



Federal Ministry
of Food
and Agriculture

Research institutes that support the BMEL

Growing Knowledge



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Dear Readers,

We are facing enormous challenges, such as global warming, the extinction of species and crop failures. The agricultural and forestry sectors are instrumental in conserving our basic resources and therefore have a key role to play in meeting these challenges.

It is imperative that we find new ways of protecting what is vital to us. Ingenuity, creative ideas and research findings have always been catalysts for the modernisation of the agri-food and forestry sectors. We need innovations that create prospects – prospects for a future in which we can combat the climate crisis, preserve biological diversity, and continue to produce high-quality food at high yields.

It is this kind of future that our research institutes are working towards. They provide scientific insights and guidance for agricultural, forestry, and nutrition policies. These policies can then conserve resources such as soil, water, and air to ensure that we can continue to harness them in the future. The institutes also identify conflicts between economic, environmental, climate-related and societal interests, develop solutions and illustrate new avenues to explore. They create knowledge, while challenging accepted knowledge at the same time. This aids the ministry's political decision-making

and benefits both consumers and stakeholders from agriculture, nutrition, forestry, and fisheries.

This brochure provides an overview of the twelve departmental research institutes that support the Federal Ministry and the particular research priorities they have set. I would like to invite you to learn more about their important work and gain an insight into the multi-faceted scientific landscape.

Yours,

Cem Özdemir
Federal Minister of Food and Agriculture

Introduction

Scientific groundwork, such as the work conducted by the six departmental research institutes and the six Leibniz Institutes affiliated to the Federal Ministry of Food and Agriculture (BMEL), is vital to the BMEL's work. Today, agricultural and food issues, such as sustainable, climate-smart and animal-friendly agricultural production, healthy eating, future-proof rural areas and food security, generate a lot of interest and debate. The fact-based, scientific insights provided by independent departmental research can help develop solutions and support the dialogue between politics, practitioners and society.

Agri-food policies are of major societal importance. They serve to ensure food security and preserve our cultivated landscapes and also have a significant economic influence. The growing world population, the shift in global dietary preferences towards processed animal and plant products, the growing demand for renewable raw materials and bioenergy, the decrease in arable land in some areas, the limited production factors (e.g. water, plant nutrients and genetic resources) and climate change are complex challenges.

At the same time, the sector is facing the challenge of making agriculture more resilient, resource-efficient and sustainable so that it remains attractive and economically viable for future generations. Agriculture's contribution to climate change mitigation, environmental protection and the conservation and expansion of ecosystem services (e.g. species protection and soil fertility) is particularly crucial in this context. We need viable solutions to these challenges. Research, innovation and modernisation also play a major role in this regard, both for farmers and for the funding policies and legislation of the Federal Government and the European Union.

The BMEL's departmental research includes four federal research institutes as well as the German Federal Institute for Risk Assessment (BfR) and the German Biomass Research Centre (DBFZ).

The four federal research centres are:

- the Julius-Kühn-Institut (JKI), Federal Research Centre for Cultivated Plants;
- the Friedrich-Loeffler-Institut (FLI), Federal Research Institute for Animal Health;
- the Max Rubner-Institut (MRI), Federal Research Institute of Nutrition and Food; and
- the Johann Heinrich von Thünen Institute (Thünen Institute), Federal Research Institute for Rural Areas, Forestry and Fisheries.

These four institutions work primarily on providing scientific guidance for decisions to be made by the BMEL, but they also undertake certain administrative responsibilities. They conduct application-oriented research and add to scientific knowledge in their fields for the common good. These two tasks in their remit - carrying out innovative research and providing competent scientific advice - are also closely connected.

The BMEL also co-funds five Leibniz Institutes and the Research Institute for Farm Animal Biology (FBN), sharing the funding equally with the Federal States. These institutes conduct application-oriented basic research, complementing the scientific range of the departmental research institutes listed above.

- Leibniz Institute of Agricultural Development in Transition Economies (IAMO)
- Leibniz Centre for Agricultural Landscape Research (ZALF)
- Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)
- Leibniz Institute of Vegetable and Ornamental Crops (IGZ)
- Leibniz Institute for Food Systems Biology at the Technical University of Munich (LSB)
- Research Institute for Farm Animal Biology (FBN)

The six departmental research centres and the six Leibniz Institutes affiliated to the BMEL are particularly well-suited to conduct long-term scientific work. They frequently engage in interdisciplinary and transdisciplinary collaboration. The institutions provide comprehensive data collections and information platforms for the scientific community and carry out monitoring duties (e.g. fisheries and forestry monitoring). Furthermore, the institutions are active in publishing scientific research findings, attracting third-party funding and training young scientists. They also cooperate intensively with universities and non-university research institutions. Research results are made available to the public. This means that many people benefit from BMEL research, from consumers and practitioners in the agricultural, forestry and fisheries sectors to the business community and people living in rural areas.

The research institutions' work is not limited to solving national issues: they also cooperate with European and international partners. Research is, for example, also conducted to develop the EU's Common Agricultural Policy, to fight global hunger and to fulfil international agreements.

Julius-Kühn-Institut

*Federal Research Institute for
Cultivated Plants (JKI)*



IN BRIEF:

Year of foundation: 2008

Head office: Quedlinburg

Management: Prof Dr Frank Ordon

Staff members: 1300

Scientific staff: 450

Internet: www.julius-kuehn.de

Twitter: @JKI_Bund

Research priorities

Breeding research and genetic diversity

Cultivated plants are the key element of agricultural and horticultural value chains. The JKI's breeding research aims to improve the resilience of our cultivated plants to biotic and abiotic stress and to expand the range of plant species we cultivate. This work is upstream of the actual breeding of plant varieties, i.e. it involves examining genetic resources, such as wild varieties or local cultivars, to identify desirable characteristics. These are then prepared for the actual breeding using cell-technological and biotechnological processes. The JKI maintains its own genetic databases of fruits and grapevines and breeds new, resilient varieties: it would be difficult in Germany to have this breeding carried out by private stakeholders due to the long breeding process, which can take up to 30 years. In this way, the JKI creates the basis for new varieties, which are important components for a climate-smart, environmentally compatible and consumer-friendly agriculture.

Concepts for the protection of cultivated plants

The JKI develops strategies and concepts to protect cultivated plants. These concepts apply to all stages from



Bee-friendly meadow sage growing at the Julius Kühn Institute's head office in Quedlinburg.

sowing to storage, to a number of different farming systems and to a large range of plant species. For instance, it develops alternative and organic plant protection methods to protect plants from pathogens and pests. Open field trials examine the long-term effects of pesticides and mineral fertilisers on ecosystems, and the effects of reducing the quantities used. Other work focuses on precision agriculture, for example sensor-based methods that will, in future, permit the quantities of pesticides and fertilisers applied to be optimised for the respective part of the field. The JKI thus helps implement the Federal Government's National Action Plan on the Sustainable Use of Plant Protection Products, the Biodiversity Strategy and the Action Programme for Insect Protection.

crops
plant genetic diversity
climate change adaptation
resilient cropping systems
agroecosystems
gene bank for fruit and vines
policy advice

Peat substitutes put to the test – the “ToPGa” research alliance

Peat extraction destroys peatlands. This means that valuable biotopes are irretrievably lost. At the same time, the drainage of peatlands releases large quantities of CO₂, thereby contributing substantially to climate change. However, peat-rich substrates are currently indispensable for horticulture. The ToPGa research alliance, which was established to develop and assess peat-reduced production systems in horticulture, aims to reduce the peat proportion in growing substrates to below 50 %. The JKI coordinates the alliance, which consists of nine subprojects. The subprojects that are run directly by the JKI focus on microbial interactions and pathogen control in peat substitutes and aim to prevent plant diseases and pest infestations and protect consumers from pathogens. Another subject of investigation is the cultivation of fibre nettles as a peat alternative. The project also focuses on compiling life cycle analyses and economic assessments.



Breeding research into important cereals such as barley is one of the JKI's key responsibilities.

Future-proof plant cultivation systems

The overall aim of the interdisciplinary work conducted by the JKI is to develop resilient and productive cultivation systems. This work includes investigating the root microbiome, surveying the diversity of beneficial species and pollinators, exploring the translocation of nutrients and agricultural chemicals in water bodies, and comparing weed growth on land farmed in different ways. The JKI participates in nationwide projects to monitor agro-biodiversity, conducts research into novel cultivation methods such as precision seeding and intercropping, monitors the occurrence of new pests and uses the results of its work to draw up recommendations for the future of plant cultivation.

The JKI as a public authority

The JKI is a federal research institute and at the same time an independent higher federal authority. It conducts research in order to carry out its statutory duties and provide policy advice. Key duties are laid down in laws such as the Plant Protection Act and the Genetic Engineering Act or are delegated to the JKI by decree. As a public authority, the JKI is an important interface between the EU and the Federal Government, between the Federation and the Federal States, and between science and practice. The JKI is involved in the authorisation of plant protection products; it also assesses plant protection equipment, and runs the national investigation centre for bee poisoning incidents and the national reference laboratory for organisms harmful to plants. The JKI represents Germany in various EU bodies dealing with plant health, a field that focuses on preventing the introduction and spread of new, non-native plant diseases and pests. The JKI also represents the BMEL in various bodies dealing with fertiliser issues and compiles the national nitrogen balances under Germany's Sustainability Strategy and the OECD/EUROSTAT country comparisons.

breeding research and plant breeding
bee protection
 digitalisation in agriculture

protection of crops
agrobiodiversity

plant health
 post-harvest protection

FRIEDRICH LOEFFLER INSTITUTE

Federal Research Institute for Animal Health (FLI)

FRIEDRICH-LOEFFLER-INSTITUT



Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

IN BRIEF:

Year of foundation: 1910

Head office: Greifswald/island of Riems

Management: Prof Dr Dr h.c. Thomas C. Mettenleiter

Staff members: 822

Scientific staff: 301

Internet: www.fli.de

Twitter: [@Loeffler_News](https://twitter.com/Loeffler_News)

The Friedrich Loeffler Institute (FLI) has been conducting research in the field of animal health for more than 100 years. The research topics covered by the institute range from animal nutrition, animal welfare and animal husbandry to livestock genetics and infectious diseases. The FLI's work is based on the One Health approach, which views human health as being closely connected to animal health and the environment. The FLI has twelve specialised institutes at five different locations and is active at both national and international level. FLI scientists collaborate with many different national and international research institutions. They participate in projects and missions initiated by international organisations such as the World Organisation for Animal Health (WOAH), the European Food Safety Authority (EFSA), the World Health Organisation (WHO) and the World Food Organisation (FAO). The FLI's Institute for International Animal Health/One Health (IITG) focuses in particular on controlling animal epidemics and zoonoses (i.e. infections that can be transmitted between animals and humans) wherever they occur in order to minimise the risk of these infections spreading and potentially reaching Germany. On the island of Riems, the FLI has level L4 (the highest security level) laboratories and animal housing for its research. At its location in Jena, new research buildings are being constructed, in particular level L2 and L3 animal testing facilities. This



The FLI conducts research into the health of animals ranging from honey bees to cattle.

makes the FLI one of the world's most modern infectiology research institutions. New research infrastructure for livestock science is also planned at the location in Mecklenhorst/Mariensee.

Remit

At the heart of the work conducted by the Friedrich Loeffler Institute is the health and welfare of food-producing animals – from honey bees to cattle – as well as the protection of humans against zoonoses. These responsibilities are laid down in the Animal Health Act (TierGesG).

The FLI carries out basic and practice-oriented research in the various specialist disciplines.

risk assessment

animal welfare
One Health

prevention
diversity
species-appropriate
requirements for species-appropriate behaviour

The novel SARS-CoV-2 coronavirus: What role do animals play?

SARS-CoV-2, a novel coronavirus that is thought to have originated in bats, first occurred in humans in China in late 2019 and led to a pandemic. Although this pandemic is being sustained by person-to-person transmission, SARS-CoV-2 is a zoonotic pathogen. The question is therefore what animal species are susceptible to SARS-CoV-2, what species play a role as reservoir hosts or intermediate hosts and what species can be used as models in science. The FLI is testing various animal species for their susceptibility to SARS-CoV-2. Fruit bats and ferrets were able to be infected, while pigs and chickens were not susceptible. The susceptibility of ferrets was a particularly important finding since this means that they can be used as infection models for trialling vaccines.



In level L3 laboratories, personal protective equipment not only includes lab coats, several layers of gloves and a visor but also a filter that is worn under the lab coat like a backpack. Work on human pathogens such as influenza viruses, SARS-CoV-2 and the anthrax bacterium *Bacillus anthracis* must be conducted at this security level.

→ laying the groundwork for state-of-the-art control strategies.

2. Improving livestock welfare and producing high-quality food of animal origin through:

- developing animal welfare-oriented husbandry systems;
- maintaining genetic diversity in livestock; and
- using feed efficiently.

As a federal research institute and an independent higher federal authority supporting the BMEL, the FLI prepares expert reports and opinions as part of its policy support. The Institute conducts epidemiological studies whenever animal diseases break out. It also compiles risk assessments on various infectious livestock diseases.

The FLI is the national approval body for veterinary infection diagnostics for the detection of notifiable animal diseases. The FLI is also a National Contact Point, providing the competent authorities with scientific support in implementing the EU's Animal Welfare Slaughter Ordinance. In addition, the offices of the Permanent High Commission on Vaccination (StIKoVet) and the National Expert Group on Mosquitoes as Vectors of Disease Agents are located at the FLI.

As the competent federal agency, the FLI operates more than 75 national reference laboratories for notifiable animal epidemics and reportable epizootic diseases. The reference laboratories examine suspected cases of disease, advise the veterinary authorities and conduct inter-laboratory tests or similar quality assurance measures for animal disease diagnostics in Germany. Additionally, the FLI runs WOA reference laboratories at national level and is the WOA Collaborating Centre for zoonoses in Europe, the FAO Reference Centre for animal influenza and Newcastle disease and the FAO Reference Centre for classical swine fever. It also houses a WHO Collaborating Centre for Rabies Surveillance and Research and is part of the EU Reference Centre for Animal Welfare.

Objectives

1. Protection against infectious diseases, animal diseases and zoonoses through:

- facilitating improved and faster diagnosis;
- developing preventive measures; and

pedigree

vaccine

indicators

nutrient requirements

metagenomics

gene reserve

control strategies

Max Rubner Institute

*Federal Research Institute of Nutrition
and Food (MRI)*



IN BRIEF:

Year of foundation: 2008

Head office: Karlsruhe

Management: Prof Dr Pablo Steinberg

Staff members: 620

Scientific staff: 180

Internet: www.mri.bund.de

Twitter: @MRI_Aktuelles

Research for delicious and healthy food

What exactly does a “healthy” diet consist of? Is the exposure of fish, meat and cereals to pollutants increasing or decreasing? How can the quality of meat, fish, milk, fats, oils, cereals, potatoes, fruit and vegetables continue to be increased and safeguarded in the long term? Approximately 180 scientists work on these and many other questions concerning diet and food at the four branches of the Max Rubner Institute.

Research for a health-promoting diet

The Max Rubner Institute (MRI) provides the BMEL with advice on consumer health protection in the field of food. The MRI was founded on 1 January 2008. Its precursor institution was the Federal Research Centre for Nutrition and Food (BfEL). In addition to its head office in Karlsruhe, the Max Rubner Institute has branches in Kiel/Hamburg, Detmold and Kulmbach. The institute currently has roughly 620 staff.



The head office of the Max Rubner Institute is located in Karlsruhe.

Scientists at the Max Rubner Institute's nine departments conduct research into a wide range of aspects of food and nutrition. The aim is to derive recommendations for a health-promoting diet. Key research priorities include investigating the nutritional and health value of foods and carrying out work in the field of food safety and bioengineering. The research covers the entire nutritional effect chain, from the molecular and cellular level up to the organism as a whole. Particular emphasis is placed on investigating dietary habits. A major topic at the Department of Child Nutrition is the influence of food on the development of children.

child nutrition

physiology

microbiology

eating habits

biochemistry

authenticity

Verified authenticity

The BMEL has made the prevention of food counterfeiting a focus of its work by establishing the National Reference Centre for Authentic Food (NRZ-Authent) at the Max Rubner Institute in 2017. Potential weaknesses along the food chain must be proactively identified and analysed in order to ensure authenticity controls are reliable and prevent fraudulent and criminal activities. The analytical verification of product-related information is an important contribution to the protection of consumers against deception. NRZ-Authent primarily supports German food control authorities and testing agencies in their work. European and international collaboration is also indispensable in order to put a stop to international food counterfeiters.



Is this fish really sole? NRZ-Authent develops methods for ensuring the authenticity of foodstuffs.

Four of the nine departments conduct research into specific food categories such as cereals, fats, oils, dairy products, vegetables, fruit, fish and meat. These departments examine the entire food chain, from harvest or production to consumption. The MRI's research, which is geared to the production chain, addresses food safety

and food quality as well as the sustainability of food production.

The National Reference Centre for Authentic Food was established at the Max Rubner Institute in 2017. The MRI is also responsible for developing and implementing National Nutrition Monitoring, for maintaining the national nutrient database and for carrying out statutory duties under the Agricultural Statistics Act and the Radiation Protection Ordinance.

Collaboration

MRI scientists are involved in a variety of national and international research projects and are represented in national and international bodies and authorities such as the European Food Safety Authority (EFSA). There is also close collaboration with universities and colleges of applied sciences: for instance, the MRI holds a number of lectureships.

The eponymous Max Rubner

The institute was named after Max Rubner (1854–1932), a physician and physiologist whose work laid the foundations of modern nutritional science. Having held a professorship for hygiene in Marburg since 1887, he was appointed professor and director of the department of hygiene at the University of Berlin in 1891, succeeding famous German scientist Robert Koch. He taught physiology there from 1909 to 1922, and founded a department concerned with occupational physiology ("Kaiser-Wilhelm-Institut für Arbeitsphysiologie"). With his experimental work on the calorific value of nutrients, Max Rubner laid the foundations of the calorie charts we still use today. Energy balances, the focus of his research, are more relevant than ever.

food technology

health

safety

fruit and vegetables

quality

meat and fish

grain

milk and dairy products

oil

Johann Heinrich von Thünen Institute

Federal Research Institute for Rural Areas, Forestry and Fisheries



IN BRIEF:

Year of foundation: 2008

Head office: Braunschweig

Management: Prof Dr Folkhard Isermeyer

Staff members: 1065

Scientific staff: 590

Internet: www.thuenen.de

Twitter: @Thuenen_aktuell

The Thünen Institute has 15 specialised departments and is distinguished by the wide range of scientific topics it covers. It specialises in developing pathways towards a sustainable use of our natural resources.

Fields, forests and oceans are the source of biological raw materials for more than 7 billion people worldwide. The more people there are on Earth, the more important it becomes to use these resources sustainably. In our globalised market economy, however, this does not happen automatically. Politics must provide appropriate guidelines. This is where the Thünen Institute comes into play, as parliaments and ministries depend on scientific groundwork to help with their decisions. The Thünen Institute provides this based both on its own research efforts and on the monitoring activities it carries out.

Research at the Thünen Institute is interdisciplinary. It unites the three dimensions of socioeconomics, ecology and technology (humans, nature, technology) in order to develop sustainable and socially acceptable recommendations for national and international politics. The goal is therefore, for example in the case of technological innovations, to also take into account the environmental impact and the economic circumstances.



The "Nackthai" high speed plankton collector enables scientists to collect plankton from a research vessel.



Measuring peatland greenhouse gas emissions early in the morning.

The Thünen Institute has three fishery research vessels at its disposal for maritime research. And the institute can draw on one of the world's largest scientific collections of wood (xylarium) for work on identifying timber species – which is particularly relevant for ensuring that wood and wood-based products imported to Germany originate from legally felled trees.

The Thünen Institute is a scientifically independent research institution and provides open access to its research results. Many of the Institute's scientists are also involved in teaching at universities as university lecturers or professors. Students can also complete their research (at Bachelor, Master or PhD level) at the Thünen Institute.

digitalisation climate change mitigation biodiversity
fisheries marine waste organic farming animal welfare



Society's perception of animal husbandry

In the SocialLab collaborative project, the Thünen Institute and its partners investigated how consumers, farmers, and retailers view livestock husbandry. Societal conceptions of how livestock should be treated and agricultural practice are often worlds apart. There is a conflict of objectives between *cheap* on the one hand and *animal-friendly* on the other, but also between *animal welfare*, *environmental protection*, and *occupational safety*. The project revealed that the population's desire for greater animal welfare was a top priority – more important than other objectives.

The results of this study and others formed an important basis for the work conducted by the Competence Network on Livestock Farming. In 2020, this network presented far-reaching recommendations for reorganising livestock farming in Germany which had been agreed upon by the different stakeholders.

Research priorities

The Thünen Institute develops concepts for sustainable and competitive:

- agriculture;
- forestry and forest-based industries;
- fisheries and aquaculture; and

contributes to solving specific problems relating to rural areas.

The following questions are examples of what scientists at the Thünen Institute work on: How are living conditions in rural areas changing? How can we make live-stock husbandry socially acceptable? What measures can we take to adapt our forests to climate change? How can illegally felled tropical timber be identified? What paths can we take to achieve sustainable fisheries and a reduction in undesirable bycatch?

To structure this wide spectrum of fields, the Thünen Institute's research activities are organised in three clusters that cover a total of 19 subject areas. The clusters are:

- natural resources and protected habitats and species;
- production and utilisation systems; and
- economy, society and politics.

Remit

The Thünen Institute has three main responsibilities: research, long-term monitoring and policy advice. The fundamental prerequisite for providing reliable advice to politics and society is high-quality **research**. In order to ensure its competitiveness, the Thünen Institute therefore participates in free scientific competition, solicits third-party funding and collaborates in consortia with external research partners.

Thanks to its facilities, the Thünen Institute is able to conduct **long-term monitoring** (e.g. National Forest Inventory, forest soil surveys, greenhouse gas inventories, fish stocks).

The **policy advice** the institute gives, whether by answering parliamentary enquiries at short notice, compiling more than 600 statements annually for the BMEL, or representing Germany in European and international scientific bodies, is based on its own research findings and monitoring data.

rural living conditions

forest conversion

soil

global food situation

renewable resources

competitiveness

German Federal Institute for Risk Assessment (BfR)



IN BRIEF:

Year of foundation: 2002

Location: Berlin

Management: Prof Dr Dr Andreas Hensel,
Prof Dr Tanja Schwerdtle

Staff members: 1151

Scientific staff: 534

Internet: www.bfr.bund.de

Twitter: @BfRde ;@BfRen

How can we make food, chemicals, cosmetics, toys and many other everyday products as safe as possible? Seeking answers to this question is the main focus of the work carried out by the Federal Institute for Risk Assessment (BfR). At three locations in Berlin, more than 1100 staff members spread across nine departments work to make our world safer.

Identifying risks and protecting health

The BfR was founded in 2002 in order to reinforce consumer health protection in Germany. As a federal authority that supports the Federal Ministry of Food and Agriculture, the BfR provides advice to the Federal Government on issues of food and feed safety as well as the safety of chemicals and other products.

The BfR's main responsibilities are to evaluate existing health risks, identify new risks, develop recommendations for risk mitigation and communicate this process transparently. The BfR conducts research and provides advice to limit animal experiments to the absolute minimum and to ensure the greatest possible protection for laboratory animals.



The BfR's scientific assessments provide pivotal impetus for consumer health protection.

All of the BfR's fields of work – science, evaluation, communication and administration – have been certified since 2010 in accordance with the DIN EN ISO 9001 quality standard.

The BfR is home to several national reference laboratories in the fields of food safety, feed safety and food hygiene in accordance with Regulations (EC) No. 882/2004 and (EU) No. 2017/625. The BfR is therefore part of the EU-wide network for improved food surveillance.

Networks and collaborations

The BfR is supported in its risk assessments and risk communication by an network of independent scientific committees and advised by the Scientific Advisory Board in its strategic orientation.

As a national contact point of the European Food Safety Authority and a partner of the European Chemicals Agency, the BfR collaborates with more than 50 national, international, governmental and non-governmental organisations on all continents and provides advice on the structuring of risk assessment authorities.

risk communication

protection of experimental animals

feed safety

risk assessment
food safety

Researching plant-based diets

How does a vegan or vegetarian diet affect a person's health? This is one issue that the BfR investigates, for example in collaboration with a number of partners in the COPLANT study (COhort on PLANT-based diets). It is the largest study on plant-based diets ever conducted in the German-speaking region. In collaboration with the Max Rubner Institute (MRI), the IFPE research centre for plant-based diets, and five partner universities, the aim of the study is to close any existing gaps in the data on potential health advantages and risks of various plant-based diets.



The aim of the COPLANT study is to gain new insights into the advantages and disadvantages of plant-based diets.

Genome analysis through next-generation sequencing (NGS)

NGS is a powerful technology for analysing nucleic acids that can sequence several hundred million fragments simultaneously. It plays an ever larger role in the assessment of microbial risks. This ensures that foodborne disease outbreaks can be traced, documented and explained more accurately. The BfR collaborates with partners such as the Robert Koch Institute (RKI), the Max Rubner Institute (MRI) and the Friedrich Loeffler Institute (FLI) in order to research and establish this technology and the digitalisation processes associated with it.

Remit

Research

One of the BfR's core competences is carrying out independent, application-oriented and incident-related research. The topics of its research are closely related to its evaluation responsibilities. The BfR has a state-of-the-art experimental infrastructure at its disposal that covers chemical analysis, microbial diagnostics, toxicology and food technology.

Food and feed safety

The BfR uses internationally recognised criteria to evaluate toxicological, microbial and nutritional aspects of food and feed, from ingredients and additives to residual substances, contaminants, germs and parasites.

Product safety

The BfR investigates constituent substances of products such as cosmetics, toys, clothing, food packaging and containers, and assesses whether these substances, and their release, can endanger human health.

Chemical safety

The BfR also assesses the risks posed by chemicals, plant protection products, biocidal products and hazardous goods in order to identify undesirable effects quickly.

Risk communication

The BfR investigates the population's risk perception and risk behaviour. The BfR is in contact with various stakeholder groups in society in order to inform the public of health risks.

Alternatives to animal experiments

The BfR acts as the German Centre for the Protection of Experimental Animals (Bf3R) and coordinates all activities throughout Germany with the objective of reducing animal experiments to an absolute minimum and providing experimental animals with the greatest possible protection.

contaminants

biocides

poisoning

plant protection agent

residues

German Biomass Research Centre (DBFZ)



IN BRIEF:

Year of foundation: 2008

Head office: Leipzig

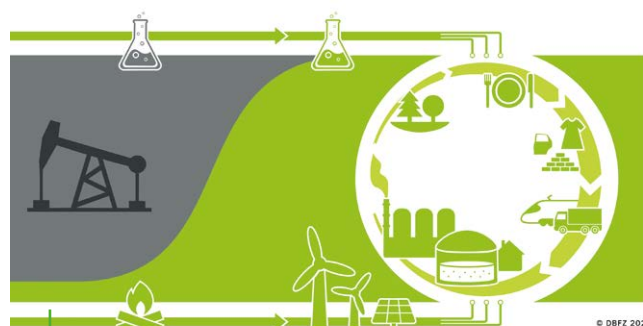
Management: Prof Dr Michael Nelles (scientific)/
Ronny Bonzek (administrative)

Staff members: 265

Scientific staff: 132

Internet: www.dbfz.de

Twitter: @DBFZ_de



“Smart bioenergy” in a sustainable bioeconomy.

The German Biomass Research Centre (DBFZ) works with partners from science, industry and civil society and carries out research to identify, develop, monitor, evaluate and demonstrate the most promising fields for the application of bioenergy and the most outstanding examples of its use. Particular emphasis is placed on carrying out research projects in a practice-oriented manner with a wide range of industrial partners. In addition to application-oriented research, the DBFZ also offers advisory services for policy-makers. These include compiling studies, analyses and background reports, as well as conducting a number of monitoring projects (on electricity generation from biomass and the use of biofuels) that focus on the long-term development of bioenergy markets. Based on this, the DBFZ then supports the development of policy instruments related to the energetic and material use of biomass.

Smart bioenergy – innovations for a sustainable future

One of the DBFZ's most important conceptual developments is the “smart bioenergy” concept. This involves

developing advanced biomass utilisation systems into integrated systems. These integrated systems optimise the interaction of different sources of renewable energy and combine the energetic and material use of biomass (see graphic). The DBFZ's work aims to expand knowledge about the possibilities and limitations of using renewable raw materials for energy and materials in a bio-based economy and to permanently secure Germany's position as an outstanding location for this sector.

Of all sources, bioenergy accounts for the largest percentage of total renewable energy, both in Germany and globally. It provides the electricity sector in Germany with a reliable, flexible and already demand-driven source of energy. For heat generation and the traffic sector, there are currently no well-established and meaningful ways of replacing or supplementing bioenergy. Bioenergy technologies must be based on sustainability in order to conserve the ecosystems that produce this energy. The aim must therefore be to increase utilisation efficiency. There is great potential for optimising the integration of bioenergy into the future energy system and the emerging bioeconomy. Optimising cascade use, utilising waste materials, and improving the joint production of products for energetic and material use in a single process are crucial areas for the further development of bioenergy technologies. In a bioeconomy, the

biomass

SmartBiomassHeat

emission reduction

biofuels

biorefineries

catalysis

bioenergy



Applied biomass research at the DBFZ Biorefineries Technical Centre.

bioenergy sector provides integrated and emission-free process energy. Achieving negative emissions (BECCS) is also viewed as a possible option for development in the long-term.

Research priorities

The DBFZ's work focuses on relevant research relating to the use of biomass for energy and materials and is divided into five main research areas. This ensures that important issues and aspects of bioenergy can be addressed with the necessary depth to facilitate excellent research:

- 1) **Systemic contribution of biomass**
- 2) **Anaerobic processes**
- 3) **Biobased products and fuels**
- 4) **SmartBiomassHeat**
- 5) **Catalytic emission control**

A value chain based on insect biomass

Global population growth is leading to an increased need for food and feed. Insect meal can make an important contribution towards covering the protein needs of the livestock industry and fish farming sector. The aim of the project is to develop a cost-optimised value chain for bio-based olefins and complex growth media based on insect biomass. Starting from a cheap growth medium made from waste material streams, the goal is to produce high-grade insect proteins and fats that can be put to a variety of purposes. The insects used are black soldier flies, which can convert organic inputs into valuable insect biomass.



Black soldier flies mating.

These focus areas are aligned to future developments and to research policy challenges and frameworks (e.g. the Federal Government's strategies such as the 2030 National Research Strategy on BioEconomy, the National Policy Strategy on Bioeconomy, the Mobility and Fuels Strategy, and the Biorefineries Roadmap). The alignment of these focus areas also depends on other important factors such as the overall funding framework, unique features of the research landscape and the DBFZ's good infrastructure.

Smart Bioenergy

biogas

solid biomass
bioeconomy

biomethane

policy recommendations

Leibniz Institute of Agricultural Development in Transition Economies (IAMO)



IN BRIEF:

Year of foundation: 1994

Head office: Halle (Saale)

Management:

Prof Dr Alfons Balmann (Department for Structural Change), **Prof Dr Thomas Glauben** (Department for Agricultural Markets), **Katja Guhr** (Department for Administration), **Prof Dr Thomas Herzfeld** (Department for Agricultural Policy)

Staff members: 150

Scientific staff: 100

Internet: www.iamo.de

Twitter: [@iamoLeibniz](https://twitter.com/iamoLeibniz)



State-of-the-art agricultural enterprises already use digital instruments. Advice at political level is crucial to also enable smaller farms, e.g. in Asia, to benefit from these instruments.

The Leibniz Institute of Agricultural Development in Transition Economies (IAMO) is the world's only agro-economic research institution that focuses on the profound changes and deficits that exist in the agri-food sectors and rural regions of countries that used to have socialist planned economies. In spite of great efforts and many successes, the development of the agri-food sector and rural areas in many transition economies still lags far behind western industrialised countries. There is a large disparity in development between successful regions and stagnating regions, with immense social implications. Large emerging countries such as Russia and China have become global players on the world's agricultural markets. One question is therefore what must happen in these and other transformation economies in order to promote sustainable growth in the face of the ongoing global food crisis and to ensure global food security despite increasing demands on agricultural resources. At the same time,

it is a major challenge to adapt agriculture and land use to climate change. Through its research, the IAMO contributes to a better understanding of institutional, structural and technological change. The regions under investigation range from countries joining the EU and the transformation regions of central, eastern and south-eastern Europe all the way to central and eastern Asia.

Research priorities

There are close links between developments at farm level, developments in rural areas, the development of functioning agricultural markets and the structuring of agricultural policy. The IAMO's scientific work is therefore organised into cross-departmental research priorities that focus on key problems of agricultural development in transformation and emerging countries:

food security
agro-holdings
rural areas
agriculture
Central Asia
climate change
bioeconomy

- I. Policies and institutions
- II. Natural resource use
- III. Livelihoods in rural areas
- IV. Organisation of agriculture
- V. Agricultural value chains

Sino-German Agricultural Centre (DCZ)

One of the IAMO's many international projects is its collaboration in the Sino-German Agricultural Center (DCZ). The centre brings policy makers together with experts from industry, science and the agricultural sector and aims to promote the exchange of experience and knowledge in the agri-food sector between the two countries. Topics such as policy tools, environmentally sound animal husbandry and collaboration in the seed sector are discussed in expert conferences and working groups. The DCZ is a joint initiative of the German Federal Ministry of Food and Agriculture (BMEL) and the Ministry of Agriculture and Rural Affairs of the People's Republic of China. The IAMO and the IAK Agrar Consulting GmbH company were commissioned to run the project.



The IAMO conducts research into rural living conditions, e.g. here in China.

Remit

The institute's key tasks are as follows:

- internationally orientated research into agricultural and nutritional economics;
- the promotion of the exchange between science, industry and politics; and
- the promotion of young researchers.

Since its foundation, the institute has placed special emphasis on training researchers from the region that is the focus of research. One of the most important factors for developing national economies is to improve research capacities, which also increases the general prosperity of the people living in these countries. Through innovative pilot projects, graduate schools and structured doctoral research programmes, the IAMO helps modernise and internationalise the higher education and science systems in these transformation countries.

Global scientific community

To deliver on its research remit, the IAMO has built up extensive collaborative ties with economic and agro-economic research centres in central and eastern Europe, central and eastern Asia, Germany itself, western Europe and the US. It therefore promotes networking across the international scientific community.

In addition to holding conferences, seminars and workshops, the IAMO also hosts the annual IAMO Forum which provides an important international platform for scientific exchange. This Forum, which was established in 2003, brings together experts from science, politics and the agricultural sector to discuss current research results, formulate recommendations for policy-makers and define research questions that will be relevant to the future of agricultural policy.

digitalisation
land markets

smallholders
value chains

Common Agricultural Policy
grain exports
animal welfare

Leibniz Centre for Agricultural Landscape Research (ZALF)



IN BRIEF:

Year of foundation: 1992

Head office: Müncheberg

Management: Prof Dr Frank Ewert (Scientific Director),
Martin Jank (Administrative Director)

Staff members: 420

Scientific staff: 171

Internet: www.zalf.de

Twitter: [@zalf_leibniz](https://twitter.com/zalf_leibniz)



The main building of the ZALF on the Müncheberg campus.

Together with stakeholders from science, politics and practice, the Leibniz Centre for Agricultural Landscape Research (ZALF) conducts research on the economically, environmentally and socially sustainable agriculture of the future.

To help tackle societal challenges such as climate change, food security, biodiversity conservation and resource scarcity, the ZALF develops and designs landscape-adjusted farming systems that reconcile the need for plant production with sustainability requirements. To this end, the ZALF combines complex landscape data with a unique set of experimental methods, new technologies, computer-based models and socio-economic approaches.

The digital transformation and novel technologies are changing production systems, presenting science with

greater challenges, and creating new job profiles in agriculture. Consumers are increasingly demanding greater transparency in production processes and asking for more sustainable and healthier products. This offers opportunities for innovative products, innovative business models and dynamically expanding markets.

With the integral role agriculture plays in society, the sector must therefore remain attractive and competitive, both now and for future generations. At the same time, targeted measures are needed to adequately support and remunerate the conservation and development of ecosystem services, biodiversity, plant health and soil health in agricultural landscapes. The ZALF's ambition is to play an active role on this pathway towards environmentally sound, climate-smart, productive, digital and knowledge-based agriculture.

sustainable land use

food security

cropping systems

climate change

Agriculture 4.0

agricultural landscapes

CarboZALF

The agricultural sector can actively help shape climate change adaptation and climate stewardship. The Carbo-ZALF project, conducted on an internationally unique experimental site, involves fully automated systems measuring gas fluxes in landscapes that have been put to various different uses. State-of-the-art technologies record soil properties and collect water samples. In combination with long-term observations, this permits conclusions to be drawn on the carbon balances of agricultural landscapes.

Research priorities

The interdisciplinary research addresses current megatrends and important challenges facing society as a whole:

- Agriculture for healthy soils and biodiversity: farming systems of the future
- Agriculture and climate change: adaptation through diversification
- Agriculture and digitalisation: synergies through emerging technologies
- Agriculture in transition: the role of humans and society
- Agriculture and globalisation: food security and sustainability



Gas measurement chambers and a globally unique gantry crane at the CarboZALF experimental site.

Remit and key competences

Interdisciplinary and transdisciplinary systems research

The ZALF's integrated systems research investigates agriculture as a whole, from processes in soils, plants and water and causal interrelations at field and landscape level to global effects and complex interactions between landscape, society and industry. The ZALF's scientific staff include experts from agricultural science, socio-economics, hydrology, soil science, biogeochemistry, geology, geography, biology, nutritional science, political science and many other disciplines who work together interdisciplinarily to develop solutions. Many research issues are identified and addressed transdisciplinarily, i.e. relevant stakeholders from politics, industry and society are involved from the outset.

Global issues with a regional focus

The ZALF analyses global challenges in a regional context: its research integrates both global and regional perspectives for sustainable agricultural production and takes regionally specific differences in the landscape, in society and in the economy into account.

It's all about data

To conduct successful agricultural landscape research, the ZALF generates, analyses and processes comprehensive landscape data from experiments at laboratory, field and landscape level as well as using near and remote sensing. The ZALF combines novel approaches to processing these data with its extensive methodical knowledge on the modelling of processes in soil, in plants, at field level and even up to calculating yield developments of entire continents under changing climatic conditions.

ecosystem services
protein plants

soil (biota)

biodiversity

plant health

transdisciplinarity

Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)



IN BRIEF:

Year of foundation: 1992

Location: Potsdam

Management: Prof Dr Barbara Sturm

Staff members: 245

Scientific staff: 112

Internet: www.atb-potsdam.de

Twitter: @LeibnizATB



CIRCLE@ATB – the Center for Research and Communication in a Circular BioEconomy, which was established in 2019.

The Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB) conducts research at the interface between biological and technical systems. The aim of its research is to sustainably produce biomass and use it both for food and as a raw material for bio-based products and energy carriers. The ATB's research uses a systems approach based on a bio-based circular economy. This means that renewable resources or waste materials of biological origin are used instead of fossil resources. They are (re-)introduced into the production cycle as valuable resources in order to produce innovative bio-based materials and energy carriers for various fields of application, e.g. in the industrial sector. Agricultural production has a key role in the bioeconomy. Material flows and processes in agriculture, in the food sector and in biomass conversion interact with each other in many different ways. The ATB develops digital technologies and management strategies across disciplines to control these processes. They enable the processes to be controlled in a knowledge-based and increasingly automated manner, and flexibly in terms of time and location. The ATB's scientists develop flexible and site-specific concepts for a bio-based circular economy and for the sustainable intensification of production systems. This work helps facilitate a local and individual response to the global challenges of food security, environmental protection, climate change mitigation and animal welfare.

Structure

The ATB is a member of the Leibniz Association. It receives half its institutional funding from the competent Federal Ministry (BMEL) and the other half from the competent Land Ministry (MWFK). In addition, the ATB attracts third-party funding amounting to roughly 30 % of its budget.

Research priorities

Research carried out in the **Precision Farming in Crop and Livestock Production** programme has a variety of aims, for example the use of sensor technology, data science methods and modelling to produce sustainable agricultural biomass. This can help improve living standards for a growing world population in spite of limited resources. Process research covers sensor-based technologies for precision farming and precision horticulture and the interaction between livestock housing systems and animal welfare. Analysis is also carried out on interrelations and effects concerning the environment and the economy, with a focus on nitrogen, greenhouse gases, germ-contaminated aerosols and water; these effects are then taken into consideration in the process management.

bioeconomy

Data Science

digitalisation

animal welfare

climate change mitigation

One Health

circular economy

Targeted plant protection protects the environment

How can wheat rust infestations in winter wheat be identified early? In cereal plants, the older, lower levels of leaves are usually affected earlier and infested more heavily by this fungal disease than the younger leaves nearer the top. In the FungiDetect project, the ATB and its partners developed a new sensor system that can optically detect the typical infestation symptoms, even underneath the top layer of leaves. If isolated occurrences are detected early, the localised treatment of the affected parts can prevent the fungus from spreading. Sensors also record information on the local plant stand and calculate the target area to be covered by the spray to counteract the wheat rust efficiently. This minimises the amount of plant protection product used, thereby conserving resources and protecting the environment.



Sensor for the early detection of wheat rust in a field trial.

The aim of the **Quality and Safety of Food and Feed** programme is to provide safe and high quality foods through tailored processes along the post-harvest value chains and thus to minimise losses. Research addresses the entire spectrum, from storage and processing to the consumption of fresh or low-processed products of plant and animal origin (e.g. fruit, vegetables, cereals, milk and meat) as well as alternative bioresources (e.g. algae, insects). The focus is on innovative packaging concepts, energy-efficient storage technologies and environmentally sound, low-impact methods for reducing germ

contamination. Research also includes the processing of little-used bioresources so that they can add bioeconomic value, e.g. for the production of polysaccharides and lipids.

The ATB's **Material and Energetic Use of Biomass** programme develops efficient technologies and methods to produce biomaterials and bioenergy carriers for a sustainable bio-based circular economy. It recycles raw and waste materials that are no longer needed for food production, in accordance with bio-refinery and cascade-use concepts. Examples of raw materials include fibre-rich plants such as hemp, nettles and oil seed flax as well as short-rotation woody plants such as poplars or black locusts from which novel products and energy carriers are developed. Thermal and biotechnological material transformation processes use sugar-rich and starch-rich waste materials to produce biogas and biochar as well as bio-based chemicals for the production of bioplastics. It is crucial in this context to better understand and control the metabolic processes in the micro-organisms involved.

Science for the good of society

As an independent scientific research institution, the ATB works in interdisciplinary teams and in collaboration with leading research groups from all over the world to help develop solutions to the challenges facing our society. This is based on intensive collaboration with universities and non-university establishments in Germany and abroad, which includes the training of young researchers.

The ATB is in constant exchange with industry, politics and civil society in order to anticipate future demands and trends, translate these into research questions and successfully transfer scientific insights from research into practice. This exchange takes place through collaboration in expert bodies and through policy advice as well as through contributions to scientific journals. The intensive collaboration with agriculture and industry ensures practical orientation and relevance.

food safety
bioenergy

bio-based substances
emission reduction

agroforestry
Smart Farming
microbiome

Leibniz Institute of Vegetable and Ornamental Crops (IGZ)



IN BRIEF:

Year of foundation: 1992

Head office: Großbeeren/Brandenburg

Management: Prof Dr Nicole van Dam

Staff members: 116

Scientific staff: 62

Internet: www.igzev.de

Twitter: [@igz_leibniz](https://twitter.com/igz_leibniz)

The Leibniz Institute of Vegetable and Ornamental Crops (IGZ) conducts basic plant science research with a view to possible applications in vegetables and ornamental crops and in the use of plant biodiversity.

Horticultural products should be of high quality, come from eco-friendly cultivation and be affordable for consumers.

With these goals, the IGZ aims to serve the environment, help the competitiveness of the horticultural sector and meet consumer demands. To this end, the IGZ's staff collaborate with universities, other research organisations and enterprises within Germany, across the EU and beyond.

Advances in basic research have led to fascinating research questions and novel analytical methods that can improve understanding of plants and of how they interact with their environment. The IGZ contributes to these advances and uses them to develop sustainable production systems in horticulture. In addition, the institute aspires to excellence in horticultural research and related scientific areas.



RNA is extracted from a cauliflower plant to investigate the transcript level in carotenoid biosynthetic genes.

Research priorities

Work at the IGZ is organised into five programme areas:

Functional plant biology (FUNCT): aims to understand the processes that enable plants to adapt to their environment.

Plant-microbe systems (MICRO): aims to improve understanding of how plants interact with microbes and the environment in order to develop better sustainable cultivation systems in horticulture. This will help ensure adequate and sustainable production of vegetables, providing consumers with greater quantities of healthy food. It will also promote human health and well-being

climate change mitigation
horticultural research

food security

plant health

sustainable use of resources

biodiversity

innovation

Nutri@ÖkoGemüse

“Nutri@ÖkoGemüse” is a collaborative project conducted by eleven partners from federal state institutions, universities and enterprises. It aims to develop nutrient management strategies for targeted and balanced fertilisation in intensive organic vegetable cultivation systems and to reduce negative environmental impacts.

Strategies and tools are developed for vegetable cultivation that facilitate need-based and balanced fertilisation with nitrogen and with the other macronutrients.



Irradiation of young chard and bok choy plants with different qualities of light for the targeted increase of secondary plant substances.

by reducing the use of pesticides and excessive mineral fertilisers and hence also reducing the associated negative effects on the environment.

Genomics and bioinformatics in horticulture (BIOINF): establishes and develops methods and structures to store and process primary “omics” data and to link these

processed data with each other and with other data, e.g. from the human sector or from ecosystem biology. The analysis of “omics” data is an important approach to personalised health in order to investigate implications for the occurrence of diseases.

Plant quality and food security (QUALITY): generates interdisciplinary knowledge from life sciences and social sciences to strengthen sustainability in horticultural production, human nutrition and food security for everyone.

Next-generation horticultural systems (HORTSYS): develops innovative management strategies for the sustainable use of resources and for climate change adaptation by using model-based decision support systems for indoor and outdoor horticulture.

Remit

The IGZ's main task is to achieve fundamental advances in our understanding of plant systems in order to accelerate the development of sustainable horticulture.

The IGZ contributes to:

- the success of horticulture in Germany and other countries;
- the scientific foundations of horticultural and plant sciences;
- the development of environmentally compatible production methods;
- sustainability in the cultivation and use of plants; and
- to healthy diets and well-being among the population.

fertiliser strategies

nutrient management

organic vegetable growing systems

advice

sustainable production method

Leibniz Institute for Food Systems Biology at the Technical University of Munich



IN BRIEF:

Year of foundation: 1918

Location: Freising

Management:

Prof Dr Veronika Somoza (Scientific Director)

Michael Paul (Administrative Director)

Number of staff: 81

Scientific staff: 40

Internet: www.leibniz-lsb.de

Twitter: @LeibnizLSB



The LSB head office.

The Leibniz Institute for Food Systems Biology at the Technical University of Munich (LSB) has a unique scientific profile at the interfaces between food chemistry and biology, chemosensors and technology, and bioinformatics and machine learning. It contributes to developing a systemic molecular understanding of biologically relevant connections along the entire “agriculture–food–humans” chain.

The aim of this research work is to compile a scientific data base that permits predictions to be made on how constituents change from raw materials to finished food and how they affect the human biosystem.

The new insights will help optimise production processes and enable the constituent and function profiles of the food produced to be based on society's health and nutritional requirements as well as on sensory preferences.

To this end, the institute combines biomolecular basic research methods with state-of-the-art bioinformatics methods and high-performance analytical technologies.

The LSB also hosts three databases:

The Leibniz-LSB@TUM **Odorant Database** contains information that helps researchers identify naturally occurring aromatic substances in foods.

The **Food Systems Biology Database** contains comprehensive information on sensorially active molecules, their occurrence in foods and the relevant chemoreceptors. It supports researchers from various specialist fields in food and nutrition science.

The **Souci-Fachmann-Kraut Database** is a comprehensive collection of tables on the composition of foods. It helps specialists in the fields of dietetics and nutritional education as well as in production, marketing and the surveillance of foods. These nutritive data also form one major basis of the National Nutrient Database published by the BMEL.

food and nutrition
systems biology
food smell
research into active substances
databases
health

Food Profiling – solutions for food authentication

The LSB works with partners from science and industry within the Food Profiling Competence Network (www.food-profiling.org). This network develops novel analytical strategies to unequivocally prove the geographical origin, botanical origin and chemical identity of plant-based raw materials. These strategies include state-of-the-art cell-biological and instrumental-analytical methods (genomics, proteomics, metabolomics) as well as high-resolution analyses of element and isotope profiles (isotopologomics). The new insights will permit the unequivocal authentication of raw materials and foods made from such materials.



Analytical laboratory.

Research priorities

Based on a new understanding of biomolecular systems, the institute conducts interdisciplinary research into complex systems of chemosensorily relevant food constituents (effector molecules) and their effects on the human organism. Its research is geared towards three main subjects which seek to answer the following questions:

1) Predictive food effector systems

How are food effector systems structured? What are they influenced by and how do they change during production along the value chain?

2) Predictive hedonics

What determines our sensory judgement of food? What factors can be used to predict this?

3) Predictive chemoreceptor-mediated human biology

What effects do ingredients that add fragrance or flavour to a food have on the body? Do they have physiological effects beyond the sensory effects?

In order to optimise the interdisciplinary work on these main subjects, the institute is divided into three research sections that collaborate across sectors and fields of expertise.

Section 1: Sensory systems chemistry

Section 2: Metabolic function, chemoreception and biosignals

Section 3: *In silico* biology and machine learning

Remit

The institute's primary task is to investigate complex constituent systems and to evaluate which of them influence the sensory, nutritive and health quality of food and the safety of foods. This also involves developing a scientific basis for methods of predicting and optimising the composition of ingredients and their effects on the biological system.

Further tasks include compiling literature data on nutritionally-relevant food ingredients, scientifically evaluating these data and documenting them in the continuously updated Souci-Fachmann-Kraut database. These data, as well as the institute's own research findings, such as the Odorant Database, support and promote science and research conducted at other institutions or enterprises.

The institute shares its insights with industry, politics and society, in accordance with the principles of the Leibniz Association.

taste

chemosensor analysis

bioinformatics

food chemistry

technology

chemoreceptors

Research Institute for Farm Animal Biology (FBN)



IN BRIEF:

Year of foundation: 1993

Head office: Dummerstorf

Management: Prof Dr Kaus Wimmers

Staff members: 259

Scientific staff: 64

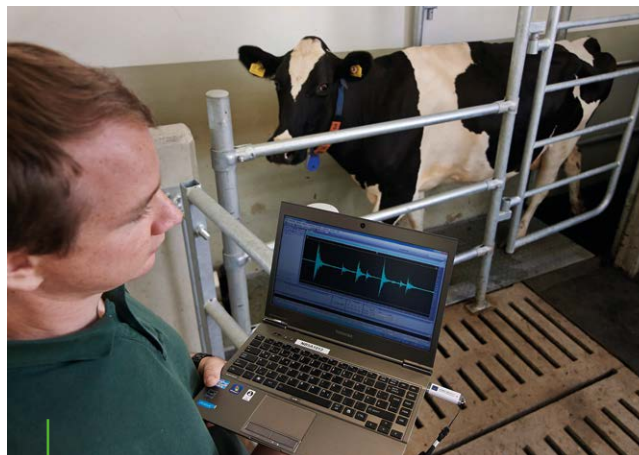
Internet: www.fbn-dummerstorf.de

Learning to understand animals

Milk, meat and eggs are important staple foods. Livestock farming thus makes a significant contribution to human nutrition. The foundation for this was laid more than 10,000 years ago with the domestication of today's farm animals. Since being kept by humans, farmed species have become very diverse, and their continued existence is our responsibility. Livestock farming currently accounts for over 50 % of the agricultural sector's production value, making it a key component of agricultural value chains, material cycles and the bioeconomy.

There is great potential in the soil – crop production – livestock farming – food production value chain to increase efficiency and conserve resources by decreasing losses and optimising material cycles. Public debate is currently focused on animal welfare, animal health, food safety and environmental footprints at local and global level. These issues must be resolved based on sound data in order to increase both the acceptance and the sustainability of livestock farming.

The FBN investigates the many different biological solutions that farmed animals have evolved during their domestication and breeding for different characteristics. The aim is for this knowledge to future-proof livestock



Volker Röttgen analysing the sound of cattle hooves as an indicator of emerging lameness.

farming and enable animals to be provided for according to their situation and individual needs.

The campus in Dummerstorf is equipped with state-of-the-art infrastructure. Scientists from six departments conduct interdisciplinary research, ranging from the molecular level to the whole organism, into innovative solutions for environmentally sound, climate-compatible and animal-friendly livestock farming.

Research priorities

Biodiversity and adaptation

Animals differ in their characteristics and their ability to adapt more or less successfully to changing environmental conditions. What causes these differences? How can these differences be used now or in future to bring the capabilities and needs of animals and their environment better into line with each another? The FBN examines the fundamental biological mechanisms of heredity, conditioning, characteristics and regulation of bodily

livestock biology
digitalisation

Deep Phenotyping

animal breeding

animal welfare
animal health

The ChronMast and BovReg projects

Udder diseases are a frequent cause of antibiotic use in dairy cattle as well as of short productive lives, a negative impact on animal welfare and negative economic consequences. In the ChronMast project, the FBN collaborated with partners to investigate what mechanisms underlie different predispositions for disease susceptibility and impact the length of an animal's productive life. One of the results of this project was that udder quarter cell counts yield important practical information. Genome immunology information on the causes of different levels of disease susceptibility can be used within the scope of genetic selection in order to improve dairy cattle health. Corresponding approaches are being continued under an EU-funded international network project ("BovReg") which is being coordinated by the FBN.



Kristina Zlatina examining cells from the female reproductive tract using a confocal laser scanning microscope.

functions. It also investigates adaptability at the level of individuals (adaptation) and populations (biodiversity) to enable our livestock to be managed and used sustainably, and their diversity to be preserved.

Animal welfare and animal health

Domesticating, breeding and keeping farm animals has led to major changes in physiology and behaviour in the animals compared with wild species. Livestock research particularly focuses on discovering what biological functions and processes are essential in overcoming challenges to health and well-being. One goal is to develop innovative bioindicators and intelligent systems for the non-invasive monitoring of health, well-being and physiological conditions. Another objective is to derive strategies to prevent disease and improve animal welfare in housing, nutrition and management.

Resource utilisation and environmental interactions

Good environmental stewardship is a key requirement for future livestock farming, with the anticipated impact of climate change posing a particular challenge. How can farm animal husbandry help close material cycles in agriculture and prevent emissions, particularly of nitrogen, phosphorus and methane? This requires a comprehensive understanding of the regulation of metabolic processes in farm animals. The FBN investigates the control of the animals' energetic and nutrient metabolism at different levels of the biological system, taking account of different housing conditions and climate effects. The aim is to identify the adaptability of various farm animal breeds and individuals and to enable this adaptability to be utilised. This will in turn make it possible to better adapt the housing environment to the requirements of farmed animals.

Experimental animal facilities

The FBN is equipped with stalls and with livestock adapted to the current research requirements in terms of origin, genetics and breeding. The experimental animal facilities for cattle, pigs, pygmy goats, fish and poultry, in combination with other key facilities such as the "Tiertechnikum" laboratory for intensive testing and the experimental abattoir, provide the prerequisites for interdisciplinary experiments. In addition, the FBN has unique mouse breeding lines as model animals and an insect breeding facility.

material cycles

resource conservation

resilience

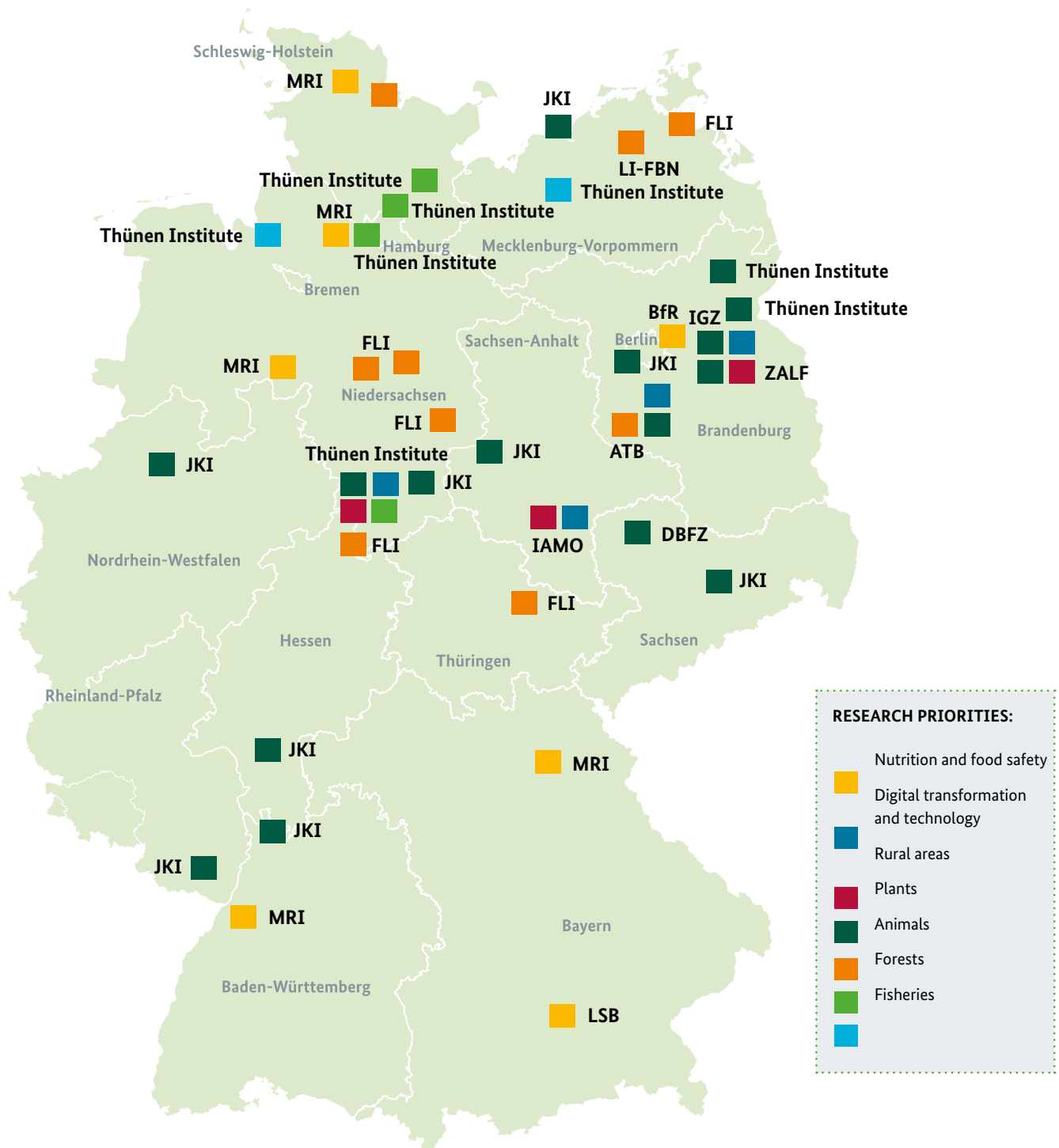
biodiversity

climate change

domestication

food and nutrition

Locations of the research centres



Locations of the research centres

Baden-Württemberg:

Max Rubner Institute, Federal Research Centre for Nutrition and Food (MRI), head office in Karlsruhe

JKI, Dossenheim branch

Bavaria:

Leibniz Institute for Food Systems Biology at the Technical University of Munich (LSB), Freising

MRI, Kulmbach branch

Berlin:

Federal Institute for Risk Assessment (BfR), head office in Berlin

JKI, Berlin branch

Brandenburg:

Leibniz Centre for Agricultural Landscape Research (ZALF), head office in Müncheberg

Leibniz Institute for Agricultural Engineering (ATB), head office in Potsdam

JKI, Kleinmachnow branch

Thünen Institute, Eberswalde branch

Thünen Institute, Waldsiedersdorf branch

Bremen:

Thünen Institute, Bremerhaven branch

Hamburg:

Thünen Institute, Hamburg-Bergedorf branch

Hesse:

JKI, Darmstadt branch

Mecklenburg-Western Pomerania:

Friedrich Loeffler Institute, Federal Research Institute for Animal Health, Hauptstz, Greifswald head office (island of Riems)

JKI, Groß Lüsewitz branch

Research Institute for Farm Animal Biology (FBN), Dummerstorf

Lower Saxony:

Johann Heinrich von Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries, Braunschweig head office

JKI, Braunschweig branch

FLI, Braunschweig, Celle, Mariensee branches

North Rhine-Westphalia:

JKI, Münster branch

MRI, Detmold branch

Rhineland-Palatinate:

JKI, Siebeldingen branch

Saxony:

German Biomass Research Centre (DBFZ), Leipzig head office

JKI, Dresden-Pillnitz branch

Saxony-Anhalt:

Julius Kühn Institute – Federal Research Institute for Cultivated Plants (JKI), Quedlinburg head office

Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle head office

Schleswig-Holstein:

MRI, Kiel branch

Thünen Institute, Trenthorst branch

Thünen Institute, Großhansdorf branch

Thünen Institute, Barsbüttel-Willinghusen branch

Thuringia:

Leibniz Institute of Vegetable and Ornamental Crops (IGZ), Großbeeren/Erfurt head office

FLI, Jena branch

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