INRAE

Clermont-Auvergne-Rhône-Alpes Centre

June 2021

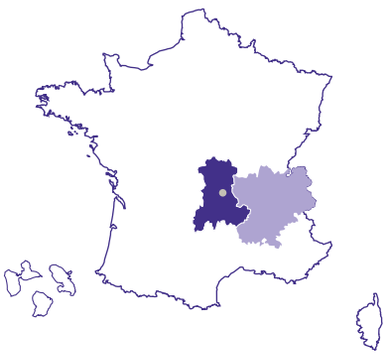
"Within a dynamic regional ecosystem, our research centre is a major research player in our areas of expertise: preventive human nutrition, cereals, the sustainability of herbivorous breeding systems, product quality, territories, robotics and the new technologies being applied to agriculture, ecology and the functioning of trees."

Emmanuel HUGO
President of INRAE Clermont-Auvergne-Rhône-Alpes Centre

THE CLERMONT-AUVERGNE-RHÔNE-ALPES CENTRE

With nearly 850 staff spread over 20 Units in 8 locations, our Centre is widely anchored in the region. Our teams implement research projects characterized by a broad disciplinary representation, as close as possible to the concerns of society. Our Centre benefits from excellent international recognition, as demonstrated by numerous international partnerships, such as the recent creation with China of the Genomics and Wheat Improvement LIA (International Associated Laboratory).
Our local long-term scientific partnerships are in the form of Joint Research Units, contributions to federative organisations, to projects of excellence (LabEx and I-Site) and are structured within the framework of the "University of Clermont Auvergne and Associates (UC2A)" territorial coordination.
Thanks to our areas of expertise and our large-scale experimental systems (cereal phenotyping and genotyping, robotics, mechanisms for studying breeding systems, grasslands...), our Centre has developed partnerships in agriculture, the agri-food, industrial, health and environmental sectors. It also contributes to the support of public policies.

The scientific teams of the Clermont-Auvergne-Rhône-Alpes Centre are involved in numerous international research networks in the fields of plant genetics, animal husbandry and human nutrition.



A STRONG INVOLVEMENT IN THE DYNAMICS OF THE CLERMONT-AUVERGNE SITE

Within the framework of the I-SITE CAP2025 Clermont Auvergne Project, the Centre is a driving force in sustainable agro-ecosystems research in a context of global change. It also conducts research on innovative systems and services for production or health.
In addition, for several years now, our Centre has been pursuing its involvement with young people and, more broadly, its science-society actions, for example its involvement in the "Clermont-Ferrand, a learning city" UNESCO initiative. Several participatory science projects also involve the local community.

REGIONAL INTEGRATION

In the Auvergne-Rhône-Alpes region, INRAE is present via its 2 research centres: Clermont-Auvergne-Rhône-Alpes and Lyon-Grenoble-Auvergne-Rhône-Alpes. These 2 centres contribute to a shared scientific scheme divided into 6 multidisciplinary themes. The research themes fall within 6 of the 8 areas of excellence identified by the Region in its Regional Higher Education Research Innovation Plan (SRESRI). They contribute to strengthening INRAE's role in the Auvergne-Rhône-Alpes in the fields of food (preventive nutrition) and the environment (management and preservation of resources), and to reinforcing its leadership in the field of agriculture (animal and plant production).

The main territorial partners

Our research priorities

Six structuring themes have been identified for INRAE in the Auvergne-Rhône-Alpes region. The Clermont-Auvergne-Rhône-Alpes Centres participates in 5 of them. This research is part of a continuum ranging from biological resources (animal, plant, microbial) to territories via products and Humans. They are conducted in close collaboration with the centre's academic partners.

1. AGROECOLOGY OF GRASSLAND FARMING SYSTEMS, PRODUCT QUALITY AND ANIMAL HEALTH
2. INTEGRATIVE BIOLOGY OF MODEL AND CULTIVATED PLANTS AND ADAPTATION TO THEIR ENVIRONMENT
3. TERRITORIES AND SOCIO-ECOSYSTEMS: QUALIFICATIONS, TRAJECTORIES AND CHANGE MANAGEMENT
4. NATURAL, HEALTH AND ENVIRONMENTAL RISKS
5. HUMAN NUTRITION, DIETARY COMPLEXITY AND HEALTH

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Livestock farming activities are being increasingly questioned due to environmental, economic and social issues.

Understanding how livestock systems work and their components is a key element in understanding their capacity for adaptation and resilience and characterising the qualities of the products and services that result from them. This is particularly the case for grassland systems.

The key challenges of this theme are: i) adapting resources (animal and plant) to the economic, social and environmental context of livestock farming; ii) the development of user-friendly technical innovations; iii) objectifying the links between grassland farming systems and the quality of the products that result from them; iv) the design and multi-criteria assessment of multifunctional, innovative and sustainable grass-based livestock farming systems, as well as territorialized streams.

Research units:

- Epidemiology of Animal and Zoonotic Diseases Research Unit (EPIA)
- Grassland Ecosystem Research Unit (UREP)
- Animal Products Quality Unit (QuaPA)
- Joint Cheese Research Unit (UMRF)
- UMR 1213 Herbivores
- Territories Joint Research Unit
- Microbiology, Digestive Environment and Health Research Unit (MEDIS)
- Technologies and Information Systems for Agro-Systems Research Unit (TSCF)

Experimental Unit:

- Low Mountain Ruminant Farming Systems Facility (HerbiPôle)

Joint scientific schemes:

- Observation and Experimentation Systems for Environmental Research: Agro-ecosystems, biogeochemical cycles and biodiversity (SOERE ACBB)
- Metabolic and Proteomic Exploration Facility (PFEM)
- UMT Services Rendered by Suckling Systems (SeSAM)
- UMT Meat Products of Tomorrow (NEWCARN)
- AgroTechnoPôle

Academic Partners:

- University of Clermont-Auvergne
- VetAgro Sup
- AgroParisTech

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2

The work of this research theme aims to develop a more sustainable agriculture.

In association with agronomic solutions, plant improvement can offer solutions by selecting varieties capable of adapting to new constraints (yields, changes in eating habits, climate change, etc.). This requires in-depth fundamental knowledge which integrated down to the scale of the crop system, and combined with technological and methodological innovations (new agronomic practices, precision farming), will help to design innovative crop systems.

The main research themes concern: i) the organization and functioning of plant genomes, ii) the development and architecture of different plant organs, iii) interactions between crop plants and their biotic environment, iv) crop plant adaptations to abiotic stresses, v) new market opportunities for plant products, vi) robotics and technologies for tomorrow's agriculture, vii) ecology, interactions and community dynamics, agro-ecology.

Research units:

- Joint Research Unit on the Genetics, Diversity and Ecophysiology of Cereals (GDEC)
- Integrative Physics and Physiology of Trees in Fluctuating Environments Joint Research Unit (PIAF)
- Technologies and Information Systems for Agro-Systems Research Unit (TSCF)
- Grassland Ecosystem Research Unit (UREP)

Experimental unit:

- Crops Field Phenotyping Facility (PHACC)

Joint scientific schemes:

- Small Grains Genetic Resources Centre (CRB)
- Clermont Genotyping and Sequencing Facility (GENTYANE)
- Observation and Experimentation Systems for Environmental Research: national network of phenology observatories (SOERE TEMPO)
- Field phenotyping platform under climatic constraints (Phéno3C)
- Wood an Tree Physicochemical Phenotyping Facility for Genetic Resources (PHENOBOIS))
- AgroTechnoPôle
- Végépôle

Academic Partners:

- University of Clermont-Auvergne
- VetAgro Sup

3

This research stems from an awareness of the urgency of environmental issues, of the impossibility of dissociating their ecological, economic and social dimensions but also, more generally, of the challenges of transition and adaptating to change in ecosystems and societies in territories.

This growing complexity has led to the emergence of the notion of socio-ecosystems and the need to take into account the challenges of maintaining, preserving and restoring ecosystems in a context of global change.
The aims of this theme are i) to understand ongoing transformations in socio-ecosystems by studying their trajectories and the interactions between ecological and socio-economic dynamics by using a multi-scale approach, ii) to identify levers and design methods that adapt to global changes in territories in order to support their stakeholders and guide their public policies.

Research units:
- Territories Joint Research Unit
- Engineering Laboratory for Complex Systems (LISC)

Partenaires académiques :
- AgroParisTech
- VetAgro Sup
- University of Clermont-Auvergne

For news and further information concerning our research
www.inrae.fr/en/centres/clermont-auvergne-rhone-alpes


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4

Global change, in all its components (climate, urbanization, pollution, etc.), has led to new risk situations for societies as well as for water resources and ecosystems. At the same time, there is strong societal demand to reduce risks which has been amplified by the media coverage of disasters and crises.

Thus, the research aims to prevent and reduce these risks. The stakes involved are people, agricultural activities, microbial, animal and plant populations within ecosystems, and more broadly the social, economic and environmental vulnerability of territories. The covered scope concerns health and environmental risks.

Research units:
- Epidemiology of Animal and Zoonotic Diseases Research Unit (EPIA)
- Engineering Laboratory for Complex Systems (LISC)

Joint scientific scheme:
- Platform for Epidemiological Surveillance in Animal Health (ESA)

Academic partners:
- University of Clermont-Auvergne
- VetAgro Sup

5


5

In recent decades, we have seen a significant increase in life expectancy in developed countries. However, the ageing of populations has been accompanied by a rise in more or less disabling pathologies that alter the quality of life and at an increasingly significant societal cost.

In this context, understanding the relationship between food and health is a major research focus of INRAE teams. The objective is to be able to propose nutritional strategies to prevent or minimize metabolic and/or age-related diseases, while taking into account the challenge of sustainable nutrition.
The main research themes concern: i) food quality and nutritional optimization, ii) understanding the mechanisms of metabolic regulation through nutrition, iii) the relationships between the intestinal microbiota, diet and host health.

Research Units:
- Human Nutrition Research Unit (UNH)
- Microbiology, Digestive Environment and Health Research Unit (MEDIS)
- Animal Products Quality Unit (QuAPA)
- Microbe, Intestine, Inflammation and Host Susceptibility Unit under Contract (M2ISH)
- Clinical Odontology Research Centre (CROC)
- Joint Cheese Research Unit (UMRF)

Joint scientific schemes:
- *In Vivo* Imaging in Auvergne (IVIA)
- Metabolic and Proteomic Exploration Facility (PFEM)
- Aurillac Experimental Cheese Hall

Academic partners:
- University of Clermont-Auvergne
- Clermont-Ferrand University Hospital (CHU)
- VetAgro Sup
- Auvergne Research Centre for Human Nutrition (CRNH)

PARTNERSHIPS, VALORISATION AND INNOVATION

The Centre's researchers collaborate with scientists from more than 70 countries, with whom they co-author more than 50% of their publications. 288 contracts were under management in 2020, including 35 French National Research Agency and 26 European contracts.

The Centre has key socio-economic partnerships within the VEGEPOLYS VALLEY, CIMES and Lyon-Biopôle Competitiveness Clusters. Others, focusing on product quality, have led to the creation of partnership structures (GIS Cheese Sectors under Geographical Indication, CReA-VIANDE). Regarding R&D in the agriculture and agri-food sectors, INRAE is a signatory to a regional framework agreement on research, innovation and development (RID). The Centre is also a co-founder of two territorial innovation laboratories (LIT) for field crops in Auvergne and for livestock farming.

Over the last few years, 4 start-ups have emerged from work carried out at the Centre.

5 major projects:

PFEM: from genes to metabolites

The Platform of Exploration of Metabolism (PFEM) is one of the 4 schemes which fall within the scope of the national MetaboHUB infrastructure. It develops quantitative high-throughput metabolism phenotyping techniques to identify and quantify biomarkers related to nutritional status, pathogen occurrence and food composition.

The Aurillac Cheese Hall: cheeses for all tastes

With technological equipment adapted to all types of cheese production and with a level 2 containment, the Cheese Hall of the Aurillac Joint Cheese Research Unit is an experimental facility that is unique in Europe. It offers a wide range of services to partners by providing services and research collaboration.

HERBIPOLE: a unique experimental scheme dedicated to the breeding of herbivores in mountainous areas

Herbipôle's goal is to respond to the challenges of breeding in mountainous areas, by setting up experiments addressing the different sustainability dimensions of breeding systems, at different scales of study (from animal to system) and time. Installed in 3 of the Centre's sites (Theix, Laqueuille and Marcenat), it offers a set of infrastructures adapted to new research issues (adaptation to climatic and economic hazards, multifunctional breeding, etc.).

AGROTECHNOPOLE in Montoldre: accelerating innovations for agroecological transitions

The Montoldre facility meets the requirements of public and private partners working to develop new technological solutions to accelerate innovations for agroecological transitions, including robotics, information and decision-making support systems, technologies and services for agricultural machinery (fertilization and seeding) and controlling environmental impacts.

GENTYANE Clermont Genotyping and Sequencing Facility:

This facility produces further research in genomics. It provides sequencing and genotyping services and participates in the evolution and fine-tuning of new technologies in this sector.

INRAE: AN OVERVIEW

Created on January 1, 2020, the French National Research Institute for Agriculture, Food, and Environment (INRAE) is a major player in research and innovation.
INRAE carries out targeted research and resulted from the merger of INRA and IRSTEA. It is a community of **12,000 people** with **267 research, experimental research, and support units located** in **18 regional centres** throughout France. Internationally, INRAE is among the top research organisations in the agricultural and food sciences, plant and animal sciences, as well as in ecology and environmental science. It is the world's leading research organisation specialising in agriculture, food and the environment. INRAE's goal is to be a key player in the transitions necessary to address major global challenges.
Faced with a growing world population, climate change, resource scarcity, and declining biodiversity, the institute is developing solutions that involve multiperformance agriculture, high-quality food, and the sustainable management of resources and ecosystems.

KEY FACTS & FIGURES OF THE CLERMONT-AUVERGNE-RHÔNE-ALPES CENTRE

The teams

14 Research Units including 9 Joint-Research Units and 2 Units under Contract
2 Experimental Units
671 members of staff with tenure (46%, 54%),
157 contract workers (FTEs, 52%, 48%)
110 Ph.D. students
407 members of staff from our Partners present in the Centre's Units

Resources

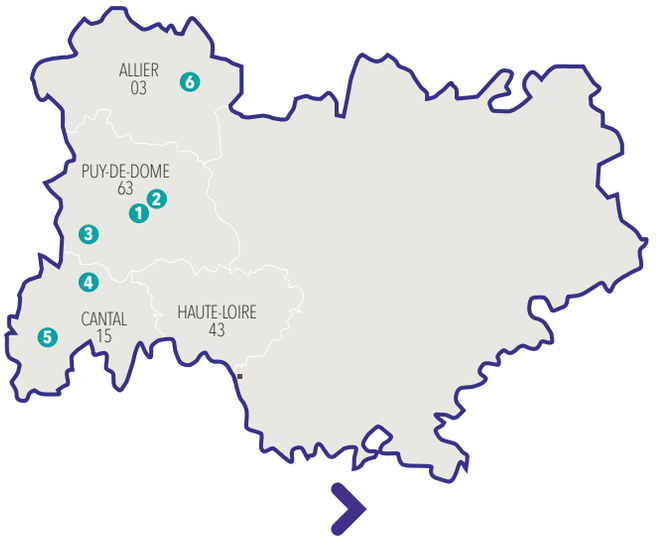
€69 million budget of which €11 million come from the Units' own resources (contractual and non-contractual)
14 joint infrastructures
113,000 m² of built heritage
1,250 ha of agricultural land
900 cattle, 800 sheep, 6,000 rodents, 350 tons of cereals harvested and 1.2 million litres of milk produced annually

Results

288 contracts under management, including 35 French National Research Agency and 26 European contracts
29 active patents and 35 licenses
473 publications in 2020 in peer-reviewed journals (source Web of science)
Nearly **2,000 hours** of teaching from 2nd year of higher education to 5th year of higher education

MAP OF THE CLERMONT-AUVERGNE- RHÔNE-ALPES CENTRE'S GEOGRAPHICAL SITES

Clermont-Auvergne-Rhône-Alpes Centre



List of locations

① Theix
② Clermont-Ferrand / Aubière :
Campus des Cézeaux
Clermont-CHU
Clermont-Crouel
③ Laqueuille
④ Marcenat
⑤ Aurillac
⑥ Montoldre

INRAE Clermont-Auvergne-Rhône-Alpes
Site de Theix
63122 Saint-Genès-Champanelle
Tél. : +33 (0)4 73 62 40 00
communication.clermont@inrae.fr
inrae.fr/en/centres/clermont-auvergne-rhone-alpes

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