RESEARCH AND INNOVATION CENTRE

TECHNOLOGICAL PLATFORMS

FONDAZIONE
EDMUND MACH
dal 1874

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BIOMASSES

Agrosystems and bioeconomy

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ACTIVITIES

Elucidation of biological processes for biomass exploitation: composting and aerobic post-treatment, anaerobic digestion, fermentation.
Agro-environmental characterization of organic fertilizers: phytotoxicity, effects on plant growth, effects on soil (nutrient dynamics, soil organic carbon, environmental issues such as nutrient loss and GHG emissions).

MAIN APPLICATIONS

+ Soil fertility management
+ Circular bioeconomy
+ Recovery of nutrients and organic matter

CONTACTS

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INSTRUMENTATION

01

Reactors

Gas Endeavour (15 bottles) for characterizing aerobic and anaerobic processes)

20L reactors (3 reactors for anaerobic processes)

02

Biostat Aplus reactor

2.5 L reactor with process regulation systems for measuring fermentation, enzymatic pre-treatments

03

Pilot plant

A composting pilot plant with biocell, aerated static pile, and biofilter

$2m^3$ pilot anaerobic reactor

04

Fertilizers - Soil

Incubators, growth chamber, gas sampling system, and dynamic respirometers (oxygen uptake for measuring various parameters of soil)

05

Process monitor

Air sampling system (pumps, static hood sampler), biogas analyzer, spectrophotometer, portable electronic nose

SERVICES

Biomass

Estimation of biological stability (dynamic respirometric index, DRI)

Biomethane potential tests

Processes

Characterization of anaerobic digestion during composting

Process monitoring

Organic fertilizers and soil

Agro-environmental characterization (e.g. phytotoxicity, soil and plant growth effects)

Estimation of soil organic matter – interaction of organic fertilizers (e.g. nutrient dynamics, soil organic carbon effects)

BIOTREMOLOGY

Agrosystems and bioeconomy

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ACTIVITIES

Development and application of innovative methods for behavioral manipulation of agricultural pests based on biotremology. The platform has the capacity to decipher insect vibrational communication, creating and selecting synthetic signals, and conducting laboratory tests, and validation of the methods under semi-field conditions.

MAIN APPLICATIONS

+ Crop Protection
+ Ecology
+ Ethology
+ Agritech

CONTACTS

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INSTRUMENTATION

01

Laser vibrometers

Three lasers for recording biotic and abiotic vibrational signals

02

Accelerometers

High sensitivity, easy usability, and maneuverability

03

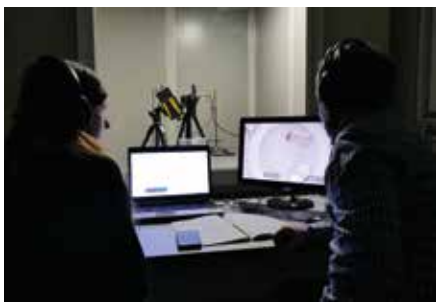
Minishakers

Instrument designed for accurate emission of signals in playback for bioassays and validation

04

Acquisition devices

Two LAN XI (8 channels) for analog signal acquisition



05

Sound insulated chamber

Equipped with an antivibrational table, this chamber minimizes background noise during the recording of vibrational signals

SERVICES

Characterization of insect vibrational signals

Bioassays of the vibrational repertoire of insects, associated with intra-specific (reproductive behavior, rivalry) and inter-specific (predators, parasitoids) communication

Creation and validation of synthetic vibrational signals

Development and optimization of vibrational signals aimed at the behavioral manipulation of insects. Bioassay trials for the validation of vibrational signals in the laboratory, semi-field, and field conditions

Measurement of the vibroscape

Description of the vibrational environment ('vibroscape') resulting from the occurrence of biotic and abiotic signals on different scales, from individual plants to agroecosystems

PLANT TISSUE CULTURE

Agrosystems and bioeconomy

ACTIVITIES

Plant tissue culture services and advanced biotechnological applications for woody fruit trees, especially grapevine and apple, supporting both plant biology research and traditional breeding.

MAIN APPLICATIONS

+ Functional characterization of candidate genes
+ Conservation and multiplication of germplasm

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CONTACTS

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INSTRUMENTATION

01

Sterile hoods

Horizontal and vertical laminar flow sterile hoods, ISO class 3 with HEPA/ULPA filters with a filtration efficiency up to 99.99%

02

Growth chambers

Three chambers with multi-level modules with adjustable temperature, relative humidity and light intensity over a wide range of values

03

GMO greenhouse

Licensed greenhouse for propagation and growth of GMO plant varieties with remote control of temperature (air and floor heating) and photoperiod, flood and drain irrigation, pollen- and insect-proof nets

SERVICES

Grapevine somatic embryogenic callus

Production of stable and homogeneous somatic embryogenic cultures, starting from inflorescences collected in the field

Grapevine and apple plants with the desired genetic modification for functional genomic studies

Agrobacterium tumefaciens-mediated gene transfer
Molecular characterization of modified plants

Phenotypic characterization of traits of interest in GMO greenhouse

Grapevine micro-graftings

Evaluation of various combinations of rootstock/scion modified for genes of interest

VARIETAL IDENTIFICATION AND GRAPEVINE GERMPLASM VALORIZATION

Agrosystems and bioeconomy

ACTIVITIES

Production and distribution of genetic material for non-commercial purposes and propagation of plant material, characterization of disease resistance at phenotypic and genetic levels, and varietal identification.

MAIN APPLICATIONS

+ Viticulture
+ Nursery
+ Genetic improvement

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CONTACTS

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INSTRUMENTATION

01

Germplasm bank

Ex situ germplasm collection with 3,120 accessions, differing in accord to their origin and/or by distinctive phenotypic characteristics

02

FEM Vitis Database (under construction)

Genetic and phenotypic database providing a complete list of the genotypes present in the grapevine germplasm collection available for consultation, including genetic profiles and phenotypic characteristics of each accession

03

Equipment for plant breeding and resistance phenotyping

Two large greenhouses and growth tunnels for plant breeding; growth chambers and mini-greenhouses with controlled temperature and humidity for carrying out artificial infections with fungal pathogens

04

Laboratory equipment for genetic analyses

Thermal cyclers (GeneAmp 192-well PCR System 9700 and Veriti 96-well Thermal Cycler, Applied Biosystems) and centrifuges (Centrifuge 5804 R, Eppendorf) for molecular biology

SERVICES

Varietal identification of *Vitis vinifera* (*sativa* and *sylvestris*) and non-*Vinifera* species and hybrids

High-throughput genotyping with nine universal microsatellites. Verification of True-To-Type can also be confirmed by pedigree analysis

Identification of genetic resistance

Genotyping at 13 resistance loci (containing genes) against downy mildew, powdery mildew, phylloxera, and Pierce's disease. We are also currently developing molecular markers associated with black rot resistance

Phenotyping for resistance to downy and powdery mildew

Artificial infections of downy and powdery mildew on potted plants and leaf disk; a protocol for the assessment of black rot resistance is also being optimized

MICROFLUIDICS, MICRODISSECTION AND MICROSCOPY

Agrosystems and bioeconomy

ACTIVITIES

State-of-the-art microfluidic and microscopy studies in multidisciplinary fields and for the support of collaborative research projects

MAIN APPLICATIONS

+ Molecular and Cell Biology
+ Biotechnology
+ Ecology and Physiology

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CONTACTS

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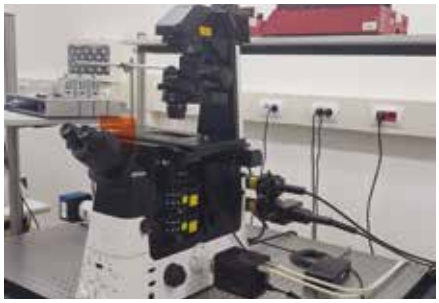
INSTRUMENTATION

01

Leica TCS SP8

Inverted confocal laser-scanning microscope for 3D reconstruction of biological samples



02

Nikon Ti2-Eclipse

Automated inverted fluorescence microscope equipped with high performance cameras for fast live cell imaging

03

Leica LMD7000

Laser Capture Microdissection Microscope for the isolation of single cells and specific areas of various tissues

04

Zeiss Axio Imager Z2

A fluorescence microscope with excellent optics and resolution

05

Singer MSM-SYS-400

Motorized-stage-controlled workstation to dissect tetrads and cells in a user-defined grid

SERVICES

Advanced imaging

Sophisticated light microscopes and camera systems for high resolution imaging, time lapse imaging, high-speed videos, and powerful image analysis

Lab-on-a-chip

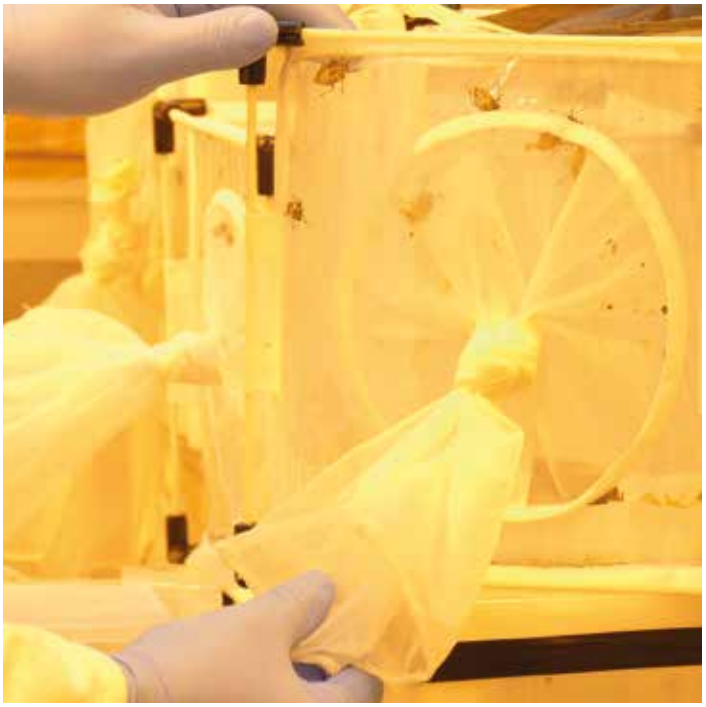
The cultivation of organisms in these microfluidic devices allows precise control of their environment and non-invasive live cell imaging in real time with high spatiotemporal resolution

Single cell biology

Precise dissection of cells from diverse tissues as well as droplet-based high-throughput manipulation, screening and sorting of single cells

QUARANTINE

Agrosystems and bioeconomy



ACTIVITIES

Dedicated to the captive breeding of pests and their natural enemies (both indigenous and exotic) with a range of instruments for studying their biology, physiology, and behavior.

MAIN APPLICATIONS

+ Biocontrol
+ Ecological impact assessment of alien insect species

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CONTACTS

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INSTRUMENTATION

01

Quarantine facilities

Confinement laboratory and climatic chamber with three levels of containment to prevent the involuntary release of captive organisms

02

Electroantennograph

Coupled with gas chromatography (GC-EAD) optimized for the recording of electrical responses from individual sensilla or nerve cells (SCR)

03

Complete setups for the extraction of volatile compounds

Extraction of VOCs in static or dynamic flow and through solid-phase microextraction (SPME)

04

Olfactometer arenas

Borosilicate glass arenas of different sizes and shapes designed for evaluating stimuli (eg. chemical, mechanical, visual) in behavioral bioassays

05

Wind tunnel

Equipped with a flow regulator, automatic system for injecting volatile compounds, and neon lamps to reproduce various light conditions (e.g., daytime, twilight)

SERVICES

Entomological production

Supply of live insects aimed at individuals, companies, and research institutions

Risk assessment of exotic insects

Study of the ecology, biology, and associated risk of releasing exotic organisms for biological control

Impact assessment

Pre-emptive studies of the biology and potential damage caused by exotic pests with a high probability of introduction to a new area

DEVELOPMENT OF BIOFUNGICIDES AND BIOFERTILIZERS

Agrosystems and bioeconomy

ACTIVITIES

Development of sustainable strategies for crop protection and biostimulation through the identification and development of new biofungicides and biofertilizers to promote plant growth and tolerance to abiotic and biotic stresses

MAIN APPLICATIONS

+ Crop Protection
+ Biological control of plant pathogens
+ Biofertilization
+ Mitigation of abiotic stress

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CONTACTS

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INSTRUMENTATION

01

Laboratory of environmental microbiology

Instruments for classical microbiology

02

Phytotrons

Growth chambers for functional characterization in high-throughput experiments

03

Greenhouse

Independent growth rooms for experiments under controlled conditions and simulated environmental stressors

04

Rain simulator

Functional characterization of rain fastness for various products

05

Biofermenter

Simulation of industrial production of microorganisms in bioreactors

SERVICES

Experimental trials

Bioassays of biocontrol agents and plant growth promoters *in vitro*, as well as under greenhouse, semi-field and field conditions

Screening and characterization of beneficial microorganisms and plant extracts

Identification of microorganisms for biological control and biostimulation, extraction of active ingredients, and identification of antimicrobial properties of plant extracts

Development of formulations

Compatibility analysis with co-formulants and other plant protection products, and simulation of industrial production in bioreactors

AEROBIOLOGY

Biodiversity, ecology and environment

ACTIVITIES

Monitoring of airborne pollen and the main allergenic and pathogenic spores (both indoors and outdoors). Assessing the viability of plants and their responses to environmental change.

MAIN APPLICATIONS

+ Human health: information to support the diagnosis and treatment of allergy diseases
+ Airborne biodiversity and plant phenology
+ Plant health and viability

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CONTACTS

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INSTRUMENTATION

01

Volumetric sampler (Hirst type)

Impaction trap for sampling airborne particles such as fungal spores and pollen

02

Real time sampler (Poleno Mars)

Real-time device for measuring and identifying airborne pollen

03

Passive sampler (Sigma 2)

Trap for the collection of aerosols based on sedimentation; pollen, fungal spores and other particulate matter are fixed on a slide or plate

04

Pollen viability analyzer (Amphasys)

Automatic analyzer for measuring pollen viability and pollen concentration

05

Foliar analysis devices

Handy PEA and M-PEA: fluorimeters for assessing the photosynthetic efficiency

SPAD 502: a chlorophyll meter for the non-destructive evaluation of the quantity of chlorophyll present in plant leaves

SERVICES

Airborne pollen and spore analysis

Sampling, identification, viability tests and preparation of reference slides for airborne pollen

Allergenic pollen risk analysis

Information services and weekly bulletin of allergenic pollen; communication and dissemination of results

Leaf trait analysis

Morphometric and physiological analysis of foliar traits associated with plant responses to environmental stress

ANIMAL, ENVIRONMENTAL AND ANTIQUE DNA

Biodiversity, ecology and environment

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ACTIVITIES

Extraction and amplification of DNA from animal biological samples for genetic, genomic and metagenomic applications. Three independent laboratories (BSL2) guarantee contamination-free processing of modern (tissues), environmental (fecal pellets, hair, water, soil) and ancient (ice cores, bones) samples.

MAIN APPLICATIONS

+ Population genetics and genomics for animal conservation
+ Species identification for biodiversity monitoring using environmental DNA
+ Characterization of diet, parasites and gut/skin microbiota to study individual health and ecosystem function

CONTACTS

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INSTRUMENTATION

01

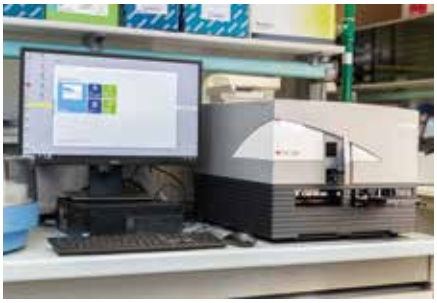
Biomark HRP Plus

Individual subcutaneous marking system with a waterproof, shockproof Pit-tag reader equipped with external antenna with adjustable power

02

Thermo Kingfisher

Automatic DNA/RNA extractor based on capture using magnetic beads used for simultaneous extraction of 96 samples



03

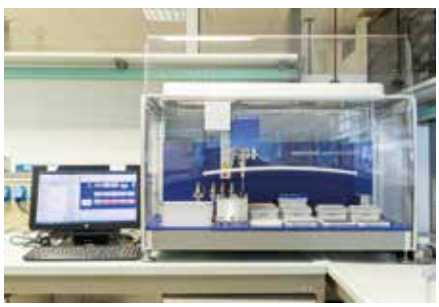
Tecan Spark

Multi-mode plate reader for genomic analysis, proteomics, microbiology and cellular assays

04

Sage Science Blue Pippin

DNA fractionator and sorter that allows separation and recovery of a well-defined band of amplified or genomic DNA



05

Eppendorf - epMotion 5075

Automated robotic system for mixing, heating/cooling samples and reagents (biologically safe thanks to the presence of an automatic BSL2 filter hood)

SERVICES

Genotyping of freshwater fish

Genetic analysis of freshwater fish species of conservation interest as well as to fish breeders, e.g. for monitoring genetic health and selecting reproducers, or definition of conservation or management units, levels of introgression, kinship and inbreeding

Genotyping of terrestrial vertebrates (amphibians, birds, mammals)

Individual genotyping (tagging) from invasive (tissue) and non-invasive (fecal pellets, saliva, hair) samples using species-specific STR markers to measure species richness, levels of hybridization, population size and genetic diversity

Wildlife forensics

Scientific support for forensic investigations including DNA extraction of low quality/ quantity forensic samples (saliva, blood traces, trophies, altered tissues) and comparison with regional databases

PLANT PHENOTYPING

Biodiversity, ecology and environment

ACTIVITIES

Automated plant phenotyping in the visible and near infrared spectra with automatic and non-destructive real time data acquisition

MAIN APPLICATIONS

+ Characterization of plant genotypes / varieties
+ Stress response research
+ Development of indices of plant stress

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CONTACTS

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INSTRUMENTATION

01

Growth chamber

Max capacity of 900 plants (trays or single pots) with programmable control of temperature, relative humidity, light intensity and light quality (LED B, R, FR)

02

Watering and weighing stations

Automatic and programmable watering station in tray and single pot formats and weighing station

03

RGB sensor

Visible spectrum of 400-700 nm, and three spectral bands, 5 MP to 15 fps for greenness quantification

04

Hyperspectral cameras FX10

A line-scan (224 bands) hyperspectral camera that operates in the visible and near-infrared (VNIR) region with a high spatial resolution of 1024 pixels. It operates in the 400-1000 nm region

05

Hyperspectral cameras FX17

This line-scan (224 bands) hyperspectral camera operates in the near-infrared region (spectral range of 900-1700 nm). It has a high spatial resolution of 640 pixels

SERVICES

Phenotyping of plants in the visible spectrum

Growth measurement of plants up to 1.3 m in height in optimal and / or stress conditions (eg. water, light, thermal stress), including data analysis (image segmentation, quantification of the projected leaf area and growth curves)

Hyperspectral phenotyping of plants

Hyperspectral imaging of plants up to 1.3 m in height in optimal and / or stress conditions (eg. water, light, thermal stress), including customizable data analysis

Development of indices of plant stress

Development of hyperspectral indices of stress and physiological state of plants under controlled conditions for field application evaluation

HYDROCHEMISTRY

Biodiversity, ecology and environment

ACTIVITIES

Chemical characterization of water and molecular profiling of cyanobacterial toxins based on standardized reference protocols.

MAIN APPLICATIONS

+ Freshwater quality control and monitoring
+ Determination of cyanobacterial toxins
+ Evaluation of water specific requirements/ treatments

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CONTACTS

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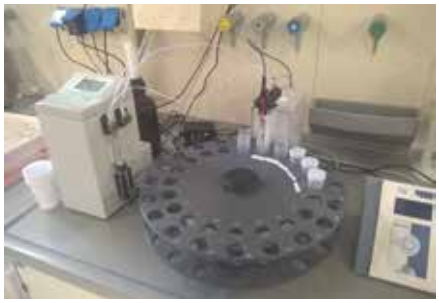
INSTRUMENTATION

01

Thermo Evolution 201 spectrophotometer

It is used in the colorimetric assays (e.g. different nitrogen and phosphorus forms, and silica) in freshwaters



02

CRISON Titromatic automatic titrator

It is used for the simultaneous determination of pH, electrical conductivity and alkalinity in freshwaters

03

DIONEX ICS5000 Ion chromatographer

It is used for the simultaneous analysis of anions and cations in freshwaters

04

Gravimetric analysis system

To determine the quantity of the solids suspended in the water sample (dry weight)

05

Waters UPLC - Sciex 4000QTRAP LC-MS system

It is used for the quali- and quantitative analysis of algal toxins: microcystins, anatoxins, cylindrospermopsins, saxitoxins

SERVICES

Water quality assessment

Determination of macro-elements, nutrients, and chlorophyll for ecological studies

Water chemical profiling

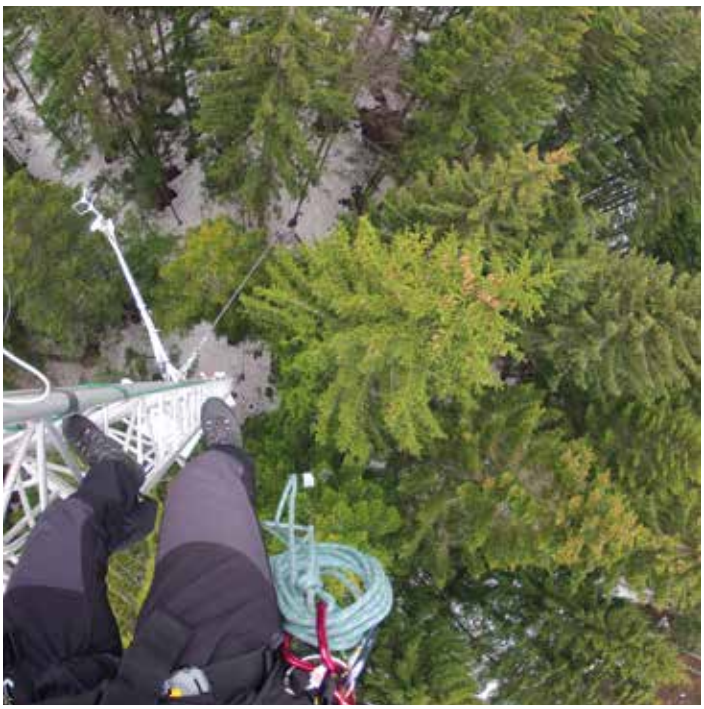
Determination of selected parameters in adequate ranges for checking specific requirements or evaluating specific treatments

Cyanobacterial toxins

Identification and quantification of toxin classes in natural/drinking water and biological matrices

MICROMETEOROLOGY

Biodiversity, ecology and environment



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ACTIVITIES

Measurement of energy and mass exchanges (C, H_2O, N) between vegetation and the atmosphere in alpine ecosystems, their eco-physiological characterization, and their modeling and upscaling through remote sensing data.

MAIN APPLICATIONS

+ Climate-smart management of natural alpine ecosystems
+ Monitoring the effects of climate and environmental changes
+ Strengthening of scientific collaboration

CONTACTS

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INSTRUMENTATION

01

LI-6400/XT Portable System + LI-6400-09 Soil Flux Chamber

Portable photosynthesis systems for gas exchange and chlorophyll fluorescence measurements; combined with the LI-6400-09 chamber, also soil CO_2 flux measurements

02

LI-COR LI-8100/LI-8150 Automated Soil Gas Flux System

Automatic system for continuous measurement of soil CO_2 flux; the control unit contains an IRGA and a panel to interface with soil chambers and the LI-8150 Multiplexer

03

LI-COR LI-7810 Trace Gas laser spectroscopy-based Analyzer

Portable trace gas (CH_4/CO_2/H_2O) analyzer for flux measurements; continuous soil flux measurements when coupled to the LI-8150 chamber system

04

Eddy covariance flux towers

Towers equipped for high frequency continuous measurements of turbulent fluxes between vegetation and atmosphere according to a standardized eddy-covariance set up

SERVICES

Micrometeorological data

Data collection at environmental monitoring sites, quality control and processing, and production of publicly available datasets through digital archives related to national and international research projects or infrastructural networks

Field activity support at experimental sites

Field collaboration on scientific research activities (experimental design, data analysis and results interpretation), including instrument set-up and assistance during field campaigns carried out at the experimental sites of the Platform

Use of scientific instrumentation

Portable instrumentation can be provided by the Platform for measurements of greenhouse gas (CO_2, CH_4) fluxes by chamber technique and of leaf physiology variables (CO_2 assimilation, fluorescence, transpiration)

BIOLOGGING

Biodiversity, Ecology and Environment

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ACTIVITIES

Development of bio-sensors and remote sensing tools to study animal ecology (e.g. GPS sensors, proximity sensors, camera traps); management and analysis of the related data with customization of solutions for specific applications.

MAIN APPLICATIONS

+ Monitoring of hunted populations
+ Monitoring of wildlife roadkill sites
+ Monitoring and protection of herding activities
+ Monitoring of species of conservation relevance

CONTACTS

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INSTRUMENTATION

01

GPS Collars

Customized collars for automated collection and remote transmission of animal locations

02

Proximity loggers

Additional option added to collars for detecting contacts between individuals or between an individual and a certain point of interest

03

Camera Traps

Deployed with permission for automated 24-hour acquisition of images/videos

04

Drop-off Releaser

Additional option for remote release of collars deployed on wild animals

05

VHF Radio

Radio for signal detection on medium frequencies (150/151 MHz)

SERVICES

Maps of animal movement

Creation of maps of animal movement from GPS locations, with customizable time scale, cluster detection of presence and overlap with cartographic layers (e.g. roads, administrative boundaries)

Management and analysis of animal movement data

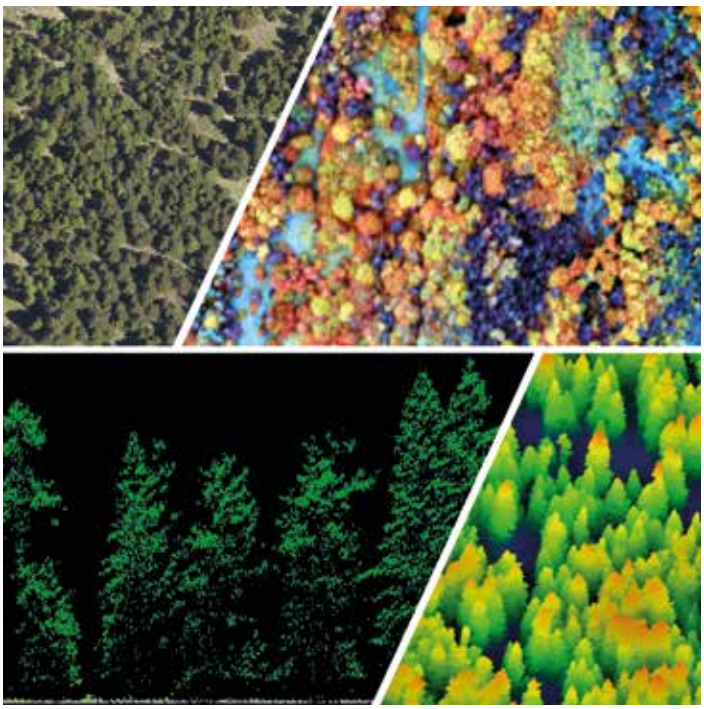
Management of data collected from bio-sensors and remote sensing tools in appropriate databases, and analysis by means of dedicated statistical software

Animal density estimates

Estimation of ungulate density in sample areas through the application of various methodologies (e.g. grid of camera traps, distance sampling) and subsequent modelling

REMOTE SENSING

Biodiversity, ecology and environment



ACTIVITIES

We use remote sensing data to estimate biophysical parameters of forest and grassland vegetation. Activities range from leaf scale to regional scale, combining ground measurements and data from aerial and satellite platforms.

MAIN APPLICATIONS

+ Climate change studies
+ Forest ecology studies
+ Support for forest management

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CONTACTS

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INSTRUMENTATION

01

VIS-NIR-SWIR Spectral Evolution spectroradiometer

Spectroradiometer with spectral range 350-2500 nm for ground reflectance, radiance and irradiance measurements of vegetation

02

Hyperspectral camera SPECIM IQ

VNIR hyperspectral camera (400-1000 nm; 512x512 pixel) for ground reflectance and radiance measurements of the vegetation cover

03

SPECIM Dual Camera System (IBIS + FX10)

Dual Camera System for high resolution measurements (on the ground and from an aerial platform), for the remote estimation of the photosynthetic activity of natural ecosystems

SERVICES

Remote sensing

Consultancy on the use of remote sensing data for estimating biophysical parameters of natural ecosystems

Proximal sensing

Consultancy on data acquisition using spectroradiometers and portable hyperspectral cameras in forests and grasslands

Validation and calibration

Support for the calibration and *in situ* validation of models estimating biophysical parameters of natural ecosystems

VOLATILE ORGANIC COMPOUNDS ANALYSIS

Food and nutrition

SCAN THE QR CODE TO BOOK THE PLATFORM

ACTIVITIES

Rapid, direct and high sensitivity monitoring of volatile organic compounds from relevant systems in food, environment and health.

PRINCIPALI CAMPI APPLICATIVI

+ Real time monitoring with high sensibility of the VOCS emission in process monitoring, air quality, In-vivo plant/fruit physiology
+ Real-time monitoring of volatile compounds in the breath for physiology studies or during food tasting for sensory studies
+ Rapid and non-invasive volatilome screening of interested samples from agricultural field

CONTACTS

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INSTRUMENTATION

01

PTR-TOF-MS

Proton Transfer Reaction Mass Spectrometry for the real-time analysis of volatile compounds with very high sensitivity and time resolution coupled to an autosampler, to a Switching Reagen Ion system and a Fast-GC

02

GC-MS

Monodimensional gas chromatography–mass spectrometry instrument coupled with autosampler for SPME analysis

03

GCxGC-MS

Bidimensional gas chromatography–mass spectrometry instrument coupled with autosampler for SPME analysis

04

Ethylene Detector

Photoacoustic detector for monitoring ethylene at low concentrations (few ppb) for plant physiology and fruit storage studies

SERVICES

Direct volatile compounds analysis by PTR-MS

Real-time/direct monitoring of volatile compounds with PTR; high-throughput screening (phenotyping or quality control) or real-time monitoring of technological or physiological processes

Breath/nose-space analysis

Real-time monitoring of volatile compounds for animal physiology studies (breath analysis) or during food tasting for sensory studies (nose-space analysis)

VOCs analysis with GC-MS/ GCXGC-MS

Identification and quantification of molecules from the head space of the matrix with HS-SPME-GC-MS/ GCXGC-MS

SENSORY ANALYSIS

Food and nutrition

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ACTIVITIES

Application of the main sensory techniques to food analyses conducted with trained panels and consumers (discriminative, descriptive, hedonic tests); innovative, rapid and dynamic methods for food analysis in combination with *in vitro* instrumental analysis and *in vivo* analyses during consumption.

MAIN APPLICATIONS

+ Development of a new food product
+ Study of production processes
+ Quality control
+ Enhancement of typicality

CONTACTS

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INSTRUMENTATION

01

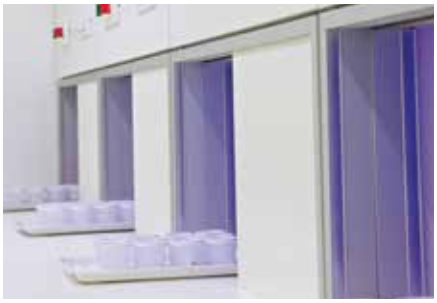
Sensory laboratory

300 sqm of dedicated laboratory space equipped subdivided into rooms for sample preparation, panel training and individual evaluations (22 booths)

02

Classroom

Primarily used for sensory analysis courses and technical tasting by product experts, this innovative learning facility consists of 48 tasting stations



03

Mobile Laboratory

Four mobile sensory booths are available for central location tests, including a fully equipped station for combining sensory tests and nose-space analysis

04

Instruments for structural, acoustic, and visual analysis

This set of instruments includes a TA-XT Texture Analyzer, Chroma Meter CR-400 Colorimeter and IRIS Visual Electronic Eye Analyzer VA 300

SERVICES

Sensory tests

Discriminant analysis aimed at determining perceptible sensory differences between 2 or more products. Qualitative-quantitative analysis of the sensory characteristics of a product carried out according to classical (conventional profile), rapid and dynamic descriptive methods

Consumer Testing

Identification of which product is liked the most, on average or by consumer segments in different situations: in the sensory laboratory, in a central location (e.g. fair, event, etc.) or at home (home tasting)

Physical Tests

We can perform physical-mechanical measurements correlated with the sensory profile of food to evaluate the texture (mechanical and acoustic parameters) and visual aspects (colour, shape and size) of a product

BIOTECHNOLOGY OF FERMENTATION

Food and nutrition

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ACTIVITIES

Creation of improved fermented food products, in terms of organoleptic properties, technological processes, or nutritional characteristics; study of biodiversity, maintenance and valorisation of food microbiomes.

MAIN APPLICATIONS

+ Development of dairy products and novel foods
+ Food safety studies along the food supply chain
+ Selection of starter and non-starter microorganisms
+ Phage control in the food supply chain

CONTACTS

fermentazioni.piattaforma@fmach.it

INSTRUMENTATION

01

Set for classical microbial analysis

Autoclaves, homogenizers, incubators, microbiological hoods, spectrophotometer and basic molecular biology equipment for characterizing food microbiotas

02

Mini-cheese lab

All necessary equipment for the production of dairy prototypes: mini-vats, and mini-brine and ripening cabinet for the production of mini-cheese from 200 g to 2 kg

03

Microbial Batch fermentation System

Two 3L and one 20 L bio-reactors with various pH, temperature and atmospheric (aerobic/ anaerobic) settings

04

Freeze dryer

Useful for extending storage times of microbiological and plant material

SERVICES

Development of dairy products and novel foods

Identification of production needs, development of suitable microbial starter mixtures, and establishing production cycles focusing on the improvement of fermentation performance.

Optimization of recipes to produce novel foods

Safety study along the food supply chain

Identification of pathogens that can compromise the food safety, both for human and animal health

Phage control in the food supply chain

Evaluation of the vulnerability of natural whey starters for the maintenance of a dairy production chain

METABOLOMICS

Food and nutrition

ACTIVITIES

We use innovative methodologies
for the quantification and characterization
of metabolites present in complex matrices.

MAIN APPLICATIONS

+ Viticulture and oenology
+ Agri-food
+ Food and nutrition

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CONTACTS

metabolomica.piattaforma@fmach.it

INSTRUMENTATION

01

UPLC-Q-TOF/HPLC-Orbitrap

High performance liquid chromatographs coupled to high resolution mass spectrometers for untargeted analysis of primary and secondary metabolites

02

GCxGC TOF

Two-dimensional gas chromatograph coupled to a time-of-flight mass spectrometer for untargeted analysis of VOCs

03

UHPLC-Qtrap
UHPLC-MS/MS

High performance liquid chromatographs coupled to triple quadrupole and/or with linear trap mass spectrometers for the quantification of primary and secondary metabolites

04

GC-MS/MS

Two gas chromatographs coupled to triple quadrupole mass spectrometers for the quantification of primary metabolites and VOCs

05

Other equipment

GC-O-MS

Spectrophotometer

Colorimeter

Preparative HPLC

SERVICES

Quantitative and semi-quantitative analyses

Identification and quantification of primary and secondary metabolites through validated and published chromatographic methods

Untarget analysis

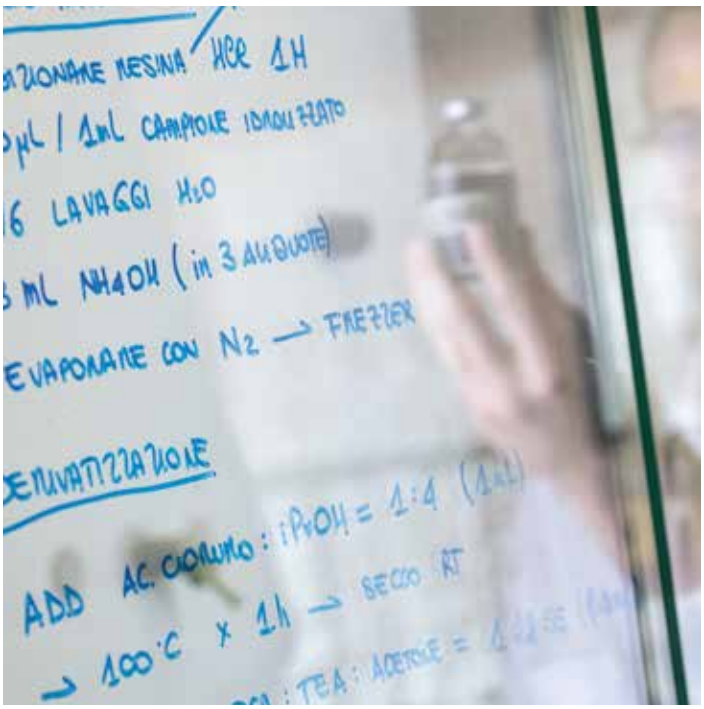
Profiling of different classes of metabolites through LC and GC techniques coupled to high resolution mass spectrometers, in different matrices

Ad hoc analysis

Development of quantitative and semi-quantitative methods ad hoc based on the compounds of interest. Isolation of compounds of interest from complex matrices or identification of volatile compounds through olfactometric gas chromatography

TRACEABILITY

Food and nutrition



ACTIVITIES

Analytical methods and statistical models are developed based on Stable Isotope Ratios Analysis and Nuclear Magnetic Resonance to verify the origin/authenticity of agrifoods and support multiple other fields.

MAIN APPLICATIONS

+ Food, agriculture, nutrition
+ Forensic sciences
+ Animal and plant ecology and physiology
+ Archaeology, paleoclimatology, hydrology

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CONTACTS

tracciabilita.piattaforma@fmach.it

INSTRUMENTATION

01

SNIF NMR (Bruker)

Site-specific natural isotopic fractionation (SNIF) measurement of deuterium-hydrogen ratio

02

NMR 400 e 600 (Bruker)

Targeted and untargeted metabolomics and profiling analyses

03

TC/EA and EA – IRMS (Thermo and Elementar)

Isotopic analyses of H, C, N, O and S in bulk solid and liquid samples

04

LC/Gas Bench/GC – IRMS (Thermo)

Compound-specific C, H and N isotopic analyses in liquid and gaseous matrices

05

Multiflow – IRMS (Elementar)

Isotope ratio mass spectrometer interfaced with an online equilibration system for H, O and C analyses in liquid samples

SERVICES

Methods for stable isotope ratios analysis

Support and development of analytical approaches based on the determination of stable isotope ratios of hydrogen, carbon, nitrogen, oxygen and sulfur of bulk and compound specific type (ISO 17025 accreditation since 1998)

Nuclear Magnetic Resonance analytical methods

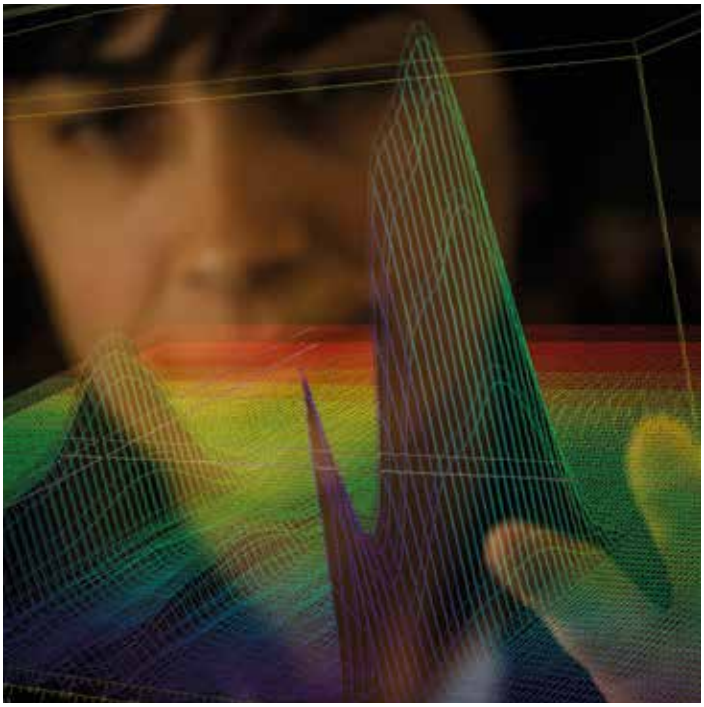
Support and development of analytical approaches based on Nuclear Magnetic Resonance (targeted, untargeted, NMR profiling)

Development of traceability models

Development of mathematical-statistical models (including isoscapes) based on isotopic and/or NMR data for the traceability/verification of authenticity of products in the agri-food or pharmaceutical / nutraceutical fields

COMPUTATIONAL BIOLOGY

Computational biology



ACTIVITIES

It supports users in defining the experimental design and provides management, analysis and statistical modeling services of genomic and metagenomic data.

MAIN APPLICATIONS

+ Genome assembly and annotation
+ Development of methods for molecular screening
+ Metagenomic data analysis
+ Integration and visualization of -omic data

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CONTACTS

computazionale.piattaforma@fmach.it

INSTRUMENTATION

01

MACHINA HPC Cluster

This cluster includes 404 cores equipped with 9 Tbyte of RAM distributed on 11 blades, one of which is equipped with GPU NVIDIA TU104GL. The full flash storage exceeds 220 Tbytes

SERVICES

Genomics and metagenomics

Genome assembly and annotation, development of genotyping arrays, resequencing data analysis.

Analysis of amplicon metagenomic data (16S, ITS) and assembly and annotation of shotgun metagenomic data

Transcriptomics

Transcriptomic assembly and functional annotation

Differential expression analysis

Functional enrichment analysis

Unsupervised analysis (clustering, PCA)

Metabolomics

Pre-processing of targeted and untargeted metabolomics datasets (NMR and LC-MS)

SEQUENCING AND GENOTYPING

Computational biology

ACTIVITIES

Genomic, metagenomic
and metabarcoding NGS analysis.
High-throughput SNP-chip array genotyping.
Development of new investigative methods
in green biotechnology.

MAIN APPLICATIONS

+ Agriculture
+ Ecology
+ Diet and food science

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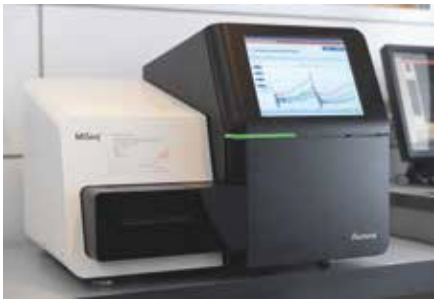
CONTACTS

sequenziamento.piattaforma@fmach.it

INSTRUMENTATION



01

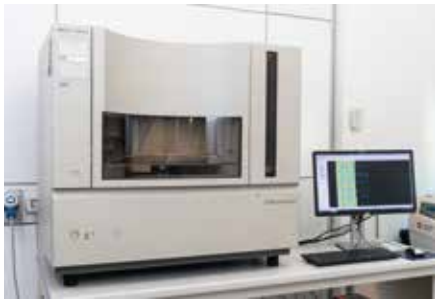
MISEQ ILLUMINA

NGS sequencing platform with the capacity to generate up to 25 million reads of fragments 25-300 nucleotides (bp) long in paired end mode (PE 2X300)

02

MinION ONT

Portable real time device for DNA and RNA sequencing using nanopore technology



03

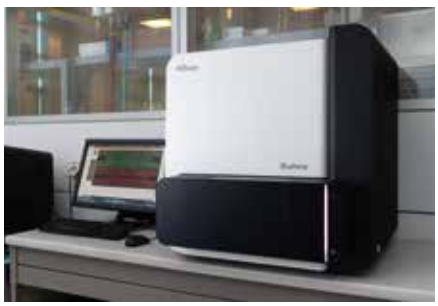
3730xl GENETIC ANALYZER

Capillary electrophoresis platform for high throughput genetic analysis of markers including microsatellites, AFLP, SNPs, as well as mutation detection and traditional DNA sequencing

04

Axiom GeneTitan

Hands-free dedicated platform for processing of Affymetrix® High-Throughput (HT) Array Plates: from marker discovery to genome-wide SNP genotyping



05

Illumina Hiscan Reader

Dedicated platform for high-precision array scanning of the Illumina BeadChips associated with GoldenGate® and Infinium® Genotyping assays

SERVICES

Sample preparation

Nucleic Acid extraction, purification and quantification (DNA, RNA, plasmid); HMW DNA extraction (Nanopore Minion); NGS Library preparation and quantification (RNA-seq, Full Shotgun, Amplicon)

Sequencing

SANGER Sequencing (PCR, Plasmid, BAC sequencing); Next Generation Sequencing: a) full shotgun gDNA and eDNA; b) transcriptomic and expression studies; c) metabarcoding analysis (16S, ITS, COI, trnL, rbcL)

Genotyping

SSR Genotyping (MAB, MAS); SNP Genotyping (WGAS); Genotyping by sequencing (GBS)

FRUITOMICS, a research infrastructure created at CRI

Research infrastructures are instruments, resources and related services used by the scientific community to conduct high-quality research in their respective fields, regardless of institutional or national affiliations.

Fruitomics is a Research Infrastructure (IR) identified in the Multi-Year Research Plan of the Autonomous Province of Trento and in the National Research Infrastructure Plan within the INTEGRA-BIOMICS IR and it is based at the Fondazione E. Mach, San Michele all'Adige (TN), Italy.

FRUITOMICS: HIGH-THROUGHPUT APPROACHES TO STUDY AND ENHANCE QUALITY AND SUSTAINABILITY IN THE AGRO-FOOD CHAIN

FRUITOMICS is a self-sustaining infrastructure and a center of excellence for research and training in food, environmental and agricultural sciences, aiming to combine economic and environmental sustainability in the agrifood sector. The main objective is the creation of a multi-scale farm-to-fork research chain for the study of food/nutritional quality and agro-forestry processes. The integration of field and laboratory data into models built to manage agro-production systems and understand their interaction with the environment, pursuing an ecological and digital transition while also providing tools to support programming in response to climate change. These ambitious objectives exploit cutting-edge analytical and instrumental approaches in analytical chemistry and the characterization of agro-ecosystems.

Fruitomics was established and strengthened through two funding calls:

FUNDING BODY: European Regional Development Fund (ERDF) in Trentino

AXIS: 1 - Strengthening research, technological development and innovation

ACTION: 1.1.1. - Support for research infrastructures considered critical/crucial for regional systems

ERDF NOTICE: n. 05/2017

RESOLUTION: n. 29 dated 21 February 2018

CUP CODE: C49H18000000001

FUNDING GRANTED: Euro 4,537,400

START DATE: 02.21.2018

DURATION: 24 months (extended until February 20, 2021)

BENEFICIARY BODY: Fondazione Edmund Mach

UNIONE EUROPEA
Fondo europeo di sviluppo regionale

PROVINCIA AUTONOMA DI TRENTO

Investiamo nel vostro futuro

FUNDING BODY: 2021-2027 Program European Regional Development Fund - ERDF

AXIS: 1 - Strengthening research, technological development and innovation

SECTOR OF INTERVENTION: 04 Investments in fixed capital, including research infrastructures, in public research centers and in public higher education directly linked to research and innovation activities

ERDF NOTICE: n. 2/2023 Support for research infrastructures approved with resolution no. 1350 of 07/28/2023

CUP CODE: C47F23000090001

FUNDING GRANTED: Euro 5,190,949.85

BENEFICIARY BODY: Fondazione Edmund Mach

COESIONE ITALIA 21-27 TRENTINO

Cofinanziato dall'Unione europea

PROVINCIA AUTONOMA DI TRENTO

Equipment purchased under FRUITOMICS

HPC virtual and computing infrastructure

376 cores with 7631.9 GB of RAM distributed across 21 Blades and over 100 TB of storage, including both GPU nodes and nodes with 2TB RAM, enabling a broad spectrum of applications ranging from Machine Learning to complex genome assembly.

Magnetic resonance spectrometry system

NMR 400MHz: Nuclear Magnetic Resonance spectrometer for routine experiments such as 1H-NMR profiling of agrifood products or the SNIF determination of the deuterium-hydrogen ratio.

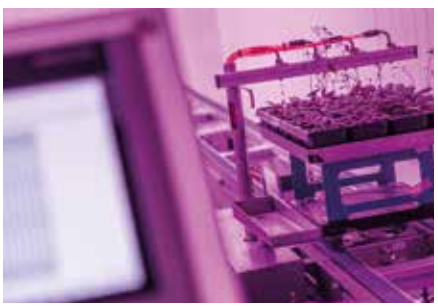
NMR 600MHz: Nuclear Magnetic Resonance spectrometer designed to analyze complex matrices such as foods, biological fluids, pharmaceuticals and industrial products, allowing the characterization of fine spectral features.

HPLC-DAD and HPLC-DAD-MS

High performance liquid chromatography system coupled to a high resolution mass spectrometer including ion mobility for the untargeted analysis of primary and secondary metabolites in complex matrices.

Fast-GC-MS/MS

Fast-gas chromatograph coupled to a triple quadrupole mass spectrometer for the quantification of primary metabolites and VOCs.



Phenotyper

High performance automated RGB and hyperspectral phenotyping platform under controlled conditions of temperature, humidity, type and intensity of lighting with automatic irrigation and weighing system for plants up to 1.3 m in height.

Equipment to be purchased on FRUITOMICS 2.0 financing

- **GC-MS-IRMS:** gas chromatograph interfaced to an isotopic mass spectrometer for the 'compound specific' isotopic analysis of the elements carbon, hydrogen, nitrogen and oxygen of molecules from solids, fluids and gases to improve the traceability and verification of authenticity of the products of the agrifood chain.
- **GCXGC TOF-MS:** two-dimensional gas chromatograph coupled to a time-of-flight mass spectrometer allowing the expansion of activities in the areas of untargeted analysis of volatile compounds by studying in detail the effect of the genotype-environment interaction on the composition and quality of foods.
- **UHPLC/DI-HRMS:** high performance liquid chromatography system and double syringe pump coupled to a very high resolution mass spectrometer (UHPLC/DI-HRMS) which transversally, in the metabolomics and isotopic platforms, will allow a decisive step forward both in the targeted and untargeted analysis of non-volatile compounds in complex matrices and in isotopic analysis.
- **HR-CI-IMS-ToF:** will improve the selectivity and sensitivity of the techniques now in use for the direct and real-time monitoring of volatile compounds allowing the enhancement of applications for sensory analysis, rapid phenotyping, plant biology, breath analysis and process control.
- **Calibration machine:** used to classify the different quality levels of fruit being processed.
- **SSD and capacitive storage and computational nodes:** components that update/expand the computational capabilities of data management of the computing infrastructure, particularly in the field of artificial intelligence.
- **High-precision gas analysis:** gas field analyzer for simultaneous and continuous high-frequency measurements of the concentration of nine greenhouse gases (nitrogen oxides, ammonia, carbon dioxide, carbon monoxide, methane, ozone).
- **Photosynthesis and fluorometry detector:** portable system for simultaneous measurement of photosynthesis and chlorophyll fluorescence in plants.
- **Porometer/fluorometer:** ultra-portable system for rapid measurements of porometry, chlorophyll fluorescence and stomatal conductance on leaf surfaces.
- **Hyperspectral system:** for continuous and automatic measurement of solar-induced chlorophyll reflectance and fluorescence.

HUMAN CAPITAL

Emanuela
Betta

Daniela
Bona

Leonardo
Cerasino

Fabiana
Cristofolini

Lorenza
Dalla Costa

Michele
Dalponte

Claudio
Donati

Isabella
Endrizzi

Mingai
Li

Elena
Franciosi

Matteo
Girardi

Claudia
Longa

Domenico
Masuero

Valerio
Mazzoni

Federico
Ossi

Massimo
Pindo

Marco Valerio
Rossi Stacconi

Pavel
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Tobias
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Zampedri


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