

BIOTECHNOLOGY

This area of research includes the use of biological processes, living cells, or products derived from organisms or systems intended to obtain and improve useful products for several applications. It develops from a multidisciplinary approach which involves Biology, Medicine, Chemistry, Engineering, Immunology, Physics, Ecology, Agronomy, Biochemistry, Genetics, Virology and others. The wide range of expected applications extends from Medicine, Pharmacy and Food, to sewage treatment or Agriculture, among other uses.

In the course of history some biotechnological processes have been discovered and applied, for example, the use of microorganisms helping the fermentation process in alcoholic drinks and bread, or those that help in the development and selection of a variety of vegetables and animals with agricultural or farming interest.

Nowadays, according with their common characteristics or utilities, there is a classification system of biotechnological uses in **five basic groups** identified by a distinctive color code:

Red Biotechnology

Red Biotechnology refers to that applied in medicine: generation of vaccines and antibiotics, development of new drugs, new methods of diagnosis, regenerative therapies and cure of illnesses by genetic manipulation. Some remarkable examples are: cellular and gene therapy and drugs based on biological molecules like therapeutic monoclonal antibodies.

Research lines at the UVIGO:

- VACCINES.
- DEVELOPMENT OF THERAPEUTIC MONOCLONAL ANTIBODIES.
- NEW ORTHOPAEDICAL IMPLANTS IMPROVED WITH BIOACTIVE PARTICLES PROCESSED BY LASER.
- NEW METALLIC COMPOUNDS WITH BIOLOGICAL ACTIVITY.
- ANTIMICROBIAL / ANTITUMORAL COMPOUNDS.

White Biotechnology

White Biotechnology, also called industrial biotechnology, focuses on efficiently improve the design of processes and products in a way that they either consume less energy or are less polluting, reducing the waste during their production. Some examples are the utilization of microorganisms for chemical products in manufacturing, the design and production of new materials for daily use (like textile or biodegradable plastics), or the development of new sustainable sources of energy like biofuel.

Research lines at the UVIGO:

- LIPASE, AMYLASE AND PROTEASE PRODUCTION. PRODUCTION OF BIODIESEL USING THERMOPHILIC LIPASES.
- NEW BIOTECHNOLOGICAL PROCESSES FOR FOOD INDUSTRY.
- BIOSENSORS.
- BIOACTIVE COMPOUNDS
- BIOFUELS

Gray Biotechnology

Gray Biotechnology covers the direct applications on the environment. They can be divided in two groups of uses:

- Biodiversity maintenance by genetic analysis of populations or species part of ecosystems, as well as their comparison and cataloguing. It also includes cloning techniques for species preservation and the utilization of genome storage technologies.
- Contaminants disposal or bioremediation using microorganisms and vegetable species to clean polluted places by the isolation and the elimination of different substances like hydrocarbon or heavy metals.

Research lines at the UVIGO:

- VERMICOMPOSTING OF ORGANIC WASTES.
- BIOCONVERSION OF LIGNOCELLULOSIC MATERIALS.
- PHYLOGENOMIC AND PHYLOGENETIC ANALYSIS.
- GREEN CHEMISTRY FOR BIOTECHNOLOGICAL PROCESSES.

Green Biotechnology

Green Biotechnology covers the application in agriculture: creation of new vegetable varieties with agricultural and farming interest, production of biopesticides and biofertilizers, *in vitro* crops and plants cloning. It looks for solutions more respectful with the environment than traditional methods of industrial agriculture.

The most famous example is the obtaining of transgenic plants, which has started with an international social controversy. This kind of technology consists in inserting into the selected plant original genes from another variety or another organism with three objectives:

- The development of resilient vegetable varieties, either able to grow in adverse environmental conditions or resistant to illness or plagues.
- The development of varieties with better nutritional properties (rich in vitamins, for example).
- The use of plants as biofactories to produce substances with biosanitary or medical interest which can be easily purified and isolated for their industrial production.

It is expected that Green Biotechnology will produce more environment-friendly solutions that traditional methods of industrial agriculture, as it avoids external applications of pesticides, and it also can be used as an ecological tool to increase or maintain natural resources like forests.

Research lines at the UVIGO:

- ALLELOPATHY: INTERACTION AMONG PLANT SPECIES. BIOHERBICIDE AND PLANT PROTECTION SEARCH.
- AGROFOOD BIOTECHNOLOGICAL.
- PLANT BIOTECHNOLOGY.

Blue Biotechnology

Blue Biotechnology, also called marine biotechnology, includes uses related to marine resources. Its development is in an early phase of research however, the expected applications are multiple. Just to mention some of the sectors that will benefit from it: aquaculture, health, cosmetics, agriculture and food.

Nowadays the commodities market with marine origin is the most popular, like hydrocolloids and gelling agents applied in food, health or purification. Several molecular markers or particles from marine organism origins and with enzymatic activity are frequently applied in research or diagnostics. Besides, biomaterials and agents with regenerative or pharmacological activity with very interesting potential uses are now coming up.

Research lines at the UVIGO:

- ANALYTICAL PROTEOMICS.
- AQUACULTURE AND FISHERY GENETICS.

Other Transversal Research Lines at the UVIGO:

- BIOINFORMATIC TOOLS: GENOMICS AND PROTEOMICS
- BIostatISTICS
- COMPUTATIONAL GENOMICS
- BIOENGINEERING
- BIOECONOMY

GRUPO DE SISTEMAS INFORMÁTICOS DE NOVA XERACIÓN (SING) (SI4)

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Oferta Diseño de algoritmos informáticos e implantación de herramientas finales totalmente funcionales aplicados al campo de la biomedicina y medicina.

- **Bioinformática.**
 - Búsqueda de nuevos biomarcadores y/o la creación de modelos predictivos en genómica (microarrays y ultra-secuenciación), metagenómica, proteómica (espectrometría de masas) y metabolómica.
 - Minería de redes biológicas.
- **Sistemas informáticos en el entorno hospitalario.**
 - Análisis de la historia clínica electrónica (big data, machine learning, minería de datos y de textos) para el reconocimiento de patrones (p.ej: infecciones nosocomiales, etc.).
 - Sistema de apoyo a la toma de decisiones médicas (diagnóstico automático mediante sistemas de razonamiento basados en casos, sistemas basados en reglas, machine learning, etc.).
 - Integración de información de diversas fuentes hospitalarias (p.ej: enfermería, farmacia, microbiología, historia clínica, etc.).

Índice temático BIOINFORMÁTICA, GENÓMICA, PROTEÓMICA, METABOLÓMICA, SISTEMAS DE APOYO A LA DECISIÓN MÉDICA, RAZONAMIENTO BASADO EN CASOS, APRENDIZAJE AUTOMÁTICO (MACHINE LEARNING), MINERÍA DE DATOS Y TEXTOS BIOMÉDICOS.

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Offer Design and implementation of novel algorithms, systems and tools in the field of biomedicine and medicine.

- **Bioinformatics**
 - Searching for biomarkers and/or implementation of predictive models for genomics (microarray and ultra-sequencing), metagenomics, proteomics (mass spectrometry) and metabolomics.
 - Biological network mining.
- **Informatics systems for hospital environments.**
 - Analysis of electronic clinical records (through big data, machine learning, data and text mining) for pattern recognition (e.g., nosocomial infections, etc.).
 - Medical decision support systems (automatic diagnosis with case-based reasoning systems, rule-based systems, machine learning, etc.).
 - Information fusion and Integration from spare sources (e.g., nursing, pharmacy, microbiology, clinical records, etc.).

Keywords BIOINFORMATICS, GENOMICS, PROTEOMICS, METABOLOMICS, MEDICAL DECISION SUPPORT SYSTEMS, CASE-BASED REASONING, MACHINE LEARNING, DATA AND BIOMEDICAL TEXT MINING.

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RESEARCH, TRANSFER AND INNOVATION CENTRE (CITI)

Offer **MAIN LINES OF RESEARCH**

- Processes that seek to improve food quality.
- Obtaining bioactive molecules.
- Obtaining bio-fuels.
- Developing, assessing and scaling fermentation processes.
- Valorising residual liquid effluents.
- Production of biodegradable composites.



CITI'S PILOT PLANT SERVICES

The pilot plant's versatility enables the execution of both scaling tests of the processes carried out in research laboratories and proofs of concept as well as pilot productions. The equipment is intended for agri-food, environmental and biotechnological fields.

- **Chemical and biological transformation lines of work**

These include different types of fermentation as well as a pressurised reactor with various working volumes which allow to execute the study of optimum conditions at a laboratory scale or scaling and production tests.

- 50 L fermentor
- Multi-vessel fermentor
- 2 L airlift fermentor
- 5 gallon pressurised reactor. Maximum operating pressure of 130 bar and 350 °C.

- **Separation, extraction and purification of compounds line of work**

It has a centrifugal clarifier, some membrane filtration equipment, a supercritical extraction plant, a cell disruptor and a pilot scale FPLC equipment. These are employed to obtain high purity compounds following environmentally-friendly processes, thus improving the final product quality and adapting it to consumer demands.



- **Food sanitation and preservation line of work**

It has the high hydrostatic pressure equipment that allows food sanitation by applying pressure, thus eliminating pathogenic microorganisms without altering its organoleptic characteristics. This treatment consumes less energy than heat treatment.

- **Material-based line of work**

It has some equipment aimed at the obtaining of composite materials, the mechanical analysis of parts and the measurement of oxygen and water vapour permeability with foils and plastic packages.

- **Technical support equipment**

Technical infrastructure to keep the centre's equipment in good working order is available.

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FOOD AND AGRICULTURAL BIOTECHNOLOGY LABORATORY

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- Offer**
1. E1.- DEVELOPMENT OF BIOTECHNOLOGICAL PROCEDURES IN ORDER TO PREPARE NATURAL FOOD ADDITIVES WITH NUTRACEUTICAL FEATURES BASED ON AGROFORESTRY AND INDUSTRIAL WASTE
ANEP AREA: ENGINEERING AND CHEMICAL TECHNOLOGIES
DESCRIPTION
 - CHARACTERIZATION OF SURPLUS AND DERIVATIVES FROM THE FOOD AND AGRICULTURAL INDUSTRY. IDENTIFICATION AND RECOVERY OF COMPOUNDS WITH HIGH NUTRITIONAL VALUE.
 - PRODUCTION AND PURIFICATION OF NATURAL FOOD ADDITIVES (FLAVOURS, AROMATICS AND SWEETENERS), WITH APPLICATION TO THE FOOD AND AGRICULTURAL INDUSTRY, SUCH AS XYLITOL, PROBIOTICS, PREBIOTICS AND VAINILLINA
 - ISOLATION, SELECTION AND IDENTIFICATION OF MYCROORGANISMS, DESIGN AND SCALE OF BIOREACTORS
 - BIOPROCEDURES OPTIMIZATION AND BIOTECHNOLOGICAL METHODS TO DEVELOP NEW PRODUCTS
 - ENZYMES ENGINEERING: DESIGN, PRODUCTION OF ENZYMES PURIFICATION AND FUNCTIONAL INGREDIENTS WITH INDUSTRIAL AND COMMERCIAL RELEVANCE
 - USE OF ENZYMES IN THE SYNTHESIS AND / OR HYDROLYSIS OF INDUSTRIAL PRODUCTS.



2. ANALYTICAL AND SENSORY CHARACTERIZATION OF FOOD AND BEVERAGES.

ÁNEP AREA: FOOD TECHNOLOGY

DESCRIPTION:

- APPLICATION OF INSTRUMENTAL ANALYTICAL TECHNIQUES AND SENSORY ANALYSIS ACCORDING TO ISO STANDARDS AND CONSUMER TEST FOR THE CHARACTERIZATION AND DIFFERENTIATION OF FOOD AND BEVERAGES.
- MONITORING OF MANUFACTURING PROCESSES, FROM RAW MATERIALS TO FINISHED PRODUCT FOR OPTIMIZATION.
- DESIGN OF NEW PRODUCTS WITH COMPETITIVE ANALYTICAL AND SENSORY PROFILE



Keywords WINE LEES, ECONOMIC NUTRIENTS, ANALYTICAL CHEMISTRY, BIOCONVERSION, BIOPROCESSES, BIOCONVERSION OF LIGNOCELLULOSIC MATERIALS, RECOVERY OF ADDITIVES, AGROFORESTRY WASTE, FOOD ADDITIVES, INDUSTRIAL WASTE, FOODS, FERMENTATION, ADDITIVES, BIOMASS

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