



University of Torino: Department of Life Sciences and Systems Biology

The Department of Life Sciences and Systems Biology (DBIOS) within the University of Torino is the point of reference for topics that bring together biology, environment and biotechnology, and present multidisciplinary aspects such as **biodiversity, ecology, evolution, conservation and microbiology**.

The Department acts as a crucial element in a series of themes that are currently central in the international scientific scene, including renewable energy, plant health, food, sensors and biotechnology, genetics, neuroscience, cardiovascular physiology, preservation of environmental resources, conservation of cultural heritage, as well as mycology and microbiology with their industrial and pharmaceutical applications.

The Department includes numerous research groups that interact in the areas of Cellular and Molecular Biology, Biochemistry, General Physiology and Plant Physiology, Developmental Biology, Genetics, Neurobiology, Zoology, Anthropology, Ethology, Ecology, Microbiology, Plant Biology and Teaching of Science. There are also many ongoing collaborations both in terms of teaching and also research which involve members of other departments of the University of Torino.

Main Research Areas are:

- Life and health
- Biochemistry and biotechnology
- Ecology and evolution

Structures associated with the Department are of great scientific importance. These include the public Botanical Garden that is part of the Turin Museum networks, the collections of the Herbarium and the collections of the Museum of Anthropology. The Department also houses a significant collection of fungal germoplasm (Micoteca), one of the few presents in Italy. Furthermore, the Department interfaces with the Museum of Natural Sciences, which houses major university-owned museum collections, ensuring their use in scientific research.

The Department also has two libraries that are a crucial and indispensable tool for research and educational activities, important both for current subscriptions as well as the antique book collections.

Moreover, since 1950 a group of CNR researchers have been working closely with the staff and Professors of this Department in the field of plant and fungal biology, despite having administrative autonomy. The collaboration is governed by agreements that define the mode of interaction and the physical presence of the CNR group in the University.

EU Research Infrastructures

The Department of Life Sciences and Systems Biology within the University of Torino is actively involved in EMBRC as one of the 16 partners of the Italian Node. The participation of the DBIOS in the research infrastructure takes place through the provision of various services involving Biological resources, Technology platforms and E-services.

BIOLOGICAL RESOURCES

CULTURE COLLECTIONS

- Access to fungal strains: At the Mycotheca Universitatis Taurinensis (MUT), approximately 2000 fungal strains representing about 700 taxa are currently preserved. Most of these strains (around 1500) were isolated from different matrices and substrates in the Mediterranean Sea. In particular, fungi have been isolated from very different substrates such as marine phanerogams (*Posidonia oceanica*), green, brown and red algae, marine invertebrates (sponges and holothurians), sediments as well as from anthropogenic environments (waters and sediments polluted by oil spills and microplastics). The MUT laboratories are equipped with all the necessary equipment to carry out the isolation, identification according to a polyphasic approach (morphophysiological, molecular and phylogenetic analyses), genotypic and phenotypic characterization and long-term preservation (freeze-drying and cryopreservation) of marine fungi.



TAXONOMIC SERVICES

- Fungal isolation: Isolation of fungi from marine substrates. Up to 100 strains will be isolated in axenic culture.
- Fungal identification: Identification of fungi in pure culture with a polyphasic approach that couples molecular and morphological analyses. The input is a strain of interest that will be identified.
- Metabarcoding analysis: A broad description of microbial communities in an environment is essential to monitor its health prior to conservation. As an input, the service requires min. 3 max. 10 reactions. As an output, it offers Illumina amplicon sequencing for the taxonomic characterization of bacteria and fungi. The users will also obtain biodiversity measures, overview taxonomy plots and an inference of putative trophic interactions in the community.
- Metagenomic analysis: Metagenomic allows to capture the widest array of organisms in a sample, bypassing primer couples' specificity. As an input, the service requires two samples (with 3 technical replicates each). As an output, it offers Illumina amplicon sequencing for

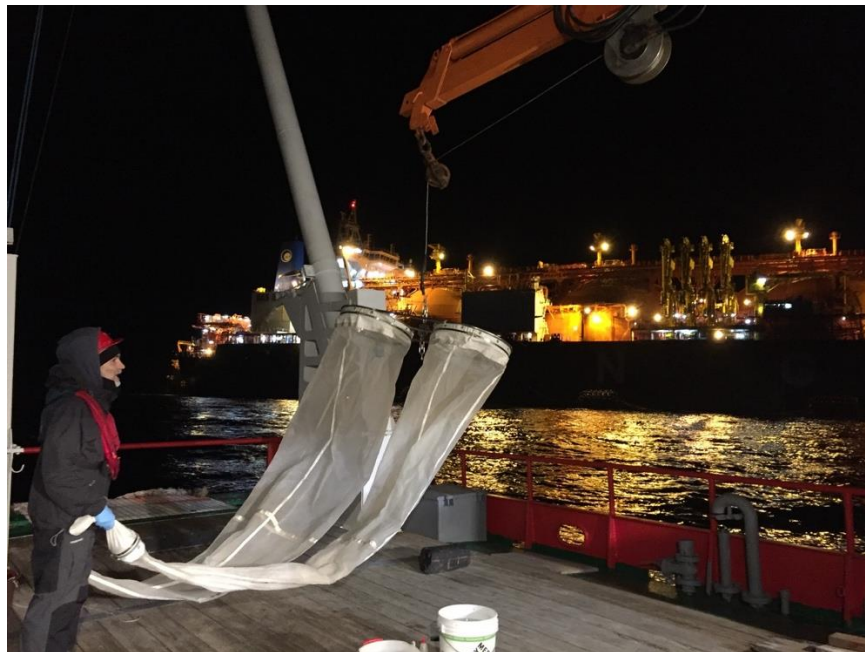
the taxonomic characterization of bacteria and fungi. The users will also obtain biodiversity measures, overview taxonomy plots and an inference of putative trophic interactions in the community.

- Fungal WGS and annotation: Genomics sequencing allows to dig into the genetic features that support the ecology and physiology of a microorganism. The input is a fungal strain of interest, whose biomass will be produced for high molecular weight DNA extraction. The sequencing will be performed with long reads (Oxford Nanopore), and the output will include gene models, characterization of gene functions, analysis of transposable elements, secreted proteins and secondary metabolites.
- Marine taxa isolation: Isolation, identification, and characterization through visual (morphology) and DNA barcoding approaches of several marine taxa.

ORGANISMS COLLECTED IN THE WILD

Collection and characterization of mesozooplanktonic communities

- BONGO-NET: An instrument consisting of two nets coupled through a metal frame that allow the mesozooplanktonic component of zooplankton and ichthyoplankton to be fished, both through horizontal and oblique and vertical fishing. Nets with diameters greater than 60 cm have mesh voids of 300 and 500 microns, making them particularly suitable for catching the ichthyoplanktonic component of zooplankton (fish larvae and juveniles), but also the larger component of copepod crustaceans, holoplankton (including gelatinous plankton) and meroplankton. A collection collector and flowmeter is coupled to each mouth to calculate the cubic meters of water filtered during the sample collection operations for the return of the data as no. of individuals/cubic meter.



- MANTA-NET: The instrument of choice for collecting floating microplastics (microlitter) and the surface component (pleuston) of marine zooplankton. Specifically, the MANTA net in the laboratory is equipped with a 330-micron mesh void and a 50x25 cm mouth. Two side

wings equipped with floats ensure stability and buoyancy to the entire structure during collection operations.

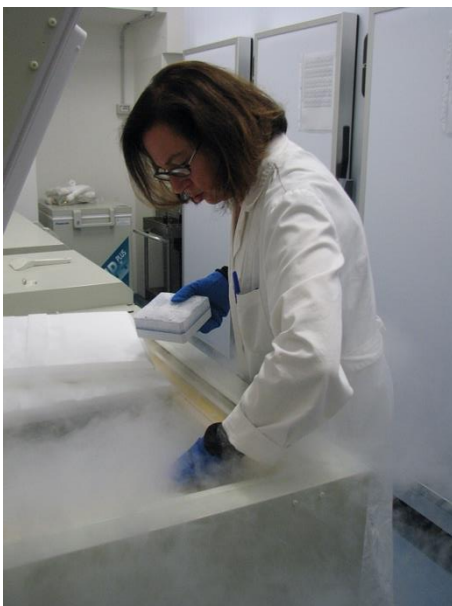


Both instruments comply with the sampling methods laid down by ISPRA.

TECHNOLOGY PLATFORMS

BIOASSAYS

- **Biochemical characterization:** Fungi may produce bioactive molecules. The input is a strain of interest, which will be grown in optimal fermentative conditions (i.e. max 2 conditions). The bioactivity of the extract will be evaluated against specific targets.



The MUT provides the consortium with a range of services related to marine fungi:

- Distribution of fungal strains of marine origin from the MUT collection
- Identification of marine fungi according to a polyphasic approach
- Isolation of marine fungi from different substrates
- Metabarcoding analysis of the fungi component of a marine matrix/environment
- Metabarcoding analysis of the microbiota of a matrix/marine environment
- WGS of marine microorganisms with special reference to filamentous fungi and yeasts

- Phenotypic microarrays of marine microorganisms with special reference to filamentous fungi and yeasts
- Cultivation of fungi in Submerged fermentation and in Solid state Fermentation for subsequent biochemical characterization of bioactive molecules.

REMOTE SENSING AND TELEMETRY

Acoustic Sensors and Autonomous Recording Units (ARUs) for the Passive Acoustic Monitoring (PAM) of the marine wildlife:

Underwater Passive Acoustic Recorders for recording the marine soundscape and passive acoustic monitoring of marine life (up to 500 kHz bandwidth; more than 100 dB dynamic range). The ARUs are equipped with release transponders, high-capacity SD cards and lithium batteries for long-lasting deployment. Unito will provide support and training for the identification of suitable areas for sensor deployment, device docking and acoustic data analysis. In addition, remote access and analysis of extensive recordings of the marine soundscape is available.



- Short, Medium and Long-term Shallow waters deployment (<200mt):
 - 2x SYLENCE-LP-220 (PHD -250 m rated, D-Cels, Integrated Colmar SC0190 Hydrophone)
 - 2x Mooring frame for SYLENCE-LP (Stainless steel structure for inline mooring)
- Short, Medium and Long-term Deep waters deployment (>200mt):
 - 3x SYLENCE-LP-440-DP-P-C (POMC -1000 m rated, Integrated Colmar SC0190 Hydrophone)
 - 2x SYLENCE-LP-440-I-P-C (Stainless Steel, Integrated Colmar SC0190 Hydrophone)
 - 2x SYLENCE-LP-440-DP-P-S (POMC - 1 000m rated, 4pts Subconn)
 - 2x Colmar GP 1280 Hydrophone (Frequency range: 5Hz- 90kHz; Sensitivity: -170 dB; 1m cable; Seacon connector)
 - 7x Mooring frame for SYLENCE-LP (Stainless steel structure for inline mooring)
 - 3x Acoustic Release Sonardyne RT6-1000 (MF wideband 2 frequency; Alkaline battery 15-month deployment life; 1000 m depth rating; SWL (4:1) 150kg)
- Acoustic sensors calibration

E-SERVICES

DATA ANALYSIS TOOLS AND SOFTWARE

- Big Data Analysis & Server testing: Development of software and toolboxes for bioacoustics and ethological studies. Unito provides the Scientific Computing Competence Centre capable of providing computing services for the departments participating in the project, and of providing computing services for other universities and territories. It represents a service for high throughput scientific computing (High Throughput Computing, HTC), consisting of a complex High Performance Computing (HPC) system, an infrastructure to support the concerted use of the HPC system itself, and a component for the technical management of the HPC system and support for the scientific computing of the research groups.

