Research Activities at the University of Orléans

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1 Introduction

Research at the University of Orléans is carried out by our 24 laboratories, grouped into multidisciplinary thematic clusters which we will describe in the next section. This represents around 850 permanent staff and 500 PhD students.

Most of our laboratories are co-accredited with academic partners: CNRS (French National Centre for Scientific Research) and more than 100 researchers are based in Orléans, INSA Centre Val de Loire (engineering school located in Bourges and Blois), University of Tours and BRGM (the French Geological Survey whose headquarters are in Orléans). A major new development is the creation, in 2022, of a new faculty of medicine, while the Orléans Hospital is being transformed into a university hospital. This will trigger new research collaborations in health, with the support of INSERM (National Institute of Health and Medical Research). All these collaborations with several national research institutes, allow us to acquire common high quality laboratory equipment and set up large scale research projects.

The University of Orléans encompasses now all major research fields, from exact and experimental sciences to human and social sciences, including medicine.

2 The Research Landscape

Fundamental and applied research performed in the 24 laboratories of the University of Orléans is grouped into 4 thematic clusters (Figure 1) [1].

The **Energy, Materials, Earth-Space systems** cluster groups eight laboratories in material chemistry, physics, power engineering, geosciences, environment, and space science. They largely work on environmental issues: propulsion systems (including hydrogen or

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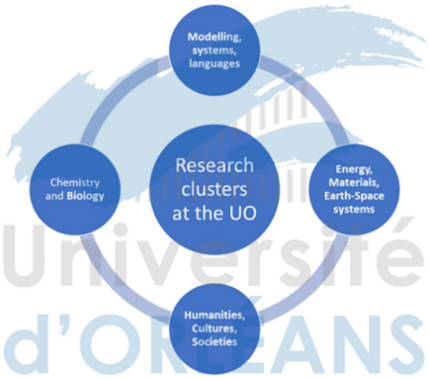

Figure 1. Four thematic clusters of the fundamental and applied research at the University of Orléans

ammonia-based engines, or even plasma propulsion for satellites), observation of pollution of the (sub)soil and the atmosphere (sensors, depollution), materials for energy storage. This cluster also has high quality teams in astrophysics (the Nançay Radio Astronomy Observatory is one of the most powerful radio telescopes in Europe), in space studies (equipment built in Orléans is on board of Rosetta, Parker Solar Probe, and more recently Juice), in the study of magmas and the deep earth.

These laboratories benefit from state-of-the-art platforms for microscopy, propulsion (engine benches, wind tunnels), the study of soils and the atmosphere, the study of materials in extreme pressure and/or temperature conditions.

The **Chemistry and Biology** cluster groups five labs of human and vegetal biology, biochemistry, sports, health, well-being. They work together on drug design, biomedicals, imaging technologies, chemical analysis, cosmetics, tumour detection, physical activities adapted to people with illness or disability, often in partnership with hospitals, pharmaceutical and cosmetics companies. The bio and chemo-informatics specialists also provide databases with selected molecules and their behaviour in clinical trials.

Research scientists share high quality platforms for molecular characterization of small molecules and biomolecules (mass spectrometry, RMN) and for imaging from cells to small animals (flow cytometry and cellular imaging, MRI / SRM, small animal imaging).

The scope of the **Humanities, Cultures, Societies** cluster ranges from archaeological heritage studies to management, from the geography of ponds to the analysis of legal, political or cultural models. The seven research labs address major societal challenges (globalization, political and cultural transformations, collective and individual responsibility, environment and heritage, citizenship) in a critical way. Research is carried out in close connection with society: museums, schools, local authorities.
Therefore, in addition to the classic scientific production (articles, books), the teams also propose exhibitions, advice to local authorities, support to teachers, etc.

The **Modelling, systems, languages** cluster comprises five teams in mathematics, computer science, automatic and signal processing, linguistics and economics. Economists and linguists have strong expertise in modelling and digital processing of economic data or written and spoken language. Gathering these teams together allows strong synergies, exchanges of skills and development of original projects.

Let us point out that most of the university's laboratories make intensive use of mathematical modelling and digital data processing via statistical and artificial intelligence tools.

In addition to this thematic structuring of the laboratories into four clusters, several large-scale projects, with durations of four to ten years, enable us to make great strides in areas of study such as cosmetic sciences (CosmetoSciences), materials in extreme conditions (MatEx), and the design of digital twins for the environment (Junon).

3 Outstanding Research

In addition to the outstanding publications listed in the dedicated chapter, let us mention a few other markers of the high level of research at the University of Orléans.

During the last two years, our researchers have obtained three ERC (European Research Council) grants in exobiology (BIOMAMA – Biogenicity of Martian Materials [2]), geology (TRACE-it: Controlling particle flow […] in geological porous media [3]) and atmosphere sciences (APATE - A primitive solar atmosphere around the young Earth [4]).

Research on hydrogen and ammonia-based engines is strongly supported by national funds France 2030 [5] (project PL-H2 - Heavy Duty Vehicle Combustion Engine Demonstrators) and international funds (projects EKI - Engine Knock Intensity Modelling for Future Fuels and ADONIS - Ammonia-Hydrogen Combustion in Micro Gas).

In life sciences, the research carried out in Orléans on messenger RNA has a high international impact. It is the subject of major funding from Horizon Europe (EIC pathfinder Challenge project Yscript - Yeast cell factory for mRNA bioproduction [6]) and our National Research Agency (project BiopRNA - Bioproduction of therapeutic mRNA and vaccines).

Excellence concerns all our research fields, for example several colleagues are members of the prestigious Institut Universitaire de France (IUF) in economy, automation, mathematics, biology and space sciences.

4 From Research to Innovation

Complementarity between fundamental and applied research is a matter of concern for all the teams at the University. Many projects are in collaboration with companies and public or private institutions, promoting joint laboratories with companies in engineering and life sciences.

Since 2019, the University of Orléans has been a founding member of the regional technology transfer structure called C-Valo [7], which facilitates the rise in technology readiness level, the patenting and creation of start-ups. Life sciences and engineering are particularly active in patenting. In 2022, the university has, for the first time, taken shares in the Viewaves start-up company emerging from in-house research activities. Its goal is to “see beyond visible to better treat cancer”, by conceiving molecules to illuminate tumours and metastases.

5 Involvement of Students

While our doctoral students are a great support to research, the involvement of master and engineering students in our laboratories still needs to be improved in several disciplines. This is the purpose of an important project led by the university, with funding over 10 years, called MINERVA. Its objective is to develop the immersion of students in our research teams (learning by doing), to generalise project-based training to strengthen the master's degree-doctorate links and the internationalisation of training paths. MINERVA is the Latin version of ATHENA… and this is no mere coincidence, the former was built as complementary to the latter.

6 The vision of ATHENA research-based cooperation

For the first phase of ATHENA, we focused on identifying partnerships, through visiting programs for researchers, joint conferences and meetings, and collaborative projects in informatics, automation and signal processing, materials sciences, linguistics. We have been greatly helped financially for these actions by the support of the French research agency (ANR) dedicated to European universities.

Research projects already structured on the scale of Orléans and our Region, such as MatEx, CosmétoSciences and Junon have invested in the organization of conferences specially dedicated to the creation of an ATHENA network in the respective fields. We relied heavily for all this animation on Le Studium, (regional) Institute for Advanced Studies.

For the second phase of our European alliance, we intend to build on these contacts to refine the strategy of exchanges and joint events, to share the use of large equipments, to propose more extensive collaborative projects, with a leverage effect to acquire European and national funds.

References

[1] "Research laboratories and clusters, University of Orléans," [Online]. Available: https: orleans.fr/en/univ/research/laboratories-and-structures.

[2] "ERC Biogenicity of Martian Materials (BIOMAMA)," 2022. [Online]. https://cordis.europa.eu/project/id/101001311.

[3] "ERC TRACE-it: Controlling particle flow […] in geological porous media," 20 Available: https://cordis.europa.eu/project/id/101039854.

[4] "ERC APATE: A primitive solar atmosphere around the young Earth," [Online https://erc-apate.com.

[5] "France 2030 / ANR," [Online]. Available: https://anr.fr/en/france-2030/france-2030/

[6] "EIC pathfinder Yscript," [Online]. Available: https://www.yscript.eu.

[7] "C-VaLo," [Online]. Available: https://c-valo.fr.