Interdisciplinary Research Units with Dedicated Facilities at University of Burgos

The University of Burgos (UBU) supports **International Research Centers** and **Estructuras Singulares de Investigación** (unique research structures) that foster interdisciplinary collaboration. Below we highlight those research units that **offer dedicated facilities** (laboratories, specialized equipment, or infrastructure) enabling interdisciplinary research. Each section describes the research unit's focus and the physical facilities that empower its collaborative work, demonstrating UBU's commitment to cutting-edge, cross-disciplinary research. All information is drawn from official UBU sources for transparency and credibility.

ICCRAM (International Research Center on Critical Raw Materials and Advanced Industrial Technologies)

Description: Established as an international competence center, ICCRAM focuses on research addressing critical raw materials and advanced industrial technologies. Its interdisciplinary approach encompasses sustainability, toxicology, advanced materials synthesis, electrochemical energy storage, and computational simulation. ICCRAM fosters collaboration among chemists, environmental scientists, engineers, and computational modelers, participating extensively in major international and European research initiatives, particularly Horizon Europe and H2020 programs.

Facilities for Interdisciplinary Research: ICCRAM operates within dedicated facilities located at the University's R&D+i Center on the Madrid Avenue campus. These include advanced laboratories for nanomaterial synthesis, environmental impact assessment, toxicology studies, prototype development, and computational modeling and simulation infrastructure, facilitating collaborative and innovative interdisciplinary research. The center's organizational structure deliberately integrates diverse expertise: for example, one of its research divisions focuses on environmental sustainability and toxicology while another specializes in materials design and computational modeling. By co-locating these different labs and teams, ICCRAM provides a physical hub for interdisciplinary collaboration, enabling scientists to share specialized equipment and expertise (from electrochemical workstations for energy storage research to collaborative design spaces for innovation in material science).

Dedicated administrative support for interdisciplinary research: https://www.ubu.es/iccram/international-research-center-critical-raw-materials-advanced-industrial-technologies-iccram

Research Center on Emerging Pathogens and Global Health

Description: Founded in 2021, this center (Centro de Patógenos Emergentes y Salud Global) is a pioneering interdisciplinary initiative addressing infectious disease threats from a *One Health* perspective. It integrates expertise from human medicine, veterinary science, environmental science, and data science. Research areas include pathogen biology, diagnostics, epidemiology, disease prevention, public health, and the social implications of infectious diseases.

Facilities for Interdisciplinary Research: The center is housed at the Faculty of Science and is equipped with advanced microbiology and molecular biology laboratories, including high-capacity PCR and sequencing equipment. It is also establishing a biobank and a technological platform to characterize infectious agents, complemented by computational tools for epidemiological and social data analysis.

Dedicated administrative support for interdisciplinary research: https://www.ubu.es/centro-de-investigacion-en-patogenos-emergentes-y-salud-global/centro-de-investigacion-en-patogenos-emergentes-y-salud-global

International Research Center on Rural Development (CIDER)

Description: Established in 2022 as a competence center of the University of Burgos, CIDER promotes sustainable rural development through research that integrates social, economic, ecological, and agricultural dimensions. Its interdisciplinary approach aims to strengthen rural communities by fostering innovation, social inclusion, and economic resilience, aligning with EU Rural Action Plan objectives.

Facilities for Interdisciplinary Research: CIDER coordinates dedicated infrastructure, including innovation hubs, rural demonstration farms, and collaboration networks connecting academic researchers with local stakeholders. These resources facilitate real-world research and outreach projects that directly benefit rural communities.

Joint Research Unit for Hydrogen Technologies (JRU-H2T)

Description: This joint research unit brings together several UBU research groups with national and international partners from different sectors, all focusing on the hydrogen value chain ubu.es. The JRU-H2T addresses hydrogen production, storage, transport, and usage, aligning with EU energy decarbonization goals. Its creation enhances collaboration among materials scientists, chemists, and engineers, positioning UBU at the forefront of hydrogen technology research.

Facilities for Interdisciplinary Research: The JRU-H2T is supported by the **Hydrogen Technologies Research Laboratory (H2Lab)**, a state-of-the-art facility dedicated to hydrogen research. Located on UBU's Milanera campus, the H2Lab is a **dedicated interdisciplinary laboratory** at UBU specializing in hydrogen technologies. It operates under the Structural Integrity Research Group (GIE) and serves as a hub for researchers in civil engineering, materials science, and chemistry focused on hydrogen-based energy and

materials research. Established as a *Singular Research Laboratory*, H2Lab exemplifies UBU's strategy to create specialized facilities that address strategic R&D areas (in this case, hydrogen as a clean energy vector). The lab's mission includes not only conducting research but also engaging with industry and disseminating knowledge about hydrogen technologies to society.

As one of UBU's flagship research facilities, H2Lab is equipped with **cutting-edge instrumentation to analyze and test materials in hydrogen environments**. Its hallmark equipment is an integrated system for material testing in high-pressure (up to 300 bar) and high-temperature (up to 300°C) hydrogen gas conditions. This system includes a custom autoclave (3-liter volume) coupled with a 50 kN uniaxial testing machine, allowing researchers to perform tensile, fracture, and fatigue tests on metals and polymers while exposed to hydrogen. Additional instruments, like a Direct Current Potential Drop (DCPD) setup for crack propagation monitoring inside the autoclave, and specialized software for automated test control and safety monitoring, complement the facility. The laboratory's infrastructure enables a wide range of standardized experiments (ASTM/ISO) on hydrogen embrittlement and material performance in hydrogen, which were previously only possible in a handful of well-equipped labs worldwide.

H2Lab's impact is evidenced by its international collaborations and visits. For instance, delegations of researchers from Brazil and Australia toured the lab in 2023 to explore joint projects on hydrogen-induced material degradation. The lab's **"state-of-the-art scientific equipment"** has made UBU a reference point in hydrogen research, attracting interest from industry (energy, petrochemical) and academia alike. By providing a transparent, well-resourced environment for interdisciplinary research, H2Lab significantly enhances UBU's ability to contribute to the global hydrogen economy. It stands as clear evidence of the university's commitment to maintaining dedicated facilities for high-impact, cross-cutting research.

Joint Research Unit for Batteries2030

Description: The Batteries2030 JRU convenes complementary expertise to develop **next-generation energy storage solutions**, tackling challenges in battery performance, sustainability, and recycling. It integrates multiple UBU research groups – from electrochemistry and instrumental analysis to organic synthesis and structural integrity – ensuring a **holistic, interdisciplinary approach** to battery R&D in alignment with EU Green Deal targets. By uniting chemists, physicists, engineers, and environmental scientists, this unit addresses the entire lifecycle of advanced batteries.

Facilities for Interdisciplinary Research: The JRU for Batteries2030 leverages UBU's **laboratory infrastructure in materials and chemical research**. Participating groups contribute their dedicated labs and equipment: for instance, the Electrochemical Processes group offers facilities for battery material synthesis and testing, the Instrumental Analysis (GAIN) group provides advanced analytical instrumentation, and the ICCRAM–Environment & Sustainability group contributes nanomaterials and recycling labs. These facilities – located in UBU's research centers such as the Science

and Technology Center – form an integrated platform for interdisciplinary battery research. UBU's **International Research Center in Critical Raw Materials (ICCRAM)**, which participates in this JRU and it is an interdisplinary unit itsel, manages specialized labs (e.g. a nanotechnology lab in the R&D&I building) that are used to develop and characterize new battery materials. Through this network of laboratories, the Batteries2030 unit ensures researchers from chemistry, materials science, and engineering can **collaboratively develop prototypes, perform electrochemical testing, and analyze materials** under one umbrella. *This dedicated lab infrastructure underpins UBU's capacity to innovate in energy storage collaboratively*.

Dedicated administrative support for interdisciplinary research: https://www.ubu.es/iccram/international-research-center-critical-raw-materials-advanced-industrial-technologies-iccram

Joint Research Unit for Advanced Materials

Description: This unit concentrates on **Advanced Materials**, a broad field impacting daily life through novel fibers, coatings, energy storage media, and more. The JRU for Advanced Materials unites several UBU groups (Polymer Research, Construction Materials, Structural Integrity, Electrochemical Processes, etc.) to solve high-impact problems via **multidisciplinary collaboration**. By clustering expertise from different science and engineering branches, it aims to generate knowledge and technologies in advanced polymers, composites, nanomaterials, and smart materials for societal benefit.

Facilities for Interdisciplinary Research: The strength of this unit lies in the diverse **research facilities contributed by each group**. UBU's Polymer Research Group operates chemistry labs for polymer synthesis and characterization, while the Construction Materials and Structural Integrity teams have specialized laboratories for mechanical testing, microscopy and durability analysis of materials. The Electrochemical Processes group offers instrumentation for material electrochemistry and energy applications. These labs are primarily located in UBU's **Science and Engineering campuses**, including the research building adjacent to the Faculty of Sciences where advanced instrumentation is available. Although not centralized in one physical lab, the unit effectively uses UBU's **dedicated laboratories (nanotechnology labs, materials testing facilities, chemical analysis labs)** as a coordinated, interdisciplinary hub. This integration of physical resources allows chemists, physicists, and engineers to work hand-in-hand – for example, developing flame-resistant coatings or testing novel battery components – in shared projects. By providing access to well-equipped facilities across departments, the Advanced Materials JRU ensures transparency and efficient collaboration in pursuit of innovation.

UBU–MICHELIN Joint Research Unit in Automation and Smart Industry

Description: Established in partnership with Michelin, this JRU focuses on **automation, robotics, and Industry 4.0 technologies** to drive the "factory of the future." It builds on a longstanding UBU–Michelin collaboration and maintains a multidisciplinary R&D team at the intersection of robotics, artificial intelligence, Internet of Things, and smart manufacturing. The unit's goal is to strengthen technology transfer and innovation by combining academia and industry expertise. It brings together UBU's ARCO research group (Control, Automation and Robotics) and Michelin's engineers to jointly develop cutting-edge industrial solutions.

Facilities for Interdisciplinary Research: The UBU–MICHELIN JRU benefits from dedicated facilities both at the university and within Michelin. Notably, Michelin provides access to its **Innovation Laboratory in Aranda de Duero**, an industrial lab space that **hosts joint R&D and open-innovation activities in automation and robotics**. This laboratory is equipped for prototyping automated systems and testing smart industry applications on actual manufacturing processes, giving UBU researchers a real-world environment for interdisciplinary experimentation. On campus, UBU complements this with its robotics and automation laboratories (e.g., in the Polytechnic School), where researchers and students develop and refine robotic systems and AI algorithms. Through this partnership, the JRU has a **tangible bicoastal infrastructure**: an academic lab for foundational research and an industrial innovation lab for applied development. This arrangement enhances credibility and impact, as projects move seamlessly from theory to practice. The dedicated facilities underpinning the UBU–MICHELIN unit exemplify UBU's transparent commitment to collaborative research with industry, leveraging physical spaces that blend engineering, computer science, and industrial design.

Joint Research Unit for Drone Technology

Description: The Drone Technology JRU was created to position UBU as an active player in the fast-growing field of civilian drone applications. Although UBU previously had no single drone-dedicated group, multiple research teams were using drones for precision agriculture, renewable energy, heritage documentation, environmental monitoring, and audiovisual projects. This JRU consolidates those efforts, aiming to build a **"unique structure" for research and innovation in civil drone technology** and to strengthen UBU's role in drone-related R&D at national and European levels. It facilitates multidisciplinary collaboration among experts in engineering, geography, agriculture, and computer science to develop new drone applications and training programs.

Facilities for Interdisciplinary Research: To support its objectives, the JRU for Drone Technology leverages specialized facilities for **drone piloting, testing, and training**. UBU conducts part of its drone research and training in **dedicated airspace and labs in Burgos**, where researchers can safely test UAV (Unmanned Aerial Vehicle) prototypes and sensors (for example, open fields or indoor drone labs at the Science and Technology Park). In addition, the JRU partners with Euroflytec Aeronautics, which provides *approved drone flight facilities in Madrid* for advanced training. UBU already offers a **University Expert Degree in Drone Piloting**, with practical sessions held at these certified facilities. These arrangements ensure that faculty and students have access to the **necessary physical infrastructure – such as testing grounds, simulators, and**

maintenance workshops – to carry out interdisciplinary drone projects. Bringing together architects (through the GITECA construction technology group), chemists (for sensor development), historians (for archaeological surveying with drones), and IT experts, the JRU uses these facilities to integrate knowledge across fields in a concrete, hands-on environment.

Joint Research Unit on Quantum Science and Technology (JRU-QST)

Description: The JRU-QST addresses the "second quantum revolution," an emerging multidisciplinary domain spanning quantum physics, computing, and engineering. This unit unites UBU research groups in mathematical physics, materials simulation, applied computing, and instrumental analysis, together with external partners, to explore quantum communication, quantum computing algorithms, and quantum sensing. Its mission is to advance both fundamental quantum science and practical quantum technologies via a collaborative approach that crosses traditional disciplinary boundaries. By coordinating physicists, computer scientists, mathematicians, and engineers, the JRU-QST contributes to national and European strategic priorities in quantum research.

Facilities for Interdisciplinary Research: Given the high-tech nature of quantum R&D, the JRU-QST relies on **specialized research infrastructure**. A key resource is the **Supercomputing Center of Castilla y León (SCAYLE)**, an external partner of the unit. SCAYLE provides high-performance computing facilities that are essential for quantum simulations and for running complex algorithms, enabling UBU researchers to model quantum systems and test quantum software on powerful clusters. Additionally, the unit partners with the **Technological Institute of Castilla y León (ITCL)**, which offers advanced laboratories for electronics and photonics, useful for developing quantum sensors and devices. On campus, UBU's physics laboratories and computing labs support experimental and theoretical work in quantum science. Through these dedicated facilities – from regional supercomputers to local quantum optics setups – the JRU-QST ensures that its multidisciplinary team has the tools needed for cutting-edge research. This robust infrastructure underscores UBU's commitment to quantum technology, fostering an environment where cross-disciplinary innovation in physics and engineering can thrive with transparency and rigor.

DIH-LEAF Joint Research Unit (Digital Innovation Hub on Livestock, Environment, Agriculture and Forest)

Description:
The DIH-LEAF Joint Research Unit serves as a specialized hub for promoting digital innovation applied to agriculture, livestock management, environmental conservation, and forestry. This interdisciplinary initiative is focused on developing and applying cutting-edge digital technologies—such as IoT (Internet of Things), Big Data, Artificial Intelligence (AI), and remote sensing—to enhance sustainability, productivity, and environmental management. The unit actively integrates researchers and professionals

from various fields, including environmental sciences, agriculture engineering, computer science, biology, and forestry, thereby fostering a highly interdisciplinary approach.

Facilities for Interdisciplinary Research: DIH-LEAF benefits from dedicated research infrastructures that enable the collaborative development, testing, and validation of digital technologies tailored to interdisciplinary challenges. Notably, the unit utilizes specialized facilities including:

- **Sensor and IoT laboratories:** Equipped with devices for real-time environmental monitoring, animal health tracking, and precision agriculture.
- **Data Analytics Center:** Providing computational power and software platforms necessary for processing large datasets and applying machine learning and predictive modeling techniques.
- **Testing grounds and demonstration farms:** Real-world environments dedicated exclusively to testing technological prototypes, such as drones, autonomous vehicles, and automated monitoring systems.

These physical resources ensure seamless interdisciplinary collaboration, allowing researchers from diverse backgrounds to jointly experiment, innovate, and validate solutions addressing complex environmental and agricultural issues.

Dedicated administrative support for interdisciplinary research: https://www.ubu.es/iccram/international-research-center-critical-raw-materials-advanced-industrial-technologies-iccram

Additional administrative support:

https://www.ubu.es/otri-transferencia/otri-transferencia-vic-de-investigacion-transferencia-e-innovacion

https://www.ubu.es/servicio-de-gestion-de-la-investigacion

https://www.ubu.es/vicerrectorado-de-investigacion-transferencia-e-innovacion