecting data under the EU Data Collection Framework (DCF). AFBI continues to develop capacity to assess and advise on the sustainable management of commercial and recreational resources in freshwater fisheries in Northern Ireland.

AFBI's coastal zone science programme of seabed mapping, marine resource assessment and inshore fisheries assessment, allows DARD to fulfil its fisheries management obligations under the Fisheries Act (NI) 1966. AFBI's network of moored instruments in sea loughs and coastal waters provides real-time environmental monitoring to help DARD fulfil its requirements to manage aquaculture sites and monitor water quality on behalf of the Northern Ireland Environment Agency and the Loughs Agency. Our coastal zone work also addresses the statutory member state reporting objectives under the new EC Marine Strategy Framework Directive (MSFD). It also enables DARD to fulfil its "Article-6" statutory obligations, under the EC Habitats Directive (92/43/EC) to produce assessments for any licensed activity that may impact designated features.

AFBI's coastal zone science programme also delivers data in support of the Department of the Environment's responsibilities under the Wildlife (Northern Ireland Order) 1995, the UK Biodiversity Action Plan 1994, and the Food and Environment Protection Act (1985), together with AFBI's own specific statutory responsibility under the Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) (England and Northern Ireland) Regulations 2007.

AFBI provides scientific support to the Loughs Agency, to underpin agency activities on resource management under the Foyle and Carlingford Fisheries Act 2007.



AFBI's scientific work on marine ecosystem health is currently being expanded in the context of a wider requirement to co-ordinate marine science at UK level, in line with the recently published UK Marine Science Strategy. It also addresses the DOE's obligations under several international agreements, including the OSPAR Convention on the Protection of the Marine Environment of the North-east Atlantic (1992). Statutory monitoring for the occurrence of toxin-producing plankton addresses the EU Shellfish Water Directive (2006/113/EC) for the Food Standards Agency.

Strategy for Protection of Fisheries and Aquatic Ecosystems: To assist DARD, DOE, DCAL, the Loughs Agency, other agencies and the local freshwater and marine fishing industries to comply with all EU, local and national legislation while protecting the health of aquatic ecosystems, AFBI will:

- Further develop the Institute's platform capabilities including marine geographical information systems
- Strategically invest in upgrades/refurbishment as necessary to maintain and develop the capability of the institute's marine research vessel, the RV Corystes
- Develop a plan to continue marine fisheries and ecosystem work after the RV Corystes comes to the end of its working life in 2018-2019, including a business case for vessel replacement.
- Invest in new technologies and scientific techniques to enhance our marine survey capabilities, including passive acoustic monitoring of marine mammals
- To further develop expertise in marine science relevant to offshore renewable energy.
- Develop strategies for evidence-based sustainable management and exploitation of recreational and commercial fisheries resources in inland waters, with a particular focus on the large lake systems of Loughs Neagh and Erne
- Maintain the provision of the scientific data in support of international reporting on the status of salmon stocks and the European eel recovery plan



Environmental Protection

Policy Context: The requirement to comply with EU and regional environmental legislation is the key policy driver for AFBI's environmental research which is aimed at gaining an improved understanding of the inter-relationships of agriculture, land use, climate change and the ecological status of freshwater resources in Northern Ireland. Environmental research in AFBI addresses land and nutrient management issues to make appropriate and efficient use of resources, while protecting the environment. The integrated research effort covers the impact of nutrients used by agriculture on air, soil and water quality. The outputs of this research have provided much of the scientific basis for the development of the Action Plan for Northern Ireland to comply with the Nitrates Directive and Derogation. AFBI contributes to the UK Environmental Change Network for long-term ecosystem monitoring and research in order to help mitigate and adapt to climate change.

Greenhouse gas emissions in Northern Ireland are subject to a wide range of Northern Ireland, UK and EU policies and legislation. The Northern Ireland Executive's Programme for Government has set a target of a 25% reduction in GHG emissions by 2025 relative to 1990 levels. Legislative pressures are likely to require a reduction in nitrous oxide emissions from soils to which synthetic fertilisers and organic manures are applied, and maintenance of the large store of carbon in soils and peatlands. As agriculture is the industry sector associated with the highest proportion of GHG emissions in Northern Ireland, there is a need for further research to reduce emissions while increasing output through more efficient production methods.

There is a continuing policy priority to improve the ecological status of Northern Ireland's freshwater systems, most of which are enriched with nutrients from anthropogenic sources. Critically, the Water Framework Directive requires improvements in ecological status by 2027.



There is evidence of deterioration of soil condition across Europe, including in Northern Ireland. To address this issue, a draft EU Soil Framework Directive was introduced by the European Commission in 2006. This directive, which is likely to be revised and ratified by Member States in the near future, seeks to harmonise and raise the level of soil protection across the EU by requiring Member States to consider soil protection and soil functions in national policy-making. In order to develop effective policies to protect and improve soil quality in Northern Ireland, robust scientific evidence on the condition of our soils is required.

A range of European and local environmental legislation are drivers for increased levels of research on nutrient management. For example, the EU Nitrates and Water Frameworks Directives, 2006 NAP Regulations and The Phosphorus Regulations (NI) 2006. There is a need to fulfil Northern Ireland's regional commitments on ammonia (Gothenburg protocol), and N_2O emissions reduction in accordance with the NI 2025 target for GHG emissions.

Sustainable farming systems depend on achievement of economic, social, and environmental objectives for nutrient management. In sensitive and valued ecosystems, such as wetlands and moorlands, emphasis is likely to be placed on environmental protection through restrictions on nutrient input, whereas in less environmentally sensitive contexts, farm profitability may dominate, and nutrient-driven production be viewed as having primary importance. Climate change, characterised by wetter winters, drier summers and more intensified events, increases the potential for nutrient losses via runoff and gaseous emissions. The depletion of global phosphorus resources means that this crop nutrient must be preserved as much as possible.



Environmental Protection Strategy: To assist DARD, DOE, DCAL and other agencies comply with all EU, local and national environmental legislation, AFBI will:

Ecological Status of Freshwater Systems

- Develop new technologies to upscale and verify emission factors for GHGs (CO₂, CH₄ and N₂O) at the field scale and to expand and upgrade its stable isotope facilities to develop environmental signatures for environmental pollutants
- Develop targeted ecological modelling tools for lake management
- Remain part of the UK Environmental Change Network for long-term ecosystem monitoring and research to detect, interpret and predict long-term environmental changes in order to help mitigate and adapt to climate change
- Maintain plot experiments, mini-catchments and the monitoring of large systems, such as Lough Neagh and its inflowing rivers, to study fundamental processes and mitigation options at farm level and to test these findings through the response of lakes and rivers.

Soil Quality

- Maintain facilities and skills for the long-term monitoring and experimental investigation of soil quality to provide early warning of the potential adverse impacts of different land use activities on soil quality e.g. "trafficability", compaction, erosion, and the impact of changes in the usage of organic and mineral fertilisers on soil and water quality as a result of the implementation of the Nitrates Action Plan.
- Maintain skills and capacity for modelling and mapping potential risks from erosion and runoff from slurry on a province-wide basis, and for the development of hazard/risk maps and soil quality assessment.

- Build on AFBI's Geographic Information System (GIS) capability to improve decision-making processes by providing spatial evidence in an easily assimilated way. These include soils (classification type and attributes), soil geochemistry, geology, climate, topography (digital terrain map), ortho-imagery, land cover, river and lake catchment boundaries and a river network classified by stream order and linked to river, lake and rainfall chemistry.
- Invest in ERDAS image processing software and associated training to enhance our remote sensing capability so as to assist DARD in monitoring the countryside to address EU requirements to auto-recognise land use/cover in satellite imagery e.g. identifying boundaries and areas of rock. These capabilities will complement AFBI's work on precision agriculture on grassland.
- Develop expertise in decision-support tools to improve the temporal and spatial application of organic and inorganic fertilisers to soils, and to maximise the agronomic benefits of nitrogen and phosphorus applications, while minimising the risk of loss to the environment.
- Build on the institute's expertise in isotope ratio mass spectroscopy and stable isotope techniques to study N_2O and N_2 emissions from agricultural systems and soil nitrogen and carbon transformations.

Climate Change and Agricultural Greenhouse Gases

- Continue to develop expertise in mitigation strategies for N_2O based on investigation of the critical factors controlling the transfer, fate and longevity of carbon inputs to soil under different farming systems
- Develop new technologies to upscale and verify emissions factors for GHGs (CO_2 , CH_4 and N_2O) at the field scale e.g. allowing simultaneous measurements in grazing systems
- Invest in additional stable isotope facilities to investigate factors controlling N_2O production so that the transformation processes can be manipulated to go to completion and produce nitrogen
- Build further expertise on the influence of biomass crops on carbon sequestration, measures to maintain the maximum sequestration of carbon in soils and peats, and use of biochar to enhance carbon sequestration in soil
- Maintain expertise in the use of biomass crops for bioremediation of effluents, wastewater streams and leachates



Socio-Economic Research

Policy Context: Socio-economic research in AFBI provides an evidence base to inform DARD policy development and to support the agri-food sector, and rural development and the wider economy.

The Northern Ireland agri-food and rural sector operates in an increasingly complex open market environment which is being influenced ever more strongly by the forces of globalisation in the market, policy and legislative spheres. The red meat and dairy sectors are likely to face the greatest challenges from evolving national and international policy and market development.

Recognition of the multi-functional nature of agriculture has led to a shift in the emphasis of the Common Agricultural Policy away from production-based payments towards the environment and rural development. As highlighted by the National Ecosystem Assessment, the rural environment has the potential to deliver a wide range of ecosystem services, including food, landscape amenity, wildlife, and the maintenance of soil and water resources. As many of these ecosystem services are public goods, they have no market price to indicate their economic value and these are not adequately considered in private and public decision-making processes.



Strategy for Socio-Economic Research: To assist DARD and the local agri-food industry to adapt to the increasingly volatile forces of globalisation and the legislative demands for increased environmental sustainability, AFBI will:

- Further develop our knowledge and skills to ensure effective provision of a socio-economic evidence base for government policy development and implementation in the agri-food sector and wider economy.
- Further develop expertise in local, national and international market and policy interdependencies, and economic appraisal
- Further develop expertise in the development and use of complex economic models, combining qualitative and quantitative approaches and in policy scenario analyses
- Enhance the capacity of our models to analyse agri-food systems as a whole, each of the main agri-food sectors and individual units within the sectors

Sustainable Agri-Food Systems

- Further develop expertise and capacity in modelling to compare the competitiveness of relatively small and relatively large farms and the differing options for farm business and household sustainability.
- Develop and enhance our ongoing capacity to provide benchmarking, monitoring and analytical systems to evaluate the sustainability of agri-food systems encompassing commodity prices, market demand, technology, production systems and food chain interactions.

Animal Health

- Develop farm models to analyse farm animal health and welfare issues. This modelling effort will involve a significant element of interdisciplinary collaboration with epidemiologists, animal geneticists and veterinary scientists.

Environment and Climate Change

- Enhance AFBI's socio-economic research and knowledge transfer capacity to explore the environmental impacts of the agri-food industry and the linkages between these industries and the sustainable development of the rural economy.
- Develop an analytical capacity to understand behaviour change, adaptive responses and levels of well-being in rural society, including the capacity to profile different categories of households and create accessible models of rural household behaviour.
- Develop capacity to identify and quantify the determinants of population and employment growth in Northern Ireland to provide a robust evidence base to assist rural development decision making and ensure public money is spent on providing and implementing policies that will add value in rural areas.
- Explore new methodologies, to enhance our capacity to analyse the system-wide effects of future policy and market developments and to move towards creation of "Green Accounts" for Northern Ireland.

Plant Protection

DARD's strategic objectives relevant to plant health are to (a) maximise the benefit to Northern Ireland of EU and national policies which impact on the agri-food, fishing and forestry sectors; and (b) to maintain and improve Northern Ireland's plant health status.

In support of these strategic objectives, DARD aims to implement EC and national regulatory measures without putting an unnecessary burden on the producers and processors concerned, thereby assisting the development of efficient markets, preventing the introduction or spread of serious plant pests and diseases that threaten agriculture, horticulture and forestry, and ensuring that markets in agricultural products are not adversely affected by plant health problems.

Under a framework for the identification and containment of an outbreak of a non-indigenous pest or disease relevant to plant health, emergency response procedures have been developed by AFBI in conjunction with DARD and are used to manage the following types of incidents pertaining to DARD's responsibilities under The Plant Health Order (Northern Ireland) 2006, the Plant Health (Wood and Bark) Order (Northern Ireland) 2006, and the Seed Potatoes Regulation (Northern Ireland) 2010.





Harmful organisms listed in Annexes I and II (Part A, Section I) to Directive 2000/29/EC which are found within Northern Ireland for the first time; or other harmful organisms previously unknown to occur in the Community, which are not listed specifically in Directive 2000/29/EC but which are of potential economic importance.

Pest management is a contentious area, mostly because of the impact of widespread pesticide usage on the environment: most recently exemplified by the potential sub-lethal impact of neonicotinoid insecticides on pollinator species. Consequently European and national legislation is constantly developing. Recent changes in pesticide legislation will impact upon DARD's remit and policy development (namely the Directive on Sustainable Use of Pesticides (2009/128/EC) and the Plant Protection Products Regulation (EC1107/2009) forming part of an EU Thematic Strategy on the sustainable use of pesticides).

Bees are high profile species, both because of honey production but also because they are seen as indicators of a healthy environment. DARD has a responsibility to ensure good bee health and enforces legislation thereof (namely the Bee Diseases and Pests Control Order (Northern Ireland) 2007). DARD and AFBI also have a joint contingency plan in the event of a non-indigenous pest or disease being found. In addition, DARD, AFBI and industry have formulated a Strategy for the Sustainability of the Honey Bee (2011), which sets out DARD's policy approach. AFBI has an important role in achieving the aims and objectives of this strategy.

Due to increases in world trade and changing climate, invasive alien species are considered a major threat to indigenous ecosystems and agriculture. Whilst there has been an artificial distinction between invasive species and pests, it is likely that this distinction will fade with changes in EU policy in the coming few years. It is likely that DARD will have to pay increasing attention to the impact and pathways of introduction of invasive species.



Vector-borne diseases represent a major threat to livestock production. The emergence of bluetongue virus in north-western Europe in 2006 and Schmallenberg virus in 2011 have caused considerable economic damage. Both of these diseases were vectored by biting midges (*Culicoides* spp.). It is therefore imperative that AFBI retains expertise in this area to provide DARD with support and advice.

Strategy for Plant Protection: To assist DARD in controlling plant pathogens or pests and responding to plant health emergencies, AFBI will:

- Develop and apply state of the art plant pathogen / pest diagnostics
- Expand capacity and expertise in the development of methods for the identification and control of fungal, bacterial and viral diseases, vertebrate and invertebrate pests and weeds of arable, horticultural, grass, forestry and sustainable energy crops that are less dependent on the use of agrochemicals.
- Develop strategies to minimise use of agrochemicals while maximising their effectiveness
- Maintain and develop expertise in the epidemiology, survival, dissemination and pathogenic mechanisms of plant pathogens, both indigenous and newly introduced organisms
- Monitor pesticide use in NI agriculture on behalf of DARD and develop integrated pest management strategies to ensure sustainable crop protection.
- Develop a better understanding of the invertebrate vectors of plant (and animal) diseases.
- Develop integrated pest management strategies based on: biological control, habitat manipulation, pest chemical ecology and alternatives to insecticides
- Seek methods to enhance invertebrate biodiversity in agro-ecosystems thus safeguarding invertebrate ecosystem services
- Maintain capability for pest risk analyses using established guidelines
- Maintain capability to respond to an outbreak of a vector-borne disease, through continued research on indigenous vectors and nuisance pests of livestock.

Animal Health and Welfare Protection

Policy context: AFBI's scientific work in the area of animal health is directed towards protecting Northern Ireland from the threat and impact of disease agents. This work contributes to DARD's strategic goals of reducing animal disease, and increasing competitiveness. The productivity gains resulting from reduction in animal disease burden contributes to sustainable agriculture by reducing overall GHG emissions from the livestock sector. It also helps protect public health through the detection of diseases transmissible to humans.

The large volume of statutory animal disease testing, and animal disease diagnostic/surveillance carried out by AFBI provides a robust evidence base for DARD animal health policy and ensures compliance with European legislation. Active surveillance for important animal diseases not present in Northern Ireland provides essential evidence to underpin EU derogations for trade in animals and animal products.

AFBI's DARD-funded animal health and welfare research provides/underpins the department's Evidence and Innovation Strategy as it relates to animal health and welfare policy. A major component of this work is directed to improving the diagnosis and control of bovine tuberculosis. Continued research on animal welfare is required to assist the local farming sector to meet and exceed the high standards demanded by customers and ensure compliance with European and national legislation.



Strategy for Animal Health and Welfare Protection: To assist DARD in controlling animal pathogens and responding to emergencies, and to assist the local industry in achieving the targets set out in the Going for Growth Strategic action Plan for the Northern Ireland agri-food industry, AFBI will:

- Develop and apply state of the art, rapid and cost-effective diagnostics for the control of animal diseases including the use of multiplex technology for epizootic disease outbreaks.
- Develop expertise in systems biology with multiplexing diagnostics tests incorporating molecular, biochemical and traditional serological testing
- Maintain the skills, expertise and laboratory infrastructure necessary for effective animal disease surveillance including effective early warning of notifiable or emergency conditions
- Maintain expertise in key scientific disciplines relevant to animal health including the safe operation of category 3 microbiological containment laboratories
- Expand expertise to detect and isolate novel virus pathogens, characterise isolates via pathogenesis studies, and develop to the first stage of vaccine development.
- Expand expertise and capacity for research on bovine tuberculosis and other mycobacterial diseases, especially in relation to immunity, diagnostics, molecular epidemiology, pathogenesis, field epidemiology and wildlife interactions

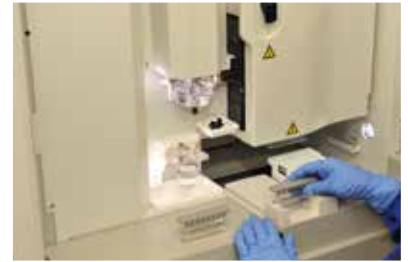
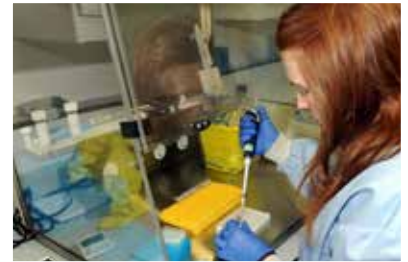


- Expand expertise and capacity for research on the genetic and molecular basis of host-pathogen interactions, including the use of transcriptomics, proteomics and metabolomics and next generation gene sequencing
- Develop expertise in novel nanoparticle technologies for delivery of vaccinal antigens with potential application to a range of veterinary species and a range of administration routes
- Develop expertise in DNA expression profiles to identify 'fingerprint' profiles that could be used as diagnostic screening tools using high throughput systems.
- Develop expertise and capacity in flow cytometry based on cell-antibody/heavy metal complex mass determination to allow for more precise definition of immune system cell sub-populations.
- Develop expertise and capacity in microfluidic cell culture systems to measure the proliferation of individually characterised cell types.
- Expand capacity in epidemiology and associated data analysis support systems, including spatial analysis techniques.
- Develop expertise in phylo-dynamics (integration of phylo-genetics with movement and contact networks) to improve understanding and control of animal diseases, including the likely sequence of transmission events.
- Develop expertise in genome-wide association studies in production and infectious diseases of farm animals to investigate and exploit the structural genetic variation underlying important traits, and ultimately the application of genomic selection techniques. This will require collaboration with other organisations.
- Develop multi-disciplinary expertise in animal welfare by bringing together behavioural science, livestock production science and veterinary science to find practical solutions for animal welfare problems.

CROSS CUTTING THEMES

Horizon Scanning

Early warning of animal, plant and environmental threats is important to minimising their impact on the local agri-food industry and wider economy. AFBI will continue to work closely with a wide range of national and international partners to identify potential threats and develop appropriate scientific response strategies. Recent examples of this activity include the development of molecular testing for Schmallenberg virus infection of livestock and Chalara infection of ash trees before these agents arrived in Northern Ireland following their emergence in continental Europe. In 2008, AFBI's application of state-of-the-art molecular tests for bluetongue virus and scientific advice allowed DARD to prevent the establishment of this virus on the island of Ireland following its arrival in a group of imported cattle. It has been estimated that the resultant trade benefits to Northern Ireland were £25m pa. Previously, the robust data set generated by AFBI's environmental research over many years was instrumental in securing a derogation for Northern Ireland under the Nitrates Directive.



Emergency Response

Under the Agriculture Order (2004), AFBI has a statutory mandate to provide an emergency response to serious incidents affecting the agri-food industry. AFBI will therefore continue to develop rapid, state-of-the-art diagnostic methods through the conduct of R&D funded by DARD and other public sector organisations. The Institute will also maintain the skills base and capacity to provide a rapid, local emergency response to animal or plant health, food chain and environmental incidents. It will continue to work with DARD to review the individual areas for which maintenance of an emergency response capability is required and the appropriate scale of response.

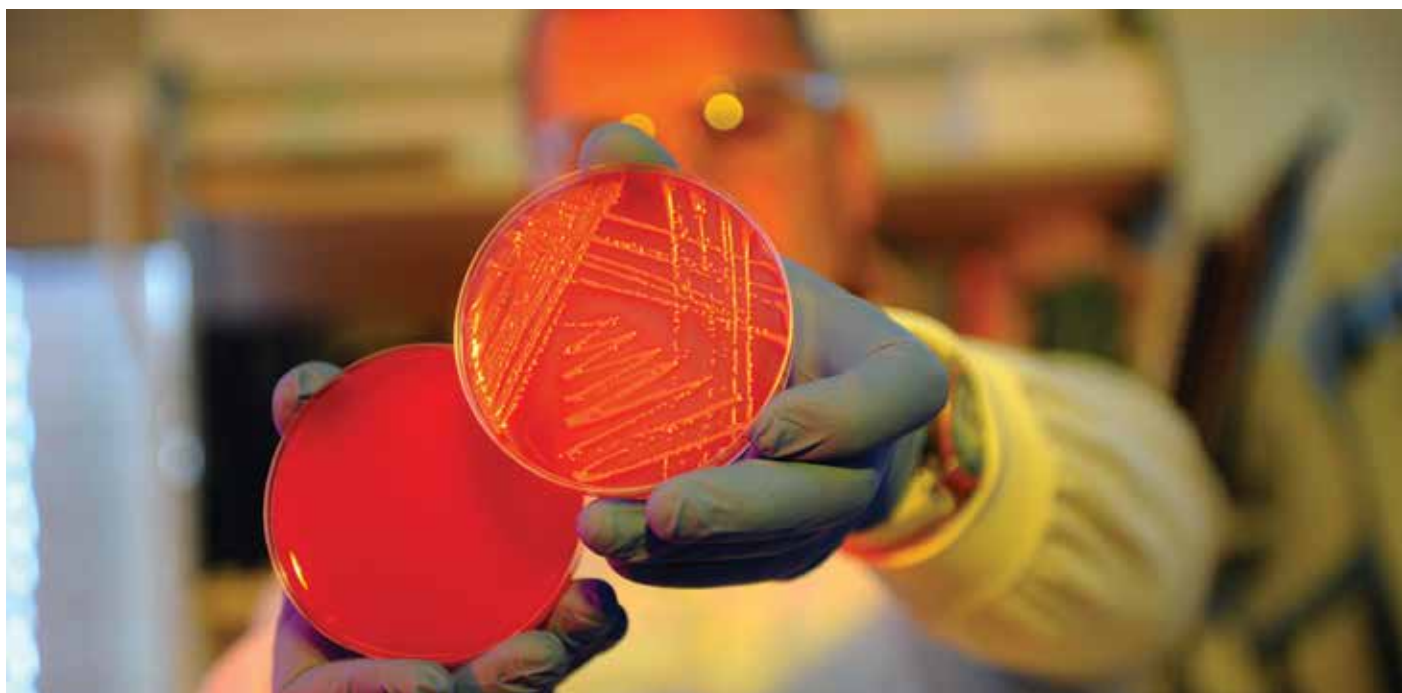


Statistical Modelling and Software Systems

Statistical modelling and software systems underpin a wide variety of AFBI's scientific projects and technology transfer initiatives. Input from AFBI's statisticians is required for effective experimental design and interpretation of results. Development and application of bespoke software systems such as the award-winning PiGIS pig carcass benchmarking system are used to assist industry to become more competitive. Within the Institute, effective software and hardware solutions are essential for the efficient management of AFBI's statutory, diagnostic/surveillance and R&D activities.

AFBI will continue to develop and apply bespoke software systems for customers and to underpin AFBI's science and corporate functions. We will also develop and implement a strategy for rationalisation and upgrading of our Laboratory Information Management systems to ensure more efficient and robust management of scientific testing.

"Big data" is a rapidly emerging area of science. AFBI will develop expertise and capacity in bioinformatic systems to analyse the large quantities of data associated with emerging technologies. This will be done in partnership with other organisations, as appropriate, due to the high costs involved.



Collaborative Partnerships

AFBI recognises that the conduct of world-class science depends on the development of effective partnerships with other leading research organisations. We already have numerous local, national and international partnerships that add value to AFBI's science and the service we provide to our customers. These relationships with organisations in Europe, North America, South America, Asia and the Middle East, (some of which are the subject of formal agreement, significantly increase the specialist knowledge and skills of our staff and access to technologies that may be required for emergency response capability. Where beneficial, for winning competitive funding, AFBI will enter into strategic alliances with groups of research organisations.

- A multidisciplinary approach will be used to exploit the wide range of scientific specialisms within AFBI in order to deliver research and innovation.
- AFBI will work with CAFRE to ensure that knowledge generated through this research and innovation is transferred effectively into the local industry.
- AFBI will actively work in partnership with local SMEs to solve practical problems. AFBI will support local industry to deliver R&D through Competence Centres in agri-food and sustainable energy and to maximise competitive R&D funding from Europe through its Horizon 2020, INTERREG and European Innovation Partnership programmes.

This will increase the spectrum of problem-solving expertise that can be directed to R&D, analytical and emergency response work for DARD and other customers. Current examples are the effective collaboration between Bacteriology, Biometrics and Information Systems and Crops and Grassland Ecology branches to conduct research on bovine tuberculosis for DARD and between Veterinary Sciences Division and Plant Health and Environmental Protection Branch on surveillance for insect-transmitted epizootic diseases.



Science Quality, Communication and Impact Measurement

AFBI will use a variety of methods to communicate the results of its scientific work to stakeholders. It will submit R&D project progress reports to DARD on an agreed basis. AFBI scientists will publish the results of their research in high impact scientific journals and produce technology transfer articles for the farming or general media.

AFBI will work collaboratively with CAFRE to ensure effective delivery of research results to the local industry via Open Days, workshops, conferences and on-farm demonstrations. AFBI scientists will continue to deliver presentations at industry meetings.

AFBI will review its website and the use of social media in communicating with its customers and wider public. Training will be provided to project leaders in order to improve the quality of communication of science to customers. Customer feedback will be sought where relevant.

AFBI will regularly seek feedback on the services that it provides to its key customers, evaluating responses and ensuring that it continuously strives to improve customer satisfaction.

AFBI will continuously review the scientific needs of its customers and seek to ensure that it has both the capability and capacity to meet these needs.

To demonstrate the quality of AFBI's science to stakeholders, AFBI will maintain ISO17025 accreditation for all tests used for official control purposes and ISO 9001 certification for delivery of research.

International rankings will be used where available to measure the quality of AFBI's research. AFBI will work with DARD to develop a process for periodic external peer review of AFBI's overall scientific programme.

Intellectual Property Management

While generation of intellectual property is not the primary aim of AFBI's publicly funded research, we recognise the added value that can be generated through the identification, protection and commercial exploitation of the Intellectual Property generated in the course of that research.

AFBI will identify and evaluate new inventions and materials generated in the course of its research activities. Where appropriate, new Intellectual property will be protected and managed toward commercial exploitation for the benefit of AFBI, DARD and the local economy.

AFBI will protect its intellectual property and ensure that confidential information is not disclosed without appropriate legal protection. The institute will also ensure that its interests in novel materials and collaborative research agreements are appropriately protected.

Maintaining and Developing our Facilities

The conduct of world-class science requires modern laboratory accommodation, equipment and land-based facilities. We will continue to work with DARD to modernise AFBI's estate to ensure that it is appropriate for the delivery of AFBI's scientific work, cost effective and environmentally sustainable.

AFBI will use this Science Strategy, together with its Assets Management Strategy, to inform decisions on the procurement of capital equipment. Sharing of equipment and facilities among branches will be employed as far as possible to reduce the Institute's running costs.

Genomics is currently a rapidly developing area of technology with applications across animal, plant and microbial science. It is essential that AFBI has access to modern genomics technologies and the Institute will carefully consider the appropriate balance of in-house expertise capacity and collaboration with partner organisations in order to ensure that it has access to the most appropriate genomics platform for application to a range of scientific disciplines.

Our marine research vessel is a strategically important national capability asset to Northern Ireland and indeed at UK and EU level, forming part of the UK research vessel fleet. We will work with DARD and other marine science organisations to ensure the most cost-effective use of this platform and to explore options for its replacement in 10 years' time.

Developing Our Staff

In keeping with our key strategic goals, AFBI will continue to invest in our people and ensure that the best systems and processes are in place to develop our staff and manage our organisation efficiently and effectively.

It is essential that our staff have up to date scientific and management knowledge and skills to effectively conduct scientific activities and deliver high quality, cost-effective services to all our customers. To achieve these aims, AFBI will conduct a review of succession planning capacity. It will develop and implement a senior management leadership and staff development programme to match the evolving business needs of the Institute. This programme will support managers in balancing the competing needs of specialist science delivery and business management in an environment in which the management of staff and consumables budgets will be devolved to divisions and branches.

We will also conduct a review of our Learning & Development Strategy to identify areas for improvement and carry out an annual learning and training needs analysis. AFBI will continue to promote its Assistance to Study Scheme to encourage staff to undertake further education towards a recognised educational, academic, vocational or professional qualification, certificate or diploma, relevant to AFBI's business objectives. We will review our people management systems and, if necessary, consider options for alternative platforms that might offer improved functionality and value for money.

We will also promote an ethos of wellbeing throughout the organisation, through the delivery of actions arising from the recent Stress in the Workplace and Morale and Motivation initiatives. AFBI will aim to minimise absenteeism across the organisation and continue to improve our absenteeism management systems and use these in performance management and strategic planning.

Organisational Structure

Following an independent strategic review, AFBI amalgamated two of its former three scientific divisions to form a single Sustainable Agri-Food Sciences Division (SAFSD) on 1 April 2013. A new Finance and Corporate Affairs Division was also formed at that time. These two divisions, together with the Veterinary Sciences Division, deliver all the scientific and corporate functions of the institute. As part of the reorganisation, the two former food science branches were amalgamated to form a single Food Science Branch, Agriculture and Food Economics Branch was placed within SAFSD while Biometrics and Information Systems Branch was incorporated into FCAD to reflect the cross-cutting corporate nature of much of the branch's work.

AFBI will embed these changes over the next five years and also undertake a review of all branches in the organisation to ensure that the Institute has the most effective and efficient organisational structure for delivery of our work programmes. This will include maximising the opportunities and synergies for multidisciplinary working across branches and divisions.

AFBI Board & Executive Management Team Organisation Chart

