CNR-IBBR

Istituto di Bioscienze e BioRisorse

Institute of Biosciences and BioResources

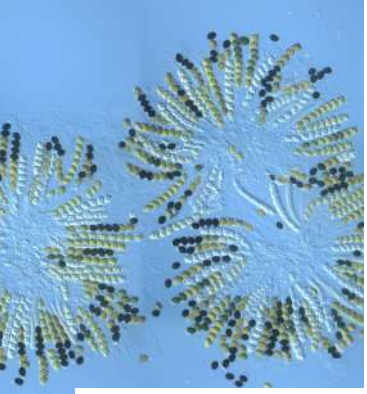
www.ibbr.cnr.it

ABOUT IBBR

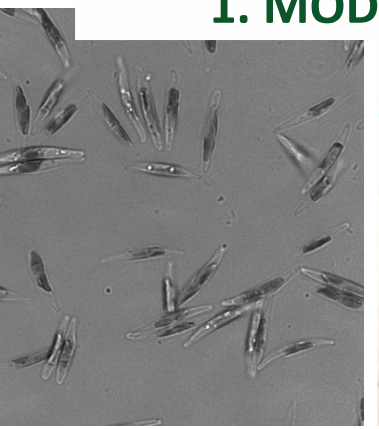
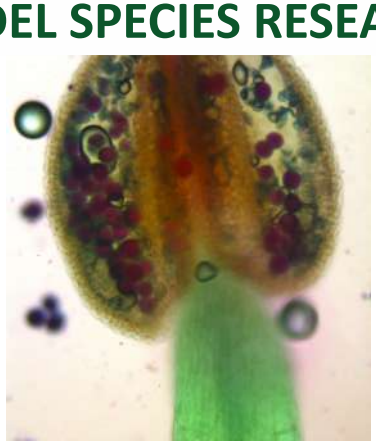
Founded in 2013, IBBR is part of the Department of Biology, Agriculture and Food Sciences (DiSBA) of the National Research Council of Italy (CNR).
The IBBR headquarters are located in Bari with 5 research divisions distributed over Italy (Florence, Naples, Palermo, Perugia and Portici). IBBR personnel amounts to 159 units, including 48 administratives and technicians, and 111 researchers and technologists with diverse expertise and research interests, ranging from fundamental biology to agrifood and biotechnology.
IBBR main research areas are:

1. Model Species Research
2. Bioresources and Sustainability
3. Biotechnology and Plant Breeding
4. Biomolecule Engineering and Biotechnology
5. Nutraceutics and Human Health

IBBR hosts one of the largest seed banks in Europe (about 60,000 accessions - https://ibbr.cnr.it/mgd/)



1. MODEL SPECIES RESEARCH

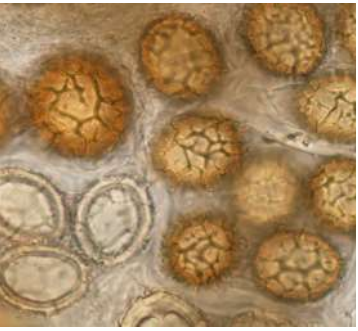



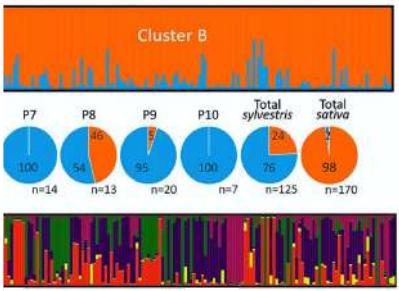

Key questions in biology are investigated in microbial, animal and plant model species. Model species may be useful indicators of climate change and pollution to identify mechanisms and tools to face current and future challenges, bioactive molecules for drug discovery, nutraceutics and health purposes. Research focuses on fertility, reproduction, immunity, development, neurobiology, apoptosis, metabolism, nutritional value, environmental response to biotic and abiotic stress (*e.g.*, nutrient, heavy metal, drought tolerance), DNA repair and replication, topology, meiotic recombination, chromosome structure, interactions between species through hormones, extracellular vescicles. Gene expression and phenotypic plasticity of model species (including collections of mutant lines) are studied by advanced techniques of functional genomics and transcriptome analysis.

Skills: **Omics, Bioinformatics, Systems Biology, Functional Analysis Tools, Genetic Transformation.**



2. BIORESOURCES AND SUSTAINABILITY

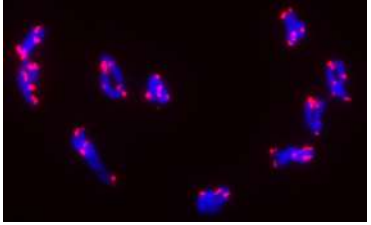
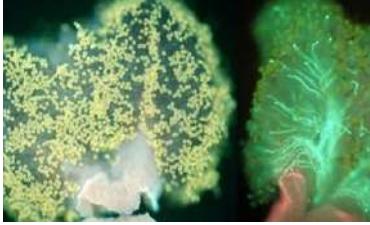


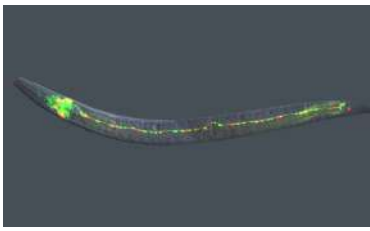


This research line is focused on the conservation of genetic resources. Conservation of plants, animals and micro-organisms (crops, forest trees, wild plants, fungal strains, including rare, endemic and endangered species) is carried out *in situ* (*e.g.*, on farm collections) and *ex situ* (*e.g.*, biobanks), with the aim of characterizing and evaluating their adaptability, regeneration and suitability to a changing environment and their potential for species translocation. Molecular and phenotypic data of germplasm collections are maintained in user-friendly online databases and shared on specialized national and international platforms.

Investigations on conservation genetics, population genetics, taxonomy and syntaxonomy, phylogeography, domestication and evolution, synecology and ethnobotany of plants, fungi and animals are conducted with the goal of counteracting the loss of biodiversity. Genomics, transcriptomics and whole genome sequencing of symbiotic organisms are performed to identify genes and pathways underlying the symbiotic interaction. Additionally, the research includes microbiome analysis by metabarcoding techniques and studies on the adaptive mechanisms of forest tree species and their response to abiotic and biotic stresses.

Skills: **Functional Genomics, Next Generation Sequencing, Marker Assisted Breeding, Genetic Association Studies, Metabolomics, Statistics, Big Data Analysis.**

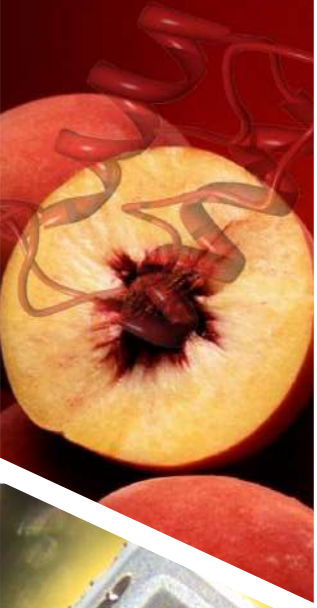
3. BIOTECHNOLOGY AND PLANT BREEDING

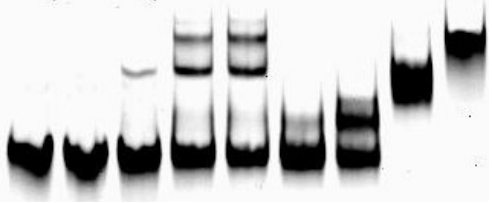
The research is focused on species and variety improvement for productions in agri-food, forestry and industry by biotechnological and genetic tools. Breeding and biotechnological strategies are key to develop improved genotypes better suited to a changing climate and to answer new demands from consumers and industry. Research interests include the characterization of selected genotypes through:

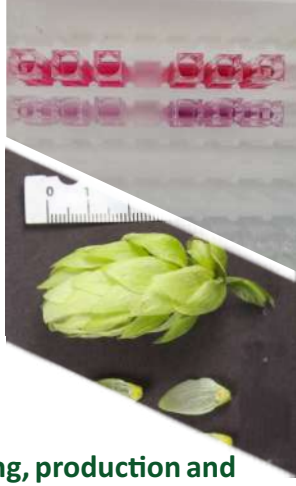
- **phenotyping, biochemistry, molecular markers, analysis of physiological traits;**
- **multi-omics approaches coupled to bioinformatics and network analysis for data integration for the identification of genes, small RNAs, and promising gene variants;**
- **genetic engineering for traits of interest;**
- **genetic improvement through introgressive breeding of crops and crop wild relatives, biotechnology and tissue culture;**
- **assessment of risks related to GMO release;**
- **propagation and *ex situ* conservation of valuable accessions through tissue culture.**

Target species include *Solanaceae*, wheat, grapevine, olive, *Citrus* spp., forest trees and biomass species.

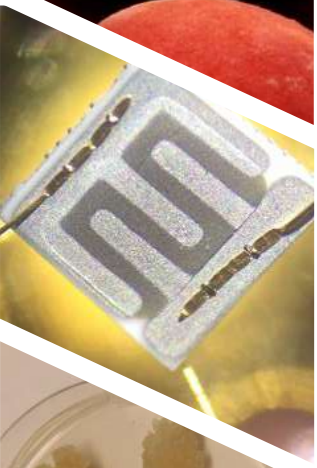
***Skills:* Structural and Functional Genomics, Plant Tissue Culture (Somatic Embryogenesis, Somatic Hybridization, Cryopreservation, Propagation), Stable and Transient Genetic Transformation of Plastids and Nuclei, Cytology.**

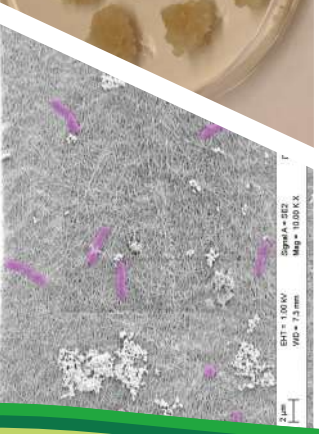






4. BIOMOLECULE ENGINEERING AND BIOTECHNOLOGY





This research aims at the engineering, production and synthesis of biomolecules by means of biotechnological platforms, and their exploitation in various sectors. Studies of the factors driving the expression of heterologous genes in model plant species and analysis of the biological mechanisms linked to protein synthesis and cellular transport are carried out. Genetic engineering is applied to generate new crops as biofactories for the production of proteins, enzymes, secondary metabolites and volatile organic compounds (VOCs) previously isolated from different sources (microorganisms, fungi, plants, algae and insects) and for their exploitation in agriculture, animal husbandry, industry and human health. Nanotechnologies in human health, functional foods and nutraceuticals are applied to nanomaterials for the delivery of bioactive compounds and micronutrients into target cells. Tailor-made nanotechnological sensors are produced using different semiconductor metal oxide as sensing elements or bacterial cellulose sub-strate for the VOCs analysis in environmental, biomedical and agri-food sectors, based on neural network algorithms.

***Skills*: Plastid Biotechnology, Bacterial Cellulose, Genetic Transformation, Genome Editing, Nanomaterials, Gas Sensors.**

5. NUTRACEUTICS and HUMAN HEALTH

This research line is focused on the identification and selection of autochthonous genotypes of tree and herbaceous species for their antioxidant content and potential resistance to environmental stresses. Studies are aimed at the identification, production and engineering of molecules with biological activity from microorganisms (including extremophiles), plants, algae, fungi, marine organisms (including polar microorganisms) and insects, as well as their application in the fields of green chemistry, functional food and nutraceutics, drug discovery and human health.

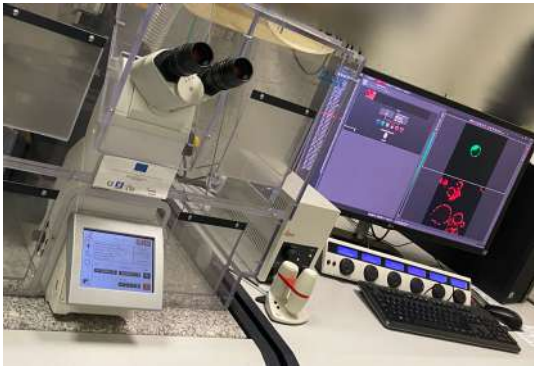
Skills : **Genetic Engineering, Omics, Bioinformatics, Enzymatic Activities, Human Cell Line Physiology .**





FACILITIES

- Stereomicroscopy, Upright and Inverted Fluorescence and Confocal Microscopy;
- Laser Capture Microdissection;
- Mass Spectrometry (HPLC, GC, Q - TOF);
- Chromatographic systems (FPLC) at low temperature;
- Tailor made nanotechnology sensors;
- Genetic and genomic labs (spectrophotometers, qualitative and quantitative real - time thermocyclers, automatic sequencers for Sanger and NGS sequencing, Ion Torrent);
- Tissue and cell culture labs;
- Biolistic particle delivery systems;
- Plant growth systems (greenhouses, walk - in chambers, growth rooms);
- Proteomic labs (vertical electrophoresis, Western Blot, liquid chromatography, etc.);
- Bioinformatic lab;
- Experimental fields.



PARTICIPATION TO RESEARCH INFRASTRUCTURES

- IBISBA - The European Research Infrastructure for Industrial Biotechnology (https://www.ibisba.eu/)
- DiSSCo - Distributed System of Scientific Collections
- BioMemory (https://biomemory.cnr.it)



BIORESOURCES/COLLECTIONS: PLANTAE

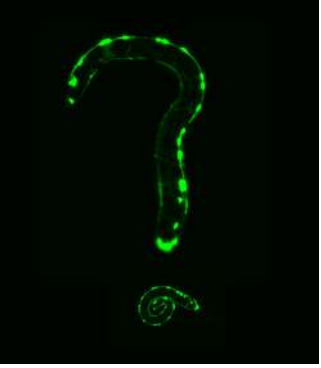


Herbaceous plants/Crop species

- Mediterranean Germplasm Seed Bank: 882 species/59,000 accessions of herbaceous species of agricultural interest, wild relatives, rare/endangered ecotypes, including about 39,000 *Poaceae* accessions
- *Cynara cardunculus*: 50 varieties and a mapped F1 population
- *Vitis spp.*: 480 accessions
- *Medicago truncatula*: 2,000 transposon-tagged lines and 2.300 EMS lines
- *Solanaceae*: 200 accessions from 40 species, 70 accession of traditional Italian tomato varieties
- *Aster*: 30 species; *Capsicum*: 20 accessions
- *Capparis spp.*, *Calendula maritima*

Trees

- *Citrus spp.* and relatives: 220 accessions
- *Olea spp.*: more than 800 accessions, including worldwide and local ancient varieties, controlled crosses
- *Abies alba*: about 1,200 DNA and tissue samples for population genetic analyses
- *Pinus hedrichii*: 500+ DNA and tissue samples for population genetic analyses
- *Zelkova sicula*






BIORESOURCES/COLLECTIONS: Animals, Bacteria and Fungi

Nematoda

- *Caenorhabditis elegans*: more than 3000 transgenic and mutant strains

Bacteria and Fungi

- Bacterial strains from rice rhizosphere, polycyclic aromatic hydrocarbons (PAHs)-degrading bacteria from polluted areas
- More than 500 endophytic fungi from hop and saffron, 200 lignicolous fungi.
- Mediterranean Plant Endophyte and Pathogens Culture Collection

From the Extremes: samples and organisms

- More than 100 Arctic and Antarctic marine bacteria, invertebrates, fish tissue and blood, and ice, water, seawater, sediment samples.

Credits:

Giovanni Giuseppe Vendramin

Editing:

Giorgia Batelli
Gabriele Bucci
Angela Carra
Mariarosaria De Falco
Claudia Riccioni
Alessandra Rogato
Wilma Sabetta
Veronica Sbervegliери

Images:

IBBR researchers

Graphics:

Gaetano Guarino

CNR-IBBR

Director:
Dr. **Giovanni Giuseppe Vendramin**

via Giovanni Amendola 165/A
70126 Bari (Italy)
+39 080 558 3400
direttore@ibbr.cnr.it