



VACCINES PROGRAM



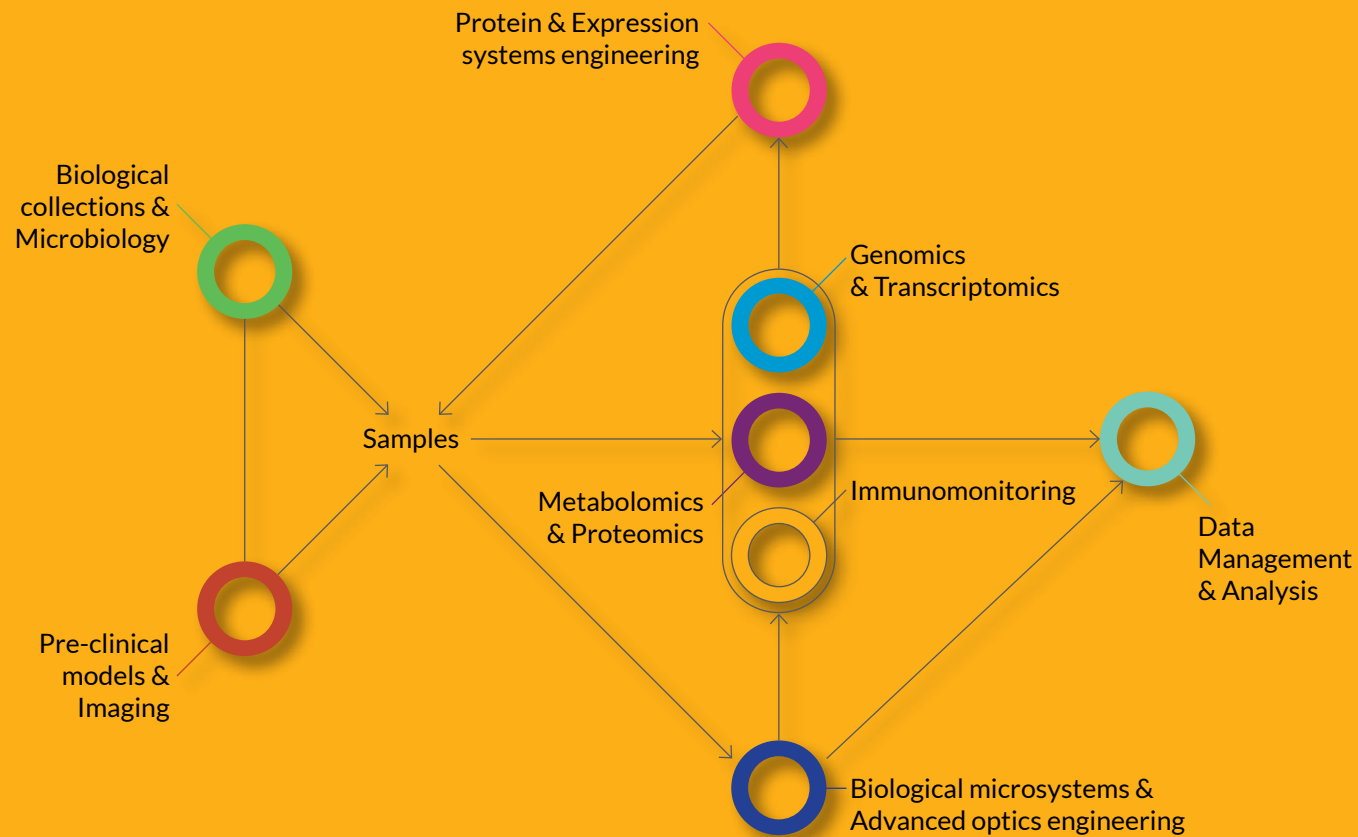
PROGRAM OPPORTUNITIES

PROVIDING TAILORED TECHNOLOGICAL INNOVATIVE SOLUTIONS TO EFFICIENTLY ADDRESS VACCINES NEEDS THROUGH:

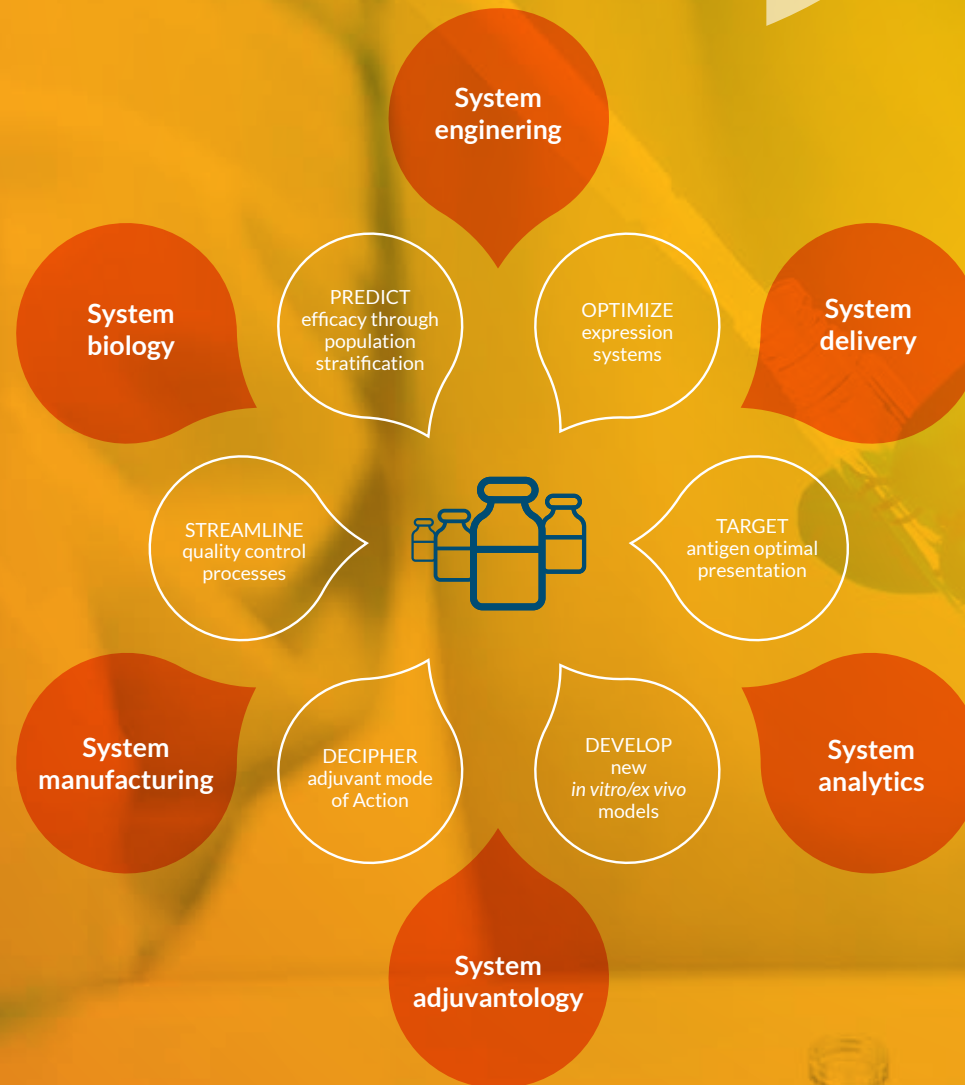
- Co-construction of focused project including relevant academic, private partners and BIOASTER experts
- Technology research units with multidisciplinary innovative strategies
- Integrated pre-clinical, multi/meta OMICs and Immunomonitoring data analyses
- Cost effective implementation

TECHNOLOGICAL INNOVATIONS

TECHNOLOGY UNITS
from sample preparation to data analysis



SYSTEM VACCINOLOGY AS THE KEY TO SUCCESS FOR FUTURE VACCINES



Examples

System engineering

New and improved expression systems through metabolomics engineering
GAME XXL

System delivery

New and optimized vaccines delivery
Nanocage

System analytics

in vitro tools and *ex vivo* models for biological read outs
Bind it

System adjuvantology

Adjuvant mode of action deciphering
MS imaging

System manufacturing

Product quality through predictive biomarkers
Insight cells

System biology

Biomarkers for population stratification and reactogenicity/efficacy prediction
Data management, infrastructure and algorithms

NEW AND IMPROVED EXPRESSION SYSTEM THROUGH METABOLIC ENGINEERING

Example
System engineering

GAME XXL: Genomic And Metabolomic Engineering for controlled and robust antigens lipidation

INTEREST

Potential applications:

- Improve lipoprotein lipidation
- Non native lipidated proteins engineering
- Universal lipidation tool for addition of TLR2 agonist activity

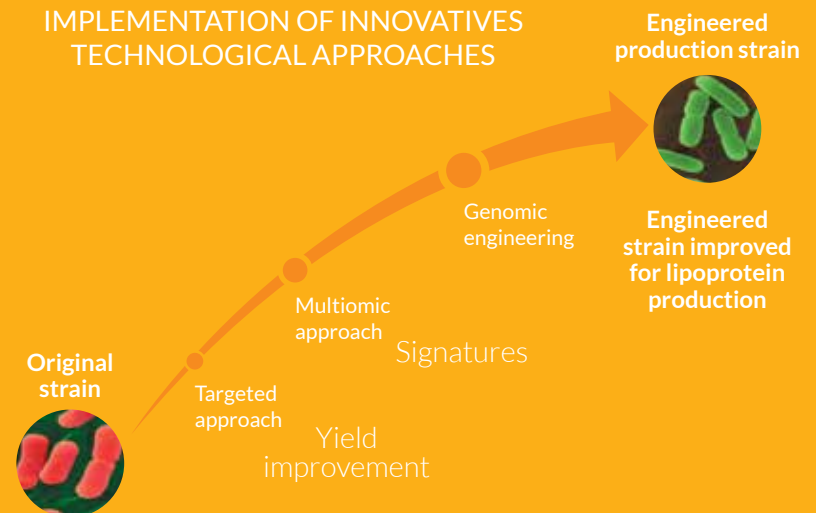
ADVANTAGES

- Improve robustness of production process
- Decreased CoGs
- Streamlined analytical tools
- Generation of self-adjuvanted antigens

KNOW HOW

- Vector optimization
- Multiomics & functional analysis workflow
- Host system engineering and optimized process

IMPLEMENTATION OF INNOVATIVE TECHNOLOGICAL APPROACHES



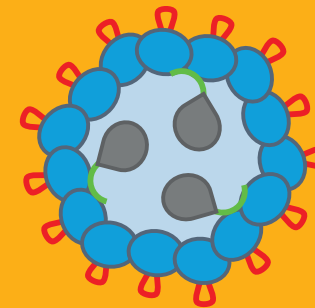
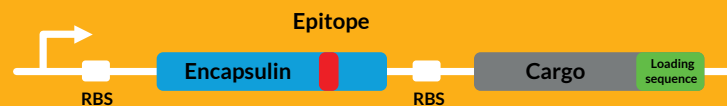
NEW AND OPTIMIZED VACCINES DELIVERY

Example System delivery

NANOCAGE: versatile protein cage nanoparticles for target epitope surface display & heterologous protein packaging

INTEREST

- Target surface presentation & internal cargo loading
- Epitope repetitiveness (high immunogenicity)
- Versatile nanocage tool

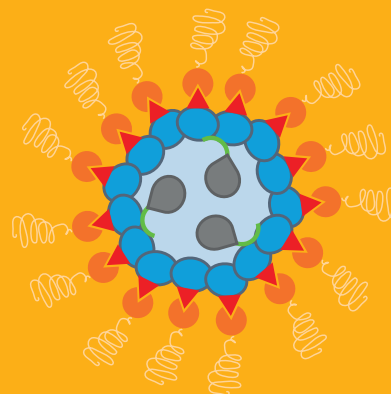
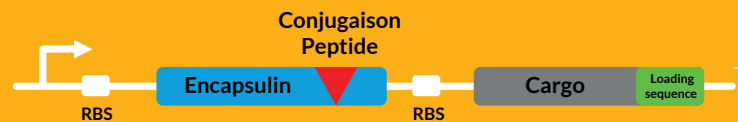


ADVANTAGES

- *in vitro* auto-assembly
- Generation of nanoparticles in *E.coli* as well as other expression systems
- Wide array of applications

KNOW HOW

- Industrial USP & DSP process
- Biochemical & physical characterization



IN VITRO TOOLS AND EX VIVO MODELS FOR BIOLOGICAL READ OUTS

Example
System analytics

BIND IT: rapid reagent development for targets of interest

INTEREST

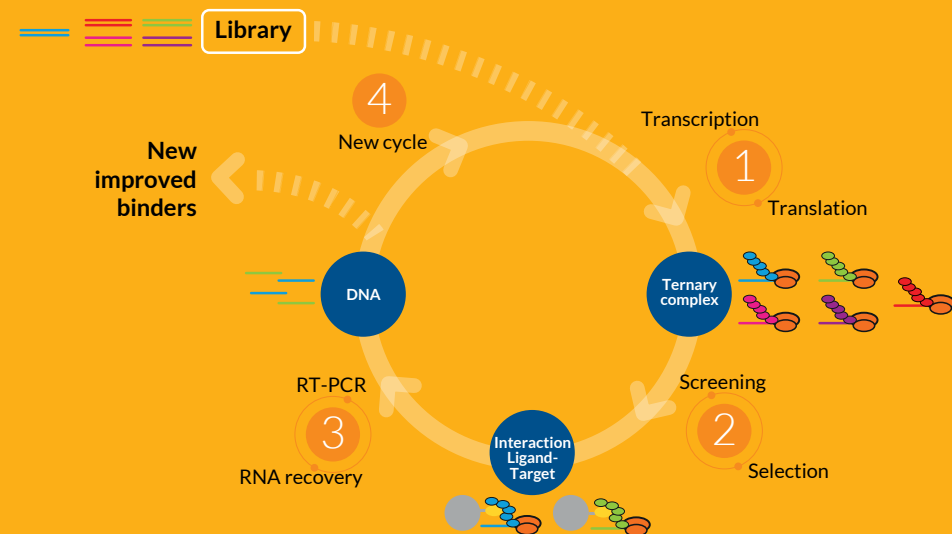
- Rapid access to protein binders/ effectors specific for relevant biological targets
- Potential applications: *in vitro* diagnostics, therapeutics, vaccines, research

ADVANTAGES

- Continuous affinity improvement loop
- Fast and versatile (days to weeks)
- No need for immunization
- Low cost & reproducible *in vitro* production process (*E. coli*)
- No post-translational modifications
- Affinities to the picomolar range

KNOW HOW

- Protein expression and engineering
- Technology display
- Cell free production
- Next generation sequencing



ADJUVANT MODE OF ACTION DECIPHERING

Example
System adjuvantology

MS-IMAGING: DESI-MS for *in situ* adjuvant tracking and inflammation monitoring

INTEREST

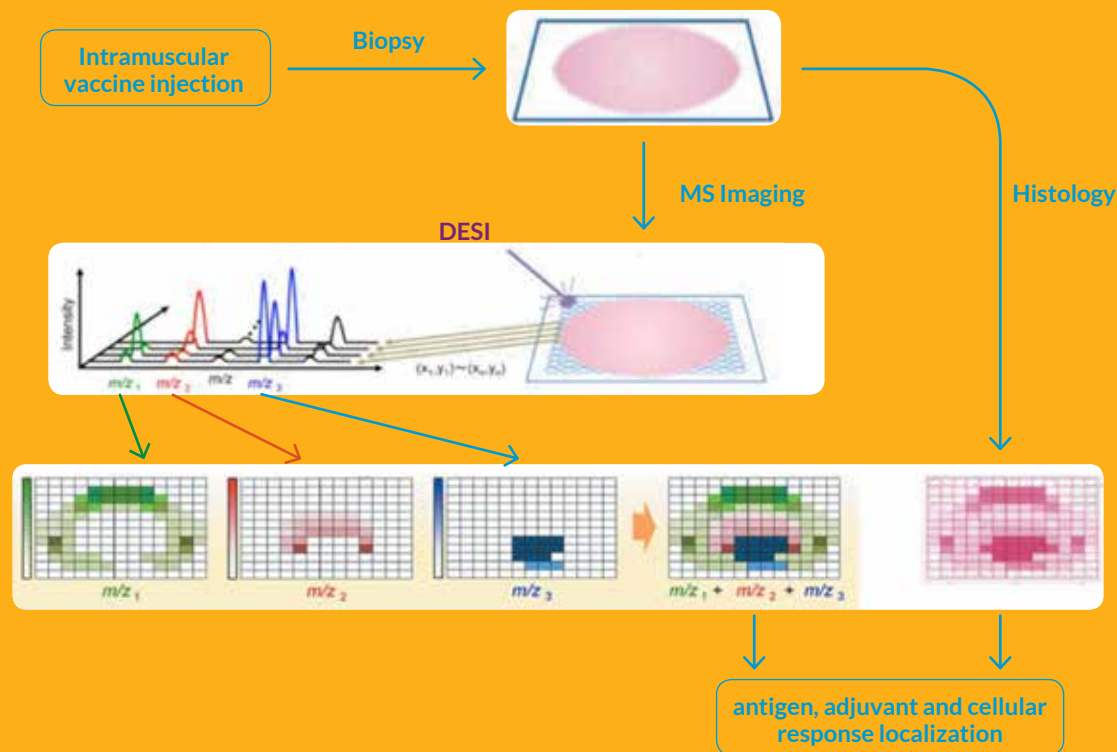
- *in situ* system vaccinology
- Application of metabolomics and proteomics, for the local characterization of vaccine and adjuvant inflammation/ reactivity

ADVANTAGES

- Imaging by mass spectrometry (MSI) allows to analyze antigens, adjuvants and inflammatory lipids simultaneously
- High Resolution MSI allows both targeted and untargeted analyses for monitoring and mechanism comprehension
- DESI is a non destructive technology compatible with histology

KNOW HOW

- DESI platform coupled to a Q Exactive™ HF (Thermo Scientific™) for highest sensitivity and resolution
- Expertise in metabolomics and proteomics for high-value data generation and interpretation
- Histology and histochemistry capacities for global imaging approaches



Adapted from Y. Fujimura & D. Miura, 2014

PRODUCT QUALITY PREDICTION THROUGH PREDICTIVE BIOMARKERS

Example
System manufacturing

INSIGHT CELLS: monitoring live cells growth through bioprocess biomarkers

INTEREST

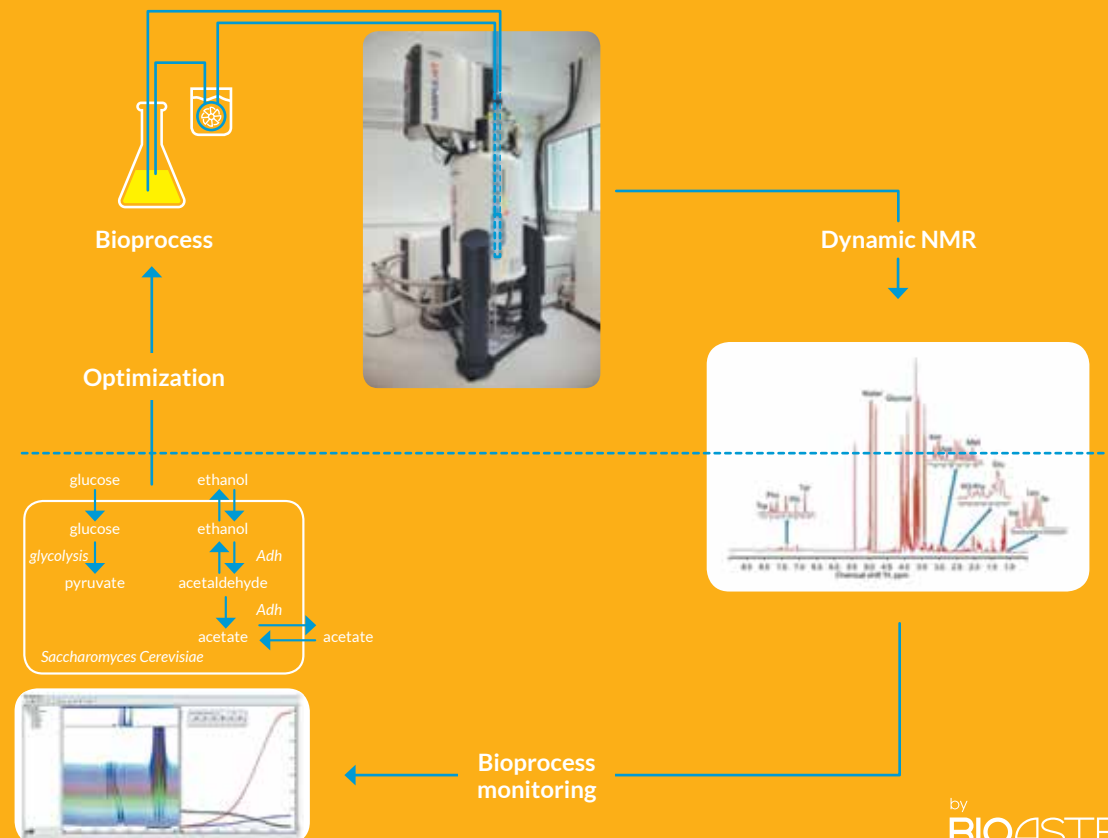
- Dynamic monitoring of cell metabolism during vaccine production, for bioprocesses comprehension and optimization

ADVANTAGES

- Monitoring in real time of metabolites production and consumption, in a closed small-scale fermentation system
- Optimization of bioprocesses together with quality biomarker identification
- High-level NMR technology allowing dynamic metabolomics studies for bioprocesses comprehension

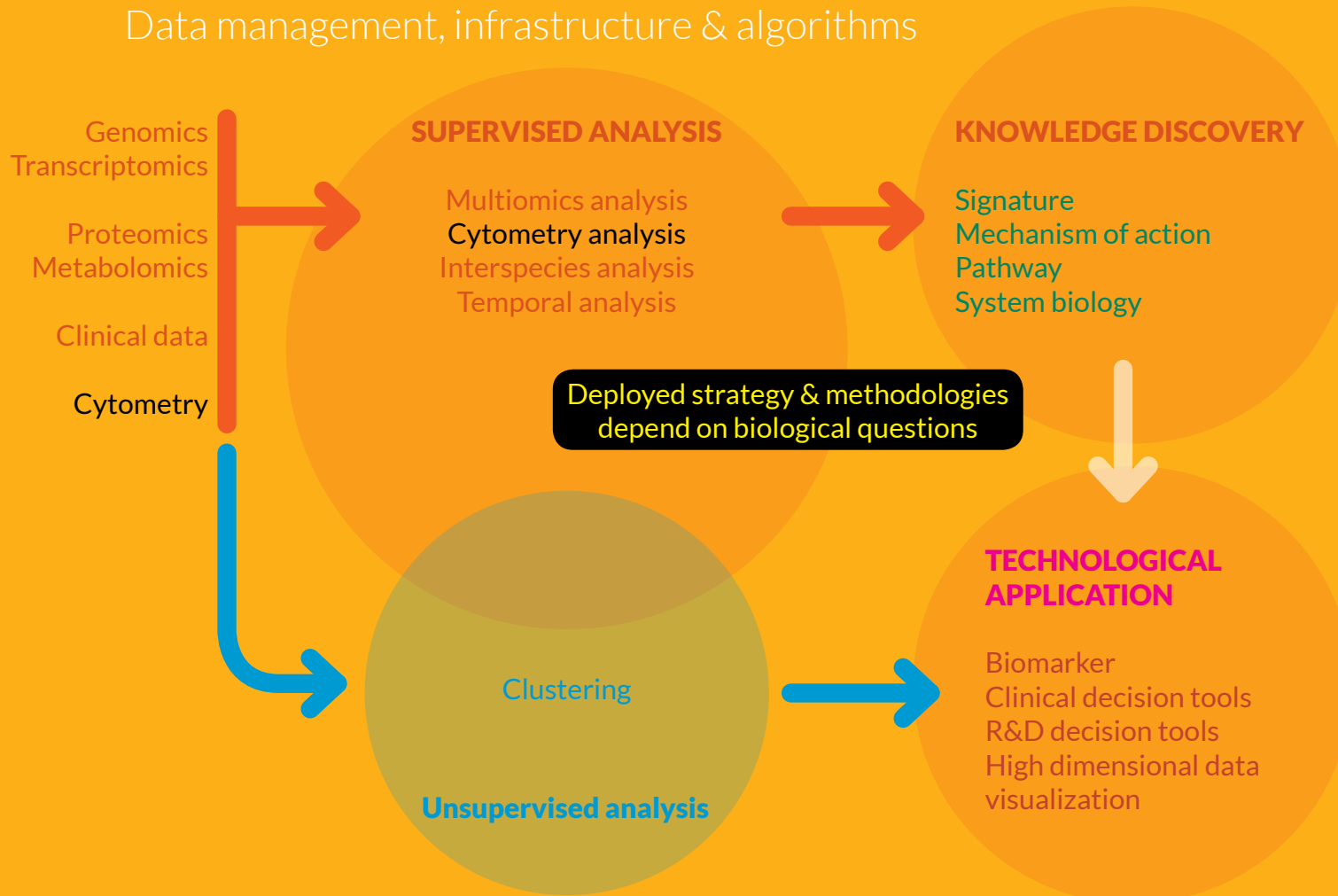
KNOW HOW

- Co-developer of the InsightCell approach, using the Insight MR™ probe from Bruker
- Expertise in NMR metabolomics, from wet lab to data interpretation
- Expertise in microbiology and bioprocesses



BIOMARKERS FOR POPULATION STRATIFICATION AND REACTOGENICITY/EFFICACY PREDICTION

Example
System Biology



WE CONDUCT PROJECTS INTEGRATING CLINICAL STUDY DESIGN AND TECHNOLOGIES FOR TARGET VALIDATION

Collect

Biological samples



Analyze

Biological samples



Immune cells
Cytokines
Antibodies

Commensal/
Infectious agents
Microbiome

Genomics
Transcriptomics
Proteomics
Metabolomics
Immunomics

- Executed in dedicated preclinical/clinical animal/human studies capitalizing on our network of experts and clinicians
- With adapted monitoring and study management overseen by our Clinical research associates

- Leading to traceable specimens of high quality capitalizing on advanced data management tools and storage and processing infrastructures
- With adapted monitoring and management of study
- Leading to traceable specimens of high quality

- Analysis through omics pipeline adapted to your needs
- Developed as reliable and validated methods from sample preparation to data generation

Explore



- Vaccine composition in function of the targeted population and pathogen characteristics
- Identify innovative biomarkers of medical value
- Improve/control/predict your biological production performance
- Existing or proposed vaccine composition

Validate



in vitro/in vivo/clinical models
Data management
Bioinformatics
Biostatistics



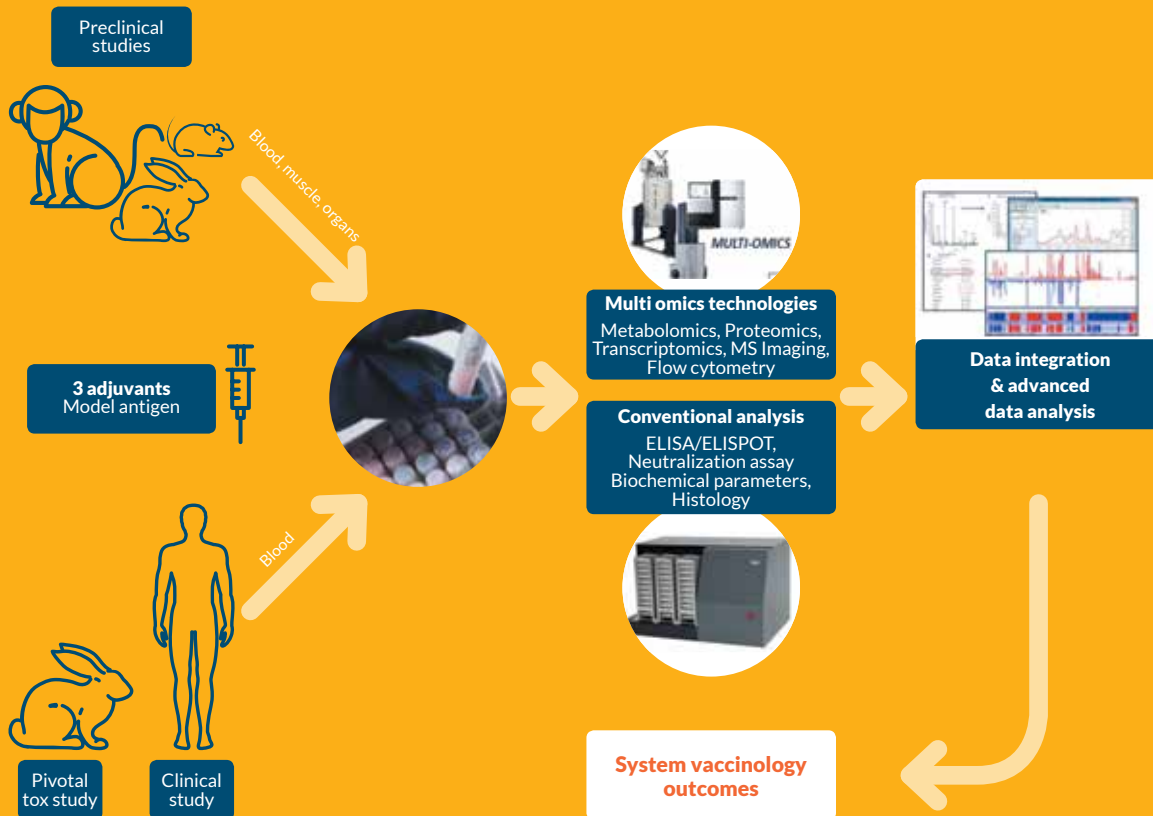
- Optimum signature for showing the highest prognostic/stratification/performance adapted to industry constrains
- Within an advance infrastructure and algorithms for time to results optimization (Machine Learning)
- That can be delivered as a visually integrated clinical multi/meta omic data



COLLABORATIVE PROJECT

MOSAIC – PROJECT SCOPE 2.2

Understanding the mechanism of action of adjuvants to help select successful vaccine candidates earlier in the development process





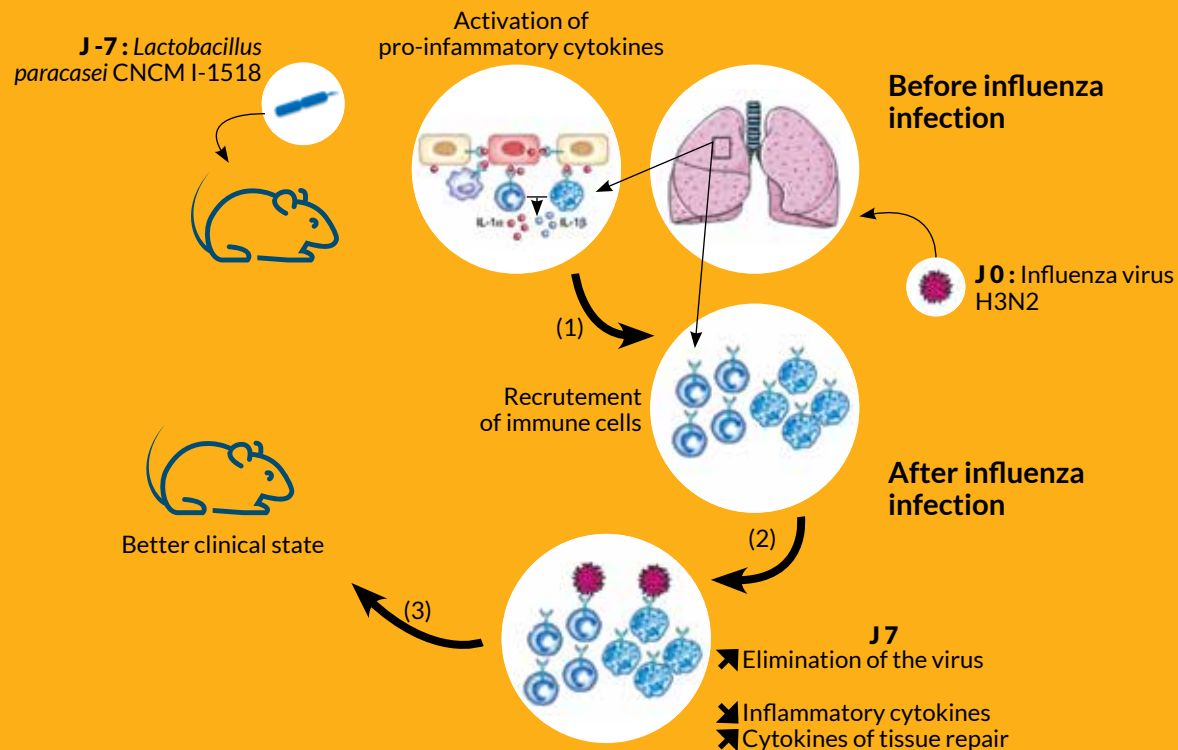
COLLABORATIVE PROJECT

IMMUNOBIOTIC

Impact of orally administered probiotic bacteria on systemic immune response

Probiotics represent an interesting source of immune modulators to increase resistance to respiratory tract infections.

In this study, mice fed with *L. Paracasei* CNCM I-1518 showed reduced susceptibility to the influenza infection, associated with less accumulation of inflammatory cells in the lungs, faster viral clearance and general health improvement.



IMPROVEMENT OF IMMUNE RESPONSE



4 YEARS

A UNIQUE MODEL

INDUSTRIAL APPLICATIONS

BIOASTER, a partner of choice
from early stage to pre-industrial development

We develop specific technologies, ready for industrialization

- Standardized and automated processes
- Appropriate methods for samples collection and storage (Iso 9001)
- Automated sample preparation
- Complex signature translation to commonly used detection tools
- Expression systems optimization, including genomic strain engineering
- Upstream and downstream production process optimization

We handle and interpret complex data

- Integrated & expert data sciences
- Data management facilities ruled by tracking and control policies
- High data storage and cloud computing capacities
- Custom bioinformatic pipelines development
- Tailor-made visualization tools

BIOASTER, Technology Research Institute, to better share innovation

- International scientific network & partners
- 80+ scientific experts, technology platforms, unique state of the art equipments
- Professional projects management and tools
- Opportunity of sharing costs and risks of your innovation projects
- Research and development collaborative projects or services
- A multidisciplinary team of experts dedicated to diagnostics projects

BIOASTER PROGRAMS

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Antimicrobials

Vaccines

Microbiota

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