CIEL
Centre for Innovation Excellence in Livestock

Tackling Grand Challenges for the Livestock Sector

Ruminants Research Capability

UKRI Innovate UK

Index

Centre for Innovation Excellence in Livestock

Introduction

The front door to a collaborative network of expertise

CIEL is a world-leading farm animal research alliance, helping to bring new technologies and processes to livestock food production within the UK and worldwide. We:

+ **Provide leadership** – joining up distinct pockets of excellence to form a world-class hub of expertise, tackling the issues that no one part of the sector can address alone
+ **Act as the broker** for one of the world's largest livestock science hubs, working with world-leading researchers and industry partners across the supply chain to identify challenges, potential solutions and routes to R&D funding
+ **Facilitate access** to £70 million of capital investment in new R&D capability across all livestock sectors, developing agri-tech to directly benefit UK farming and the wider agrifood industry.

Access the research capability you need

In partnership with twelve of the UK's leading research institutions and Innovate UK, the UK's innovation agency, CIEL has made strategic investments to improve the UK's capacity for livestock science research.

This brochure is your guide to some of the key capability we have helped to develop to support the dairy, beef and sheep sectors. Research capability is readily accessible to any business operating within the food supply chain and we can bring you together with the research expertise and facilities you need.

[CONTACT US]

The wider CIEL network

Over and above working alongside our research partners, CIEL brings together an active network of Industry Members spanning the food supply chain, including producers, processors, retailers, veterinary health, feed companies and SME innovators, all with an interest in R&D and improving UK food systems.

CIEL's reach also extends across government, providing a voice to ensure important industry issues are addressed, championing new ideas, and providing our Members with unparalleled opportunities to partner in projects.

[SUPPORT FOR YOUR PROJECT]

Together, the CIEL network of collaborative expertise is:

- **Tackling grand challenges for livestock production**
- **Finding new ways to feed an ever-growing population**
  - Using less resources
  - Maximising productivity
  - Minimising impact on the environment
- **Supporting the production of affordable, safe, nutritious, high quality food**
- **Helping those who produce food to do so profitably and sustainably.**

The UK Agri-Tech Centres

CIEL is one of 4 Centres of Agricultural Innovation, established as a unique collaboration between government, academia and industry to drive greater efficiency, resilience and wealth across the agrifood sector. Each Centre has its own unique focus, offering capabilities that can lead the world in delivering sustainable food and farming solutions. [www.agritechcentres.com]

CIEL at a glance

The front door to a collaborative network of expertise and innovation

12
ACADEMIC PARTNERS
Nationwide network of leading livestock research institutions

≈800
RESEARCHERS
Collaborative network tackling the grand challenges facing the livestock industry

≈70
INDUSTRY MEMBERS
Covering all aspects of the livestock supply chain from pre-farmgate, processors and retailers to animal health and SME innovators

MULTI-DEPARTMENTAL
GOVERNMENT PARTNERS
Working across UK Government including BEIS, UKRI, Innovate UK, Defra, DHSC, DIT and devolved administrations

£70M
INVESTMENT
Greatest joint investment in livestock research capability in a generation

26
FACILITIES
Capital investment in new or enhanced research facilities nationwide, spanning all livestock species

>30,000
LIVESTOCK
Multiple research populations – adult, youngstock, breeders, sucklers, grower/finishers, layers/broilers

£££Ms
PROJECTS
Projects managed and in the pipeline

Research Capability: **Beef and Sheep**

Beef and sheep production faces challenges in several areas - with changes to farm support mechanisms, environmental legislation, fragmented supply chains, price volatility and relatively low adoption of new technologies. To improve productivity, profitability & sustainability in the sector, CIEL investment is focused on genetic improvement, precision nutrition, disease reduction, novel management approaches and environmental measurement.

+ Productivity
+ Nutrition
+ Health & Welfare
+ Environmental Impact

Expertise includes

- Soil, water quality and ecosystem services
- Grazing research and farm system-based analysis
- Nutritional efficiency and energy metabolism
- Grassland farming, ruminant metabolism, food science
- Virology / immunology / vaccinology and bioinformatics.

Additional expertise and facilities to support the beef and sheep sector are also available through the following CIEL academic partners: Harper Adams University; University of Edinburgh Roslin Institute; Newcastle University; University of Bristol; and University of Nottingham.

Small Ruminant Research Platform

In partnership with Prifysgol Aberystwyth University

Providing capability to carry out detailed metabolic studies.

Overview

Sited on Aberystwyth University's Gogerddan campus within the Institute of Biology, Environmental and Rural Sciences (IBERS), the Small Ruminant Research Platform is supporting the commercial development of new and existing products and systems to improve nutrient use efficiency in sheep and goats.

The research platform caters for monitoring feed efficiency, production and environmental parameters for individual, or groups of, animals. There is dedicated space for specific tasks; from preparation & processing, setting treatment and study parameters, to monitoring real-time data with increased precision.

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Key research expertise

- Evaluating new feeds for DM intakes and real-time performance measurements
- Capturing methane emission data from individual animals
- Monitoring behavioural responses to new feeds and additives
- Studying the potential impact of climate on nutrition and performance
- Investigating the effects of new diets on individual water intake.

Principal Features

- **Group feeding facility** fitted with systems for measuring individual feed intake and animal performance, whilst animals are housed as a group. The system records individual real-time live weights each time an animal feeds. Behavioural tracking equipment allows assessment of feed preference and feeding patterns, alongside social behaviour interactions
- **Six individual pens** enable more detailed monitoring of water and food intake
- **Automatic feeders** allow for individualized feeding of different diets
- **Four 'EnviroPods'** provide capability to regulate and simulate a wide range of environmental conditions, including temperature and humidity, to measure in detail the effects of different factors on animal performance and gaseous emissions. Each offers a spacious area with large viewing windows allowing animal to animal visibility
- **Adjacent laboratory facilities** link to the EnviroPods, providing a fully automated monitoring system to study the responses of livestock to different feeds, feed additives or environmental conditions.

Impact

- More efficient use of feed
- Fine-tuning genetics so animals produce meat as efficiently as possible with least environmental impact
- Informing research into "bioactive compounds" – extra-nutritional constituents of interest in manipulating metabolism and preventative health treatments.

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition

For enquiries and further information please click here

Sustainable Beef Production Research Platform

In partnership with afbi AGRI-FOOD & BIOSCIENCES INSTITUTE

Optimising production efficiency, environmental sustainability and animal health & welfare.

Overview

AFBI offers research capability in the areas of grazing and indoor feeding systems with capacity to precisely monitor individual dietary intake, behaviour, health & welfare, from birth through to adulthood. Dedicated calf and youngstock research facilities enable investigation of feed digestion, metabolism and overall gaseous emissions from young and adult cattle.

Additional specialist facilities include individual respiration chambers, along with SF6 methane and greenhouse gas measuring apparatus and access to cattle Greenfeed systems.

AFBI manages a productive beef herd which includes a suckler herd of 100 cows. The research herd also includes an annual intake of approximately 150 dairy-bred calves from the AFBI dairy herd, which are predominately Holstein male calves. In addition to the AFBI herd, the beef research programme expands to a number of other herds throughout Northern Ireland which are engaged with on-farm research projects.

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Key research expertise

Research is focused on developing a sustainable and competitive beef industry. Expertise includes growing and finishing beef of suckler and dairy origin, and suckler cow health, welfare, genetics and productivity. Capability is further strengthened by strong linkages with AFBI's Food Science Branch.

- Suckler and dairy origin beef production systems
- Nutrient use efficiency
- Environmental sustainability
- Animal health and welfare
- Industry support tools and technology transfer
- Expertise in food science and consumer experience.

Principle features

- Ability to record individual or group feed intake
- Remote and automated precision livestock weighing equipment for in-field measurement
- Individual animal, in-field concentrate feeding system for grazing beef cattle to include monitoring of animal liveweight and concentrate/water intake
- Individual forage and concentrate intake monitoring from birth through to adulthood
- Detailed monitoring of animal grazing and intake behaviour through pedometers and rumination halters
- Access to both instrumental and sensory meat quality evaluation
- On site feed mill for the production of specialist diets.

Precision Grassland Platform

The beef herd also has access to 10ha of Precision Grassland Platform for detailed studies of the grazing environment, testing new innovations in grassland management and tracking the interactions from the soil, through the plant to the animal and the resultant meat and milk produced.

Impact

- Precision nutrition regimes and feed formulations to develop new feed products and ensure animals turn feed into meat as efficiently as possible
- Informed grassland management to maximise use of high quality pasture
- Integrated precision management systems that consider production and welfare based on nutrition, behaviour, health, and reproduction.

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition
+ Health & Welfare Management

For enquiries and further information please click here

North Wyke Farm Platform

In partnership with ROTHAMSTED RESEARCH

A unique national and global research facility linked to real-world farming.

Overview

Rothamsted Research North Wyke Farm is the world's most instrumented grazing platform, coupling three self-contained 'farmlets' with an analytical laboratory to measure changes to soil, water and air, enabling the impact of grazing ruminant livestock to be characterised. Precision yield and quality assessment in real-time can be carried out as grass is harvested to characterise the whole crop, utilizing sensors mounted on grass harvesting equipment for more precise assessment of grass quality and yield, accounting for variation across the field.

The facility is used by national and international collaborators from a wide spectrum of scientific disciplines, with particularly strong capability to accommodate studies on pasture-based livestock production systems.

Research is helping identify land management strategies to optimise the transfer of essential nutrients from soil to crops, livestock, and then into food, thereby contributing to a healthy diet and cleaner natural environment at the same time.

The core data collected from across the Platform are available to researchers and collaborators via a data portal:
[nwfp.rothamsted.ac.uk]

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Robert Orr Small Ruminant Facility

The Robert Orr Small Ruminant Facility is an integral part of the Farm Platform. It can house 400 or more ewes and up to 60 goats, with group and single pen facilities for feeding and behavioural research trials, including 24 automatic feeding pens.

The flocks reared on the Farm Platform's different farming systems are separated over winter to examine and compare the environmental and efficiency benefits of each.

Nutrients taken in, animal growth, urine and faeces produced, and the greenhouse gases being emitted by the animals, individually or in groups, are measured during housing.

Key research expertise

This internationally unique facility allows research outputs to be relevant to real-world food producers and makes the platform an excellent venue for knowledge exchange events. Particular areas of expertise include:

- Soil science
- Grazing systems
- Greenhouse gases
- Ruminant health & nutrition
- Trade-off analyses for farm management and interventions
- Hydrology and water-based emissions.

[DOWNLOAD TECHNICAL SPECIFICATION]

[VIRTUAL TOUR]

Impact

- Enhanced efficiency with which livestock can be finished off on grass – improving weight gain while reducing feed cost or time on farm and lowering environmental emissions
- Improved modelling of grass production that will drive next generation pasture models for pasture rationing management tools
- Increased efficiency with which grass is turned into meat or milk.

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Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition

In Action

Reducing the environmental impact of protecting livestock against pests

Rothamsted Research is teaming up with the Denis Brinicombe Group and utilising the CIEL-supported Robert Orr Small Ruminant Facility to develop an innovative diet-based approach to managing parasites in ruminant livestock. Success will reduce dependence upon current pest management tools such as acaricides and other chemical treatments. A new and effective diet-based approach to pest management could also prove effective in treating endoparasite infections and mitigate against the growing threat of antimicrobial resistance (AMR).

[READ FULL CASE STUDY]

Improving the carbon footprint of sheep farming

Individual feed conversion trials with Exlana sheep at the Robert Orr Small Ruminant Facility aim to identify genetics that will allow more feed-efficient sheep with a reduced carbon footprint to be produced. The trials, sponsored by Mole Valley Farmers and using research capability co-funded by CIEL, will help identify trait leaders for feed conversion to be used in future breeding programmes.

[READ FULL CASE STUDY]

For enquiries and further information please click here

Sustainable Sheep Production Research Platform

In partnership with afbi AGRI-FOOD & BIOSCIENCES INSTITUTE

Optimising production efficiency by improving animal health and performance.

Overview

A major component of AFBI's sheep research programme is to improve production efficiency through enhancing animal health and performance. An additional research area aims to improve environmental sustainability by minimising the impacts of sheep production on the environment. Researchers are developing and evaluating the effects of different management strategies to promote biodiversity and limit the emissions of greenhouse gases. The livestock team also collaborate closely with food scientists at AFBI to ensure that consumer satisfaction and expectations are not compromised though novel production methods.

Studies utilise the AFBI 300+ sheep flock and most work is also evaluated at a number of commercial farms across Northern Ireland, in collaboration with co-research farmers from both lowland and upland production systems.

State of the art facilities at AFBI Hillsborough enable studies to quantify greenhouse gas emissions from sheep production systems and quantify the effects of mitigation strategies.

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Key research expertise

AFBI's comprehensive research programme additionally provides the opportunity to monitor and analyse a wide range of data, including animal performance, grazing behaviour, health & welfare and product quality. In summary, areas of expertise include:

- Effect of genetic and environmental factors on animal performance
- Energy and nutrient use efficiency
- Greenhouse gas emissions and the effects of mitigation strategies at farm and animal levels
- Management strategies to promote biodiversity and other ecosystem services
- Health (notably in terms of internal and external parasite infections), welfare and product quality.

Principle features

- AFBI sheep flock – 320 breeding ewes and several ram breeds depending on research needs
- Group and individual pens for winter housing, indoor lambing and feeding/welfare studies
- Unique set up of six individual calorimetric chambers for metabolism and greenhouse gas studies (including CH_4, CO_2, NH_3, N_2O)
- UK-first individual feed box and water intake system with integrated live weight assessment, suitable for a range of life stages and diets
- Mobile DEXA scanner assessing carcass quality and bone density
- Access to a network of hill and lowland commercial farms, where management strategies can be applied and monitored consistently across farms
- On site feed mill for the production of specialist diets.

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Sheep Nutrition and Metabolism Unit

This bespoke CIEL-funded facility enables the assessment of individual dietary intake of forage, concentrates and water within a group feeding environment complete with automated in-pen weighing of livestock.

The facility is partnered with six cutting-edge individual metabolism chambers enabling detailed investigations into the impact of genetics, diet and management factors on nutrient and energy utilisation efficiency and gaseous emissions – a unique platform for investigating the role and impact of the microbiome in livestock production.

Impact

- Improved understanding of ruminant metabolism leading to better rationing systems
- Increased efficiency of feed conversion to lamb production
- Development of new feed products and phenotypes for genetic improvement
- Reduced greenhouse gas and ammonia emissions for livestock systems.

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition
+ Health & Welfare Management

For enquiries and further information please click here

Beef & Sheep Research Centre

In partnership with SRUC

Increasing the efficiency and improving the environmental performance of ruminant production systems.

Overview

SRUC's beef and sheep research links leading-edge developments in biology and engineering through to effects on the financial and environmental performance of ruminant production systems. Current research is focusing on improving feed conversion efficiency and reducing the carbon footprint of ruminant livestock farming. The Beef & Sheep Research Centre also provides optimal conditions to carry out meat quality research. Techniques and protocols are available to determine carcass and meat eating and nutritional quality.

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Key research expertise

SRUC brings together a range of biological and engineering skills and works synergistically with leading industry expertise and academic collaborators, both nationally and globally:

- Animal imaging and sensing systems (precision livestock (or SMART) farming)
- Biomarkers for animal performance, efficiency and health – for management or breeding
- Measurement systems and proxies for greenhouse gas (particularly methane) emissions
- Role of the rumen microbiome (microbial species and genes) in animal performance
- Carcass and meat quality evaluations
- Whole-farm/system modelling.

Principle features

Measuring Emissions

- Six respiration units to measure methane emissions from individual cattle, accompanied by training pens to accustom animals to being housed individually prior to going into the respiration facility
- Each unit is equipped with weigh cells to measure individual feed intake. This allows methane emissions from each animal to be expressed accurately on an intake basis
- Feeders are fitted with integrated canopy 'sniffers' which allow measurement of methane emitted specifically whilst the animal is eating
- The respiration units are similarly able to measure methane emissions from paired sheep.

Feed Efficiency

- Integrated handling and weighing facilities
- HOKO feeders allowing for individual intake measurements of up to 132 animals at a time. This system allows for measurements in grouped pen situations through the use of RFID tags, with the benefit of offering contrasting diets within each pen
- Multiple silage clamps allowing for differing diets to be offered to cattle year-round
- Feeding wagons allowing for precise diet formulation and nutrition, giving the ability to offer different diets within each pen.

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Principle features

Mobile Sheep Feed Intake Facility

Enabling precision assessment of individual sheep intake, to assess variation between sheep and enable selection for feed efficiency. The equipment can be employed in ram breeding flocks around the UK.

Meat Quality

- Measures of colours and pH
- Tenderness measurement equipment such as slice shear force as well as spectral measurement techniques such as visible and near infrared spectroscopy (Vis-NIR) and hyperspectral imaging (HI)
- Mobile computer tomography (CT) scanner to obtain detailed carcass characteristics.

Impact

Strategic research strongly linked to application by farmers to enable the efficient and profitable production of sustainable, tasty, high quality and nutritionally rich meat products.

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition

For enquiries and further information please click here

Beef Grower-Finisher System

In partnership with Harper Adams University

Accelerating improvements in beef production.

Overview

The Harper Adams University modern beef research platform measures intake of feed & water, greenhouse gas emissions, body weight and feeding behaviour of individual cattle, to assess feed efficiency in growing and finishing animals.

The beef unit is based on finishing dairy-bred bull calves from the University's 390 head dairy herd. The majority of the bulls are Holstein and Continental cross Holsteins. The cattle are finished intensively on either a cereal beef system with concentrates, fed ad lib with straw, or on a silage beef system with restricted quantities of concentrates to slaughter at 13 – 15 months old. Weaned suckled calves are also occasionally purchased for 'yard finishing'.

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Key research expertise

Harper Adams University conducts both strategic and applied research on improving the efficiency of production of farmed animals, with a particular focus on nutrition. The beef unit provides opportunities for trial work to be carried out, including projects for commercial organisations, education and demonstration purposes. The University has also the tenancy of 178 hectares (440 acres) of mixed farmland near Telford. Some of the grassland is used to extensively finish Hereford cross Holstein calves from the dairy unit at 19 – 22 months old.

Impact

- Improving the profitability and sustainability of beef farming
- Defining best practice for farms in the future
- Increasing the efficiency of beef production while improving environmental impact.

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition

For enquiries and further information please click here

Research Capability: **Dairy**

Dairy products achieve a huge penetration across UK households, although there is increasing competition from non-dairy alternatives. Key challenges requiring research and innovation are environmental impact, whole-lifetime health and welfare, resource efficiency, novel feeds and disease reduction. Genetic improvement can help best equip the modern dairy cow for future farm systems.

+ Productivity
+ Nutrition
+ Health & Welfare
+ Environmental Impact

Expertise includes

- Improving cow health & welfare through optimising production environments
- Increasing the efficiency for milk production from feed
- Enhancing the rumen microbiome and the cow genome to improve efficiency & sustainability
- Managing youngstock to enhance productivity, health & longevity of the herd
- Novel strategies and new tools to improve health e.g. diagnostics and vaccines.

CIEL provides facilities to conduct research on both housed and grazing systems, addressing all types of dairy farming in the UK.

Additional expertise and facilities to support the dairy sector are also available through the following CIEL academic partners: Aberystwyth University; Harper Adams University; Queen's University Belfast; University of Bristol; Newcastle University; and Scotland's Rural College (SRUC).

Centre for Dairy Science Innovation (CDSI)

In partnership with University of Nottingham UK | CHINA | MALAYSIA

Internationally-leading dairy science research facility at the forefront of research into the health, nutrition and welfare of dairy cows and calves.

Overview

The £6 million Centre for Dairy Science Innovation (CDSI) is a state-of-the-art extension to the University of Nottingham's longstanding dairy facilities. It brings together existing expertise in dairy science, dairy herd health & welfare and dairy food science, and positions the University at the forefront of research into the health, nutrition and welfare of dairy cows.

The CDSI houses a 340-strong dairy herd and enables studies with up to 100 individually fed, high-yielding dairy cows and heifers to test the effect of a range of diets on milk production and composition, feed intake and live-weight change.

A dedicated Youngstock Facility (calf and heifer) additionally enables the research team to track animals throughout their lives, using precision systems for monitoring performance, welfare, health, nutrition and behaviour.

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A wide range of sensing and monitoring systems are in place across the CDSI to automate detailed data collection and process this data to generate meaningful information.

Key research expertise

The facility brings together researchers from the University's Schools of Biosciences and Veterinary Medicine and Science alongside industry. The CDSI offers the latest research technologies for studying a range of dairy-related topics including mastitis control, antimicrobial resistance, feed efficiency, environmental emissions and 'wearable' technologies for the herd.

Wider issues studied range from reproduction to rumen function, feeding behaviour and digestibility, to emerging technologies to prevent disease and improve cow welfare and greenhouse gas emissions.

Cutting-edge laboratory facilities expand the Dairy Herd Health Group's capacity to study mastitis and investigate novel therapies and vaccines derived from new genomic technologies.

The CDSI offers the latest research technologies for studying a range of dairy-related topics including:

- Antimicrobial resistance
- Environmental emissions
- Feed efficiency
- Lameness
- Mastitis control
- New wearable technologies for the herd.

Principle features

- Nutritional research unit
- Flexible housing unit
- Category 2 containment unit
- Youngstock unit (calf and heifer).

[DOWNLOAD TECHNICAL SPECIFICATION]

[VIRTUAL TOUR]

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Impact

- Developing guidelines for precision nutrition of cows
- Evaluating the impact of spatial environment on health, welfare and production of housed dairy cows
- New therapies to reduce the impact of mastitis while reducing or eliminating use of antibiotics.

In Action

Providing the space to enhance the health, welfare, and productivity of dairy cattle

The first study worldwide to quantify variability and impact of space allowance for dairy herds, providing a freely available online 'living' space calculator and evaluating the extent to which variation in quantity and quality of space influences cow health, welfare, and productivity, as well as farm economics and emissions.

[READ FULL CASE STUDY]

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition
+ Health & Welfare Management

For enquiries and further information please click here

Duchy Future Farm

In partnership with DUCHY COLLEGE

Precision livestock farming with a green 'hoofprint'.

Overview

Duchy Future Farm is a first of its kind for England, driving improvements in efficiency, animal health & welfare, environmental best practice and technological advancement in dairy farming.

The 220-cow, 2 acre dairy research platform offers a host of features, including an ability to split the College's commercial Holstein Friesians into three mini herds, allowing measuring and comparison of different management techniques. Installed is a computerised, precision-control feeding system, plus an ability to separate slurry and manure from the different groups of animals, allowing multiple research projects to be run simultaneously – including exploring the storage, spreading and treatment of slurry and manure.

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Key research expertise

This innovative dairy facility with a low environmental footprint can provide essential information for the precision management of grazing dairy cattle. It offers the capability to compare all production systems e.g. extensive (grazing) v intensive and to measure manure, resource management and environmental impact.

Animals are all monitored using ground-breaking research techniques.

Principle features

- Capability to manage 3 mini-herds with segregated slurry stores
- Automatic feeding system
- Herringbone milking parlour
- Cow sensors for health, welfare, breeding, welfare & nutrition
- Building and parlour sensors.

[VIRTUAL TOUR]

Impact

- The ability to define the attributes of robust cows that can sustain high productivity
- Economic evaluation of management techniques and interventions.

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition
+ Health & Welfare Management

For enquiries and further information please click here

Precision Grassland Dairy Platform

In partnership with afbi AGRI-FOOD & BIOSCIENCES INSTITUTE

Protecting the environment and developing production efficiency through diet and improved animal health and performance.

Overview

AFBI offers extensive research capability in the areas of grazing and indoor feeding systems with capacity to precisely monitor individual dietary intake, behaviour, health and welfare from birth through to adulthood.

AFBI's 330 cow dairy herd comprises approximately 230 Holstein-Friesian cows (within the top 1% of UK herds for £PLI), with the remainder of the cows being crossbred (predominantly 3-breed crossbreds). Cows calve from early September through to mid-April, meaning that there are freshly calved cows available for use in research programmes involving either winter feeding or grazing strategies. Female offspring from the herd are mostly reared for replacements, and for use in calf and heifer research programmes. There are approximately 220 dairy youngstock on the farm, with heifers reared to calve at 24 months of age.

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Key research expertise

Key areas of expertise include novel nutrition, breeding and broader management strategies:

- Calf and heifer nutrition and management strategies
- Crossbreeding and alternative genotype
- Dairy cow nutrition, including concentrate supplementation strategies, novel nutritional approaches, including grazing systems incorporating precision technologies, forage production and utilisation
- Health and welfare – calves through to adulthood
- Environmental challenges, such as ammonia, greenhouse gases and phosphorus
- Milk quality and economics of milk production systems.

Principle features

Precision Dairy

50-point fully automated rotary milking parlour equipped with a concentrate feeding system which allows up to four different concentrate types to be offered at any one time. All cows are weighed twice daily, following each milking.

- Individual intake monitoring to record intakes of individual cows from birth through to adulthood: 58 'controlled access feed boxes' allowing intakes of up to 170 individual cows to be monitored at any one time and a further 26 'controlled access feed boxes' in the youngstock house which can be used to record intakes and behaviour from weaning until heifers calve for the first time
- Dairy cow concentrates can be offered either in-parlour, via out-of-parlour feeding systems, or in the form of a Total Mixed Ration. Total mixed ration and out-of-parlour feeding solutions are also available within the youngstock accommodation. During the calf stage, milk and concentrate feeding can be conducted via an individual pen system, computerised feeders or group feeders
- Individual animal precision in-field concentrate feeding system for grazing cattle of all ages to include monitoring of animal liveweight and intake
- Individual forage and concentrate intake monitoring from birth through to adulthood. Detailed monitoring of animal grazing and behaviour through pedometers and rumination halters
- On site feed mill for production of specialist diets
- Range of thermal imaging technologies, including a fully automated system that acquires highly standardized thermal images of dairy cows as they come off the milking parlour.

Precision Grassland Platform

Enabling detailed studies of the grazing environment, testing new innovations in grassland management and tracking the interactions from the soil, through the plant to the animal and the resultant meat and milk produced. A better understanding of these interactions will drive improvements in both productivity and environmental sustainability. Highly instrumented, technology and data driven, the platform provides:

- 78ha of "connected landscape" within 310ha grassland farm
- Live data feed from weather and soil sensors to give a comprehensive view of the key components of the grassland ecosystem and their interactions
- Network of wireless relay towers feed data back from the grazing environment every 15 minutes day and night
- Range of aerial drones including NDVI and hyperspectral imaging technology
- Providing trial facilities under commercially relevant conditions.

The research facilities are additionally supported by an extensive range of sensor, scanning and performance monitoring technologies.

Impact

- Better management of grasslands to ensure animals convert grass into milk in an efficient and sustainable manner
- Profitable and sustainable farm systems
- Improved youngstock rearing regimes to enhance health, welfare and lifetime performance.

Grand Challenge Focus

+ Climate Smart Food Systems
+ Resource Efficiency & Precision Nutrition
+ Health & Welfare Management

In Action

Optihouse: How clean is your house?

The Optihouse project is seeking to increase the efficiency of feed and labour within calf rearing enterprises by optimising the rearing environment and calf management. The research will help inform best practice and refine calf rationing systems to better reflect performance under a range of environmental conditions.

[READ FULL CASE STUDY]

For enquiries and further information please click here

TB Advantage

In partnership with AHDB

Helping dairy farmers make informed decisions to breed cows with improved resistance to bTB

Overview

CIEL investment has supported the development of this genetic index, published by AHDB Dairy, to help dairy farmers make informed decisions to breed cows which have an improved resistance to bovine tuberculosis (bTB).

The index follows extensive research into the genetics of bTB, undertaken jointly by the University of Edinburgh's Roslin Institute and SRUC. Their work showed genetic variation between animals and formed the basis of TB Advantage, the first genetic index of its kind in the world. Using data on over 650,000 Holstein cows who have bTB data recorded by the Animal and Plant Health Agency (APHA), breeding patterns were established and more resistant bloodlines identified.

CIEL's support has enriched the data set of this state-of-the-art genomic prediction tool by enabling more cattle to be genotyped and included in the data asset.

TB Advantage can be used as part of a range of important genetic traits to form a balanced breeding plan for the herd.

Impact

- Helping dairy farmers make informed decisions to breed cows with improved resistance to bTB
- A herd's strengths are maintained and weaknesses improved, reducing both infected and infectious animals on farm
- Designed to be used in addition to current eradication policies already in place, the decision to breed for improved resistance in a herd is a permanent benefit which accumulates with each new generation.

Grand Challenge Focus

+ Endemic Disease Reduction
+ Health & Welfare Management

For enquiries and further information please click here

Research Capability: **Multi-sector**

Across the livestock sector, CIEL-supported research capability is finding new ways to feed an ever-growing population. It is supporting the production of affordable, safe, nutritious, high quality food, produced to the highest welfare standards, with the least possible impact on the environment, and helping those who produce and supply food to do so profitably and sustainably.

+ Health & Welfare
+ Genetics
+ Behaviour
+ Reproduction
+ Food Integrity

Expertise includes

- Informatics and clinical genome sequencing
- Adopting cutting-edge human health science to develop novel, targeted innovations for the livestock and food sectors
- Characterising nutritional value, food quality, and investigating food fraud.

Centre for Digital Innovation Applied to Livestock (C-DIAL)

In partnership with Newcastle University

Dedicated to the development and use of the latest sensor-based and automated technologies to support precision livestock farming and enhance the performance, health and welfare of livestock.

Overview

C-DIAL capability enables the automated measurement of animal performance and detection of certain animal behaviours that are early signs of health or welfare compromise. By identifying the probability of disease, animals that require treatment can be targeted for treatment. This can result in more efficient use of antibiotics and faster recovery.

Digital imaging enables remote visualisation of behaviour and physiology, requiring minimal physical interaction with the animals. Automation enables tailor-made management and continuous monitoring of performance.

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Key research expertise

C-DIAL boasts wide-reaching technical expertise from an interdisciplinary team comprising livestock scientists, veterinarians, computer scientists, mathematicians and engineers to address health and welfare management challenges.

- A farming systems approach to enhancing animal health and welfare
- Development of practical on-farm monitoring and assessment of livestock
- Refining husbandry and housing practices to improve health and welfare
- Application of cutting-edge video and computing techniques for livestock monitoring.

Specialist research capability includes:

- High definition networked digital cameras and depth perception cameras for behaviour observations
- State-of-the-art, 18m length gait analysis laboratory and associated equipment for tracking movement of any point on the body in 3D & high definition
- Farmex BarnReport® remote monitoring system to monitor and record environmental conditions
- Advanced thermal and hyperspectral imaging and flexibility to accommodate a wide range of sensors
- A Bluetooth weighing system and Nedap feeders to monitor individual animal performance.

[DOWNLOAD TECHNICAL SPECIFICATION]

[VIRTUAL TOUR]

Impact

- Automated and accurate determination of the welfare status of individual animals
- Early diagnosis and intervention of health or behaviour issues, aiding quicker recovery and reduced need for antibiotics
- Enhanced animal health & welfare to support profitable production and superior product quality.

Grand Challenge Focus

+ Health & Welfare Management

For enquiries and further information please click here

Large Animal Research and Imaging Facility (LARIF)

In partnership with THE UNIVERSITY of EDINBURGH The Royal (Dick) School of Veterinary Studies | ROSLIN

Enabling unprecedented insights into the health and well-being of livestock and the prevention of human diseases – a One Health approach.

Overview

Research within the LARIF supports the One Health framework, recognising the link between human, animal and environmental health. It offers exceptional specialist facilities for in-depth studies of all major farmed livestock, including: containment areas for work involving infectious pathogens; facilities for advanced gene technologies; environmentally controlled units suitable for behaviour and welfare studies; imaging, surgical and critical care facilities for large animal models of disease; and development of medical technology that will benefit both humans and animals.

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Key research expertise

The LARIF allows users to benefit from a wide range of expertise in farm animal production, health and welfare including:

- Infectious diseases and zoonoses
- Vaccines
- Genetics and genome editing
- Imaging
- Radiology
- Medicine
- Surgery and critical care.

A Culture of Care is central to the function of the LARIF and animal welfare is of utmost priority. All work is undertaken in line with UK Home Office Guidelines and licencing requirements, and is overseen by a team of dedicated Named Veterinary Surgeons who are independent from the work carried out within the facility. Behaviour and welfare studies are supported by environmentally-controlled units with CCTV and can take advantage of the imaging and surgical facilities as required.

[DOWNLOAD TECHNICAL SPECIFICATION]

Impact

- Linking One Health initiatives with farm animal health and disease epidemiology
- Advancing study of the physiological state of animals and gene expression
- Supporting research in animal health & veterinary therapies
- Enabling advances in immunology and host defence, neuroscience and developmental biology across multiple livestock species.

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Grand Challenge Focus

+ Endemic Disease Reduction
+ Climate Smart Food Systems
+ Health & Welfare Management

In Action

Developing next generation mastitis testing

Researchers from the University of Edinburgh Roslin Institute are producing gene expression data for mastitis causing pathogens and identifying the most prevalent causes of mastitis in the UK and worldwide. This data will be used by veterinary diagnostics company Biotangents to develop a new diagnostic test for mastitis on the global market. New diagnostic solutions are answering the need for reliable and affordable tools to monitor animal health and rapidly diagnose diseases to advance the life quality and productivity of livestock.

[READ FULL CASE STUDY]

Battling Bovine Tuberculosis

Bovine tuberculosis (bTB) is one of the biggest challenges facing the UK cattle farming industry. Whilst there are currently no effective, deployable vaccines for bTB, the Bacillus Calmette–Guérin (BCG) vaccine used in humans is known to induce protective immunity in calves. By studying immune responses to the BCG vaccine to understand the mechanisms of protective immunity, University of Edinburgh researchers are gaining new insight and knowledge that can be applied to further vaccine design and implementation. These studies will enable us to define 'signatures' associated with successful vaccination, enabling screening of new vaccines or testing of new vaccination regimes. This novel approach to understand how protective immunity is induced can be applied to studies of a wide range of animal diseases, as well as bTB.

[READ FULL CASE STUDY]

For enquiries and further information please click here

Mobile CT Scanner

In partnership with SRUC

Portable, high-resolution assessment of animal carcass or live animal body composition.

Overview

The SRUC Animal & Veterinary Science Research Group provide CT (computer tomography) scanning services to livestock breeders, to other research organisations and for veterinary diagnosis. In addition to a modern CT scanning unit and a team of specialist staff based in Edinburgh, CIEL investment has enabled the provision of a mobile service, for use in a wide range of applications by farmers, researchers and external organisations across the UK.

Key research expertise

- Growth
- Productivity
- Genetic improvement
- Animal health
- Meat quality.

Benefits of CT Scanning (Sheep)

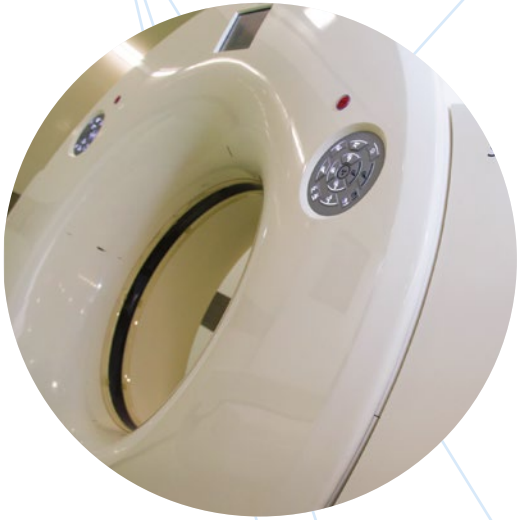
CT scanning allows more accurate identification of the best animals in a flock for breeding. It assists delivery of rams to the commercial sector that will make a real difference to product quality and profitability.

Used in partnership with ultrasound scanning, in a 2-stage selection programme, CT offers the opportunity to accelerate the rates of response to selection for improved carcass quality in a cost effective way.

Impact

- Helping to improve the efficiency of production systems and product quality
- Increased precision of assessment and introduction of novel traits to genetic improvement programmes
- Faster genetic gain, better breeding objectives.

[DISCOVER MORE]



Grand Challenge Focus

+ Climate Smart Food Systems
+ Food Safety, Quality & Integrity

For enquiries and further information please click here

EGENES

In partnership with SRUC

Edinburgh GENetic Evaluation Services (EGENES)

Overview

EGENES is a leading centre for the development and delivery of genetic improvement tools for the livestock industry.

EGENES produces national genetic and genomic evaluations for all dairy cattle and sheep and for the UK's biggest beef breeds. The process uses performance and pedigree data recorded by farmers, breeders and other industry players. These data are combined, quality controlled and analysed to produce routine genetic evaluations, which are then fed back to industry.

Impact

- Ensuring livestock breeders benefit from breeding tools that are being continually improved in the light of new research
- Faster genetic gain applied to better breeding objectives for future farms
- Supporting the provision of premium products from profitable, sustainable farming systems.

Grand Challenge Focus

+ Climate Smart Food Systems

For enquiries and further information please click here

Mobile Sensory (Product Quality) Laboratory

In partnership with SRUC

Enabling large volume product quality assessments, wherever needed.

Overview

Thought to be the first mobile unit of its kind, this portable facility brings the latest imaging and meat quality testing technologies direct to where it's needed, supporting research, animal breeding programmes and ensuring consumer preferences are at the heart of the innovation process.

The sensory lab, equipped with state-of-the-art imaging and product quality technologies uniquely housed within an articulated lorry, can travel around the UK. It enables companies to capture very large amounts of consumer data concerned with sensory aspects (organoleptic traits) related to product quality. The mobile lab is versatile in its applications, able to deliver trained/semi-trained or consumer sensory data collection. Standardising the testing platform in a mobile facility enables geographical and demographical studies with consumers to be easily applied.

Throughput of the mobile lab is dependent upon the questionnaires presented to participants and the nature of the product being tested (e.g. cooked/uncooked). Capacity of more than 500 participants per day (6 hours) can be realised.

[DOWNLOAD TECHNICAL SPECIFICATION]

Impact

- Assessment of product quality can be used to provide signals to producers and breeders that reward excellence
- Data can be used to inform breeding programmes for sheep, cattle, pigs or poultry to ensure breeding objectives combine productivity, efficiency and product quality.

[VIRTUAL TOUR]

Grand Challenge Focus

+ Climate Smart Food Systems
+ Food Safety, Quality & Integrity

For enquiries and further information please click here

Centre for Plasma in Agrifood (AgriPlas)

In partnership with Queen's University Belfast

New plasma research facility focusing on potential uses of the antimicrobial properties of cold plasma for livestock healthcare & biosecurity, food hygiene and shelf-life extension.

Overview

AgriPlas is a dedicated research facility within the Institute for Global Food Security (IGFS), Queen's University Belfast.

It builds on existing expertise in plasma knowledge at the IGFS and involves a multidisciplinary team of physicists, pharmacists, animal health experts, feed and food safety experts and analytical chemists.

Cold plasma research, particularly in the agrifood space, is still a relatively young field and is being increasingly seen as a potentially revolutionary 'wonder technology'. AgriPlas is believed to be the first of its kind, dedicated to focused research on agrifood, agriculture and veterinary scenarios.

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Applications of cold plasma for the food industry

Because of their potential to reduce, or in some scenarios even supplant, the use of antibiotics, plasmas could be key in the fight against antimicrobial resistance (AMR).

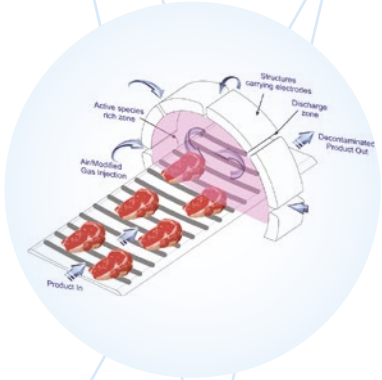
It also makes them ideally suited to applications in farm animal healthcare and biosecurity, feed safety, and food shelf-life extension. Scaled-down plasma technology could be available for use outside of laboratories by food producers and processors within a few years.

It is anticipated that, by leading to reduced use of chemicals and antibiotics in food-production systems, the technology should ultimately enhance the sustainability and global marketability of the UK agrifood industry.

Impact

- Cutting-edge technology offering the potential to transform commercial food production – reducing harmful chemicals and antibiotics in the food chain and lessening the threat of antimicrobial resistance (AMR).

[WATCH VIDEO]



Grand Challenge Focus

+ Food Safety, Quality & Integrity

For enquiries and further information please click here

Advanced ASSET Technology Centre

In partnership with QUEEN'S UNIVERSITY BELFAST

State-of-the-art scientific platforms to facilitate increasingly rapid and powerful identification of feed and food contamination.

Overview

The ASSET ('Assured, Safe and Traceable') Centre is a linchpin of the Institute for Global Food Security (IGFS), Queen's University Belfast. In July 2020 it was listed as a 'Centre of Expertise' by the Food Authenticity Network – a Defra initiative.

ASSET provides leading platforms to facilitate increasingly rapid identification of feed and food contamination and adulteration.

The mass spectrometry element features a range of hyphenated MS instruments. Various LC-MS/MS and GC-MS are available for tailored measurements of predetermined analytes such as toxins, pesticides or targeted metabolomics. Also available are high resolution accurate mass instruments (QTof) coupled to UPLC for non-targeted metabolomic analysis or equipped with an Ambient ionisation source such as REIMS, DESI or DART.

>>

Equipment includes:

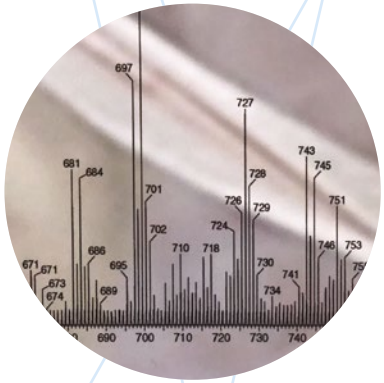
- Mass spectometry
  REIMS research system, incorporating 'iKnife'
- DART (Direct Analysis in Real Time) ionisation couple to single quadrupole detector
- UPLC-QTof
  With associated processing software workflow suite
- Spectroscopy instrumentation
  FTIR (Fourier Transform Infra-red)
- NIR (Near Infrared)
  in benchtop and portable format
- Raman

Impact

- Promoting global food integrity and enhancing the sustainability and global marketability of UK agrifood products.

Grand Challenge Focus

+ Food Safety, Quality & Integrity



For enquiries and further information please click here

Working with CIEL

Helping to streamline and simplify your research & innovation process

CIEL brings together all the necessary elements for conducting research – simplifying the process and speeding up translation of ideas into new products and services to increase business competitiveness and profitability.

CIEL can help you:

+ Connect with new UK research capability and insight
+ Engage in innovation to stimulate new ideas and business opportunities
+ Access additional skills and resource
+ Meet potential partners and build the best project consortia
+ Identify and secure R&D funding
+ Deliver ideas, projects, and help commercialise and market new products and services
+ Address important industry issues
+ Champion new ideas to our network.

Membership

CIEL is a membership organisation, working with businesses to help identify and develop their livestock research needs, and then building relevant collaborations to deliver new technologies and processes for livestock food production.

We have a network of Industry Members encompassing all aspects of the livestock supply chain.

As a CIEL Member you'll have access to tailored support to meet your R&D requirements and facilitated access to representatives across the CIEL network. We connect people for mutual benefit, helping you build productive working relationships; we remain independent, becoming a trusted source of knowledge and guidance.

Support for research

Understanding the different types and sources of R&D funding available is important in maximising the chances of securing either grant or commercial funding.

For grant funding CIEL supports Members by providing a free grant notification service via monthly newsletters, as well as targeted one-to-one searches for specific project needs across regional, national and international funding sources.

Once funding is identified, a dedicated CIEL team member will work with the lead project partner to form a consortium of relevant partners and capability, and jointly prepare a comprehensive application for funding, managing the submission process throughout.

For commercial funding, whether private funding or precompetitive collaborative funding, CIEL will support in developing proposals and pitches for industry and linking organisations together to deliver programmes of work that will deliver mutual benefit. As with all funding opportunities, CIEL is ideally setup to deliver a project management service, ensuring all elements of the work are delivered on time and within budget.

Leveraging CIEL staff enables businesses to rapidly speed up the time required to find and write a funding proposal and improves the chances of success by opening doors to collaborate with major routes-to-market and innovators across the livestock and agrifood sectors.

"CIEL is an important facilitator in bringing industry together to discuss key issues the sector needs to address and identify ways to overcome them. CIEL is a good support network. The team actively works on our behalf and we certainly recognise the value membership brings to our business."

Paul Billings, Germinal GB

Project Management

All R&D projects are risky, but most funding bodies have little tolerance for poor project management. Increasingly, projects will involve partners to specifically help manage projects and exploit results. This is a central marking criterion for new funding sources.

CIEL provides a cost-effective solution, combining project management expertise and knowledge exchange via our CIEL Member WebPortal, in-house R&D events, and a growing network of agrifood businesses across the livestock supply chain. We have built streamlined reporting channels with full governance and compliance with funding bodies to ensure admin costs are reduced and technical staff time can be maximised.

Helping farmers improve grassland productivity

Improving grassland management efficiency is a key driver of profitability on beef, sheep and dairy farms across the UK, with each additional 1 tonne DM utilised per hectare worth £334 and £204 per annum to dairy and beef farms, respectively.

Grassland agriculture underpins the ruminant livestock sectors in the UK. The potential for high levels of grass production and utilisation gives British agriculture a key competitive advantage against many other livestock production regions across the globe. However, there is significant scope to improve grassland productivity in the UK from the current estimated production levels of 7.5t DM/ha/yr and 4.7t DM/ha/yr on dairy and beef farms, respectively.

To assist farmers in making the most of this valuable feedstuff, CIEL is working alongside researchers from the Agri-Food and Biosciences Institute (AFBI) and Rothamsted Research, supported by a group of industry sponsors and the three GB levy bodies AHDB, HCC and QMS, to deliver GrassCheckGB.

GrassCheckGB is helping farmers to improve both grass growth and utilisation by providing weekly updates on grass growth, grass quality and weather conditions from up to 50 locations across Great Britain.

"It's so important that farmers are involved with projects like GrassCheckGB. Farmers can help researchers by bringing practical knowledge, and researchers can help us as farmers.

"We now consider ourselves to be grass farmers more than we're cow farmers – we utilise the cow to utilise the grass we grow."

Andrew Brewer, Dairy Farmer, Ennis Barton

Key contacts

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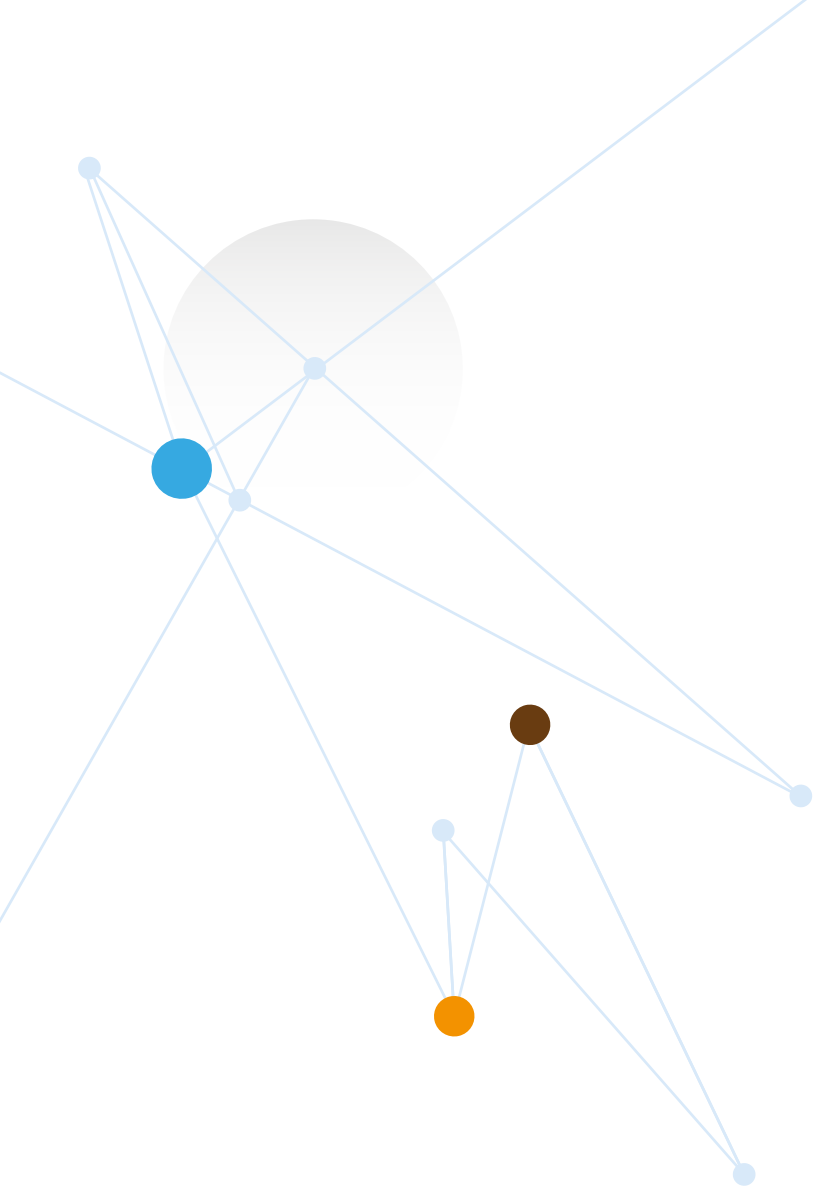

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