





## MICROBION

**Open Innovation in Agri-Food Microbiology** 

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### 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





















### **OUR STORY**





Spin-off Verona University

2011



1<sup>st</sup> business partner

2012



1<sup>st</sup> Strain licenced

2014



1<sup>st</sup> Patent deposit

2015



1st EU project + EIT Food acceleration

2017





















### **OUR STORY**



Spin-out from campus

2018

- √ 300 m<sup>2</sup> 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)



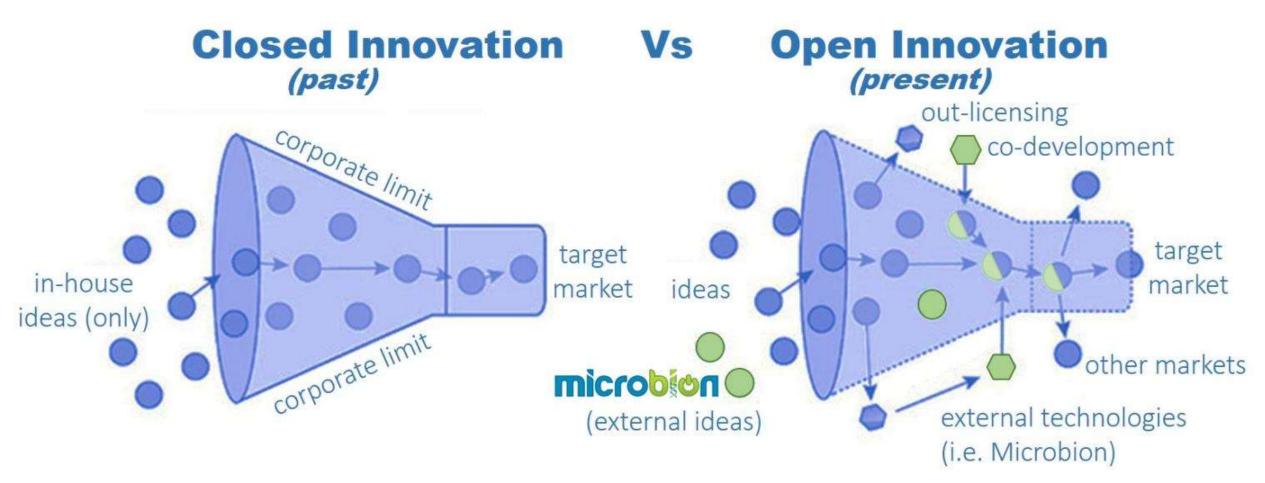








### THE OPPORTUNITY

























### **OUR PLAYGROUND: MICROBIAL BIODIVERSITY**

### un film di SERGIO LEONE



GOOD BAD UGLY

un film di SERGIO LEONE

CLINT EASTWOOD

ELI WALLACH

LEE VAN CLEEF

cvc

com ALDO GIUFFRÈ ANTONIO CASAS RADA RASSIMOV ALDO SAMBREL ENZO PETITO LUIGI PISTILLI
LIVIO LORENZON AL MILLIOCH SERGIO MENDIZARIAL MOLINO ROJO LORENZO ROBLED
e com MARIO BREGA moriche di ENNIO MORRICONE
produtto da ALBERTO GRINALDI per la FEA. - Fredoriumi Europee Associate





















Spoiling microbes

**Synergy & Antagonism** 

at species and intra-species level



Pathogenic microbes

### **OUR PLAYGROUND: MICROBIAL BIODIVERSITY**



### **Naturally Occurring**

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

Spoiling, outbreaks
Product shelf-life

### **Food Safety**

Product stability Challenge test

### **Process Validation**

Risk assessment Genomics of Antibiotic Resistance

### Health

Identification, rapid kits
Detection, portable devices

**Molecular Diagnostics** 

We provide insight and

practical solutions for **any application** 

### **Industrial microbes**

- Selected, manufactured and applied
- Controlled spontaneous fermentation

Bio-fertilisers Bio-pesticides

### Agriculture

Cultured food & beverages
Spontaneous Fermentations

### Food

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

### Health

Bio-fuels, bio-plastics Bio-preservatives

**Green Chemistry** 





















### **OUR EXPERTISE**





Microorganisms Identification



Microorganisms Characterization



Microorganisms Validation



Challenge Tests



Technical Problem Solving



IPRs & Regulatory
Support

















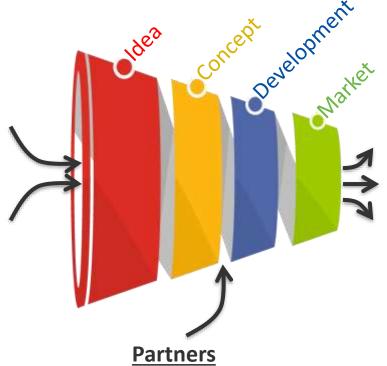




### **OUR KNOW-HOW AT WORK**

### **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





















### **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)
- Bioinfomatics
- ☐ Transcriptomics
- Metabarcoding
- Metagenomics
- ☐ Flow Cytometry
- ☐ Infrared spectroscopy
- MALDI-TOF

...and more





















Practical example of one of our projects

### The problem:

Amarone wine is made from <u>2 months dried grapes</u>

→ only 2 strains <u>commercially available</u> 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 CO<sub>2</sub> footprint

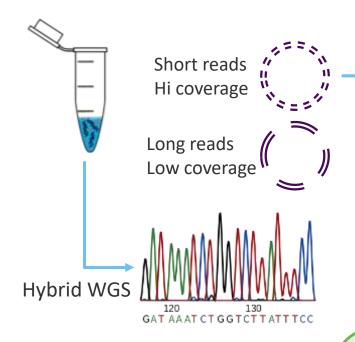
**Seasonal consistency** 

Unique on the market!

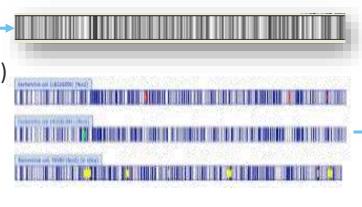


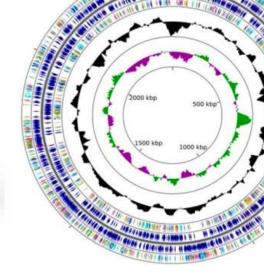


### **COMPARATIVE GENOMICS PIPELINE**



WG Mapping barcoding + assembly validation (1-scaffold genome goal)





Comparative genomics <u>dedicated standard/custom databases</u>



- -Pathogen antagonism
- -Adhesions genes
- -Short chain fatty acids
- -Bacteriocins
- -Mechanism of action genes



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





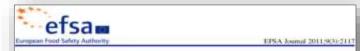
- -Field trials tracking
- -Genome stability
- -Differentiation from prior patented strains





### **TAXONOMY & REGULATORY UPDATE**





#### SCIENTIFIC OPINION

### Guidance on the assessment of microbial bi

EFSA Panel on Additives and Products or Substances (

European Food Safety Authority (EFS)

#### BACKGROUND

Directive 82/471/EEC4 regulated the use of certain products in direct or indirect protein sources. Included in these certain prod fermentation of different substrates by microorganisms. The a value of these products was done according to the guidelines fix

In 2009, the European Parliament and Council adopted Regula on the market and use of feed, which repeals both Directives September 2010. Biomasses produced from non-genetically mo authorisation/assessment to be placed on the market. However, those biomasses which are produced from a genetically modifie

In recent years EFSA has received several dossiers related market of biomasses obtained from the production of amino a applications fall under the scope of Regulation (EC) No 13 genetically modified nucroorganisms. Applicants have been rec by the GMO Panel<sup>4</sup> for the assessment of the genetic modi-Directive 83/228/EEC for the assessment of the product itself. now been repealed, are more than 25 years old and the requir assessment practices of the FEEDAP Panel.

Therefore, there is a need for an up-to-date guidance document dossiers for the assessment of biomasses for use in animal mit nutritional value and safety of the product itself but not modification, which are covered by the guidance of the GMO P.

- On request of EPSA, Question No EPSA-Q-2010-00009, subspect on 96 Mg Panel members: Gabriele Aquillina, Georgeo Breies, Andrew Chessen, Albert Dierick, Miliolaj Artoni Gralak, fürgen Gropp, başrid Hulle, S. Limdebye Huklorien, Alberto Mazeovani, Mikito Mirzes, Denk Si FEEDAP@chacumpact.
- Acknowledgement: The Panel wishes to thank the numbers of the Workin and Atte you Wright, for the preparatory work on this scientific opinion.
- OF L. 213, 21.7, 1982, p. K.
- OF L 126, 13-5, 1983, p. 23.
- OFF 229, 1.9.2009, p. 1 OF L. 26%, 18, 10, 2003, p. 1.
- http://www.efserampe.au/en/edsea/odoc/774.htm

Supposted citation: EPSA Panel on Adultives and Products or Substances as assessment of assertinal biomasses for use in animal matrices. EFSA Journal dis. 10:2003/j.chia. 2011;21:17. Assaliable online: www.efsa.compa.co/efsa/mi

© European Front Safety Authority, 2011

#### WHAT IS AN INTERNATIONAL PROTOCOL?



Users may be corporations, laboratories, research centers, individuals, indigenous peoples and local communities interested on utilizing genetic resources to produce foods, medicine, cosmetics or biochemical. procedures based on biotechnology and research of the geratic information in plants, animals, microorpanisms. lungi and any other sort of being containing genetic information and their derivatives

Furthermore, the protocol is a scientific research incentive guaranteeing legal certainty within an international

framework since it seeks to avoid misappropriation and illegal practices by establishing clear and transparent mechanisms to access genetic resources and associated traditional knowledge.

#### DALS OF THE UMOP-SEMPRIMAT PROJECT

mechanisms between users and suppliers of genetic



To have a logal frame in Mexico and to establish administrative or public paticy measures to regulate access and utilization of genetic resources and associated traditional knowledge thus. guaranteeing fair and





To create a biodiversity value-priented culture among relevant actors as a base for preservation and sostainable use of genetic resources and

annociated traditional

To strengthen institutional

Nagoya Protocol.

capacities related to the



To protect genetic resources and sesuciated traditional knowledge and to foster capabilities related to that protection within indigenous peoples and local communities.

factorial and polymores of

Saley agreeme.



To integrate universities. research centers, civil society organizations, prisate initiative and society overall in the project morementation





### 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



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



### 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 PROPRIETARY TECHNOLOGY

(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)

WIPO | PCT



Highly polymorphic and modular extragenic (<u>HPME</u>) 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 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





### **CHALLENGE TEST 2.0**

**Classic Challenge-test** 

Buy quantified reference contaminants

Inoculum

Verify efficacy

**Equipment sanitization** 

**✓** Pasteurization temperature

**Storage conditions** 

✓ Shelf-life

✓ Packaging barrier

**Preservatives** 

**More reliable** modelling!

**Challenge-test 2.0** 

**Raw Materials** 

Equipment

Contaminants bio-bank

of **native contaminants** 



Production and inoculum

### **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:**













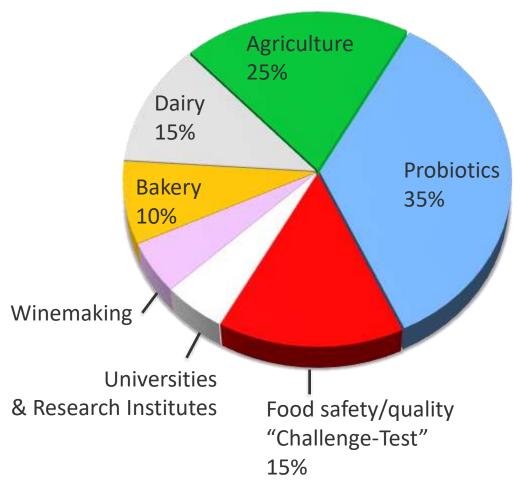








































**EIT FOOD INVOLMENT** 





### EIT FOOD FOCUS AREAS

2.11 Alternative Proteins	<ul> <li>Fungi based foods</li> <li>Microalgae as protein source</li> <li>Bactria for texture in meat analogues</li> </ul>
2.12 Sustainable Agriculture	<ul> <li>Plant growth promoting rhizobacteria</li> <li>Bacteria for biological control of plant disease</li> <li>Nematocides moulds</li> <li>Post-harvest treatment to increase shelf-life</li> </ul>
2.13 Targeted Nutrition	<ul> <li>Probiotics, prebiotics, post-biotics and synbiotics</li> <li>Microbiome changes</li> <li>Fermented foods</li> </ul>
2.14 Sustainable Aquaculture	<ul> <li>Fermentation based feed ingredients</li> <li>Bacteriophages for aquaculture disease control</li> </ul>
2.16 Circular Food System	<ul> <li>Fermentation of side products for feed</li> <li>Shelf-life extension with bio-preservatives</li> </ul>



### **EIT FOOD PAST PROJECTS**



INNOPOULTRY BP2018

New feeds for poultry industry

- **→** Probiotics
- ➤ Microbiome improvement

click here to know more



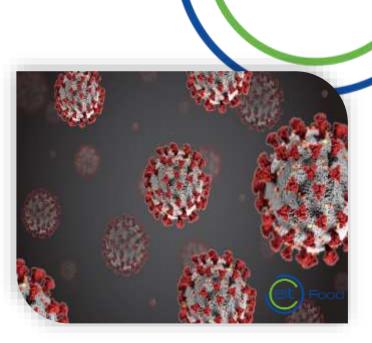


**FISH TRUST BP2018 & 2019** 

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

# ONGOING EU PROJECTS Horizon Europe (2022-26)



### **TITAN**

### Transparency solutions for transforming the food system

• 27 EU partners: Universities, Industries, NGOs

15 Solutions in 3 domains:

- Solutions for Safety
- Solutions for Sustainability
- Solutions for Health
- Disruptive technologies:
  - **DNA-based Rapid Detection**
  - Blockchain
  - Artificial Intelligence
  - Internet of Things

T4.1C (leader)

**Transparency of fermented foods and supplements** 

T4.1D (member)

Safety and sustainability of long shelf-life foods





**Project Leader** 



# ONGOING EU PROJECTS COST Actions (2021-25)



### **PIMENTO**

### 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









- ✓ 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







**THANK YOU!** 



