

IS_MIRRI21

**Implementation and Sustainability of Microbial
Resource Research Infrastructure for the 21st Century**

@Institut Pasteur

TransNational Access programme (TNA) catalogue

Financial and logistical support for access to microbial resource research institutions

14 facilities across Europe offer funded access to microbial resources, experimental facilities, technology platforms and the expertise and experience of their staff to conduct scientific studies.

Applications for the 1st TNA call are open from 25th January to 16th April 2021.



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Transnational Access

Users from research organisations and companies (in the fields of biotechnology, agro-food, pharmaceuticals, environment, etc.) are invited to apply for funded access to any of the 14 microbial facilities partners of the IS_MIRRI21 project across Europe. The TNA offers access to a wide variety of microbial resources, laboratories and state-of-the-art facilities and technological platforms.

The TNA offer includes:

- ✓ Technical and scientific support.
- ✓ Administrative and logistic support.
- ✓ Access to the products, services and facilities offered in the IS_MIRRI TNA catalogue.
- ✓ Hands-on training needed to access the facilities.

The IS_MIRRI21 TNA programme sponsors:

- Access to the partners' facilities including: platforms, laboratories, standard consumables, chemicals and disposables.
- Travel expenses (one round trip, economy class). Up to 800 EUR/project
- Subsistence (meals and accommodation up to 30 days, weekends included).
- Shipping costs of project material from the IS_MIRRI21 facility to the home institution up to 400 EUR.

The TNA programme provides two means of access:

On-site access: in this type of access, the users visit the infrastructure and carry out their research projects on-site. The facility provides scientific, technical and logistic support.

Remote access: this does not involve an in-person visit of users to the infrastructures. There are two types of remote access:

- *Shipping of strains/biological material:* The User requests a specific "Product" from the Access provider (e.g. samples, strains and their derivatives such as DNA).
- *Remote Services:* A set of experiments are carried out at the Access Provider but the User is not physically present at the installations (e.g. sample analysis and processing).



Figure 1. Examples of the microbial resources, services and facilities offered by IS_MIRRI21 partners.

Users can apply to one or several of the 14 TNA offers proposed by our partners or carry out their projects within the workflow strategy. The later approach will allow users to refine and mature their research and innovation projects and to benefit from the experience and expertise of several access providers.

The **Access Officer** is the main contact person to discuss the details about the TNA application. **After the initial contact with the Access officer, applications will be transferred to the liaison officer(s)** from the research infrastructure(s) of interest for technical verification and feasibility of the proposals **before application**.

The 1st TNA call will be launched the 25th January 2021. Submit your project online through our TNA portal.

Access Officer: **Liliana Avila Ospina**
TNA@mirri.org

Find out more about IS_MIRRI21 TNA programme on:
<https://ismirri21.mirri.org/project-platforms/tna/>

- 1 MICOTECA DA UNIVERSIDADE DO MINHO
- 2 COLLECCION ESPAÑOLA DE CULTIVOS TIPO
- 3 BANCO ESPAÑOL DE ALGAS
- 4 INSTITUT PASTEUR
- 5 INRAE
- 6 BELSPO/BCCM - MUCL
- 7 BELSPO/BCCM - IHEM
- 8 BELSPO/BCCM - ULC
- 9 WESTERDIJK FUNGAL BIODIVERSITY INSTITUTE
- 10 MYCOTHECA UNIVERSITATIS TAURINENSIS
- 11 NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS
- 12 CULTURE COLLECTION OF INDUSTRIAL MICROORGANISMS
- 13 UNIVERSITY OF LATVIA
- 14 ALL RUSSIAN COLLECTION OF MICROORGANISMS



Find out more about IS_MIRRI21 project on: ismirri.mirri.org

For more information about the TNA programme please contact: TNA@mirri.org

Our social media



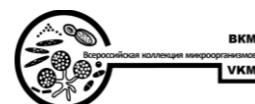
@MIRRI_live



@mirri.esfri



MIRRI/IS_MIRRI21



Access Providers

IS_MIRRI21 partners offer funded access to products, services and facilities in the TNA programme.

Table 1 – IS_MIRRI21 Access Providers

Access Provider	Infrastructure	TNA offer	Country
PRODUCTS			
Universitat de València – UVEG	Spanish Type Culture Collection - CECT	Delicate microorganisms	Spain
National and Kapodistrian University of Athens - NKUA	Culture collections of the National and Kapodistrian University of Athens - CCUoA	Bacteria and archaea from extreme Greek environments	Greece
Institute of Biochemistry and Physiology of Microorganisms, Russian Academy of Sciences – IBPM - RAS	All Russian Collection of Microorganisms - VKM	Microbial strains from extreme Russian environments	Russia
FACILITIES			
Universidad de Las Palmas de Gran Canaria - ULPGC	Spanish Bank of Algae - BEA	Experimental plant for microalgae and cyanobacteria production	Spain
Netherlands Academy of Arts and Sciences-Centraalbureau voor Schimmelcultures - KNAW	Westerdijk fungal biodiversity institute - CBS	Heterologous expression of silent fungal gene clusters	Netherlands
Belgian Federal Science Policy Office/Belgian Co-ordinated Collection of Micro-organisms - BELSPO-BCCM	Agro-food & Environmental Fungal Collection - MUCL	<i>In vitro</i> culture of arbuscular mycorrhizal fungi	Belgium
BELSPO-BCCM	Fungi Collection: Human & Animal Health - IHEM	Dermatophytes: taxonomy, identification and medical importance	Belgium
BELSPO-BCCM	Cyanobacteria Collection - ULC	Cyanobacterial isolation, cultivation, preservation, taxonomy and molecular characterisation	Belgium
Institute of Agricultural and Food Biotechnology - IAFB	Culture Collection of Industrial Microorganisms - CCIM	Identification of <i>Alicyclobacillus</i> sp. by molecular biology techniques	Poland
SERVICES			
University of Minho - UMinho	Micoteca da Universidade do Minho - MUM	Food mycology	Portugal
Institut national de recherche pour l'agriculture, l'alimentation et l'environnement - INRAE	Centre International de Ressources Microbiennes - CIRM	<i>In vitro</i> screening of anti-infectious activities: antibacterial, antiviral and antiparasitic	France
Institut Pasteur - IP	Centre de Ressources Biologiques de l'Institut Pasteur - CRBIP	Analysis by BioNumerics of MALDI-TOF mass spectrometry profiles	France
University of Latvia - UL	Microbial Strain Collection of Latvia - MSCL	<i>In vitro</i> screening and testing of Minimal Inhibitory Concentration (MIC)	Latvia
Università degli Studi di Torino - UT	Mycoteca Universitatis Taurinensis - MUT	Metabarcoding of fungal communities	Italy

TNA Workflows

This initiative proposes an interconnected set of products, services and resources offered by clusters of IS_MIRRI21 partners that will allow the users to refine and mature their research and innovation projects. Through this approach, the users also benefit from the experience and knowledge of several access providers. For its 1st call, the IS_MIRRI21TNA programme offers 3 workflows:

Table 2 – TNA Workflows

Workflow	Access providers	Countries
WF1. From Field Collection to Metabolites Extraction	BCCM-ULC and BEA	Belgium and Spain
WF2. Identification of taxonomically related <i>Streptomyces</i> strains from extreme Greek environments using mass spectrometry profiles.	CCUoA and IP	Greece and France
WF3. Coupling MALDI-TOF mass spectrometry protein and molecular biology techniques to identify taxonomically related <i>Alicyclobacillus</i> strains.	IAFB and IP	Poland and France

A combined set of research activities will lead to the characterisation of microorganism-derived resources by exploiting the state-of-the-art facilities and expertise of IS_MIRRI21 Research Infrastructures.

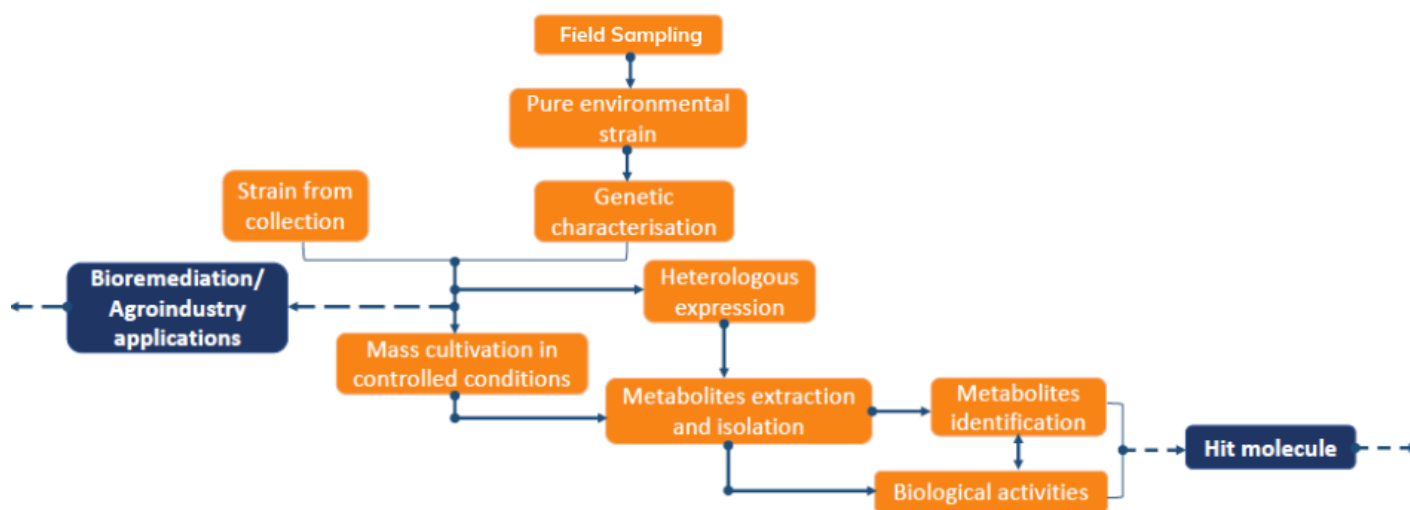


Figure 2 – Research expertise from IS_MIRRI21 partners assembled to create the TNA workflows.

To apply to the TNA workflows, applicants should **contact the Access Officer** to coordinate technical details and pre-check the eligibility and feasibility of the proposals before submission.

A microscopic image of a mold, likely Aspergillus, showing a network of thin, branching hyphae. Several clusters of spores are visible, each consisting of several oval-shaped cells with distinct internal structures. The spores have a brownish outer layer and a blueish inner core.

Products

Strains and microbe-derived resources



DELICATE MICROORGANISMS

Universitat de València Estudi General – UVEG
Colección Española de Cultivos Tipo – CECT

The University of Valencia (UVEG) is a leading academic organisation at national level, with a remarkable international dimension. The Spanish Type Culture Collection (CECT) is a central service of the UVEG and it is located within the University of Valencia Science Park (PCUV), an initiative to link university research and its scientific potential with the production system, promoting innovation as well as the creation and consolidation of technology-based companies.

The CECT is a broad scope collection and the only public Microbial Biological Resource Centre (mBRC) in Spain serving as a repository and provider of bacteria, archaea, yeast and filamentous fungi. With more than 10,000 holdings (most of them prokaryotes, followed by yeasts and filamentous fungi), the collection has long experience in handling delicate microorganisms, and continuously works on new procedures for improving their culture and preservation.

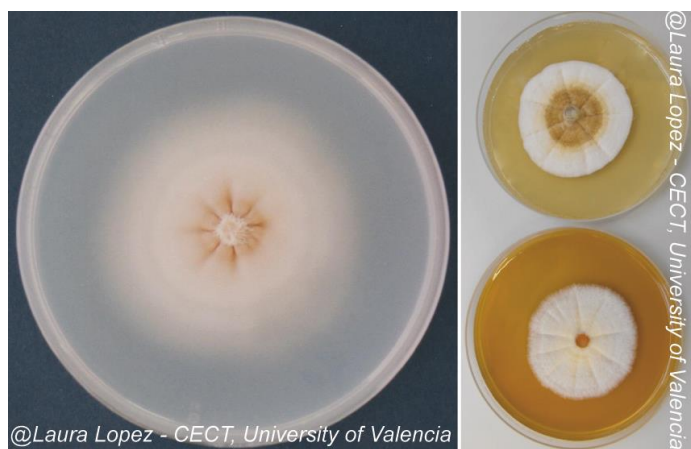


Figure 3. *Hebeloma sinapizans* grown in PDA media and *Ciniophora olivacea* grown in SDA and MEA media.

Modality of access

Strains or derived products such as DNA, inactivated cells or extracts. Emphasis is given to the delicacy, meaning difficulty in preserving and replicating them, especially from the users' perspective. Good examples are halophilic archaea and bacteria, acidobacteria, *Frankia* spp., *Pisolithus* spp., *Hebeloma* spp., among others, many of which are in addition underrepresented in public culture collections.

Unit of access

One strain

Support offered

Facilitated access to delicate resources, making a short-cut to derivatives and desired forms of presentation.

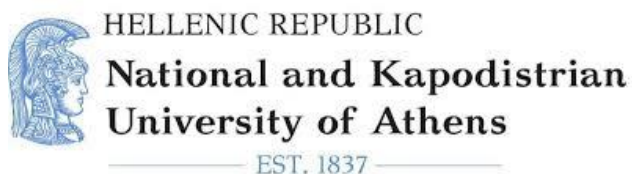
Besides, the CECT offers a wide portfolio of services: deposit of strains (public, safe and for patents), supply of strains for research, teaching, quality control, biotechnological applications, etc.; identification and characterization of strains by gene sequencing, MALDI-TOF MS protein profiles, cellular fatty acid composition (MIDI) or genome analysis (assembly and annotation); training and counselling on conservation and taxonomy. In the last 3 years, the CECT served users from 43 different countries (about 50% in Europe).

Founded in 1960, it is a member of the World Federation on Culture Collections (WFCC) since 1977 and of the European Culture Collections' Organization (ECCO) since 1983. In 1992 it was recognized as International Depositary Authority (IDA) for storing microorganisms for patent purposes under the Budapest treaty and it is ISO 9001 certified.

Campus de Burjassot-Paterna
Calle Catedrático Agustín Escardino, 9 46980 Paterna. Valencia, Spain
<http://www.cect.org>

Liaison officer

David Ruiz Arahal



BACTERIA AND ARCHAEA FROM EXTREME GREEK ENVIRONMENTS

National and Kapodistrian University of Athens
– NKUA Culture Collections of the University of Athens - CCUoA

The National and Kapodistrian University of Athens (NKUA) is the oldest University in Greece and the first Higher Education Institution in the Balkan and Eastern Mediterranean area. In an effort to organize and facilitate the study of the Greek microbial diversity and evaluate its biotechnological and biomedical potential, the NKUA has established the Culture Collections of the University of Athens (CCUoA), a unified network of laboratory preserved culture collections that belong to three different labs of the National and Kapodistrian University of Athens. It comprises of 5 individual units distinguished by the type of microorganism they are specialized. These units are: i) ATHUM for fungi, ii) ATHUCY for cyanobacteria, iii) ATHUAL for algae, iv) ATHUBA for bacteria and archaea and v) UOA/HCPF for pathogenic fungi.

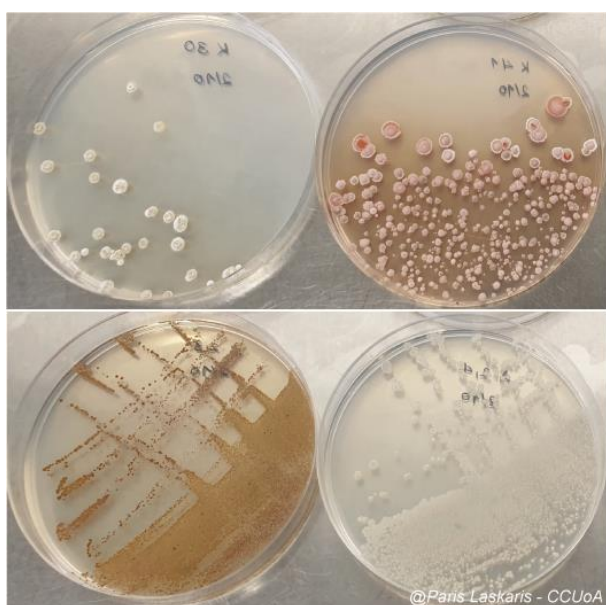


Figure 4. Streptomyces isolates

Modality of access

Bacterial and archaea strains isolated from volcanic, thermal spring and high salinity environments. These microorganisms are sources of thermostable enzymes suitable for biotechnological applications (detergents, biorefineries).

Unit of access

One type of biological material (living strain or DNA).

Support offered

Facilitated access to microbial strains with high biotechnological potential.

The majority of the strains are isolated only from Greek specific habitats with special climatic characteristics. The isolates are originated either from food products, soil, marine environment or airborne; others are clinical strains, lignicolus, fungicolous or/and pathogenic strains.

The unique geo-climatic characteristics of Greece result in soil and marine reservoirs of high taxonomic and functional diversity compared to other European countries. It has been proved that Greek ecosystems (like thermal springs, volcanoes, caverns, mountain highs, etc.) host multi active microbial strains which are producing bioactive compounds useful to pharmaceutical companies (mainly strain members of the Actinobacteria family), to agriculture as biocontrol agents, to food industry (enzymes, growth promoters....), or industry for dermo-cosmeceuticals etc. CCUoA analyses and study the physiology, survival and activities of each isolate, by employing state-of-the-art cultivation, biochemical and molecular techniques.

Among the services offered are the deposit, identification/characterization and supply of strains for both industry and academia. Phenotypic and molecular characterisation. Screening for enzymatic activities and bioactive compounds.

Faculty of Biology, section of botany.
Panepistimiopolis, 15781 Athens, Greece
<https://en.uoa.gr/>

Liaison officer
Paris Laskaris



MICROBIAL STRAINS FROM EXTREME RUSSIAN ENVIRONMENTS

Institute of Biochemistry and Physiology of Microorganisms, Russian Academy of Sciences – IBPM – RAS - All Russian Collection of Microorganisms - VKM

VKM is a department of the Skryabin's Institute of Biochemistry and Physiology of Microorganisms (IBPM) inside the "Pushchino Scientific Centre for Biological Research of the Russian Academy of Sciences" (PSCBR-RAS). VKM is the largest non-medical microbe collection in Russia including over 20,000 strains of archaea, bacteria, fungi and yeasts from various sources, both identified and not-yet-identified. Nearly 7,500 strains are presented in the on-line catalogue.

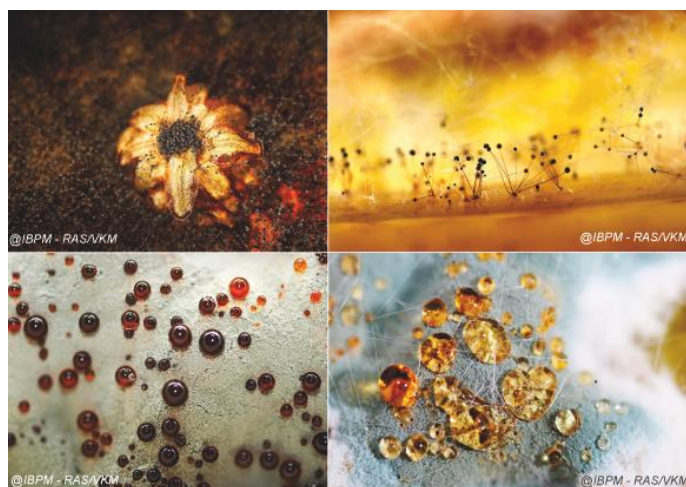


Figure 5. Strains isolated at the IBPM-RAS/VKM

The VKM activities are focused on: (i) collection, maintenance and supply of microorganisms; (ii) research in the field of microbial biodiversity and systematic; (iii) use of microorganisms in biotechnology and ecology-related area, (iv) molecular and genomics approaches and (v) taxonomy.

Modality of access

Microbial strains isolated from permafrost and high salinity environments. These microorganisms are sources of metabolites suitable for biotechnological applications (mycotoxins, enzymes and others).

Unit of access

Five living strains.

Support offered

Facilitated access to microbial strains with high biotechnological potential.

Since 1987, VKM has the International Depositary Authority (IDA) status from the World Intellectual Property Organisation, in the framework of international patent legislation (Budapest Treaty).

VKM led the creation of a joint catalogue for the 31 microbial culture collections of USSR, Eastern Germany, Vietnam, Bulgaria, Czechoslovakia and Mongolia from 1988-1990, the on-line catalogue of non-medical Russian collections from 1999-2002 and nowadays is working in the VKM catalogue. VKM is a member of ECCO and WFCC, was been involved in European projects GBRCN (2011-2012), BRIO (2011-2014) and MIRRI (2012-2015), participates in EOSC-Life project and conducts genomic research with WDCM GCM2.0.

All VKM microbial collections and microbiology laboratories are equipped for the isolation, identification and characterization of microbial strains. VKM data are integrated in the WDCM/GCM and contain information from five separate information systems for VKM cultures: preservation, publications, nutrient media, metabolites and catalogue.

Russia, 142290, Moscow Region, Pushchino, pr. Nauki, 5, IBPM
<https://www.vkm.ru/>

Liaison officer
Alexander Vasilenko



Facilities

State-of-the-art technology platforms



EXPERIMENTAL PLANT FOR MICROALGAE AND CYANOBACTERIA PRODUCTION

Universidad de Las Palmas de Gran Canaria –
ULPGC - Banco Español de Algas – BEA

On the east coast of Canary Islands, BEA is situated into the infrastructures that the ULPGC has recognized as the Marine Pole of Taliarte (Telde), which have been declared as an International Campus of Excellence.

BEA is recognized by the World Intellectual Property Organization (WIPO), as an authorized culture collection for tropical, subtropical and extremophiles microalgae and cyanobacteria, particularly from the Macaronesian region. The collection is accredited, since October 2005, as an International Authority for the Deposit of Microorganisms, for the deposit of algae with the purposes of recognition of industrial property, in accordance with the Budapest Treaty by the WIPO. Nowadays, BEA holds more than 1840 living microalgae and cyanobacteria strains, as clonal or single cell isolates.



Figure 6. Wet-transfer cultures; Biotechnology laboratory; open-air cultures; BEA facilities.

Modality of access

Outdoor pilot scale facility for testing mass culture production and processing of microalgae (cyanobacteria) for different purposes (i.e. biomass production, bioremediation, strain biotech evaluation, etc.). Users can access to different PBRs (up to 100L) at indoor or outdoor conditions, cultivation tanks (90-1500L) and all dry laboratory facilities.

Unit of access

9 culture systems/8weeks.

Support offered

ULPGC- BEA will give advice on experimental design and methodology, documentation of results for all experiments conducted and technical support for the production of extracts for screening and determination of metabolites of interest.

BEA facilities and staff members are specialised in the cultivation of microalgae (including cyanobacteria) and macroalgae at different laboratory and pilot-scale photobioreactors, tanks or raceways. Facilities include several laboratories, a greenhouse for experimental assay and demonstration of algae cultivation technologies. BEA holds light, photoperiod and temperature-controlled growth rooms, separated incubators for housing back up stocks, a culture transfer area with laminar flow hoods and inverted microscopes; control rate -150°C freezer, ultrasound sensor, centrifuge, fluorescence microscope and stereomicroscopes; glass wash and autoclave separate facility. BEA's main goal is to develop under the frame of the "Marine Agronomy" and "Blue Biotechnology" concepts, an important agro-industrial sector based upon Algal Biotechnology (algae cultivation and application developments). Research thematic include physiology, biochemistry, biomass transformation and industrial applications of algal biomass under intensive cultivation, and the development of biofiltration systems using algae.

Muelle de Taliarte, s/n 35214 - Telde Gran Canaria -España
www.bea.marinebiotechnology.org

Liaison officer
Antera Martel



Belgian Federal Science Policy Office – BELSPO/ Belgian Coordinated Collections of Micro-organisms – BCCM

BCCM is a consortium of 7 microbial Biological Resource Centres (mBRCs) organised around a coordinating cell at BELSPO. The mBRCs preserve and supply microbial and genetic resources, provide scientific services and perform research activities.

The coordination cell supports the mBRCs for quality management, information management, regulatory affairs, marketing, external communication and international cooperation. The management system of the BCCM consortium is multi-site ISO 9001 certified.

The mBRCs participating in the TNA programme are: BCCM/IHEM Fungi Collection for Human & Animal Health (located in Sciensano, Brussels), BCCM/MUCL Agro-food & Environmental Fungal Collection (located in Université catholique de Louvain, Louvain-la-Neuve) and BCCM/ULC Cyanobacteria collection (located in University of Liège).

The 3 collections use a common Quality Management System. They are ISO9001 certified for all aspects of accessioning, preservation, quality controls, storage and supply of the biological materials and associated information of their public and safe deposit collections, and for BCCM/IHEM and BCCM/MUCL for their patent deposit collection.



IN VITRO CULTURE OF ARBUSCULAR MYCORRHIZAL FUNGI

Agro-food & Environmental Fungal Collection – BCCM/MUCL

BCCM/MUCL is a fungi collection (~ 25 000 strains in public) dedicated to agro-food and environment, embedded in the laboratory of mycology of the Université catholique de Louvain.

BCCM/MUCL offers public, safe and patent deposit and supplies strains and genomic DNA. It has expertise in identification of fungal strains (via morphology, molecular biology and physiology), detection, enumeration, isolation, bio-prospecting and screening of fungi from various substrates, testing material resistance testing and antifungal agents.

Modality of access

Experiments to set up and perform in vitro cultures of the obligate arbuscular mycorrhizal fungi (AMF) roots symbionts, going through each phase of the establishment of in vitro culture from the sampling of the AMF in pot cultures to their maintenance and sub-subculture under in vitro conditions. During this experiment, both in vitro cultivation of AMF on root organs (ROC-system) and on autotrophic plants (Medicago, potato and others) will be tested as well as the more recent systems developed (e.g. mycelium donor plant system). The genetic, cell biology, biodiversity and physiological investigation of AM fungi and their hosts. Additionally, non-destructive microscopic observations, reliable cell, root and plant physiology studies, clean biochemical and molecular analyses, highly controlled interaction studies with other micro-organisms and mass production at an industrial scale, are amongst other applications permitted with in vitro cultivation techniques.

Unit of access

5 days in BCCM/MUCL.

Support offered

Guidance of experienced scientists and technical personnel.

It offers consultancy and research contract, general and personalized trainings in mycology (morphology, molecular methods) and *in vitro* cultivation of arbuscular mycorrhizal fungi.

BCCM/MUCL research is mainly focused on (i) fungal diversity in natural and man-made ecosystems, (ii) agro-food (food and feed transformation and spoilage) and (iii) fungal-plant interactions.

The activities carried out at BCCM/MUCL include the identification, taxonomy and classification, phylogenetic sequence analyses, detection, cultivation and preservation of different fungal groups (lignocellulolytic fungi, fungi involved in food processing and spoilage, fermentative yeasts, arbuscular mycorrhizal fungi, fungal pathogens in tropical environments).



Figure 7. International training course in the in vitro arbuscular mycorrhizal fungi (2015) at BCCM/MUCL Facilities.

Croix du Sud 2, box L7.05.06
B-1348 Louvain-la-Neuve
(Postal address)
<http://bccm.belspo.be/>
<https://bccm.belspo.be/about-us/bccm-mucl>

Liaison officer
SylvieCranenbrouck



DERMATOPHYTES: TAXONOMY, IDENTIFICATION & MEDICAL IMPORTANCE

Fungi Collection: Human & Animal Health - BCCM/IHEM

BCCM/IHEM is a fungi collection (more than 15,000 strains) dedicated to human and veterinary health, embedded in the Mycology & Aerobiology service of Sciensano, the scientific institute for public health in Belgium. It is equipped with a biosafety level 3 laboratory. Certifications: ISO 14001, ISO 9001 and ISO 17025. Research interests in taxonomy, phylogeny, dermatophytes, MALDI-TOF MS identification of fungal strains, antifungal resistance and metabarcoding.



Figure 8. BCCM/IHEM Sciensano Facilities, Brussels.

BCCM/IHEM offers public, safe and patent deposits and supplies both strains and genomic DNA. Scientific services at BCCM/IHEM include identification of fungal strains (using DNA sequencing, MALDI-TOF MS and morphology), genotyping, antifungal susceptibility testing, microbial counting and various trainings. More than 40 international users request IHEM strains or services each year. Over the last 5 years, about 650 publications cited BCCM/IHEM strains.

Modality of access

Dermatophytes fungi are the most common fungal infections causing skin diseases and other superficial mycoses. Their identification is reputedly difficult due to often subtle or atypical characters. The BCCM/IHEM Fungi collection (Sciensano, Brussels, Belgium) offers a 2-days' workshop on dermatophytes fungi (taxonomy, identification and medical importance) and welcomes attendees in its facilities. The training includes theoretical/practical sessions and specialised guidance for identification and taxonomy as well as access to specialised equipment. Methods of identification that will be emphasized are microscopy and MALDI-TOF mass spectrometry.

Unit of access

2 days' workshop

Support offered

BCCM/IHEM has the expertise, the staff and the equipment to work with and identify dermatophytes.

Sciensano - Section Mycology and Aerobiology
Rue J. Wytsmanstraat 14
B-1050 Brussels
<http://bccm.belspo.be/>
<https://bccm.belspo.be/about-us/bccm-ihem>

Liaison officer
Pierre Becker



CYANOBACTERIAL ISOLATION, CULTIVATION & PRESERVATION

Cyanobacteria Collection – BCCM/ULC

BCCM/ULC is a recent (2011) public collection of cyanobacteria in a growth phase (246 strains) that aims to gather a representative portion of terrestrial, freshwater and marine cyanobacterial strains with a focus on (sub)Polar Regions (Antarctica, Svalbard, Canada,...). BCCM/ULC is hosted by InBios-Centre for Protein Engineering of the University of Liège (Belgium). BCCM/ULC possesses equipment for microbiological and molecular work including, amongst others, sterile cabinets, light microscopy, incubators with light at different temperatures and PCR machines. Furthermore, BCCM/ULC is experienced in the research in polyphasic taxonomy and molecular identification. 'Hands on' trainings on handling, isolation, preservation, taxonomy and molecular characterization, adapted to the users' needs.

Modality of access

'Hands on' training going from sampling, cultivation, and isolation procedures to unicyanobacterial and axenic strains, maintenance of living strains and cryopreservation using a Quality Management System for each step and tailored to the users' material. Cyanobacterial taxonomy and molecular characterisation are also covered. The new biological material and its characterization will enable future research and novel screenings for secondary metabolites, pigments, etc.

Unit of access

Three days in BCCM/ULC.

Support offered

Sharing of expertise, practice under the guidance of experienced scientists and personnel, and usage of the needed equipment.



Figure 9. Tubes of cyanobacterial cultures; isolated Cyanobacteria from a cyanobacterial bloom sample on Petri dish and under the binocular.

BCCM/ULC offers deposit (public and safe) and supply of strains and genomic DNA, microscopic and molecular characterization and identification, molecular detection of cyanotoxin producing genes, as well as "hands-on" training on handling, isolation, preservation, taxonomy and molecular characterization adapted to the users' needs.

InBios - Centre for Protein Engineering
Allée du 6 Août, 11 - University of Liège
B-4000 Liège
<https://bccm.belspo.be/about-us/bccm-ulc>

Liaison officer
Anne-Catherine Ahn



**WESTERDIJK
FUNGAL BIO
DIVERSITY
INSTITUTE**

HETEROLOGOUS EXPRESSION OF SILENT FUNGAL GENE CLUSTERS

Koninklijke Nederlandse Akademie van Wetenschappen – KNAW
Westerdijk Institute - WI

KNAW acts as a management body for 15 national research institutes in the Netherlands, and advises the Dutch Government on matters related to scientific pursuit. KNAW-WI (formerly Centraalbureau voor Schimmelcultures, KNAW-CBS) performs mycological research that contributes to the discovery and understanding of the biodiversity of fungi, their biology and potential solutions to societal challenges. The institute maintains one of the oldest and largest public collections of living fungi (yeasts and filamentous fungi) in the world. The collection comprises a total of 100.000 strains, representing 6000 genera, 19.000 species, and 12 600 type strains. Data associated with these strains (including DNA barcode sequences of all strains) are maintained in databases and available online. These resources are utilised by public and private parties in over 60 countries annually. The institute also maintains the Netherlands Culture Collection of Bacteria (NCCB), including 10.000 strains of bacteria and over 500 plasmids and phages.

The six research groups of the institute focus on the taxonomy and evolution of fungi, as well as on functional aspects of fungal biology such as ecology, fungal physiology and novel products. Among services currently offered are the deposit of strains (public, safe and patent deposits) including biological agents up to risk group 3 and plant quarantine organisms, supply of living strains (or DNA extracts) to users globally, identification service and

Modality of access

Analysis of fungal genomes revealed that most secondary metabolite biosynthetic pathways are cryptic under regular laboratory conditions. Activating the underlying biosynthetic gene clusters is a challenge that can be tackled using heterologous expression in *Aspergillus oryzae*. This TNA provides access for the expression of a single gene cluster of four genes maximum. Genomic DNA of the species of interest and PCR primers should be provided for cloning purposes. The output is *A. oryzae* transformants expressing the core gene from the gene cluster of interest or expressing the complete predicted gene cluster. Only transformants that produce new compounds according to profiling of organic extracts will be selected.

Unit of access

One-day stay and minimal amount of access is 10 units.

Support offered

Access to the fully equipped laboratory and scientific staff.

contract research for industrial partners. The institute provides an annual course of fungal biodiversity, and special courses in the fields of clinical fungi and food- and indoor mycology.



Figure 10. KNAW-W facilities.

University campus area « Uithof », Uppsalalaan 8, 3584CT
Utrecht, The Netherlands.
<https://wi.knaw.nl/>

Liaison officer
Gerard Verkleij



IDENTIFICATION OF *Alicyclobacillus* sp. BY MOLECULAR BIOLOGY TECHNIQUES

Prof. Wacław Dąbrowski Institute of Agriculture and Food Biotechnology – IAFB
Kolekcja Kultur Drobnoustrojów Przemysłowych – KKP

IAFB is one of the main institutions in Poland that provides agriculture, food industry and universities with pure cultures of microorganisms. Identified and characterized bacteria, yeast and filamentous fungi from the KKP collection are available for research at universities throughout the country. The IAFB has the status of a national and international microbial deposit authority, which is the subject of patent applications. The collection is registered in the World Federation for Culture Collections and since 1992 belongs to the European Culture Collections' Organization (ECCO). Research work at IAFB covers: technical microbiology and food microbiology, cellular and process engineering, chemistry and biochemistry, food technology, human nutrition and dietetics. The Institute's fields of activity also include many sectors of the agri-food industry: yeast industry, distillery, viticulture, acid production, brewing, fruit, vegetable and cereal processing and storage, potato and starch processing, bakery and confectionery, food concentrates industry, frozen and chilled food, sugar, meat and fat, and the production of microbiological preparations (enzymatic, probiotic, starter cultures and others).

KKP collection comprises over 3.000 strains of yeasts, fungi and bacteria. Yeasts (baker's, brewer's, wine and other types) are the largest and most important group among microorganisms preserved in the Collection.

Classical (microscopic analysis, selective media) and molecular biology methods are employed for the identification of microorganisms.

Modality of access

The IAFB has developed an efficient methodology of sample preparation for detection and identification of *Alicyclobacillus* sp., with particular emphasis on guaiacol-producing *Alicyclobacillus* strains. The presence of some *Alicyclobacillus* strains poses a serious problem for the processing industry, causing spoilage in contaminated fruit juices. Users will be welcomed to bring their material for isolation, identification and characterization of the above-mentioned bacteria. They will perform *Alicyclobacillus* sp. and guaiacol-producing *Alicyclobacilli* identification by PCR-RFLP and sequencing, using genus and species-specific primers. Strain identification will be carried out by standard PCR reactions (followed by RFLP and sequencing of the products) using primers designed for the housekeeping genes: *rpoB* and *gyrB*, as well as a fragment of the guaiacol synthesis involved *vdC* operon.

Unit of access

Access to the equipment for 4 days.

Support offered

Equipped laboratory and expertise in molecular biology techniques like microbial DNA isolation, PCR, electrophoresis and RFLP pattern analysis.

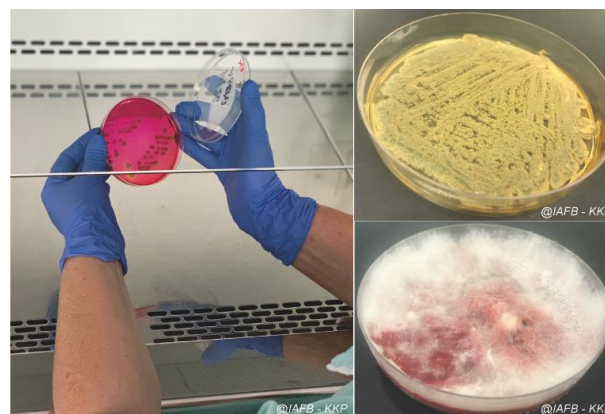


Figure 11. Strains cultivated at IAFB-KKP. *Aspergillus rectrix*; *Byssoscleromyces nivea*.

ul. Rakowiecka 36, 02-532 Warsaw, Poland
www.ibprs.pl

Liaison officer

Joanna Bucka-Kolendo

A microscopic view of a petri dish containing a large number of small, round, translucent cells, likely bacteria or yeast. A glass pipette tip is visible in the upper left, with some cells clustered around it. The cells are densely packed in some areas and more sparse in others.

Services

Experience and expertise from IS_MIRRI21 access providers



FOOD MYCOLOGY

University of Minho – UMINHO

Micoteca da Universidade do Minho – MUM

UMinho is a research University, engaged in the valorisation of the chain Knowledge-Research, Development and Innovation. MUM is a filamentous fungi culture collection established in 1996 and it is hosted by the Centre of Biological Engineering (CEB). CEB's research activities are focused on 4 interdisciplinary thrust areas covering: Industrial, Environmental, Health and Food Biotechnology and Bioengineering.



Figure 12. Strains cultivated at MUM. *A. flavus*; *A. aculeatus*; *P. brevicompactum*.

The Applied Mycology Group (AMG) is one of 9 the working groups of CEB. AMG has a long experience in applied mycology studies, namely in food and drink mycology and, in recent years efforts have also focused on mycotoxins and others secondary metabolites as well as in molecular mycology. Furthermore, the AMG and their laboratories host the MUM culture collection. The mission of MUM is to

be a resource centre for fungal biodiversity preservation and information creating solutions for sustainable development and human well-being with the wide vision of “A world in which fungal biodiversity is preserved and available for all”. In order to keep its high standards, since 2011, MUM has implemented a quality management system based on the normative reference ISO 9001.

Modality of access

UMinho-MUM provides a polyphasic approach to identification of fungal contaminants including: classical taxonomy based on macro- and micro-morphologies (access to optical, fluorescent, confocal and SEM microscopes); biochemical characterisation, including enzymatic and secondary metabolites/mycotoxins profiles; spectral analyses using SARAFIS software for MALDI-TOF ICMS and Bionumerics for FT-NIR; genotypic analysis based on housekeeping genes for phylogenetic studies. RFPL, RAPD and other approaches for strain typing, and specific primer analysis of genes involved in the mycotoxins metabolic pathways can be also used. The occurrence and quantification of fungal contaminants in different food matrices (e.g., nuts, cereals, wines, juices, bottled and tap waters) and in fungal biofilms in water distribution systems are provided for risk assessment.

Unit of access

1 strain characterized.

Support offered

Scientific support and experienced staff.

MUM maintains fungal collection with main focus on *Aspergillus* and *Penicillium* as well other relevant strains for reference providing expertise and information associated to well-characterised strains. MUM offers services mainly for food industry (identification and consultancy). Fungal identification based on a polyphasic approach is one of the main services provided.

Centro de Engenharia Biológica - Campus de Gualtar
4710-057 Braga, Portugal
www.micoteca.deb.uminho.pt/
www.ceb.uminho.pt

Liaison officers

Nelson Lima & Célia Soares



IN VITRO SCREENING OF ANTI-INFECTIOUS ACTIVITIES: ANTIBACTERIAL, ANTIVIRAL AND ANTIPARASITIC

Institut National de la Recherche Pour l'Agriculture, l'Alimentation et l'environnement – INRAE
Centre International de Ressources Microbiennes – CIRM

INRAE is Europe's top agricultural research institute and the world's number two centre for the agricultural sciences, it has 17 research centres in France specialised on food, nutrition, agriculture and the environment.

The CIRM is a unique ISO 9001 certified network of 5 BRCs that holds over 22,000 strains and its research areas cover agro-food, white and green technologies, plant and animal pathogens, biocontrol etc.

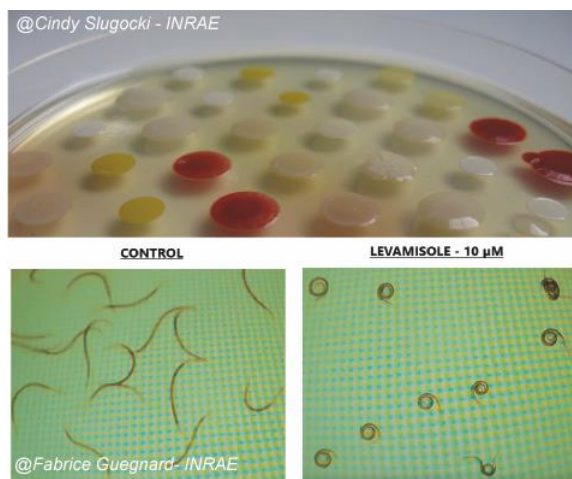


Figure 13. (upper) antibacterial activity testing; (lower) Larval migration assay

The CIRM offers a wide range of services: deposit, identification/characterization and supply of strains; high throughput phenotypic characterisation; molecular typing of isolates or ecosystems; characterisation of properties of

food isolates; high throughput screening of enzymatic activities; determination of strain virulence gene repertoire; antibiotic sensitivity testing; characterization of the antimicrobial potential of molecules of interest; MALDI-TOF-based identification; taxonomic characterization.

The CIRM-BP is located within INRAE centre of Val de Loire and benefits from a rich scientific environment with expertise in the domains of knowledge of pathogenic agents and infection mechanisms knowledge.

Modality of access

Remote access to CIRM-BP in Tours. The antibacterial activity will be tested by determining the Minimal Inhibitory Concentration on a panel of 36 pathogenic bacterial strains selected for their relevance in current veterinary pathologies. Antiviral activity will be tested in an avian influenza virus infection system using a unique chicken lung epithelial cell line (CLEC213). Specifically, the putative antiviral and cytotoxic activities of a serially diluted compound will be tested on CLEC213 infected with 1-2 low pathogenic avian influenza virus strains. The antiparasitic activities will be studied by (1) testing of the «anthelmintic» activity of each compound on the L3 larval stage 2 of *Haemonchus contortus* and (2) by evaluating their efficacy in vitro on epithelial cell culture with the parasite *Eimeria tenella*.

Unit of access

The unit of access comprises the *in vitro* testing of antibacterial, antiviral and antiparasitic (anthelmintic and anticoccidian) activities of 3 molecules or extracts.

Support offered

Users will access to the technical and scientific expertise of the CIRM- BP and 3 other research teams of the ISP unit: "Avian Immune Response and Pathogenesis"; "Apicomplexa and Mucosal Immunity"; "Multi-resistances and Pathogeny factors of Nematodes".

CIRM-BP, UMR Infectiologie et Santé Publique
INRAE Centre Val de Loire - Site de Tours
37380 Nouzilly – France
<https://www6.inrae.fr/cirm/>

Liaison officers

Marwa Zaarour & Emmanuelle Helloin



ANALYSIS BY BIONUMERICS OF MALDI-TOF MASS SPECTROMETRY PROFILES

Institut Pasteur – IP

Centre de Ressources Biologiques de l'Institut Pasteur – CRBIP

The Institut Pasteur (IP) is dedicated to the prevention and treatment of diseases through biomedical research, education, and public health activities. The IP is recognized as a leader in infectious diseases research, and ranked as a top-level institution for publication impact in the field of microbiology.



Figure 14. MALDI-TOF experiments at the CRBIP. Sampling from *Shigella* colonies; preparation plate for MALDI-TOF analysis.

The CRBIP encompasses the five public collections hosted by the IP: Collection de l'institut Pasteur – CIP, Collection Nationale de Cultures des Micro-organismes – CNCM, Collection de Virus de l'institut Pasteur – CVIP, Pasteur Culture Collection of cyanobacteria – PCC and Investigation Clinique et Access aux Ressources Biologiques – ICAREB, making it one of the five richest culture collections in the world and providing access to more than 16,000 bacterial strains, 750 cyanobacterial strains and 500 viruses (including viruses of risk group 3).

The CRBIP activities are focused on: collection, maintenance and supply of microorganisms and research in the field of microbial biodiversity and systematic. The CRBIP is a member of the European Culture Collections' Organisation (ECCO) and of the World Federation for Culture Collections (WFCC).

Modality of access

The profiling of a set of 10 strains taxonomically related using a Brucker equipment and further analysis of the raw data by the BioNumerics software to study and compare profiles of the strains tested. The objective will be the detection of peaks allowing the differentiation between close species, which are difficult to distinguish by the Biotyper software of Brucker.

Unit of access

MALDI-TOF MS analysis of 10 strains taxonomically related.

Support offered

Expertise gained from the daily use of MALDI-TOF MS at the CRBIP.

Among the services offered by the CRBIP are the deposit, characterization/identification, supply of microbial resources, training in microbiology and culture collection related topics. The CRBIP has whole-genome sequencing, MALDI-TOF facilities and benefits from all technological facilities offered on the IP campus (ultrastructural bioimaging, cytometry, crystallography, biomaterials and microfluidics and an animal facility including a centre for gnotobiology) along with its support services (human resources department, financial department, patent office, etc.).

25-28 Rue du Docteur Roux 75015, Paris France

<https://research.pasteur.fr/fr/team/crbip/>

https://catalogue-crbip.pasteur.fr/recherche_catalogue.xhtml

Liaison officer

Liliana Avila-Ospina



IN VITRO SCREENING AND TESTING OF MIC (Minimal Inhibitory Concentration)

University of Latvia – UL

Microbial Strain Collection of Latvia – MSCL

UL is one of the largest comprehensive and leading research universities in the Baltic State and offers more than 130 state-accredited academic and professional study programs. The MSCL was founded in 1993 and during the last decade it has become the leading microbial service collection in Latvia. MSCL holds more than 1600 strains of bacteria, filamentous fungi and yeasts which are of present and future interest for the Life Sciences, biotechnology and industry in Latvia.

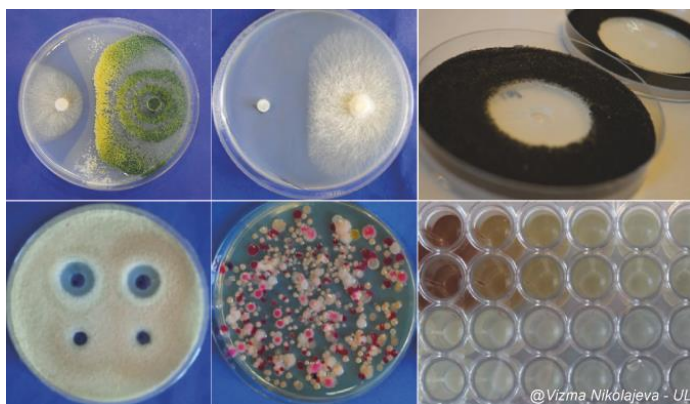


Figure 15. Testing of antibacterial and antifungal activity for compounds, extracts and other formulations using different methods.

The MSCL is recognized as International Depository Authority (IDA). The Collection is a member of the World Federation for Culture Collections (WFCC) and of the European Culture Collection's Organization (ECCO). The MSCL is also registered in the WFCC-MIRCEN World Data Centre for Microorganisms (WDCM). All deposited cultures are preserved in liquid nitrogen (exceptionally – under mineral oil) thus providing their genetic stability, purity and

authenticity. The MSCL services comprise deposition of strains for public access, for safe deposit (with all property rights retained by the depositor) and for patent purposes. Apart from the standard service functions, the MSCL carries out research in collaboration with scientific institutions and academia in the prior scientific areas approved by the Cabinet of Ministers Republic of Latvia.

Modality of access

Agar and Broth-dilution method for in vitro testing of MIC of antibacterial /antifungal agents and compositions of biological origin, provided by users (private companies, research institutes, academia, etc.) will be used.

Unit of access

In vitro screening and testing of antimicrobial activity comprise 1 activity against 1 microbial strain (bacterium, fungus).

Support offered

Test cultures preserved at MSCL and experienced staff.

Through the partnerships and collaborations, MSCL has been involved in several joint projects funded by both the European Regional Development Fund (ERDF) and the National Research programme (strain identification, isolation, antagonisms tests, antimicrobial activity, etc.). Safe and secured maintenance of microbial cultures has encouraged several private companies to store their commercially important strains at MSCL. Upon request the viability tests of their microbial cultures are carried out. Improved techniques for microbial strain storage as well as new methods for the identification will be developed.

University of Latvia, Faculty of Biology
Microbial Strain Collection of Latvia
Jelgavas str., 1, Riga, LV-1004, Latvia
<http://mikro.daba.lv/EN/>
<http://www.lu.lv>

Liaison officer
Vizma Nikolajeva



UNIVERSITA
DEGLI STUDI
DI TORINO



METABARCODING OF FUNGAL COMMUNITIES

Università degli Studi di Torino – UNITO Mycotheca Universitatis Taurinensis – MUT

UNITO is one of the most ancient and prestigious Italian universities open to international research and training, and a remarkable tradition of science and innovation. MUT is the fungal collection of the Department of Life Sciences and Systems Biology and belongs to the Turin University Culture Collections (TUCC). It operates according to the standards of ISO 9001 and currently preserves about 7,000 strains belonging to almost all classes of filamentous fungi ascribable to more than 1,100 species, coming from marine environments, polluted soils and wastewaters, or food. Many have been characterized for their ecological and physiological properties and include mycorrhizal strains, biocontrol and bioindicator agents as well as antimicrobial and enzyme producers to be used in industrial and bioremediation applications.



Figure 16. Fungi isolates cultivated in MUT.

The aims of the TUCC are the acquisition, identification, characterization, preservation and distribution of microorganisms to support research and bio-based economy.

Modality of access

Culture-independent analysis of fungal communities assisted by high-throughput sequencing is crucial in research studies ranging from the human microbiota to field bioremediation. This method requires awareness of specific fungal features (e.g. anamorph-teleomorph connections), methodological biases and limitations of markers and entails bioinformatic challenges and large-scale sequencing risks, which may yield artificial results and misleading conclusions. DNA metabarcoding is the targeted sequencing of taxonomically informative genetic markers; it allows biodiversity to be measured rapidly, cheaply, and comprehensively. This technology can be used for different applications e.g. in biodiversity, conservation, environmental management, the study of trophic interactions, food safety, etc.

Unit of access

Metabarcoding of 1 environmental sample including bioinformatics analysis (i.e. read quality check, filtering, OUT clustering, taxonomic assignment, data normalization).

Support offered

Longstanding experience in metabarcoding (mass-amplification of DNA barcodes from environmental DNA/RNA) of fungal assemblages in a range of habitats.

Among the services offered by UNITO-MUT are the deposit (either public or restricted), identification, characterization and supply of fungi, training and consultancy, especially about biotechnological application of fungi. In the last 5 years UNITO provided more than 600 strains to industrial and academic users (25% outside Italy), accepted in deposit more than 700 strains (33% outside Italy, often from African countries where no public mBRC exist). Most services are provided to companies.

Dipartimento di Scienze della Vita e Biologia dei Sistemi
Viale Mattioli, 25 - 10125 Torino
<https://www.unito.it/>
<https://www.mut.unito.it>

Liaison officers

Giovanna Cristina Varese & Valeria Prigione

A microscopic image showing Bacillus anthracis. It features long, thin, light blue vegetative cells and numerous oval-shaped spores. The spores are purple with a distinct lighter-colored core, giving them a 'bullet' appearance. They are arranged in clusters and chains, some attached to the vegetative cells.

Workflows

Combined set of research activities to develop research & innovation projects

WF1. From Field Collection to Metabolites Extraction: Exploring Secondary metabolites production in Cyanobacteria

Banco Español de Algas – BEA & BELSPO-BCCM/ULC

Nowadays, the search for new secondary metabolites needs to widen its scope by turning to yet unexplored microorganisms. Cyanobacteria are essential and resilient primary producers in aquatic, marine and terrestrial ecosystems. Furthermore, they harbour a yet undiscovered and diverse reservoir of secondary metabolites, which waits to be unravelled. The culture collections, BCCM/ULC and BEA, propose this TNA on the characterization of Cyanobacteria. In the first part of this TNA, BCCM/ULC proposes to train the grant recipient to isolate and purify cyanobacterial strains from one or several environmental samples. The strains will be identified by a polyphasic approach, based on their morphology (light microscopy) and molecular characteristics (16S rRNA and ITS sequencing) and preserved by cryopreservation techniques. Alternatively, the user can also learn these techniques based on strains from the BCCM/ULC if wished.

The biotechnological characterization of the isolated or selected cyanobacteria strains will be performed at BEA facilities, addressing aspects such as how much biomass and fine biochemicals yields can be obtained under indoor controlled parameters (temperature, quality/quantity of irradiation, photoperiod, culture media, CO₂ addition,...) and outdoor conditions using different intensive cultivation units (photobioreactors, tanks and raceways).

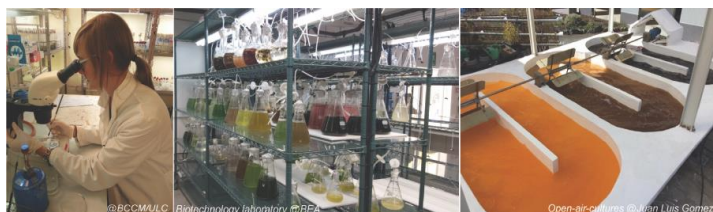


Figure 17. Facilities offered at BCCM/ULC and BEA.

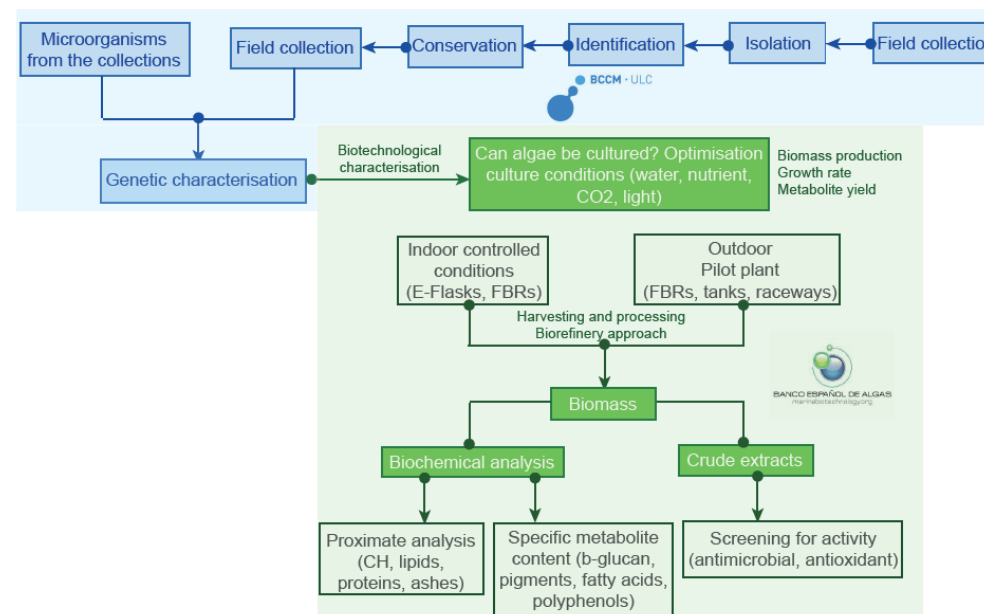


Figure 18. WF1-From field collection to metabolites extraction: exploring secondary metabolites production in Cyanobacteria.

Cultured cells will be harvested by centrifugation or filtration and freeze-dried biomass will be analysed to quantify carbohydrates, lipids, protein, β -glucan and polyphenol content, fatty acid and pigment profiles. The antioxidant, antimicrobial and plant bio-stimulant activity of crude extracts will be also assessed. Under this approach, growth characteristics and biomass composition data will be characterized to prepare a yield improvement strategy and potential applications.

BCCM/ULC possesses more than 250 strains from terrestrial, freshwater and marine environments with a focus on polar ecosystems and BEA-ULPGC offers 404 cyanobacteria from different habitats mainly from the Macaronesia Region.

WF2. Identification of taxonomically related *Streptomyces* strains from extreme Greek environments using mass spectrometry profiles.

National and Kapodistrian University of Athens – NKUA & Institut Pasteur – IP

Streptomycetes are widely recognised as industrially important microorganisms since they are a major source of bioactive secondary metabolites, notably antibiotics. They are also an important part of the soil microbiota and aquatic environments such as lakes, seas and oceans.

Standard techniques used in the characterization and identification of *Streptomyces* isolates such as morphological methods or 16S rRNA gene sequencing lack sufficient phylogenetic resolution for precise classification. They also are relatively time consuming, comparatively expensive and require additional experimental work, which render them unsuitable for a rapid screening and identification.

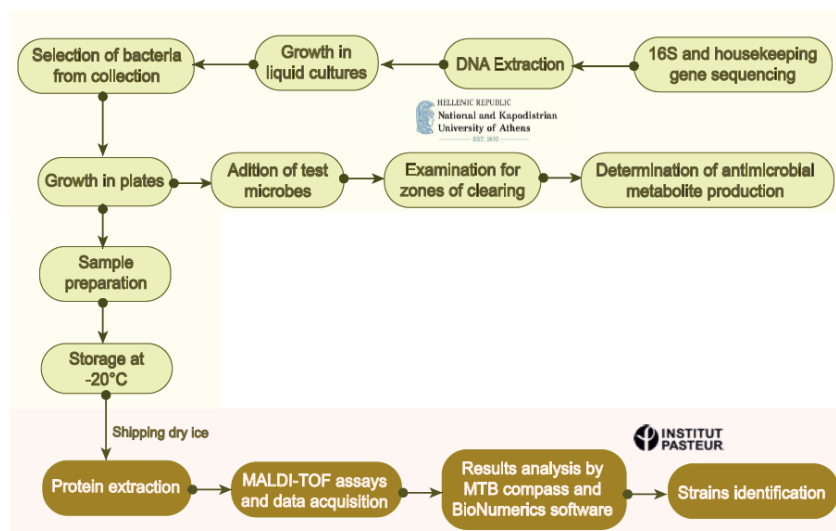


Figure 19. WF2- Identification of taxonomically related *Streptomyces* strains from extreme Greek environments using mass spectrometry profiles.

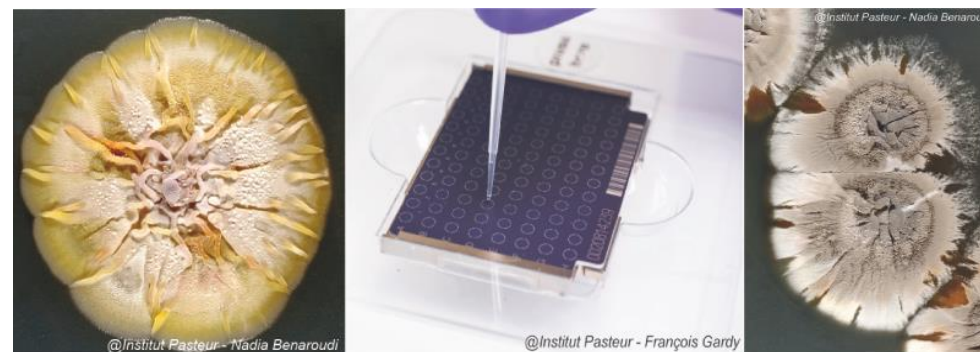


Figure 20. *Streptomyces* strains and facilities at the IP.

The Matrix-Assisted Laser Desorption Ionization Time Of Flight Mass Spectrometry (MALDI-TOF MS) has emerged as a powerful, accurate, rapid and cost-effective tool for the identification of microorganisms. This technique has been recently used for the routine clinical diagnosis of human pathogens, the identification of environmental organisms and also for the identification of fastidious, difficult-to-culture and slow-growing organisms.

CCUoA and the IP offer this TNA workflow for the identification of *Streptomyces* species isolated from extreme Greek habitats. CCUoA offers over 300 strains from a wide variety of species belonging to the genus *Streptomyces* and a wide expertise in the culture and molecular analysis and taxonomy of these species. On the other hand, the IP offers wide its expertise in the identification of bacteria species using MALDI-TOF MS through the analysis of protein profiles using MTB Compass and BioNumerics software.

WF3. Coupling MALDI-TOF mass spectrometry protein and molecular biology techniques to identify taxonomically related *Alicyclobacillus* strains.

Institute of Agriculture and Food Biotechnology – IAFB & Institut Pasteur – IP

The contamination of fruit juices by *Alicyclobacillus* has recently become one of the most important issues in the juice and beverage industry. These acidophilic, thermophilic, and spore-forming bacteria are very hard to eliminate from contaminated drinks. *Alicyclobacillus* spores survive under typical pasteurization conditions and are able to germinate and grow in an acidic environment. Thermal treatment may even impel germination of the spores. Certain species of *Alicyclobacillus* produce guaiacol (2-methoxyphenol), a taint compound causing a phenolic, medicinal, or disinfectant-like flavour and/or odour in juice products.

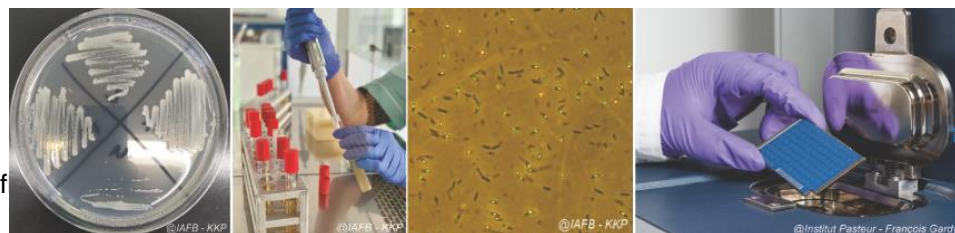


Figure 21. Strains, methods and facilities offered at IAFB and IP

The classic method for isolating and characterizing *Alicyclobacillus* in the juice and beverage industry takes about 15 days and includes the detection of guaiacol by the peroxidase method, HPLC and GC. Therefore, alternative approaches have been adopted (flow cytometry, IR spectroscopy, and genetic methods targeting the rDNA operon). MALDI-TOF MS has emerged as a powerful, accurate, rapid and cost-effective tool for the identification of microorganisms. It has been used for routine clinical diagnosis of human pathogens, identification of environmental organisms, difficult-to-culture/slow-growing strains and recently introduced to food and beverage manufacturing companies.

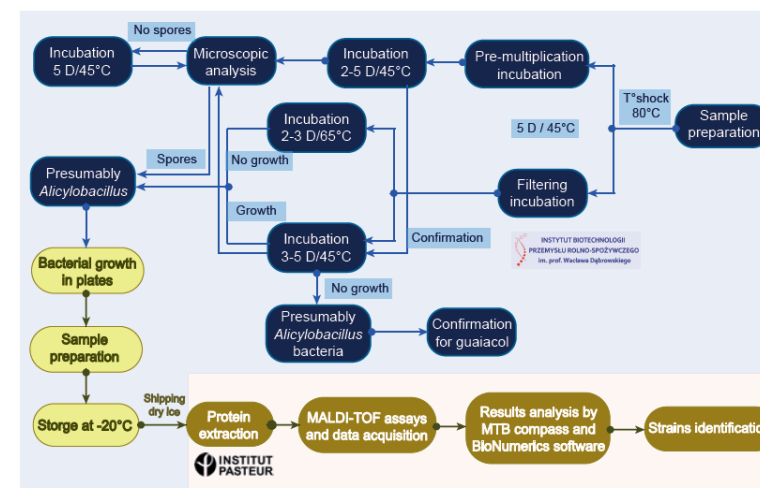


Figure 22. WF3-Coupling MALDI-TOF mass spectrometry protein and molecular biology techniques to identify taxonomically related *Alicyclobacillus* strains.

The IAFB and the IP offer this TNA workflow for the coupling of MALDI-TOF MS and molecular biology techniques to identify taxonomically related *Alicyclobacillus* strains. The IAFB has developed an efficient methodology of sample preparation for detection and identification of guaiacol-producing *Alicyclobacillus* strains using PCR-RFLP and sequencing, focusing on the use of *rpoB* and *gyrB* genes and the *vdC* operon as molecular markers. The ability to produce guaiacol is associated with the presence of *vdC* gene cluster, consisting of three genes, *vdCB*, *vdCC*, and *vdCD*. *RpoB* gene, encoding the β subunit of bacterial RNA polymerase, is one of the single-copy housekeeping genes and is widely used in studies on bacterial taxonomy. On the other hand, the IP offers its wide expertise in the identification of bacteria species using MALDI-TOF MS through the analysis of protein profiles using MTB Compass and BioNumerics software.

