



MICROBION

Open Innovation in Agri-Food Microbiology

Antonio Del Casale

CEO & Business Development

a.delcasale@microbion.it

mobile +39 347 483 1103



WHO WE ARE

Microbion is a CRO providing **microbiology R&D** services to

✓ **discover** ✓ **control** ✓ **exploit**

the **best performing** microbes (strains) for each application,
through innovative **DNA-based methods**.

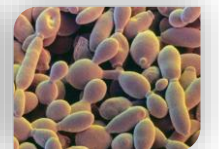
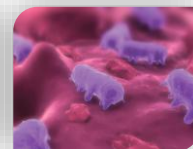
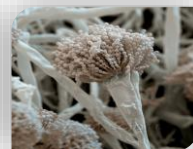


Problem solvers

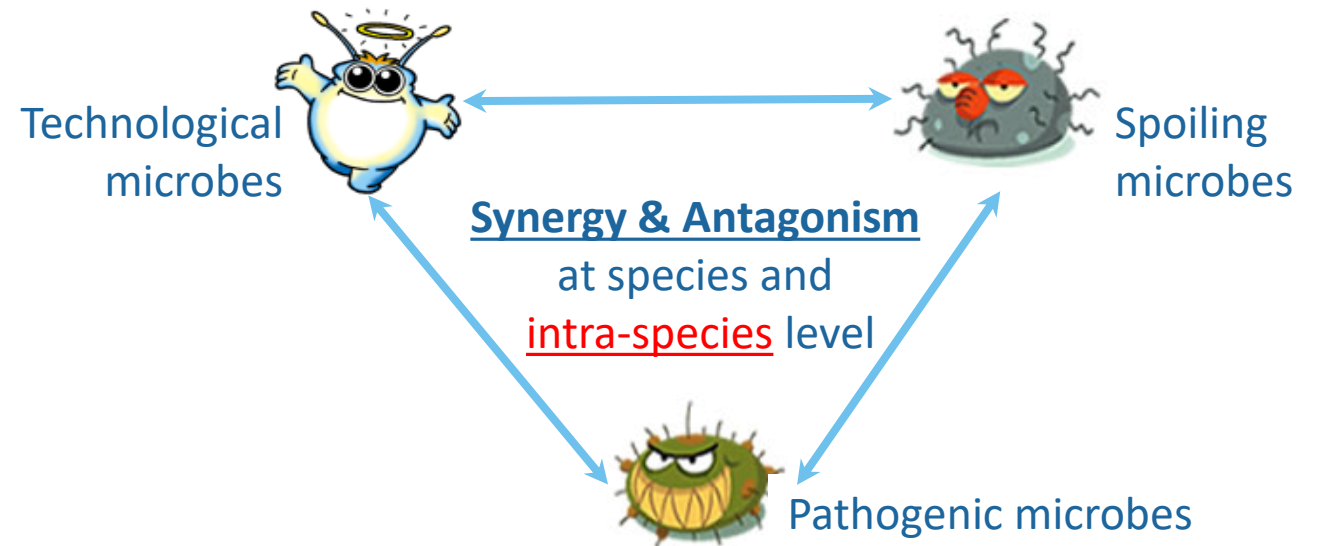
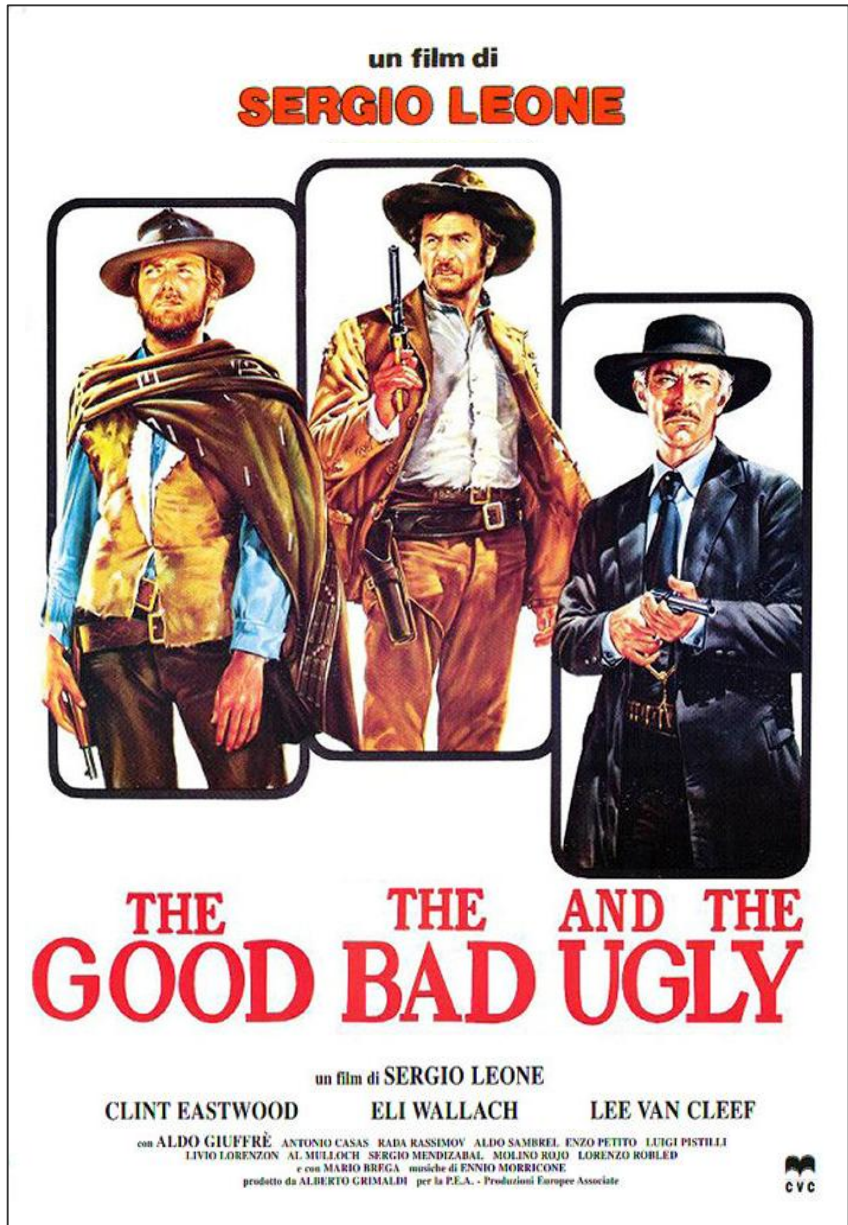


Innovation enablers

microbion



OUR PLAYGROUND: MICROBIAL BIODIVERSITY



OUR STORY



Spin-off
Verona
University

2011



1st business
partner

2012



1st Strain
licenced

2014



1st Patent
deposit

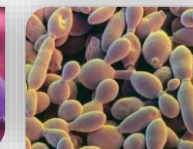
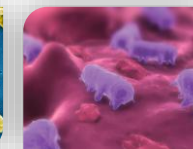
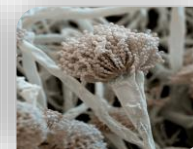
2015



1st EU project
+ EIT Food
acceleration

2017

microbion



OUR STORY



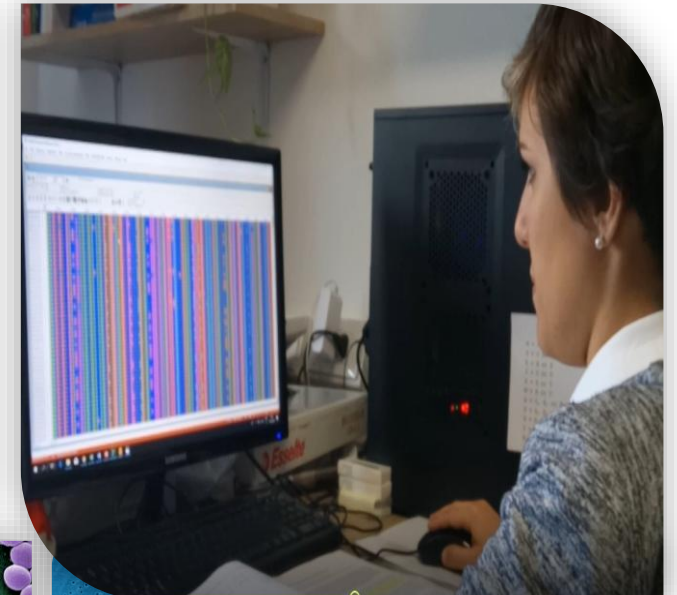
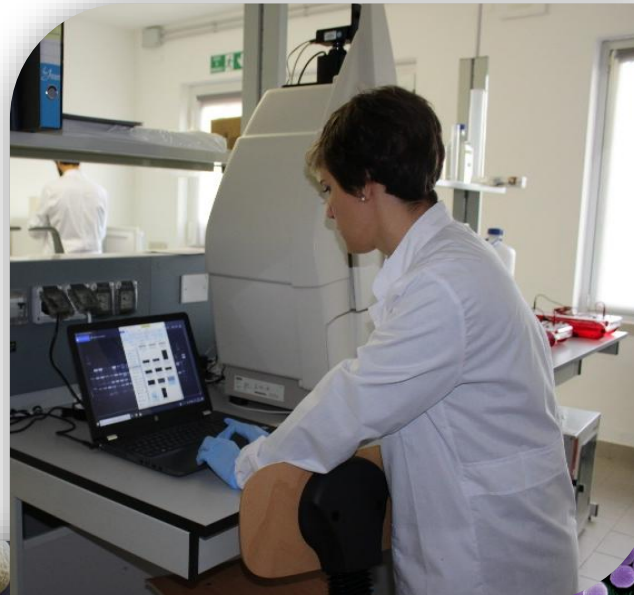
Spin-out
from campus

2018

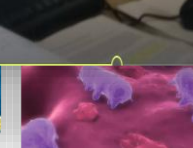
- ✓ **300 m² labs**
- ✓ 5 lab technician
- ✓ 4 R&D managers
- ✓ 3 freelance specialists

- Microbiology lab (BSL2)
- Molecular biology lab
- Bio-banking unit
- Bio-informatics unit

> 60 customers served
> 1 M€ service sales
(cumulative)



microbion

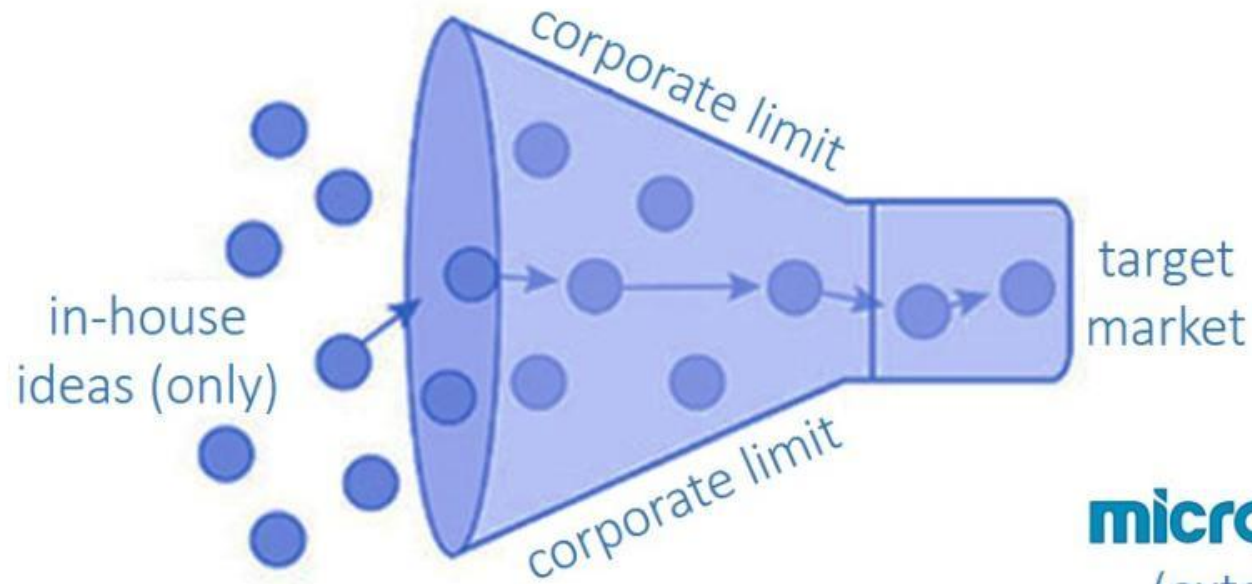


THE OPPORTUNITY

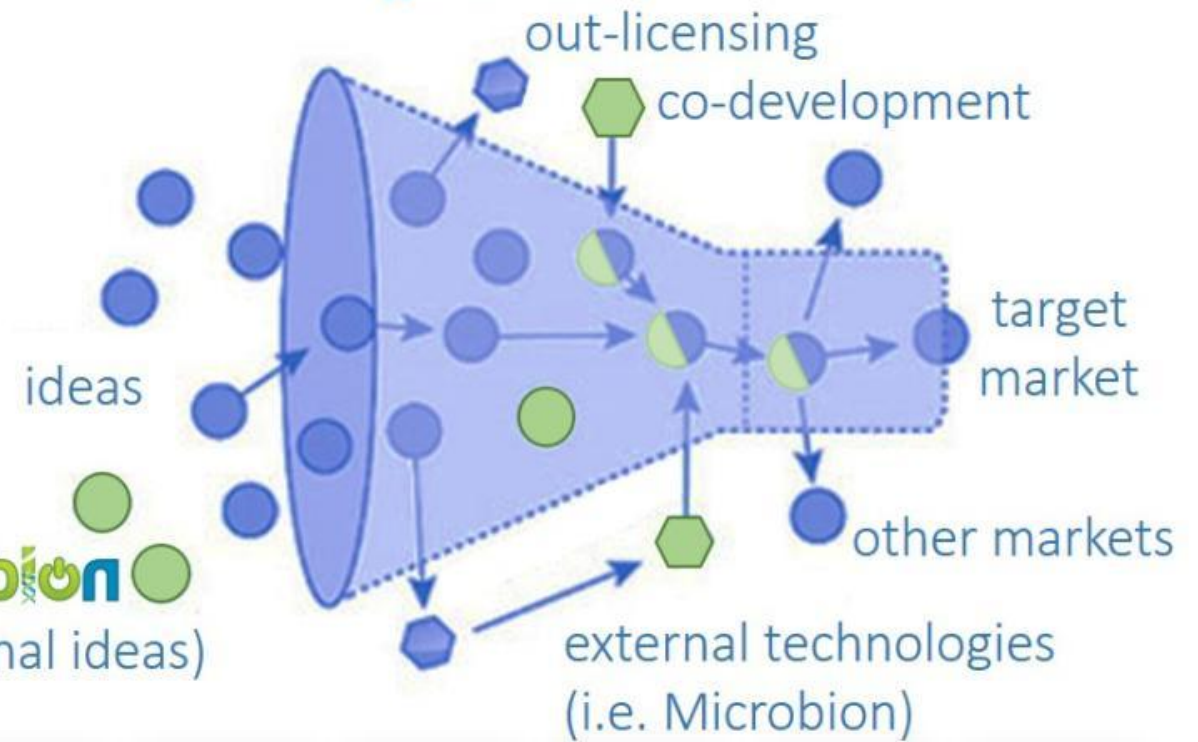
Closed Innovation (past)

Vs

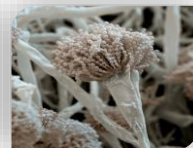
Open Innovation (present)



microbion
(external ideas)



microbion



OUR PLAYGROUND: MICROBIAL BIODIVERSITY



Naturally Occurring

- Biofilms, spores, heat-resistant
- Emerging resistant strains

Spoilage, outbreaks, RCA
Batch val. & Product shelf-life

Food Safety

Product stability
Challenge tests

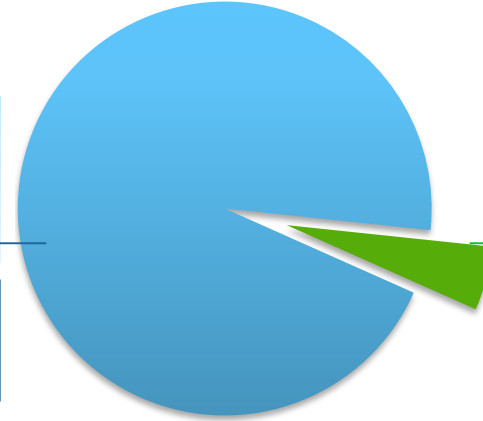
Process Validation

Risk assessment
Genomics of Antibiotic Resistance

Health

Identification, bioindicators
Detection, rapid & portable dev.

Molecular Diagnostics



We provide
insight and
practical solutions
for any application

Industrial microbes

- Selected, manufactured and applied
- Controlled spontaneous fermentation

Bio-fertilisers, biostimulants
Bio-pesticides, biocontrol

Agriculture

Cultured food & beverages
Spontaneous Fermentations

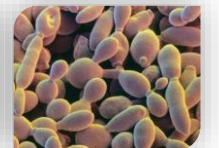
Food

Probiotics, pre/post-biotics
Microbiota in-depth analysis

Health

Bio-fuels, WWTP, bio-plastics
Precision Fermentation

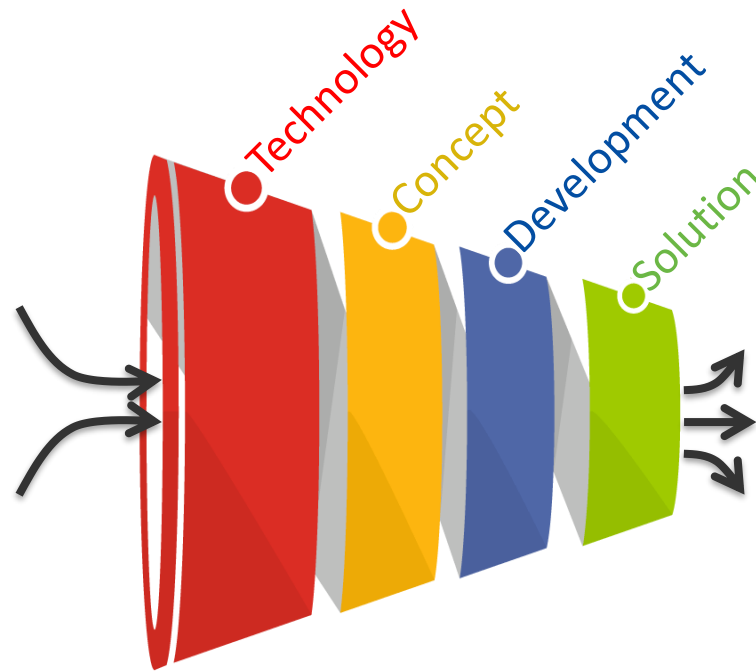
Green Chemistry



OUR KNOW-HOW AT WORK

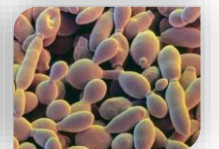
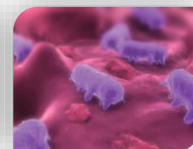
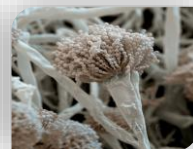
Know-how:

- Molecular microbiology
- Species identification
- Strain characterization
- Strain authentication
- Bio-banks screening
- Genome analysis
- Comparative genomics
- Metagenomics
- Culturomics
- Patents expertise
- Agri-Food & Pharma Regulatory



Services provided:

- ✓ Starter selection
- ✓ Strain tracking
- ✓ Fermentation monitoring
- ✓ Safety assessment
- ✓ Strain manufacturing & quality control
- ✓ Microbial stability tests
- ✓ Microbiota analysis
- ✓ Challenge-tests of product/plant
- ✓ Bio-banks of contaminants/strains
- ✓ Strain-specific diagnostics
- ✓ Intellectual Property Rights
- ✓ Business intelligence
- ✓ Regulatory Compliance



INNOVATIVE STRAINS SELECTION

A practical example of one of our projects

The problem:

Amarone wine is made from 2 months dried grapes

➔ only 2 strains commercially available can work at this sugar/alcohol concentration ranges

The solution:

- Bio-based fermentation optimisation
- Regulatory compliance (DOC)
- Distinctive traits and improved quality wines

Native yeast populations study (1000+ yeasts)



MASI Yeast Bio-Bank (100+ yeasts)



Experimental wine production (10+ yeasts)



Scale-up winemaking (2 yeasts)

***S. cerevisiae* & Non-Saccharomyces**

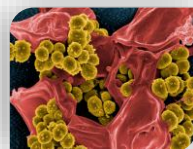


- ✓ Distinctive flavours
- ✓ Cost saving & less CO₂ footprint
- ✓ Seasonal consistency
- ✓ Unique on the market!

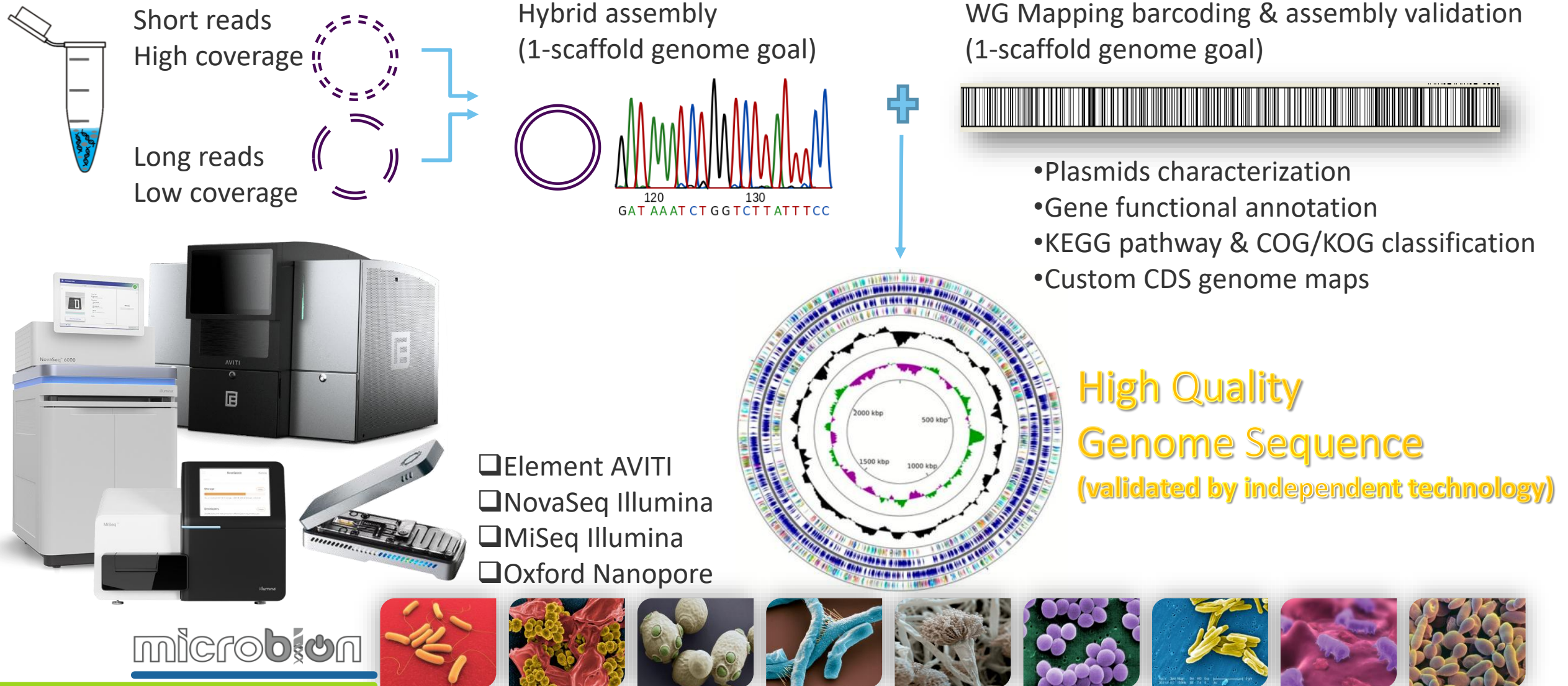


MASI
AGRICOLA

microbion

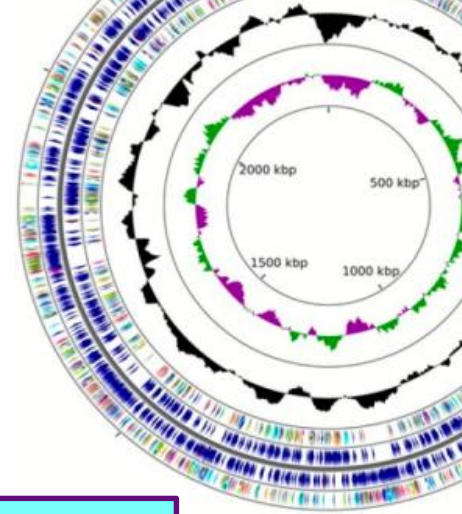


COMPARATIVE GENOMICS PIPELINE



COMPARATIVE GENOMICS PIPELINE

Comparative genomics dedicated standard/custom databases



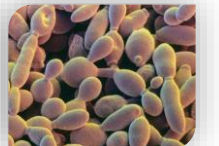
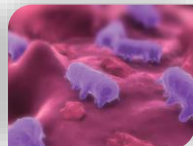
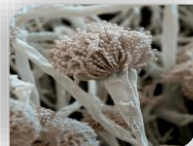
- Pests antagonism
- Adhesions genes
- Short chain fatty acids
- Bacteriocins
- C/N metabolisms
- Mechanism of action genes



- Virulence genes
- Antibiotics resistance
- Biogenic amines
- Antigens
- Bacteriophages
- Horizontal gene transfer



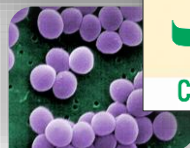
- Plasmids
- Diagnostics biomarkers
- Field trials tracking
- Genome stability
- Differentiation from prior patented strains



Need support?

Need support?

Based on: Patel and Gupta (2020). *Int. J. Syst. Evol. Microbiol.* 2020;70:406–438.



UNITED NATIONS

REGULATORY COMPLIANCE

Experience with international regulatory authorities:

EFSA (EU)
EMA (EU)
FDA (USA)
EPA (USA)
SAHPRA (South Africa)
CFIA (Canada)
MFDS-KFDA (Korea)

Experience in compliance of product categories:

Agro-chemicals
Food/Feed Ingredients
Food/Feed Additives
Food/Feed Supplements
Medical Devices
Drugs (Live Biotherapeutic Products)

Experience with the demonstration process:

Genome-bases safety assessment
QPS status
GRAS status
Field Trials for claims substantiation
Clinical Trials for claims substantiation

Adopted: 28 June 2024

DOI: 10.2903/j.efsa.2024.8912

STATEMENT

efsa JOURNAL

EFSA statement on the requirements for whole genome sequence analysis of microorganisms intentionally used in the food chain

European Food Safety Authority (EFSA)

Correspondence: feedap@efsa.europa.eu

Abstract

Microorganisms, genetically modified or not, may be used in the food chain either as active agents, biomasses or as production organisms of substances of interest.

Microbion is among the panellist for new standard for genome sequencing and analysis!

mic



INTELLECTUAL PROPERTY RIGHTS

Business Intelligence services:

- ✓ collect strains from IDA bio-banks anonymously
- ✓ compare your strains with competitors and with prior-art strain
- ✓ technology scouting and market research
- ✓ competitive advantage analysis

Patent filing services (microbes and/or their application):

- ✓ prior-art search
- ✓ requirements check
- ✓ IDA compliant deposit
- ✓ technical description to the patent attorney
- ✓ reply to evaluators with the patent attorney

Examples of patents registered by our customers:

EP3194565A2 - Strain of the yeast species *Saccharomyces cerevisiae*, strains essentially derived from it and use thereof

WO2019123329A1 - Composition for use in the treatment and/or improvement of sleep and mood disorders (probiotics)

ITUB20152796A1 - Ceppo di *Saccharomyces cerevisiae* CS1, sue composizioni e suoi usi



We can collaborate with your favourite patent attorney, or we can offer turnkey service together with N&G law firm

microbion



OUR TECHNOLOGIES

MICROBIOLOGY

- ☐ Plate counts
- ☐ Antagonism assays
- ☐ Phenotypic assays
- ☐ Antimicrobials resistances
- ☐ Fermentation
- ☐ Stability-tests
- ☐ Lyophilization
- ☐ Cryopreservation
- ☐ Microscopy

..and more

MOLECULAR BIOLOGY

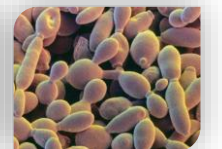
- ☐ End-point PCRs
- ☐ Fingerprinting PCRs
- ☐ Real-Time PCRs
- ☐ Quantitative PCRs
- ☐ Viability PCRs
- ☐ LAMP-PCRs
- ☐ Multi-locus sequence typing
- ☐ In-situ FISH
- ☐ Optical mapping

...and more

INNOVATIVE TECHNOLOGIES

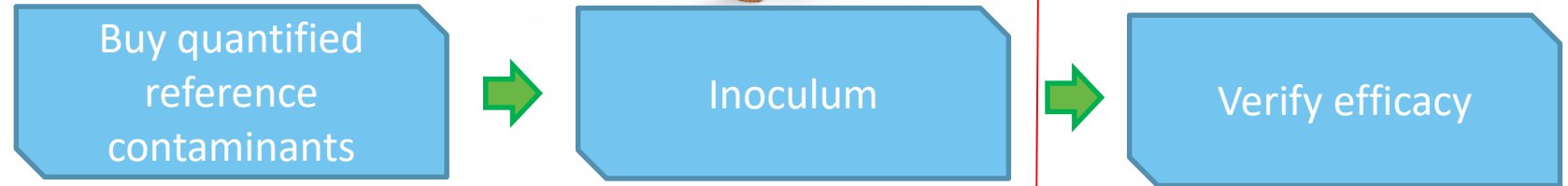
- ☐ Whole genome sequencing
(long reads & short reads)
- ☐ Bioinformatics
- ☐ Transcriptomics
- ☐ Metabarcoding
- ☐ Metagenomics
- ☐ Flow Cytometry
- ☐ Infrared spectroscopy
- ☐ MALDI-TOF

...and more

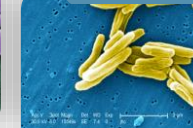
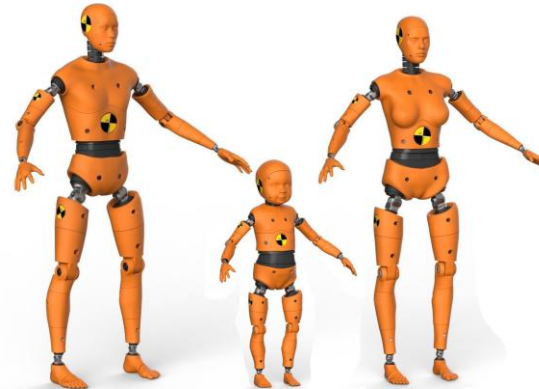


CHALLENGE TEST 2.0

Classic Challenge-test



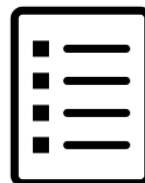
Challenge-test 2.0



OUR EXPERTISE



Microorganisms
Identification



Microorganisms
Characterization



Microorganisms
Validation



Challenge
Tests

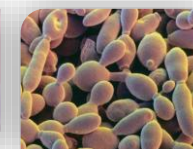
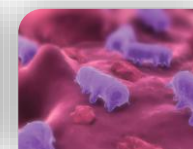
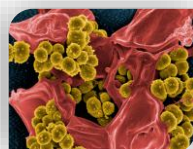


Technical
Problem Solving



IPRs & Regulatory
Support

microbion



OUR MARKETS

Best-selling services:

- ✓ Genome-based safety assessment reports
- ✓ Customised molecular analyses (PCRs)
- ✓ Strains selection and characterization
- ✓ Food Challenge-Tests & cleaning validation
- ✓ Open Innovation microbiology services

Our products:

- ✓ SAFEbion-V (SARS-CoV-2 surrogate)
- ✓ Biological Standards for validation of microbial load reduction and sanitization

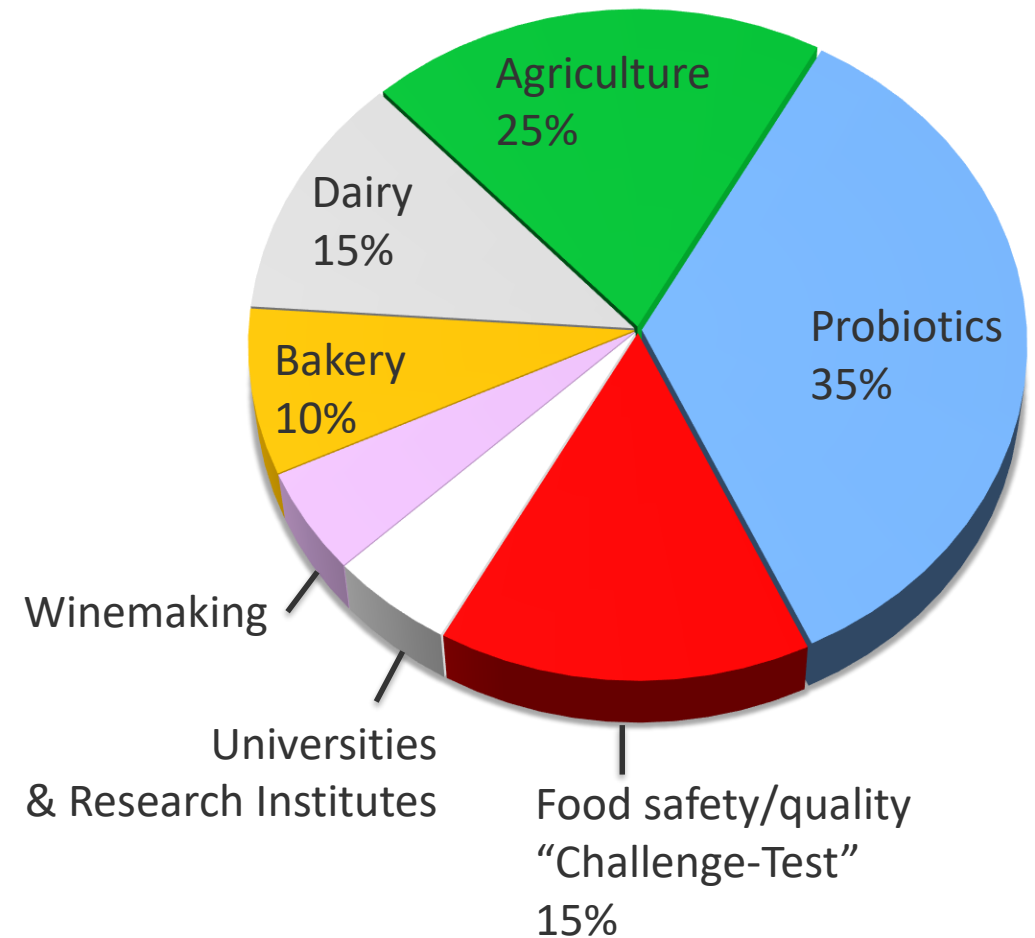
International markets served:



microbion



Customer's markets



MICROBION PROPRIETARY TECHNOLOGY (HPME)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization

International Bureau

(43) International Publication Date
25 January 2018 (25.01.2018)



(10) International Publication Number
WO 2018/014979 A1



Granted 2024



In progress

Highly polymorphic and modular extragenic (**HPME**) markers within specific taxa of microorganisms and use thereof for their differentiation, identification and quantification:

- TRL 9 Probiotics application
- TRL 8 Agriculture bio-control application
- TRL 7 Fermented foods application

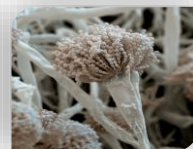
Validated differentiation of all species & subspecies of:

- ✓ ***Lactobacillus***
- ✓ ***Bifidobacterium***
- ✓ ***Bacillus***
- ✓ More genera with HPMEscan

Distinguish genetically close-related microbes even in mix
Solve the problem of very similar 16S rRNA sequences!

- Microbion unique services
- License for diagnostic devices

microbion





Transparency solutions for transforming the food system



Funded by
the European Union

Horizon Europe
HORIZON-CL6-2021-FARM2FORK-01-17
Grant Agreement 101060739

September 2022 – September 2026
Budget € 11M
27 Partners



www.titanproject.eu



[@TITANprojectEU](https://twitter.com/TITANprojectEU)



[@TITAN Project EU](https://www.linkedin.com/company/titan-project-eu)



PROJECT CONCEPT

Platform for innovations that aid transparency to make the food system **fair, healthy, and environmentally friendly**.

- Food system is highly fragmented
- Claims are difficult to be verified

15 innovative solutions

(prototype to market launch)

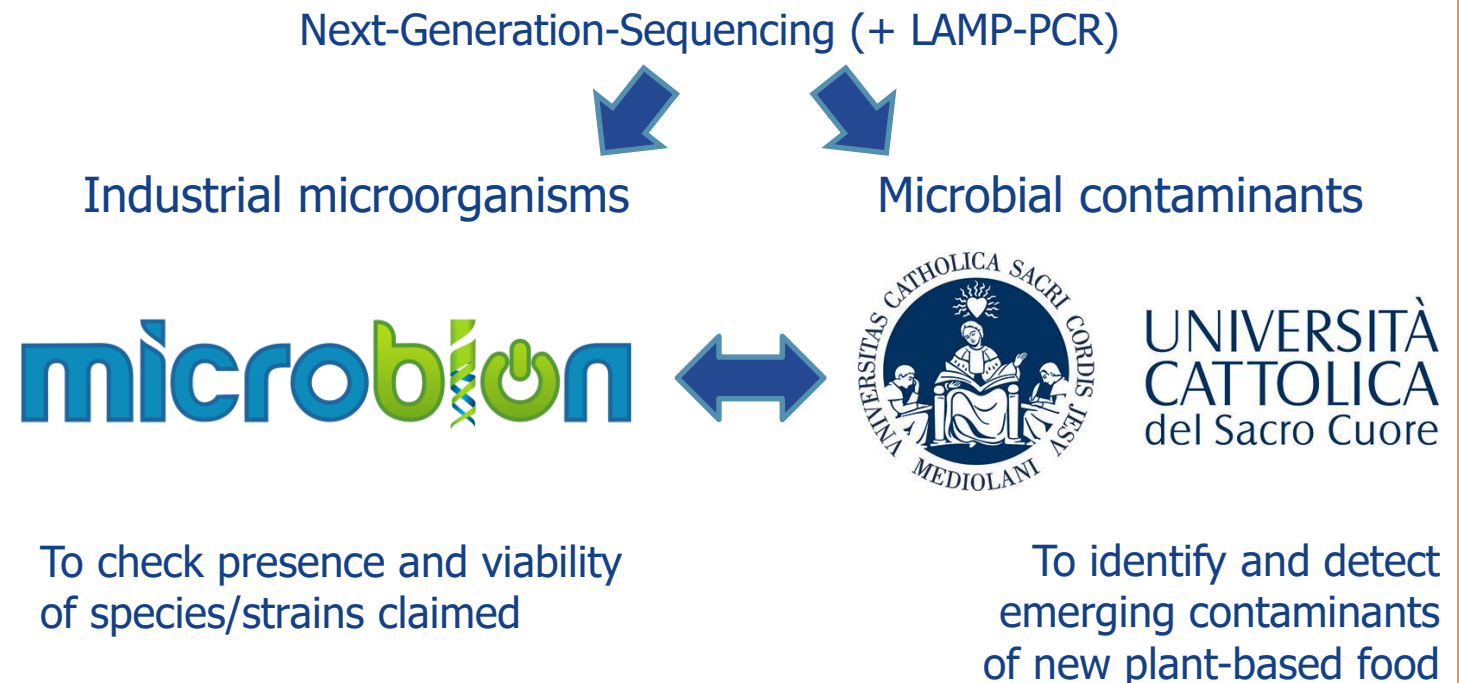
DNA-based Rapid Methods

- Blockchain
- Artificial Intelligence
- Internet of Things



3 Domains

- Safety
- Sustainability
- Health



STATE OF THE ART

Huge potential of NGS

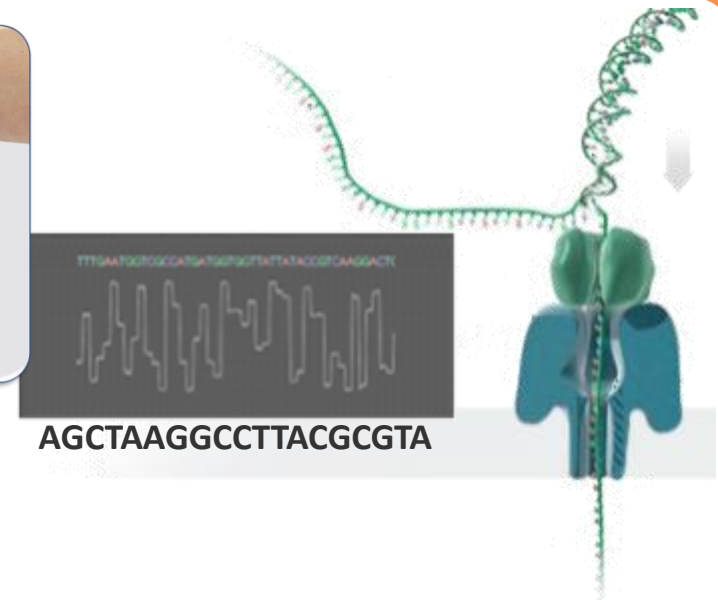
- Portable NGS devices
- Easy to use
- Inexpensive
- Fast protocols

Metabarcoding based on **16S rRNA**

- Universal marker (universal PCR primers)
- Comprehensive public databases for match
- Identical in close related species
- Great for research (not for QC)

Metabarcoding based on **HPME markers**

- Genus-specific markers (multiplexable)
- **Hyper variable regions** (sequence & length)
- Resolve close related species/subspecies/strains
- Match with Microbion database
(international patent WO2018014979A1)



.....*..**..***.....***..*
AGCTCGTTC**CGGATC**GGCATGCAT**GCAT**TGATACGCT
AGCTCGTG**CATGCG**AGGCATGCAT**AGCT**CGATACGCT
AGCTCGT**CCCGGATG**GGCATGCAT**CAAT**AGATACGCT

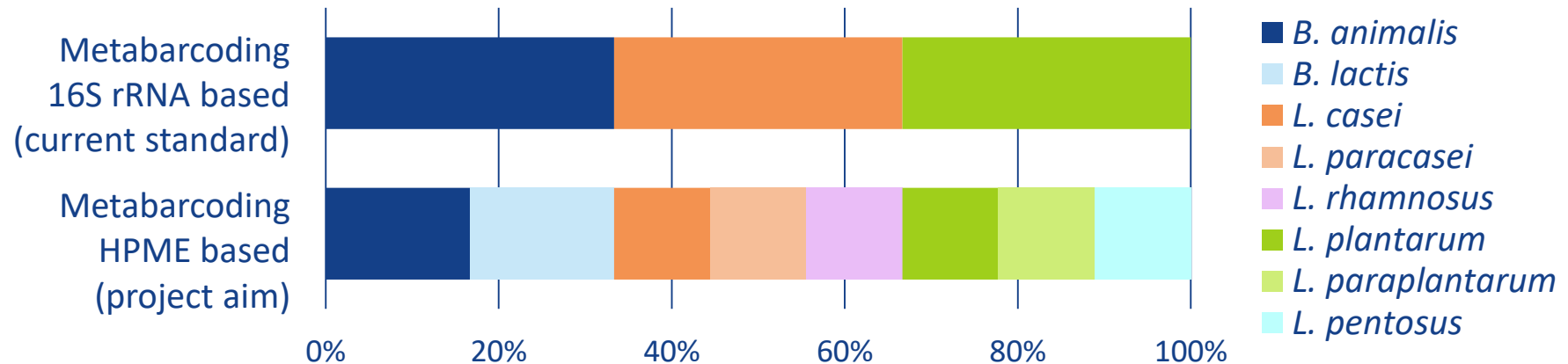
Conserved
(PCR primers)

Variable
(informative)

Conserved
(PCR primers)

.....*****.....
AGCTCGT**TC**--**GATGCATT****CGG**--**CATGCATT**--**CGATT**GATACGCT
AGCTCGTGATCG--ATC---ATCGCAGGCGCAGCTTCGCGATACGCT
AGCTCGT**CT**--**CGATC**--**GC**----**CAAA**-----**GTACC**GATACGCT

FIRST DELIVERABLE



NEW SERVICE!
Flow Cytometry + NGS
Enumeration and identification within 24 hours

- ✓ Probiotics
- ✓ Food Cultures
- ✓ Biocontrol & Biostimulants

EIT FOOD PAST PROJECTS



INNOPOULTRY

BP2018

New feeds for poultry industry

- Probiotics
- Microbiome improvement

[click here to know more](#)



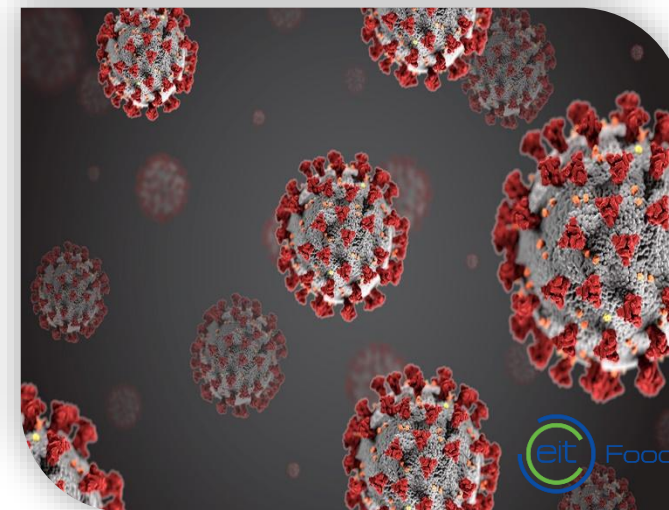
FISH TRUST

BP2018 & 2019

Portable device for fish fillets
quality & safety

- Microbial load
- Listeria detection

[click here to know more](#)



COVID-19 BEAM IT UP

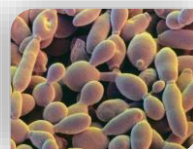
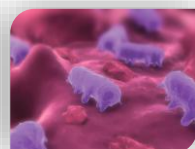
BP2020

SARS-CoV-2 model to validate detection
and sanitization products and protocols

- Surrogate virus
- Portable, fast, easy-to-use
diagnostic device

[click here to know more](#)

microbion



PIMENTO COST Actions (2021-25)



Promoting Innovation of ferMENTed fOods


- **200+ experts:**
Universities, Industries, NGOs
- **Main WPs:**
 - Cartography of Fermented Foods (FF)
 - Health benefits and risks of FF
 - **Federating scientists and FF producers to boost innovation for society (co-leader)**
- **Microbion's role:**
Research-Industry connector and catalyser

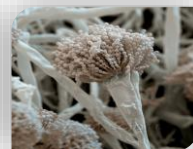
[Click here to know more](#)



SCAN ME!



- ✓ Survey on bottle-necks of innovation in FF 
 - Regulatory
 - Food Safety
 - Tech & Processing
- ✓ Position paper to EU Commission
- ✓ Partnership with EFSA for guidelines
- ✓ Association of the European FF industry





Antonio Del Casale
CEO & Business Development
a.delcasale@microbion.it
mobile +39 347 483 1103



THANK YOU!

microbion

