



Infrastructure for Omics  
Technologies

Genomics, Proteomics and  
Metabolomics for the scientific  
community



# INFRAESTRUCTURAS CIENTÍFICAS Y TÉCNICAS SINGULARES (ICTS)



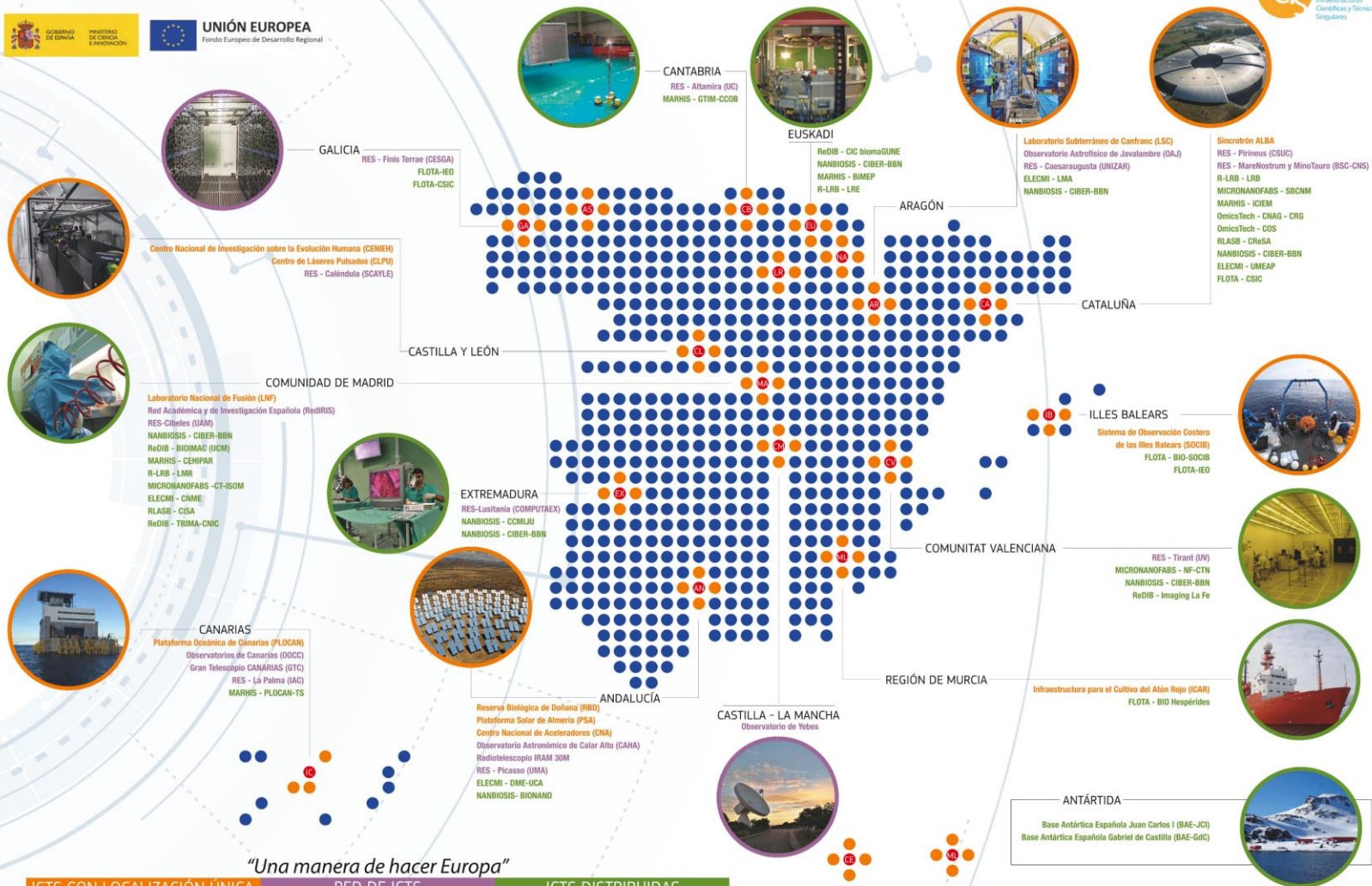
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## MAPA DE INFRAESTRUCTURAS CIENTÍFICAS Y TÉCNICAS SINGULARES



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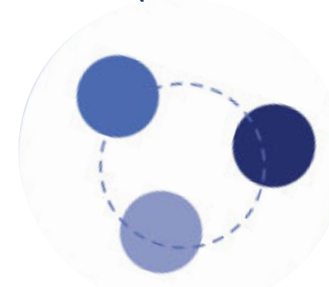
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## Infrastructure for Omics Technologies

Genomics, Proteomics and Metabolomics  
for the scientific community

Is a distributed ICTS formed by the Centro Nacional de Análisis Genómicos (CNAG), the CRG/UPF Proteomics Unit and the Center for Omic Sciences (COS-URV/Eurecat)



Make the most out of your omics projects!

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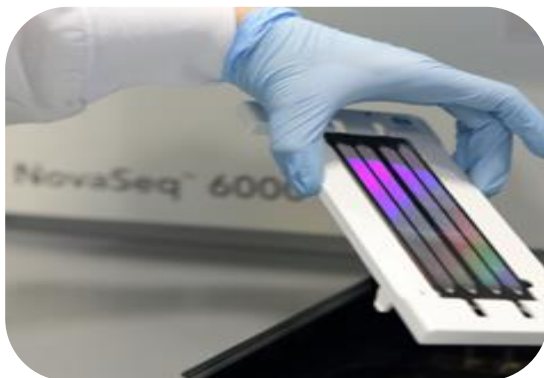


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**Genomics Area**  
**CNAG and COS**



**Proteomics Area**  
**CRG and COS**



**Metabolomics Area**  
**COS**



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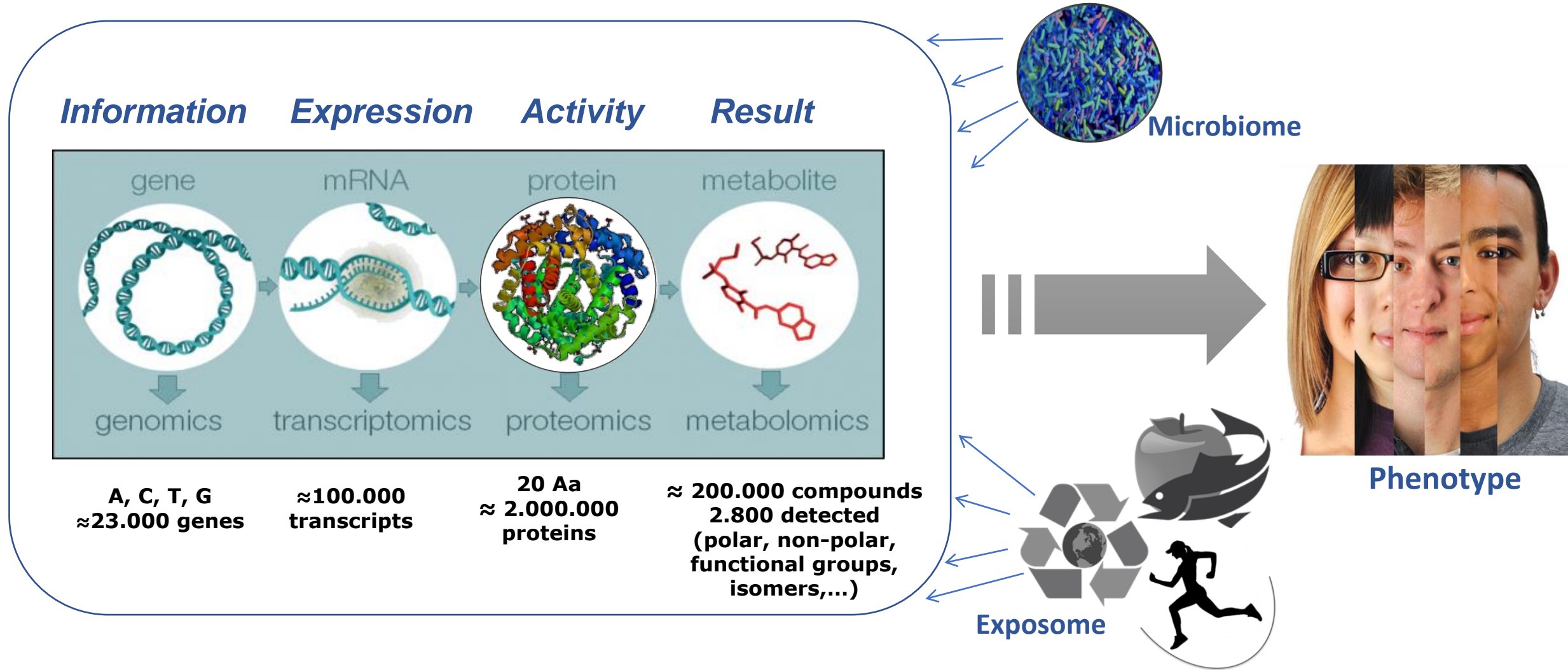
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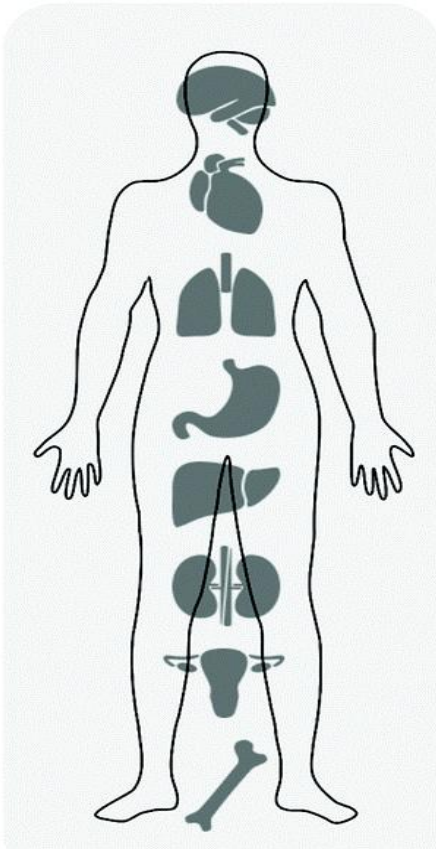
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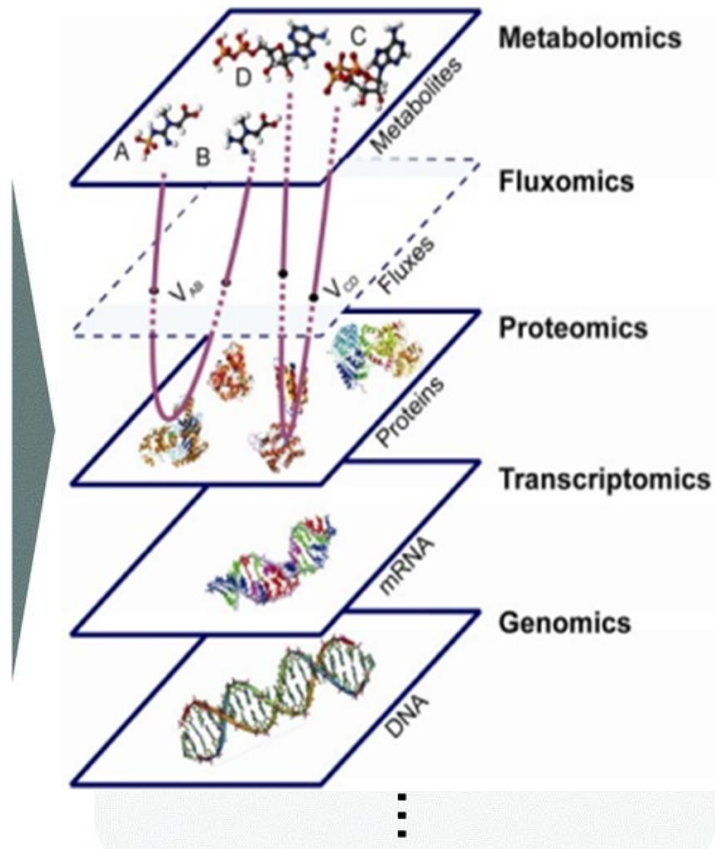




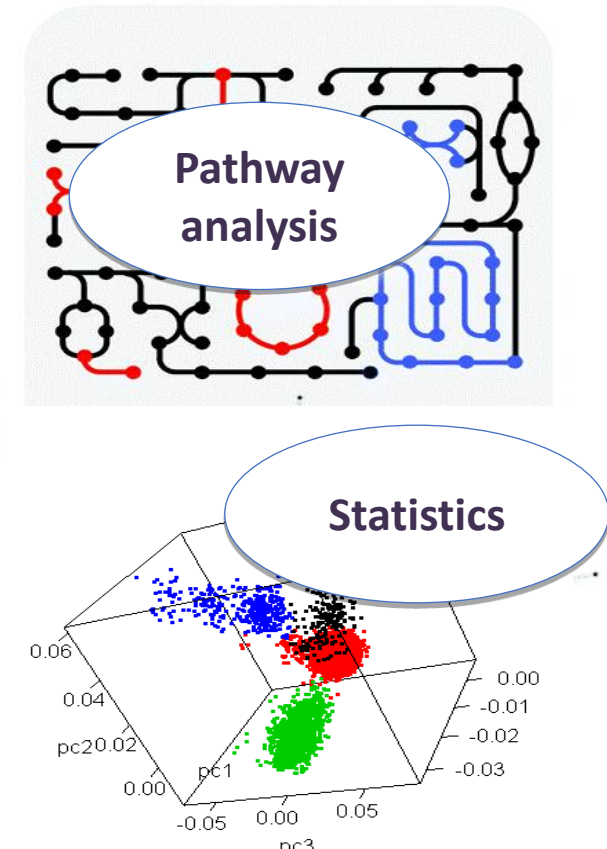
## Experimental systems/samples



## High-throughput omics data



## Network-integrated data





## Medical and Healthcare

- personalized medicine, and health management
- disease mechanisms and diagnosis
- biomarker discovery
- drug discovery and development
- pharmacogenomics



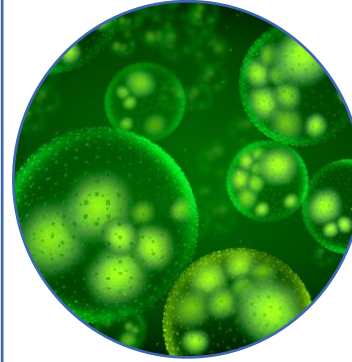
## Agriculture and Crop Sciences

- crop improvement
- plant breeding
- genetic engineering
- understanding plant responses to environmental stresses
- improve crops with enhanced traits



## Environmental Sciences

- Ecosystems biodiversity
- environmental pollution
- climate change



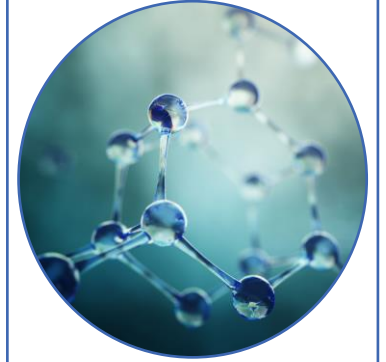
## Industrial Biotechnology

- optimizing industrial bioprocesses
- development of sustainable energy sources and biofuels
- producing bio-based chemicals
- engineering microorganisms for various bioproduction applications



## Food and Nutrition

- food safety
- quality control
- nutritional analysis
- understanding food-related diseases.
- study foodborne pathogens
- assess nutritional content and bioactive compounds food products



## Chemical Industry

- Process Optimization
- Catalyst Development and Screening
- Chemical Safety Assessment
- Sustainable Chemistry and Green Processes
- Chemical Analysis and Quality Control
- Bioprocessing and Biomanufacturing

Omics approaches provide valuable insights into the genetic and metabolic aspects of chemical processes, enabling more efficient and sustainable production methods

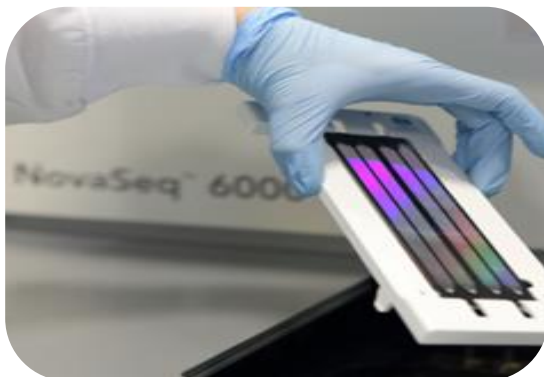


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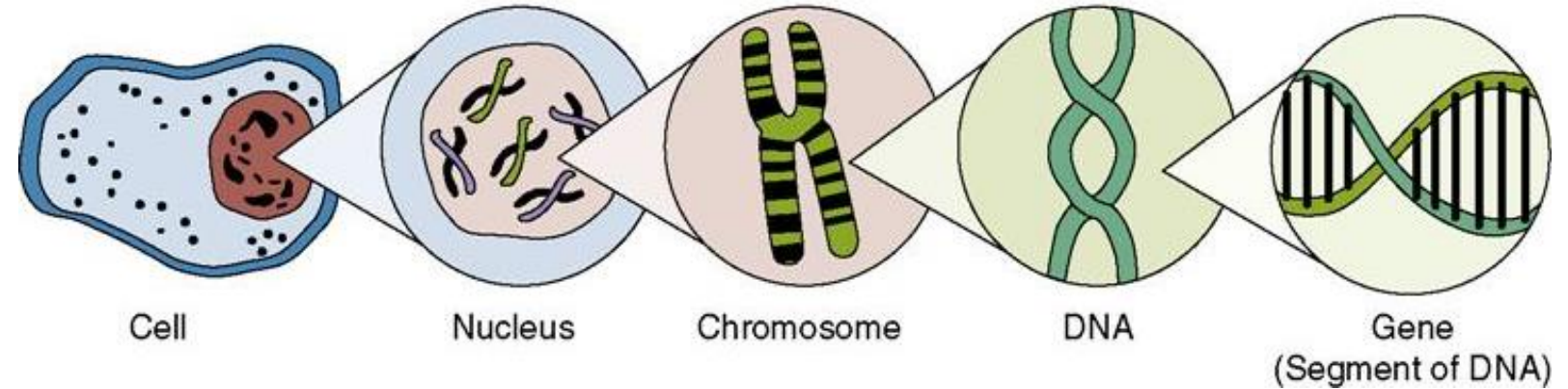
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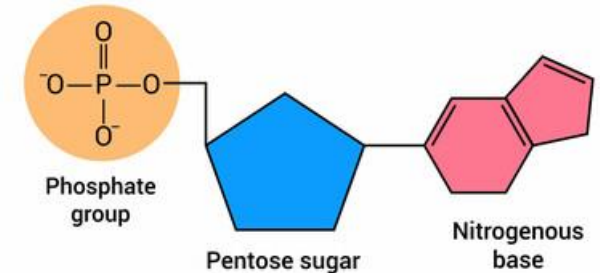
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## DNA , GENOMES, GENES



- ✓ **DNA:** molecule that carries the genetic information.
- ✓ One molecule of DNA is made up **nucleotides**: with a sugar group (deoxyribose), a phosphate group and a base. There are four bases: Adenine (A), Thymine (T), Guanine (G) and Cytosine©.
- ✓ **Genome:** all of the genetic material in an organism
- ✓ **Genes:** are segments of DNA with the instructions to make specific proteins with specific functions in our body.



## DNA SEQUENCING

DNA sequencing is the process of determining the nucleic acid sequence, the order of nucleotides (A, T, C, G) in DNA ([https://en.wikipedia.org/wiki/DNA\\_sequencing](https://en.wikipedia.org/wiki/DNA_sequencing))

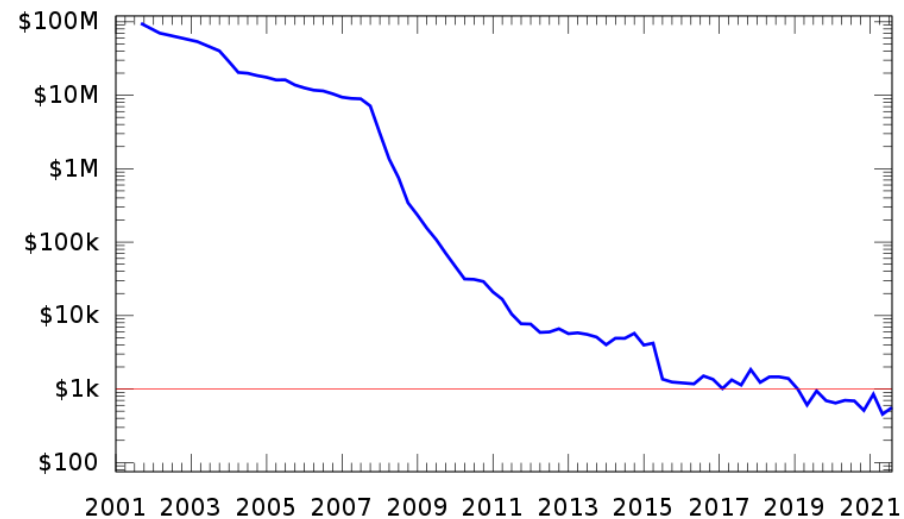
Human genome:                   21,000 genes  
                                           3,000,000,000 base pairs  
                                           >3,000,000 genetic variants

Reference Genome	AATCATGTGTGGCTACTTACTGTCACT
Person's sequenced DNA	AATCATGTGT <b>G</b> GCTACTTACTGTCACT AATCATGTGT <b>A</b> GCTACTTACTGTCACT
	↓
	<b>G   A</b>
	Person's genotype for this variant

Some gene variants can cause some genetic diseases or contribute to susceptibility to certain diseases.



Cost to sequence a human genome (USD)

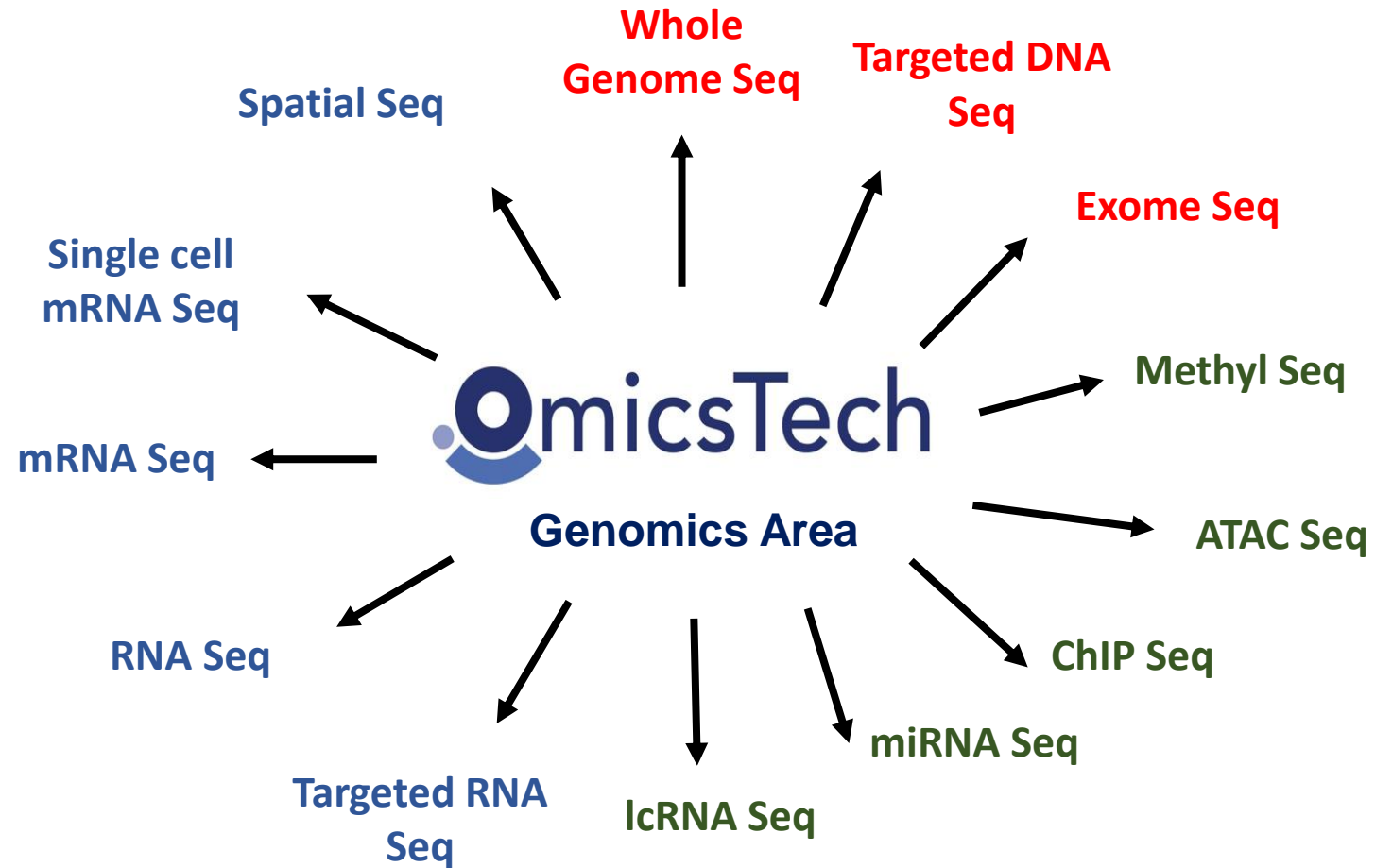


2001: first human genome,  
13 years Project, > 100M \$

2010: 15,000 \$/ human  
genoma

2023: 600 \$/ human genome





## CENTRO NACIONAL DE ANÁLISIS GENÓMICO (CNAG)

- ✓ Created in 2010
- ✓ 100 people, directed by Ivo Gut
- ✓ Located at the Barcelona Science Park

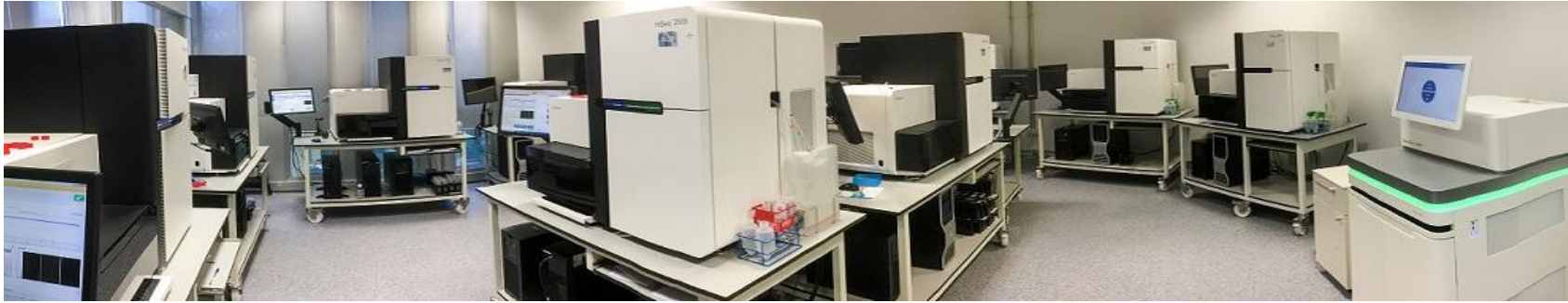
### Mission

- ✓ To carry out projects in genome analysis that will lead to significant improvements in people's health and quality of life, in collaboration with the Spanish, European and International research and clinical community.

### Quality

- ✓ ISO 9001 Certification (Quality management system)
- ✓ ISO 17025 2005 Accreditation (General requirements for the competence of testing and calibration laboratories)
- ✓ ISO 27001 Certification (information security management system)
- ✓ Genomic Quality Assessment Programs (GenQA)





## Sequencing instruments

5 Illumina sequencers (3 NovaSeq6000, 1 HiSeq2500, 1 MiSeq)  
2 Oxford Nanopore Technologies sequencers (1 GridION, 1 PromethION)

## Sequencing capacity

>10,000 Gbases/day = 100 human genomes/day at 30x

## Single cell Genomics

10x Chromium Controller, 10x Chromium Connect

## Spatial Genomics

Vutara microscope  
CosMX

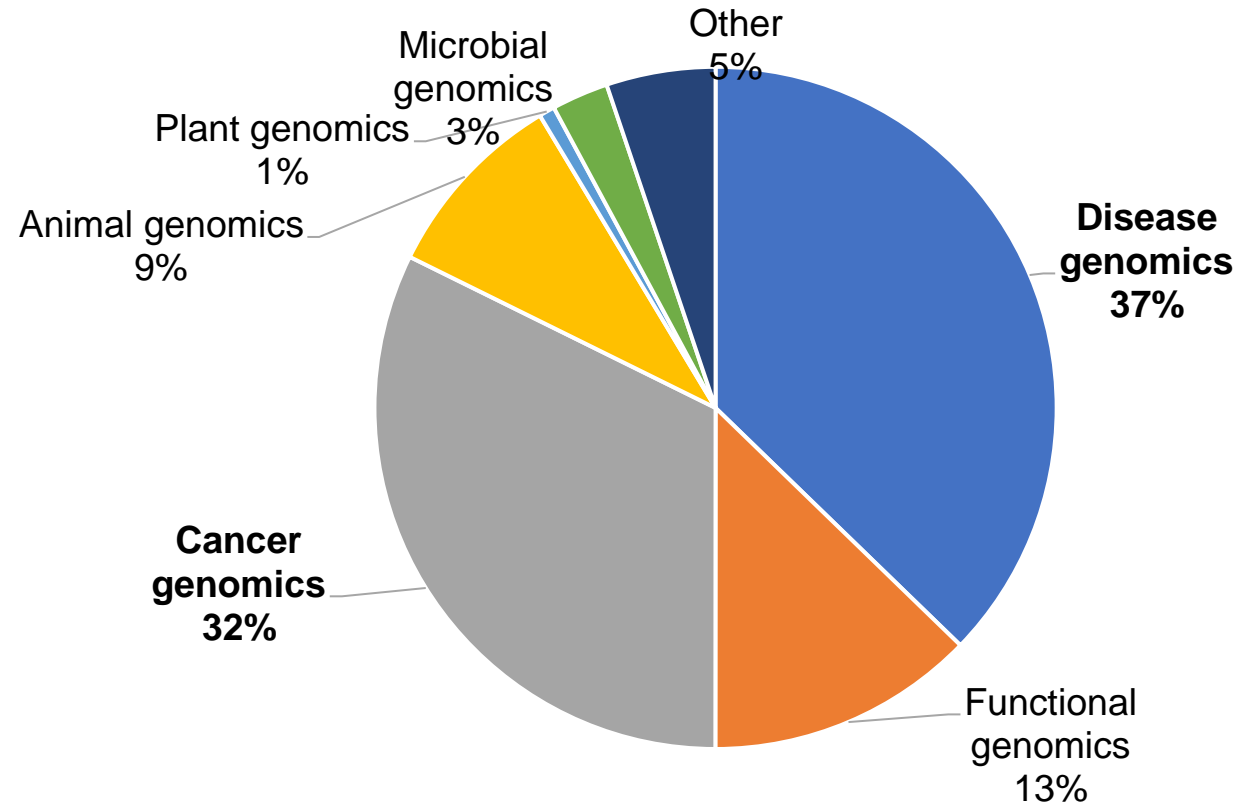
## Computing

13,000 cores  
13 PB disk + 3 PB tape



## 2022 CNAG-CRG activity

- ✓ **1,021** Projects completed
- ✓ **237** Different Users
- ✓ **17,343** Samples processed
- ✓ **486** Terabases of sequence produced
- ✓ **248** Projects analyzed



## AREAS OF COLLABORATION WITH BIOMEDICAL SECTOR

### Discovery science

- Characterization of disease biology and/or treatment response
- Identification of new targets for drug development
- Biomarker identification and validation
- Characterization of rare cells (circulating tumor cells, immune cells, progenitor cells)

### Translational research

- Precision medicine clinical trials with robust genomic patient stratification for increasing drug safety and effectiveness

### Clinical applications

- Diagnostics and companion diagnostics
- Pharmacogenomics
- Clinical Decision Support Tool

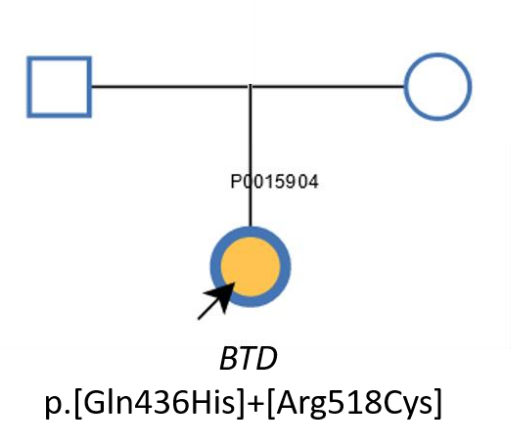
## Success story I: Implementation of whole genome sequencing for pediatric cases in the Navarre health care system

### Collaboration with Complejo Hospitalario de Navarra

- ✓ Whole genome sequencing
- ✓ 75 children at Intensive Care Units with suspected genetic disorder
- ✓ Results in 14 days
- ✓ Disease causing mutation identified in 40% cases

### Case report

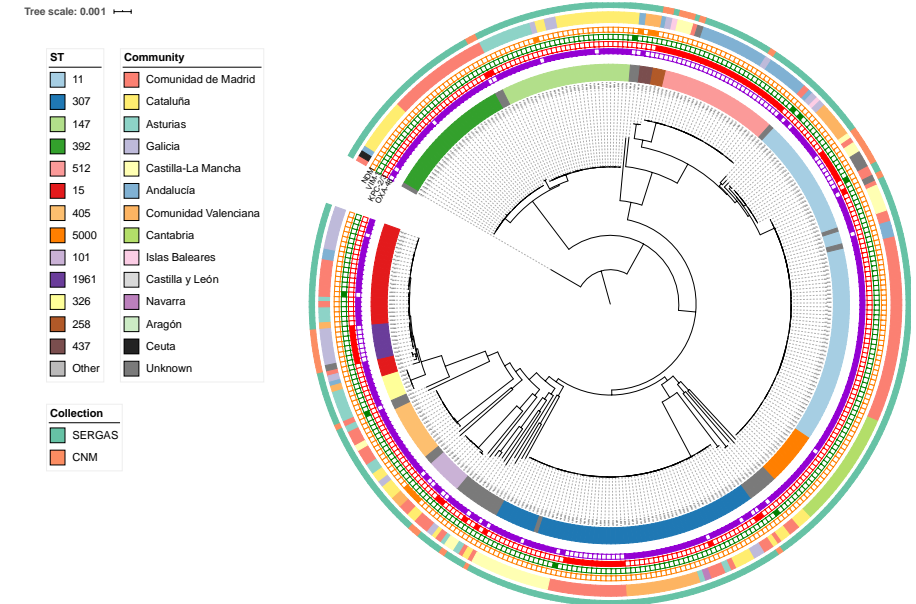
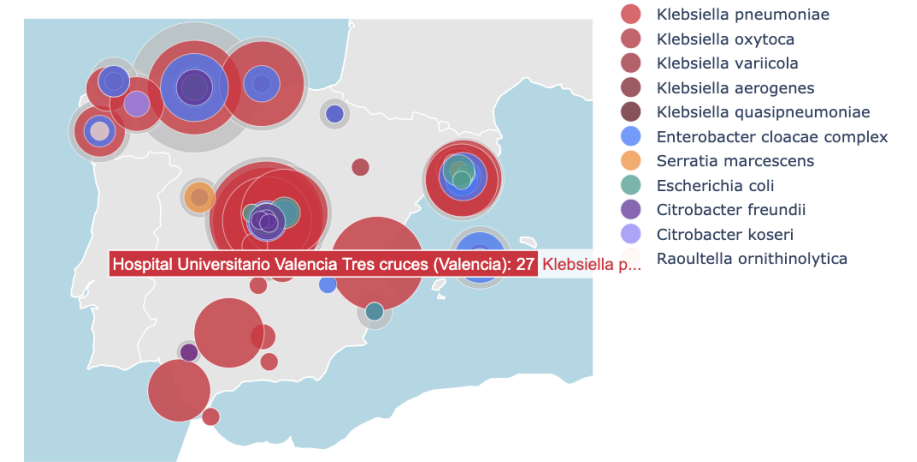
- ✓ 1 month old female newborn with seizures, hypotonia, breathing problems, hearing and vision loss, ataxia, skin rashes, alopecia and candidiasis
- ✓ Identification of two pathogenic variants in the *BTBD* gene
- ✓ Diagnostic: biotinidase deficiency
- ✓ Treatment: oral biotin





## Success story II: Studying multi drug resistance bacteria

- ✓ Carbapenem-resistant bacteria is an ongoing public-health problem of global dimension
- ✓ They produce an enzyme called a carbapenemase that makes antibiotics like carbapenems, penicillins, and cephalosporins ineffective
- ✓ Public-private collaboration (**Roche Diagnostics**, Universidad de la Coruña, Sociedad Española de Enfermedades Infecciosas)
- ✓ Sequencing the genome of 461 samples of **Carbapenemase-Resistant Enterobacteriaceae**
- ✓ inCREDBle database for browsing clinical and genomic data.



## AREAS OF COLLABORATION WITH AGRO SECTOR

### Discovery science

- Plant and animal biology: understanding the genetic influence on traits and disease.
- Biomarker identification and validation

### Applied research

- Inform breeding decisions: genomic selection
- Characterize disease susceptibility
- Biodiversity monitoring

## Success story III: Generation of reference genomes of ecologically and socioeconomically important species

### De novo assembly of the genome of several species:

- ✓ Senegalese sole (Manuel Manchado, IFAPA)
- ✓ Turbot (Antonio Figueras, CSIC)
- ✓ Mediterranean mussel (Antonio Figueras, CSIC)
- ✓ Phaseolus vulgaris (Roderic Guigó, CRG)
- ✓ Melon (*García-Mas*, CRAG)
- ✓ Olive tree
- ✓ Silver fir (David B. Neale, UC Davis)

### Participation in **local and international initiatives in Biodiversity Genomics**

- ✓ Earth Biogenome Project (**EBP**)
- ✓ Catalan Initiative for the EBP (**CBP**)
- ✓ Vertebrate Genome Project (**VGP**)
- ✓ Biodiversity Genome Europe (**BGE**)





## Environmental DNA for impact assessments

Environmental impact assessments are carried out to predict the effects of a particular development project on the natural environment, such as a new mine or new oil pipeline. Next generation sequencing (NGS) allows the massive detection of environmental or eDNA by barcoding techniques together with metagenomics of environmental microbiomes.

### Enviromental metabarcoding workflow



### Outcomes:

- Biodiversity Assessment
- Detection of Bioindicator Species
- Detection of Rare Targets such as Invasive or Endangered Species
- Baseline environmental assessment
- Environmental effects monitoring
- Site decommissioning
- Climate change
- Pathogen detection
- Aquatic, terrestrial, sediments health

**Other environmental genomics strategies offered by COS**

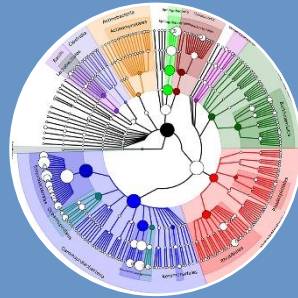
	Start-up cost	Per-sample cost	Sensitivity	Number of taxa	Flexibility
qPCR	High	Low	High	Low	Low
Metabarcoding	Low	Med	Med	Med	Med
Capture	High	Med	Med	High	High
Shotgun	Low	High	Low	High	High

## Genomics-based water quality monitoring

DNA-based technologies can quickly and accurately detect pathogens in a water supply, identifying unsafe water before it can make people sick. They allow us to determine the microbiological composition/quality of the wastewater or drinking water produced and distributed.



Generation of fingerprints (sometimes called barcoding or barcodes) of the complete microbial population present in (drinking) water based on Next Generation Sequencing (NGS). With this analyses the effect of disturbances on the fingerprint can be examined and indicator organisms/markers can be characterized.



Metagenomic Analysis of Environmental Water Samples provides insight into microbial responses to environmental changes in a water reservoir.



Shotgun metagenomic sequencing, enables to examine the complete genomes of the organisms in a given sample comprehensively to evaluate bacterial diversity, detect microbial abundance and changes in their genes, in various environments.



Develop tools for faster and more comprehensive water monitoring for contaminants of existing and emerging concern such as pathogens and pollutants.



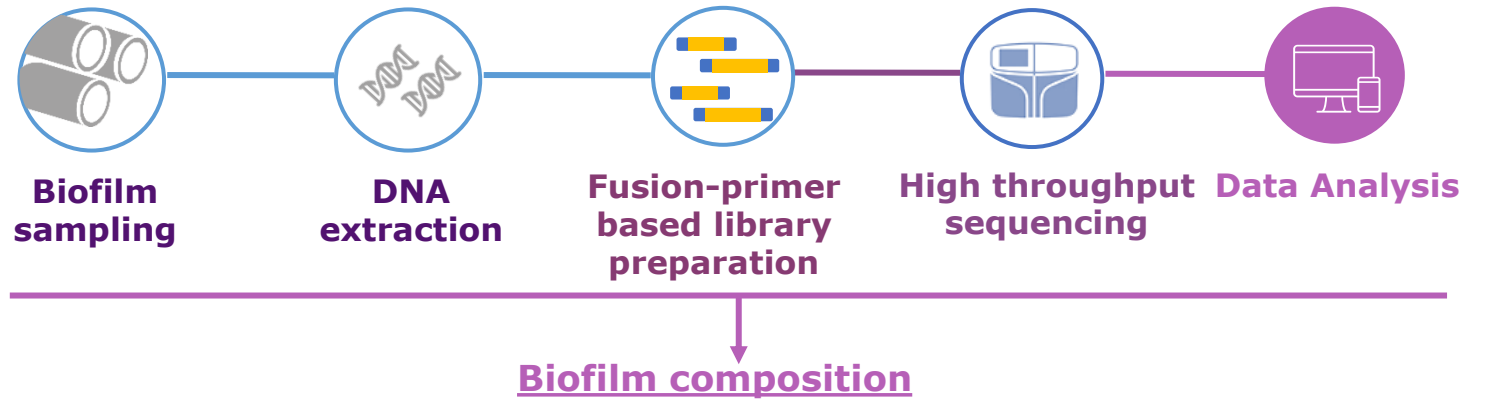
Generate information to optimize the microbial processes in industrial and municipal wastewater treatment.



## Metagenomics applied to biofilm analyses

Biofilms basically consist of microorganisms embedded in a polymeric extracellular matrix, mostly produced by the organisms themselves. Biofilms are found in several environments, and play both beneficial and detrimental roles depending on whether their formation is controlled, or it occurs naturally

In drinking or industrial water distribution systems, biofilms are the predominant mode of microbial growth, and their formation poses a significant problem to the water distribution network conditions in buildings as a potential source of bacterial contamination, and also affecting the taste and odor of drinking water and promoting the corrosion of pipes.



- **Untargeted biofilm characterization**: determine which microbes (bacteria and fungi) are present, for instance in a corrosion process
- **Intermicrobes' interactions**: investigate and determine which of the microbes present in the biofilm are active and how they interact with each other
- **Omic data generation**: Genomic data to develop mathematical models that positively influence predicting the impact and necessity for biocide deployment
- **Treatment method efficacy testing**: determine the microbial composition of a biofilm before and after mitigation strategies to assess treatment efficacy.

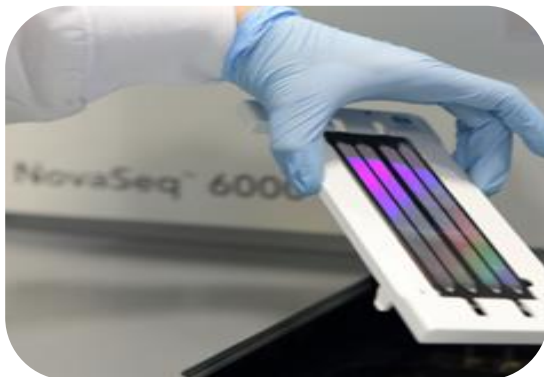


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# PROTEINS



**GLP-1 receptor**

**OZEMPIC**

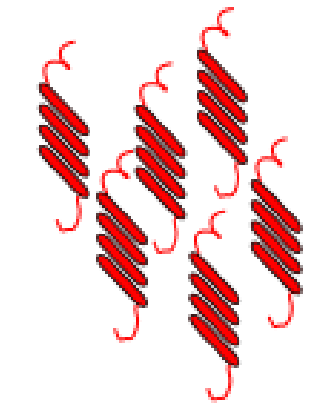
Proteins work together in a coordinated manner to maintain homeostasis and “health”

## DRUGS

- act on proteins
- are proteins themselves
- lead to the production or degradation of proteins
- use the protein machinery to exert their therapeutic effect

## Proteomics Applications

 Protein abundance changes



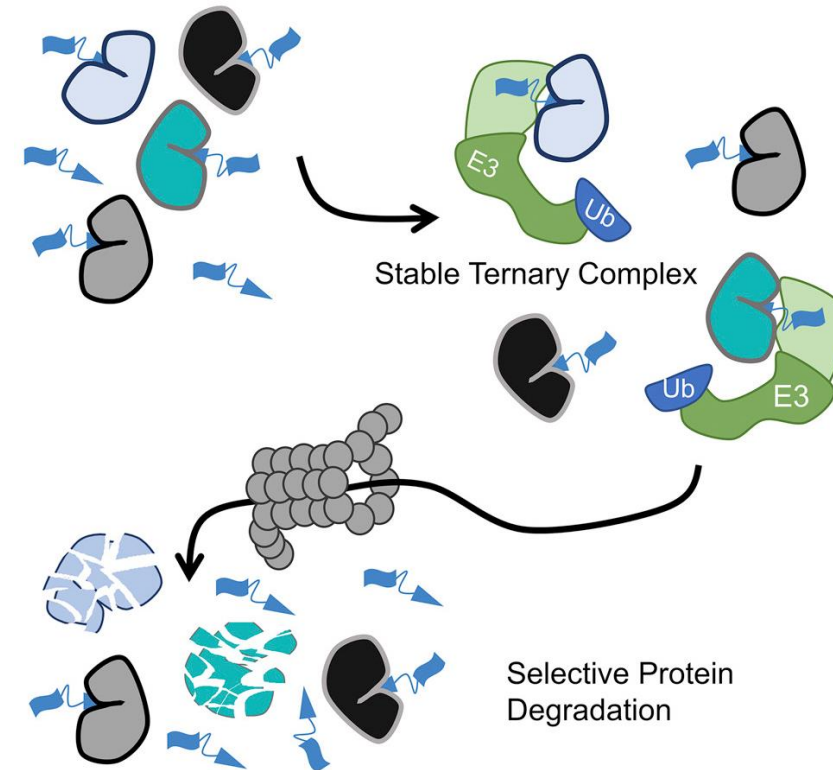
Condition A



Condition B

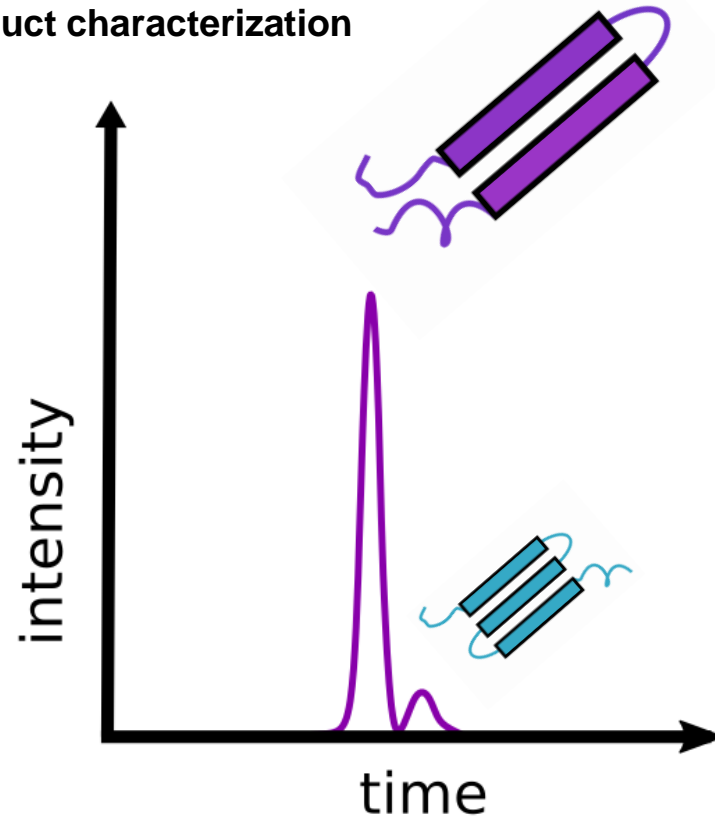
## Examples — Targeted proteome degradation

Promiscuous Kinase PROTAC



## Proteomics Applications

● Product characterization

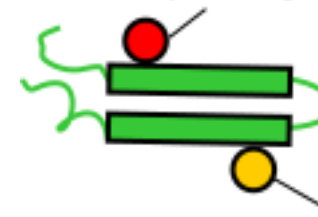


Examples

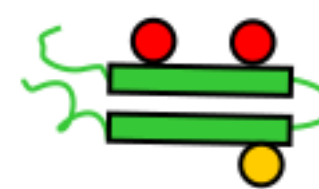
- Production of protein products
- Production of biosimilars

## Post-translational modifications

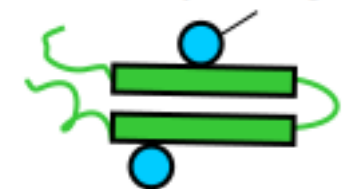
Phosphorylation



Acetylation

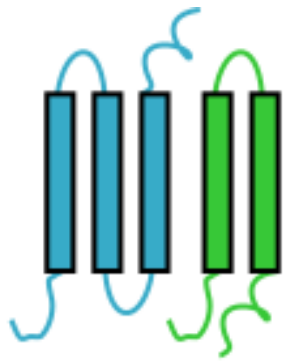


Ubiquitinylation

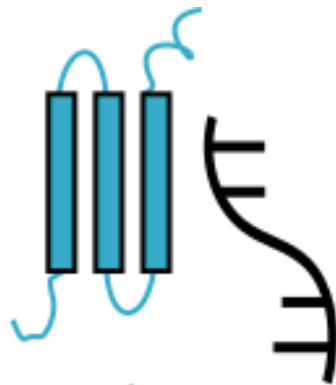


## Proteomics Applications

### ● Characterization of protein interactions



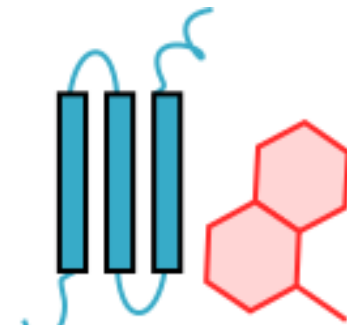
Protein-protein



Protein-RNA



Protein-DNA



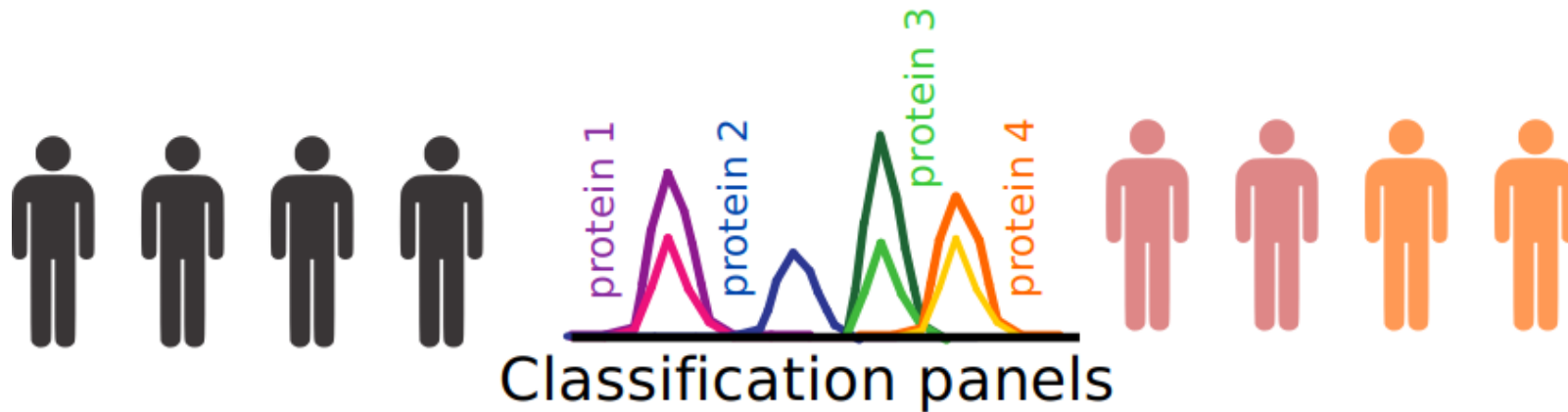
Protein-Small molecule

Examples — Identification of off-target drug binding



 Biomarker discovery  
and validation

Liquid biopsies



## Mass spectrometry-based proteomics



## Antibody-based proteomics

Bioplex 200



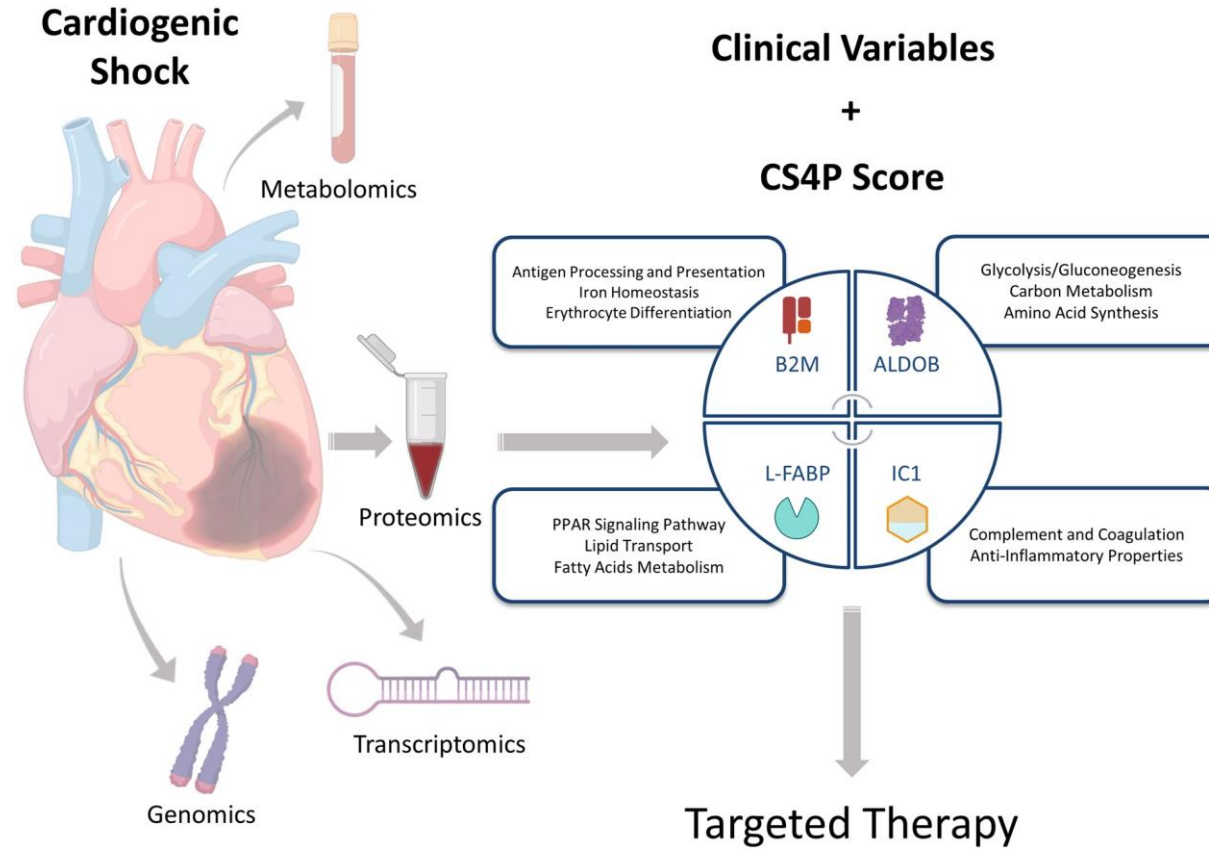
Luminex kits MAGPIX



## Success story I: Development of the CS4P Kit for prognosis of Cardiogenic Shock

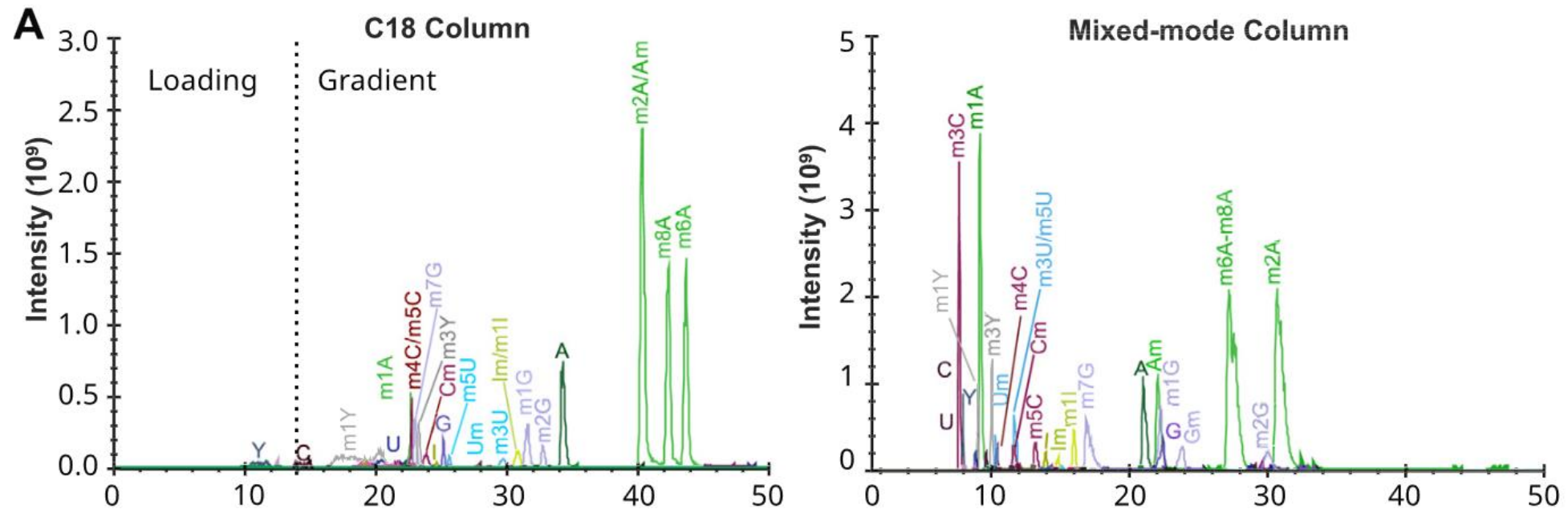


Dr Toni Bayès





## Success story II: High-performance nano-flow liquid chromatography column (RNA nucleosides)



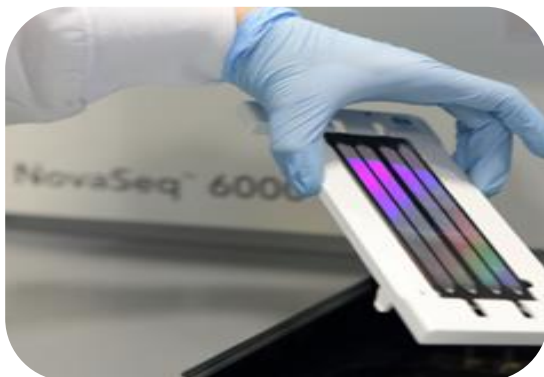


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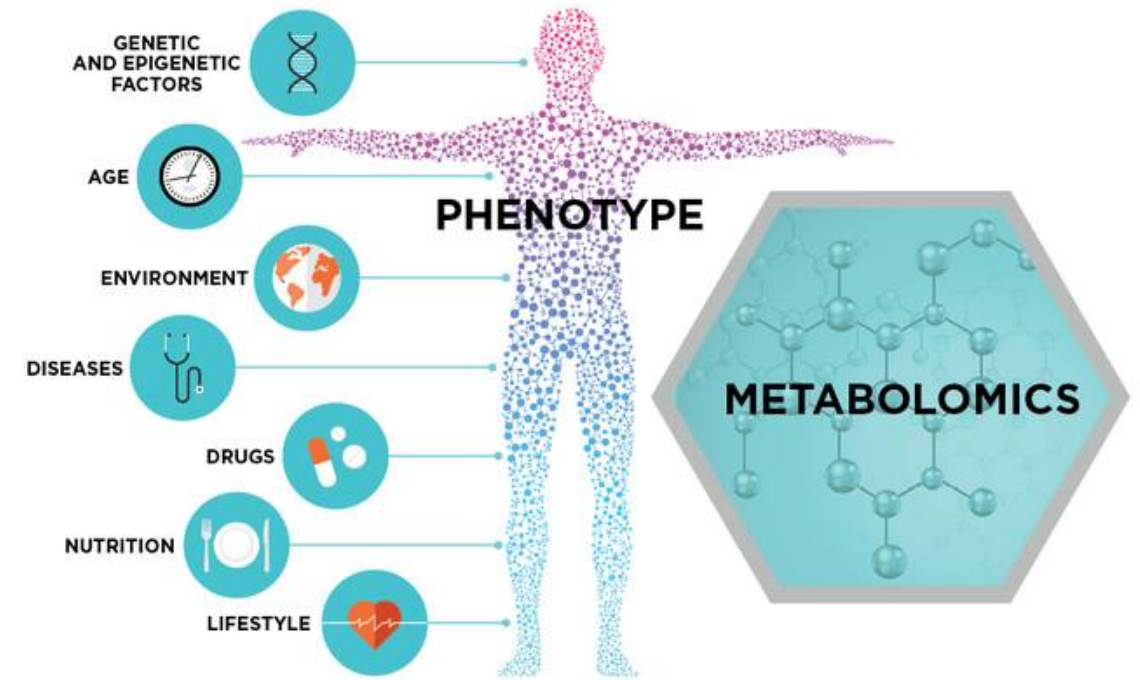


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- **Metabolomics** is the measurement and quantitation of **small molecules** (< 1500 Dalton). The **Metabolome** study.
- A metabolite is the **intermediate or the end product of metabolism**, and they have many functions such as energy, structural, signaling, catalytic activity, defense and interactions with other organisms.
- **Small molecules** may be **endogenous compounds** involved in cellular metabolism, although they may also come from **drugs, food, microbes or the environment**.
- Analysis of an individual's metabolic status leads to **personalized medicine and nutrition, the discovery of pathology-related pathways, and new diagnostic and prognostic biomarkers**.

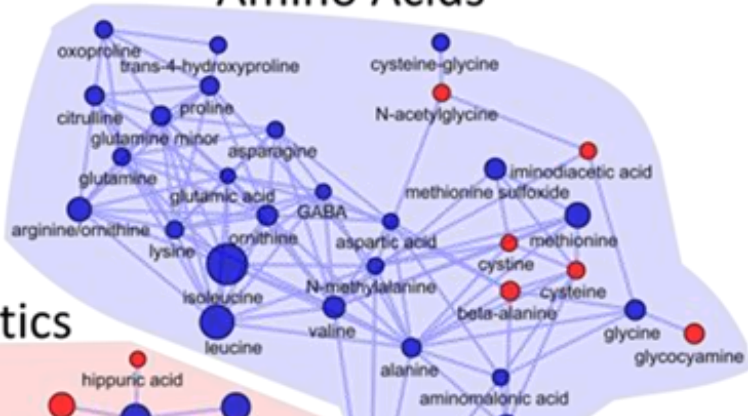


*“The metabolites provide us with direct measures of the effects that genetic and lifestyle factors can have on the phenotype”*



### Structural Diversity of Metabolites

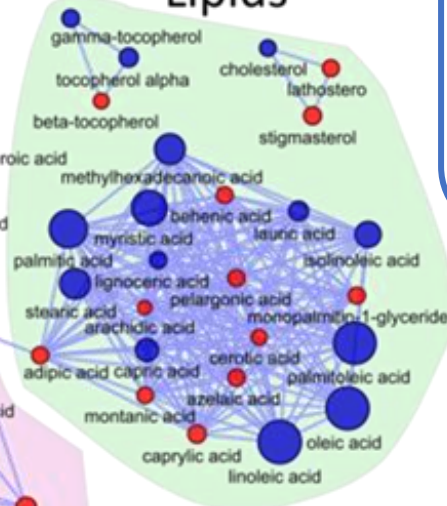
#### Amino Acids



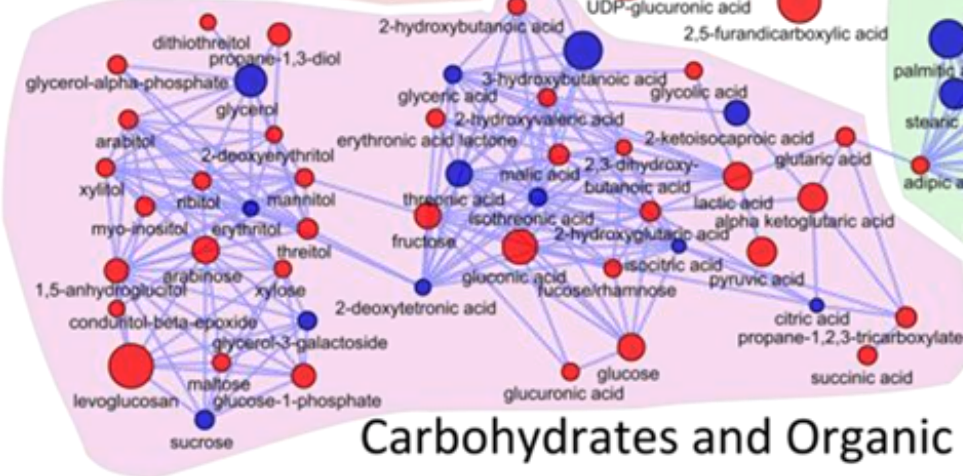
#### Aromatics



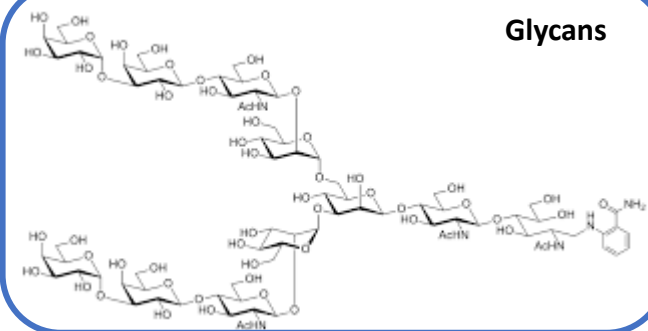
#### Lipids



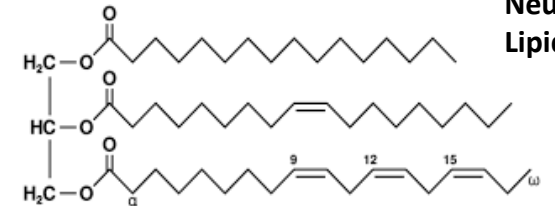
#### Carbohydrates and Organic Acids



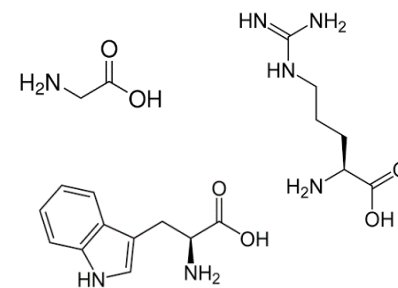
#### Glycans



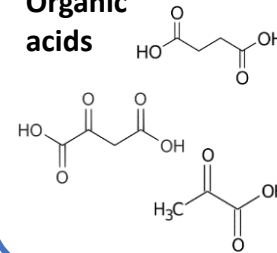
#### Neutral Lipids



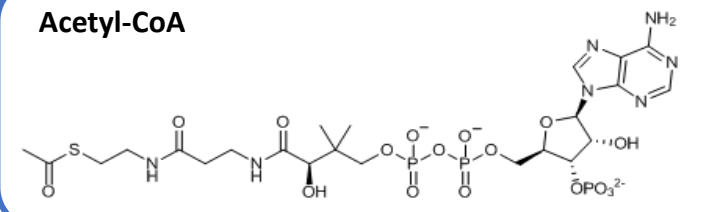
#### Aminoacids



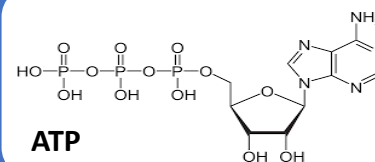
#### Organic acids



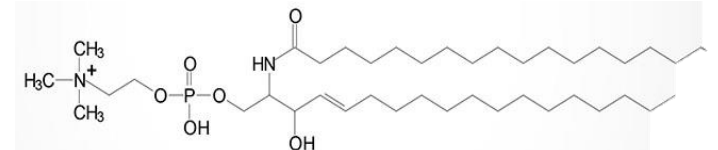
#### Acetyl-CoA



#### ATP

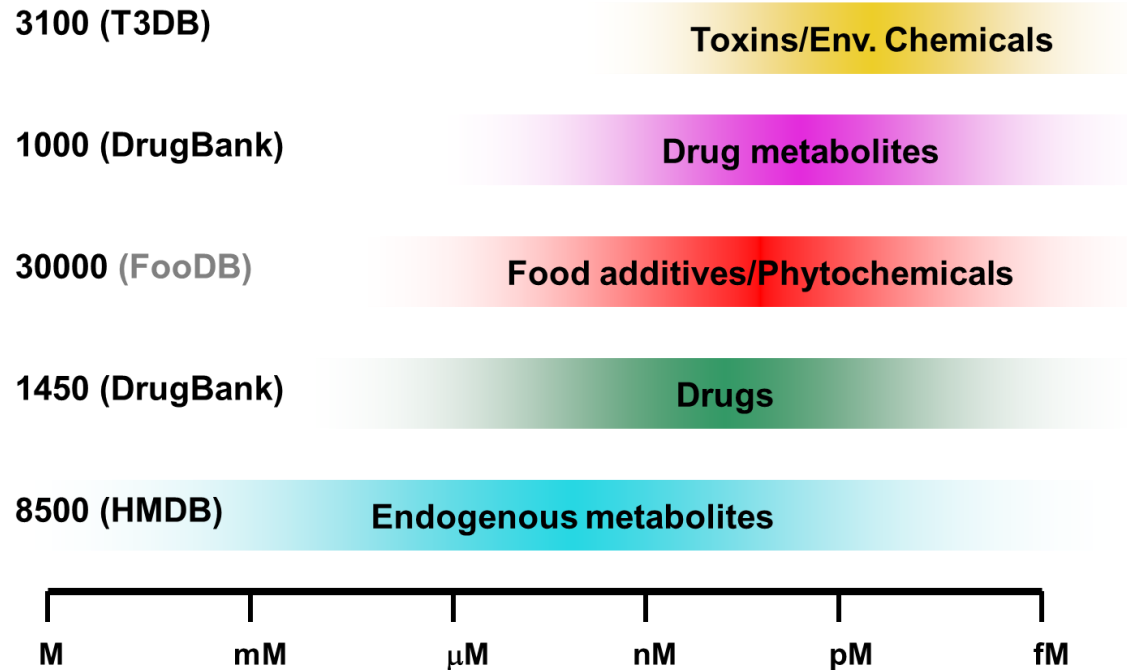


#### Phospho lipids

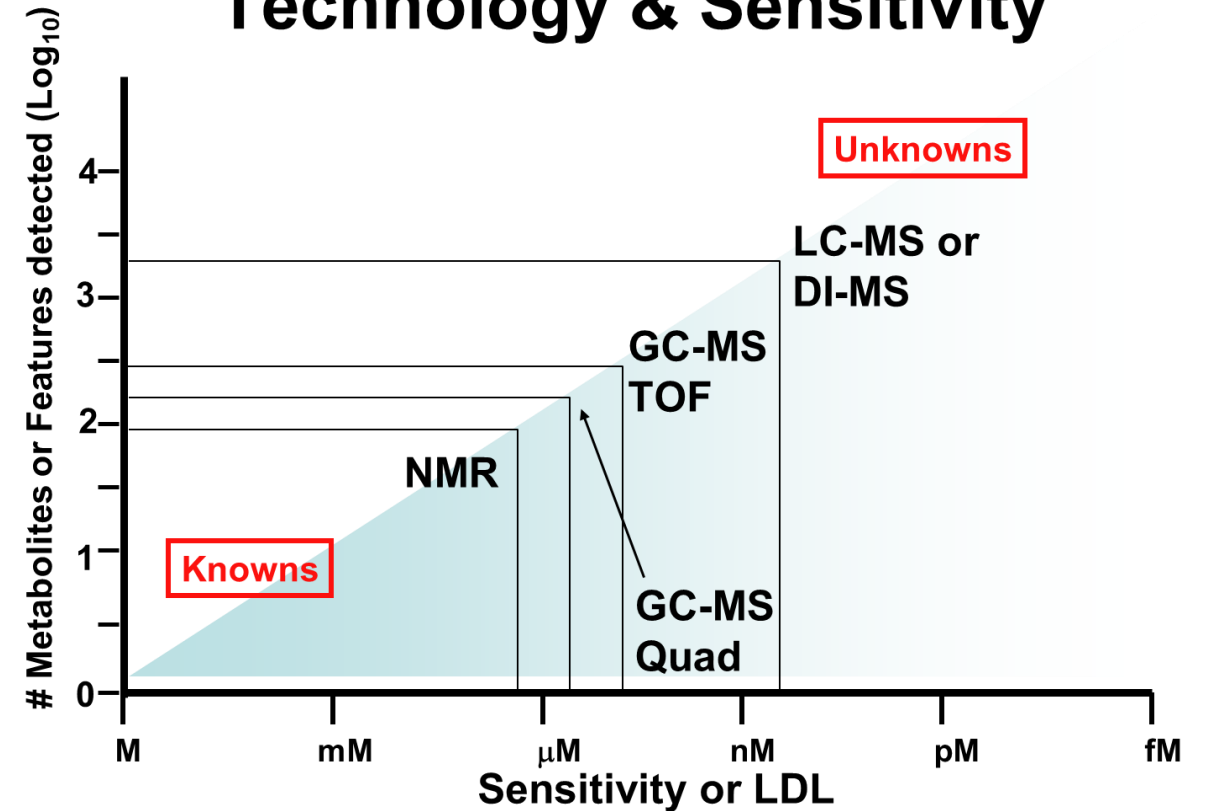




## Human Metabolomes



## Technology & Sensitivity





FEATURE	GC-MS	LC-MS	NMR
SENSITIVITY	GOOD TO EXCELLENT		<b>POOR</b>
METABOLITES	IONIZABLE COMPOUNDS		HIGH CONCENTRATION
ROBUSTNESS	REASONABLE (INTRALAB)		GOOD TO EXCELLENT (INTERLAB)
SPEED	DEPENDING ON CROMATOGRAPHY		DEPENDING ON SENSITIVITY
QUANTIFICATION	STANDARDS ARE NEEDED		LINEAL DETECTOR

## *Analytical platforms*

Agilent 6470 Triple Quadrupole LC-MS/MS

Agilent 6490 Triple Quadrupole with iFunnel technology LC-MS/MS

Agilent 6490 Triple Quadrupole with iFunnel technology LC-MS/MS

Agilent 7000 Triple Quadrupole GC-MS/MS

Agilent 7010 Triple Quadrupole GC-MS/MS

Agilent 6550 Quadrupole Time of Flight with iFunnel technology LC/MS

Agilent 6546 Quadrupole Time of Flight LC/MS

Agilent 7200 Quadrupole Time of Flight GC/MS

Agilent 7250 Quadrupole Time of Flight GC/MS

LECO Pegasus 4D GCxGC-TOFMS

Thermo Orbitrap Velos Pro

Thermo Orbitrap Eclipse Tribrid

Bruker MALDI-TOF/TOF UltrafleXtreme

Bruker 400 Hz Nuclear Magnetic Resonance (NMR)

Bruker 600 Hz Nuclear Magnetic Resonance (NMR)

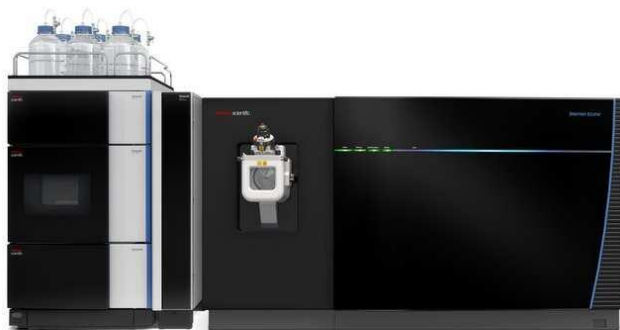
Gilson System for automated liquid handling

Agilent Bravo liquid handling system

Agilent Bravo liquid handling system



## Thermo Scientific™ Orbitrap Eclipse™ Tribrid™ mass spectrometer



*New installation  
in May 2023*

Orbitrap Eclipse, is an instrument designed to address the most difficult analytical challenges, providing accurate and high-throughput full-metabolome or proteome quantitation, characterization of complex mixtures of protein or small molecule-based pharmaceuticals, and deciphering higher-order protein structures.

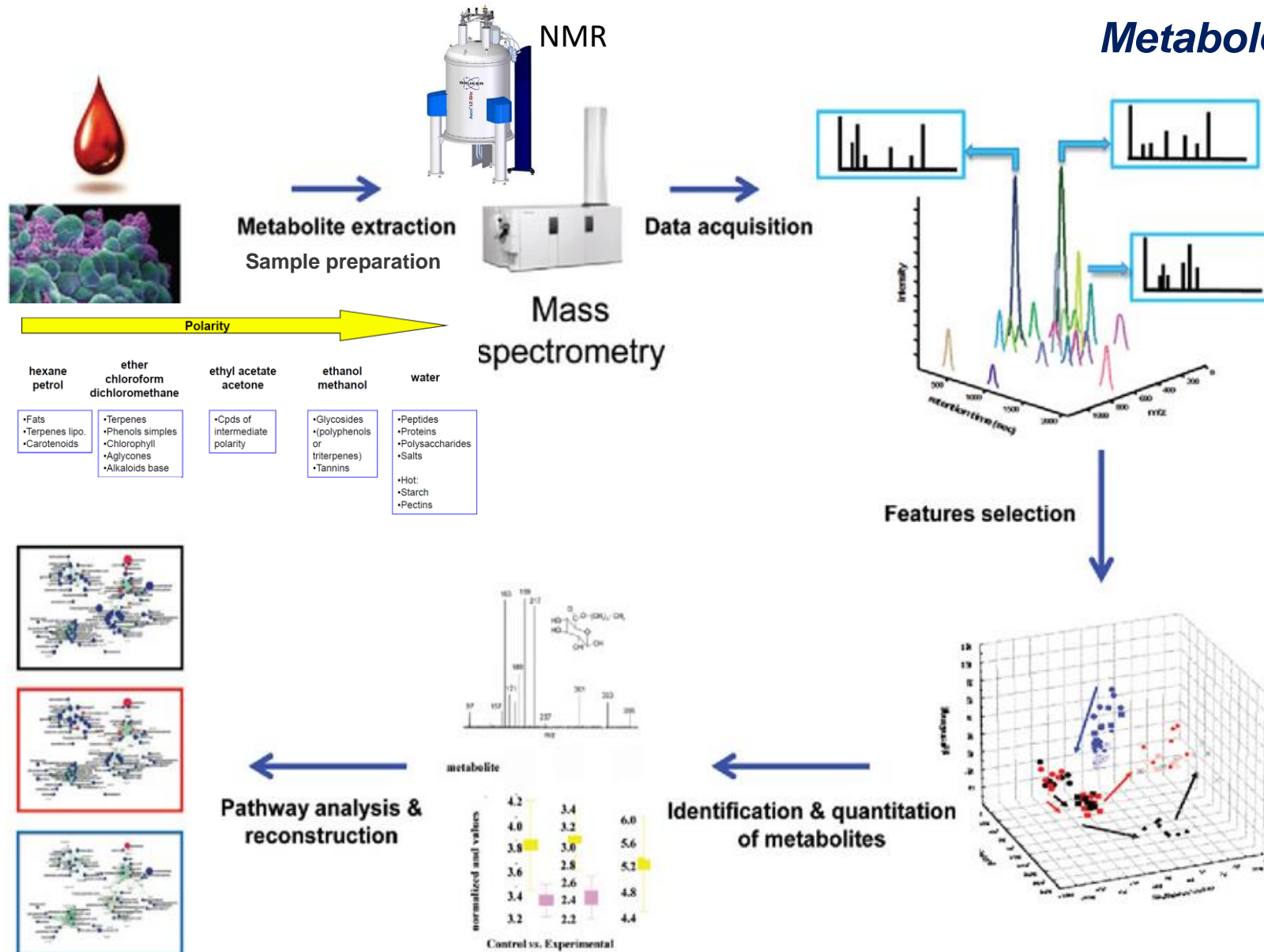


**Financiado por  
la Unión Europea**  
NextGenerationEU

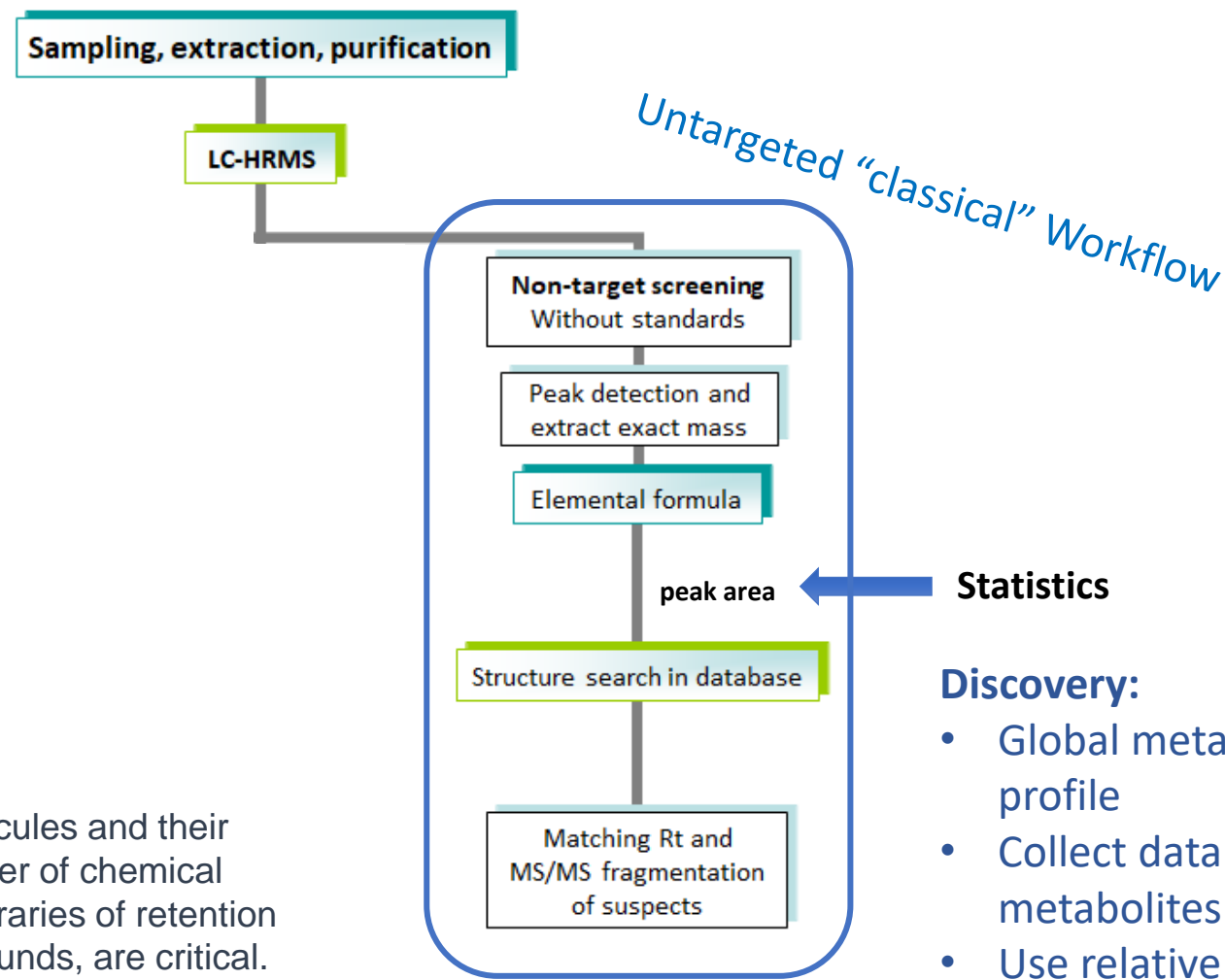
## Metabolomics Area

### *Analytical platforms*

- Advanced Ion Management Technology (AIM+)
- Exceptional precursor selectivity and sensitivity with the nextgeneration quadrupole mass filter QR5
- Unmatched depth and accuracy of TMT analysis with novel Real-Time Search
- High Mass Range MS<sub>n</sub> (HMR<sub>n</sub>) option for comprehensive analysis of native protein complexes
- Unique Proton Transfer Charge Reduction (PTCR) option for simplifying complex top-down spectra
- Enhanced Vacuum Technology
- Full experimental flexibility with revolutionary instrument control
- A wide range of optional functionalities for unprecedented versatility
- Common user interface with Thermo Scientific™ Orbitrap Exploris™ 480 and TSQ™ triple quadrupole mass spectrometers





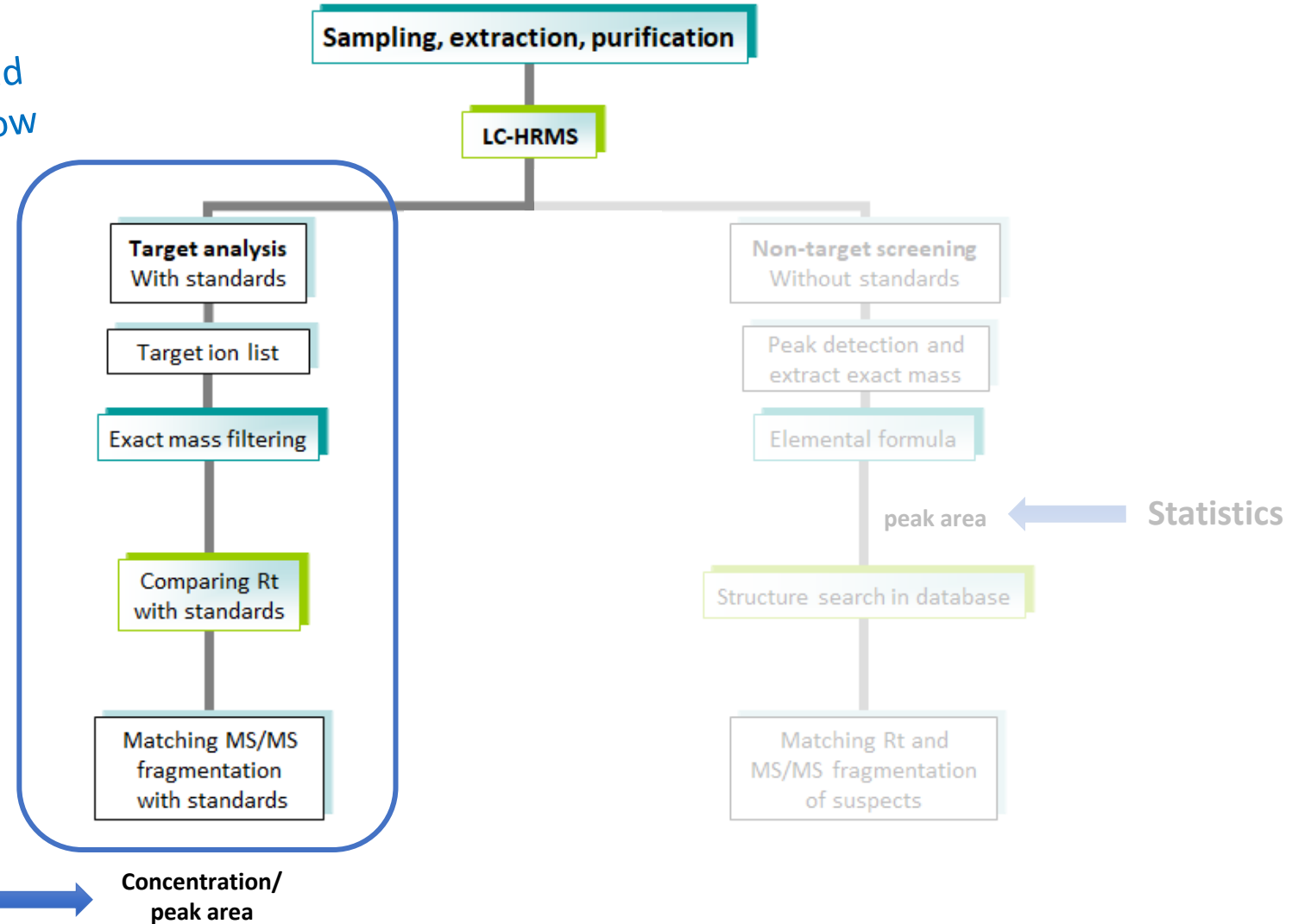


Unfortunately, knowing only the exact masses of molecules and their fragments is not enough to identify them. Huge number of chemical structures can have the same exact mass. This is why libraries of retention times and mass spectra, determined for standard compounds, are critical.

### Discovery:

- Global metabolome profile
- Collect data for all metabolites
- Use relative quantification

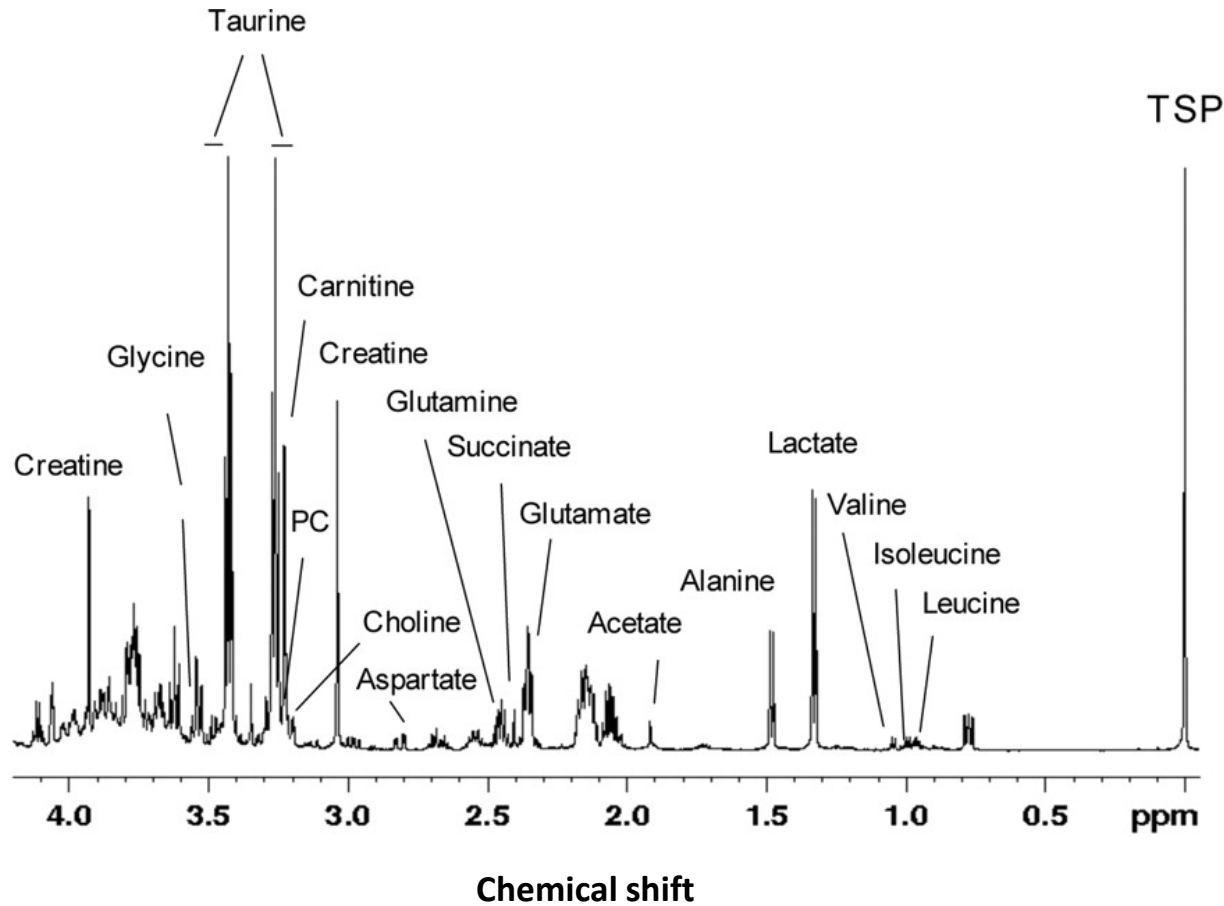
Targeted  
Workflow



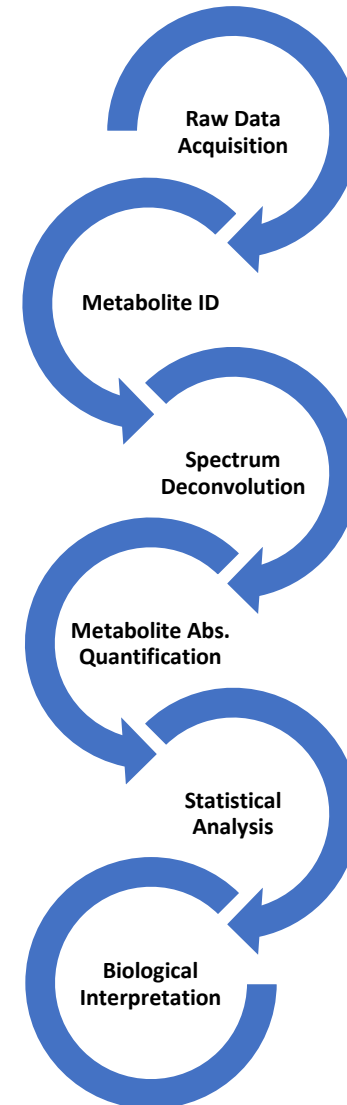
### Targeted:

- Collect data on only target metabolites
- Use relative or absolute quantification

## $^1\text{H}$ -Nuclear Magnetic Resonance (NMR)



*$^1\text{H}$  NMR spectrum of an example sample with metabolite peak annotation*



NMR does not destroy the sample

NMR can detect and quantify metabolite because the signal intensity is only determined by the molar concentration

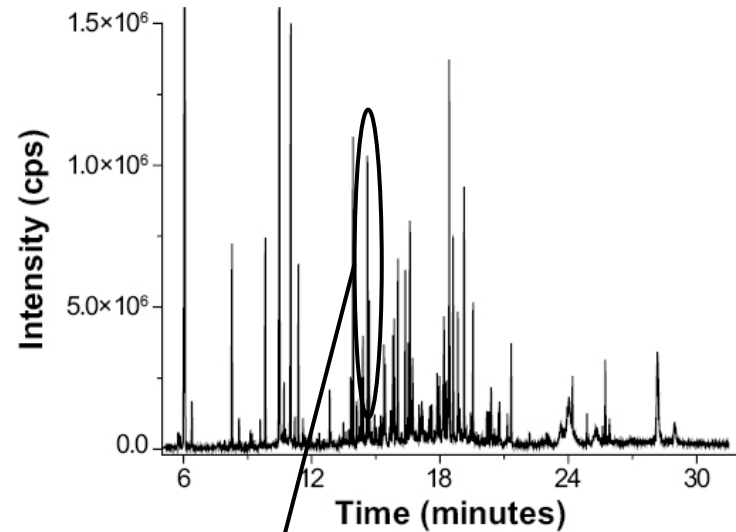
The main weakness of NMR is low sensitivity relative to MS.  $^1\text{H}$  is more sensible than  $^{13}\text{C}$

NMR can provide comprehensive structural information, including stereochemistry

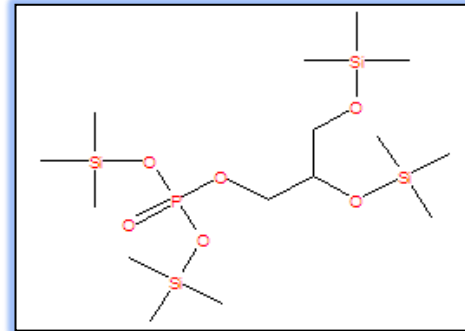
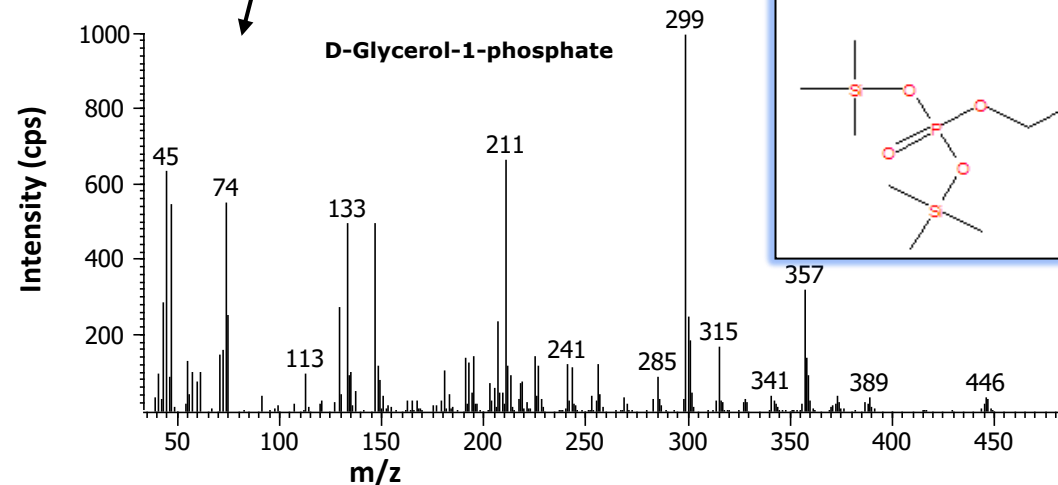
Many atoms have nuclei that are NMR active, but most NMR data are collected for  $^1\text{H}$  and  $^{13}\text{C}$  since these are present in all organic molecules

PMID: 21435731

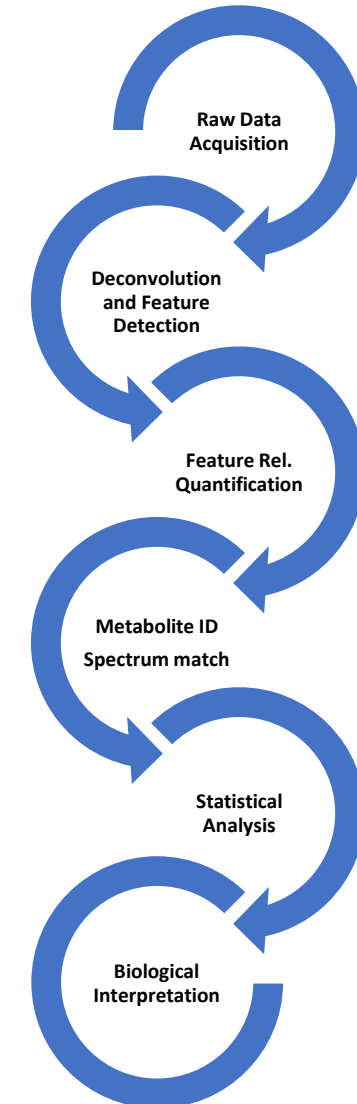
## GAS CHROMATOGRAPHY – MASS SPECTROMETRY (GC-MS)



In GC/MS, it may be necessary to first derivatize the sample to increase metabolite stability and volatility. The derivatized mix is then fractionated by a gas chromatograph that is coupled to a mass spectrometer.

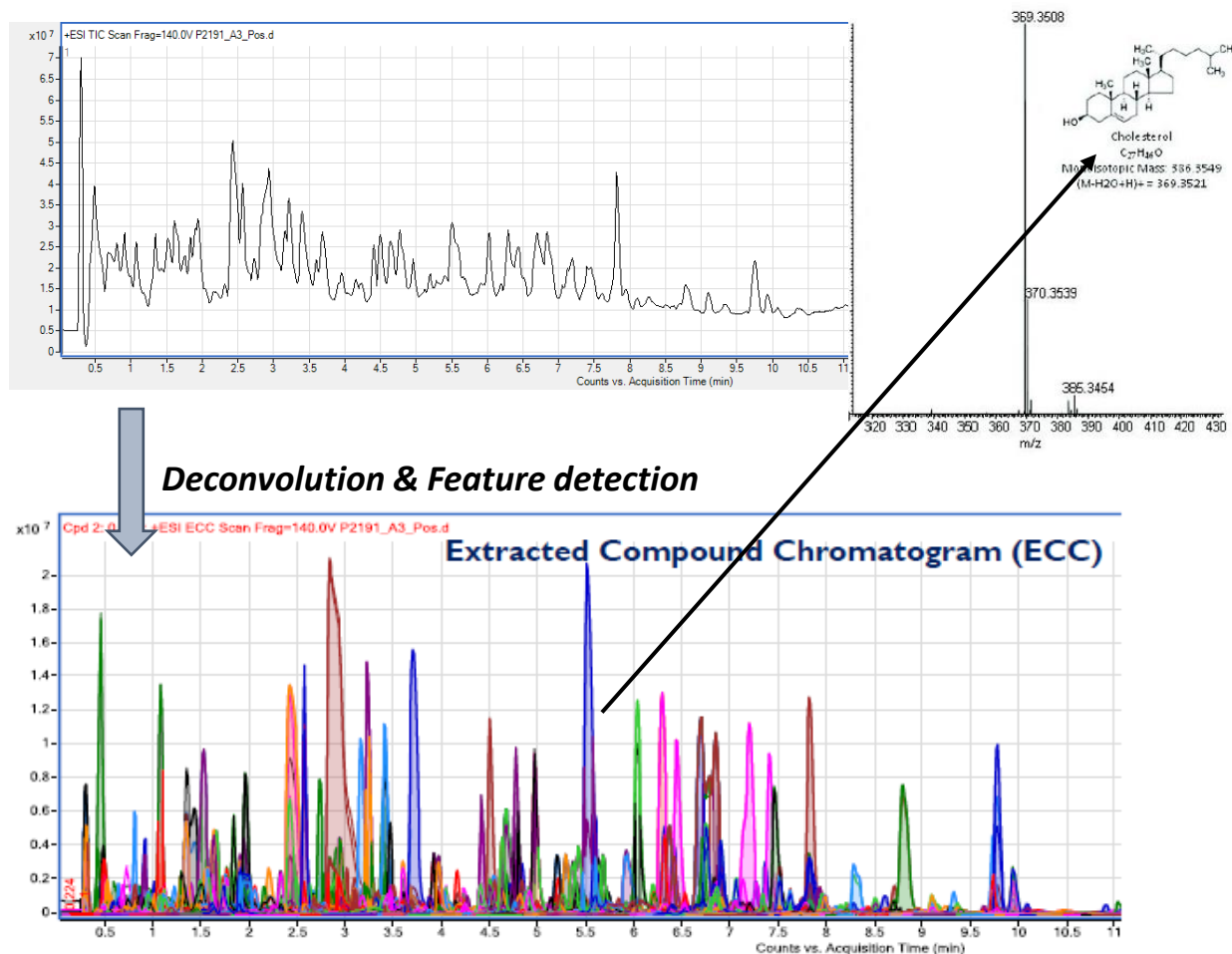


GC-MS chromatogram and MS spectrum match for a selected metabolite





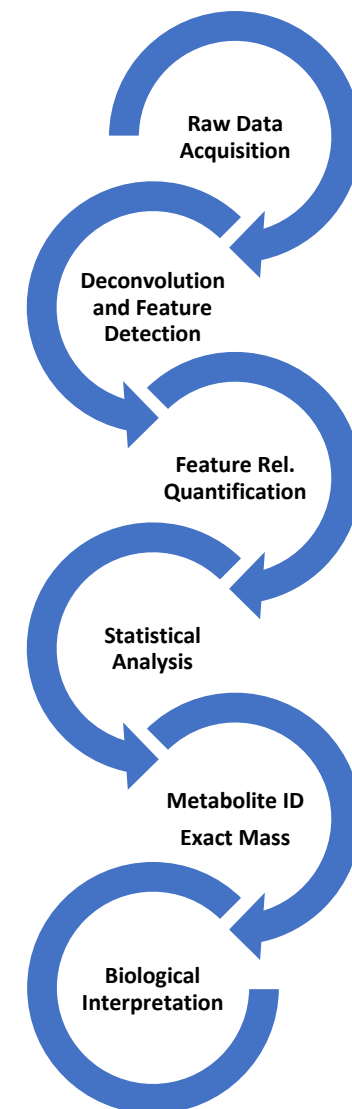
## LIQUID CHROMATOGRAPHY – MASS SPECTROMETRY (LC-MS)



In LC/MS (also termed high performance liquid chromatography, HPLC/MS) the samples are not derivatized before analysis and an HPLC instrument is used for separation.

LC/MS is more suitable than GC/MS for labile compounds, for those that are hard to derivatize, or hard to render volatile.

LC/MS is less developed than GC/MS. A closely related method is capillary electrophoresis (CE)/MS.

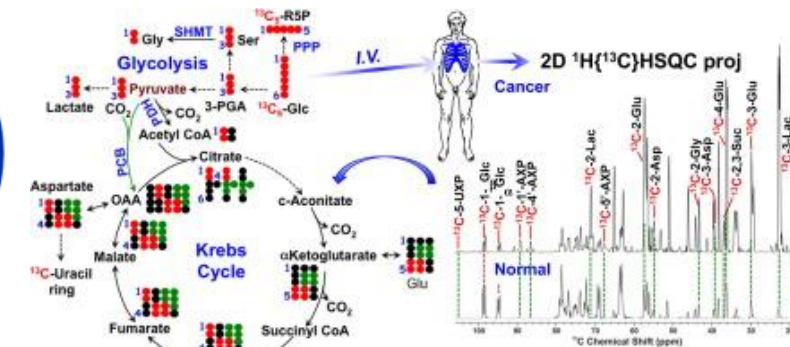
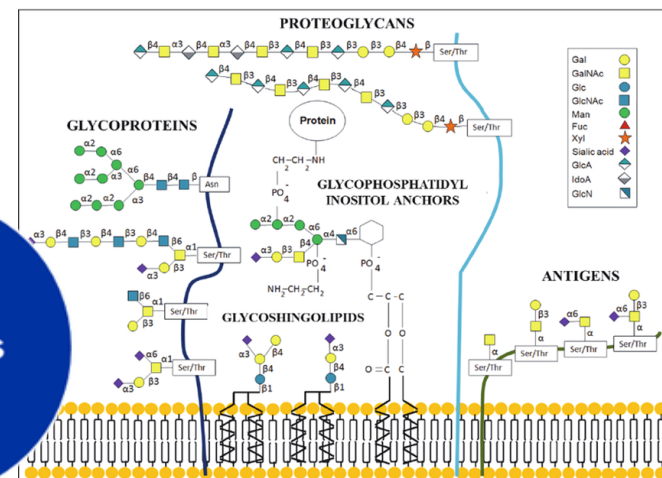
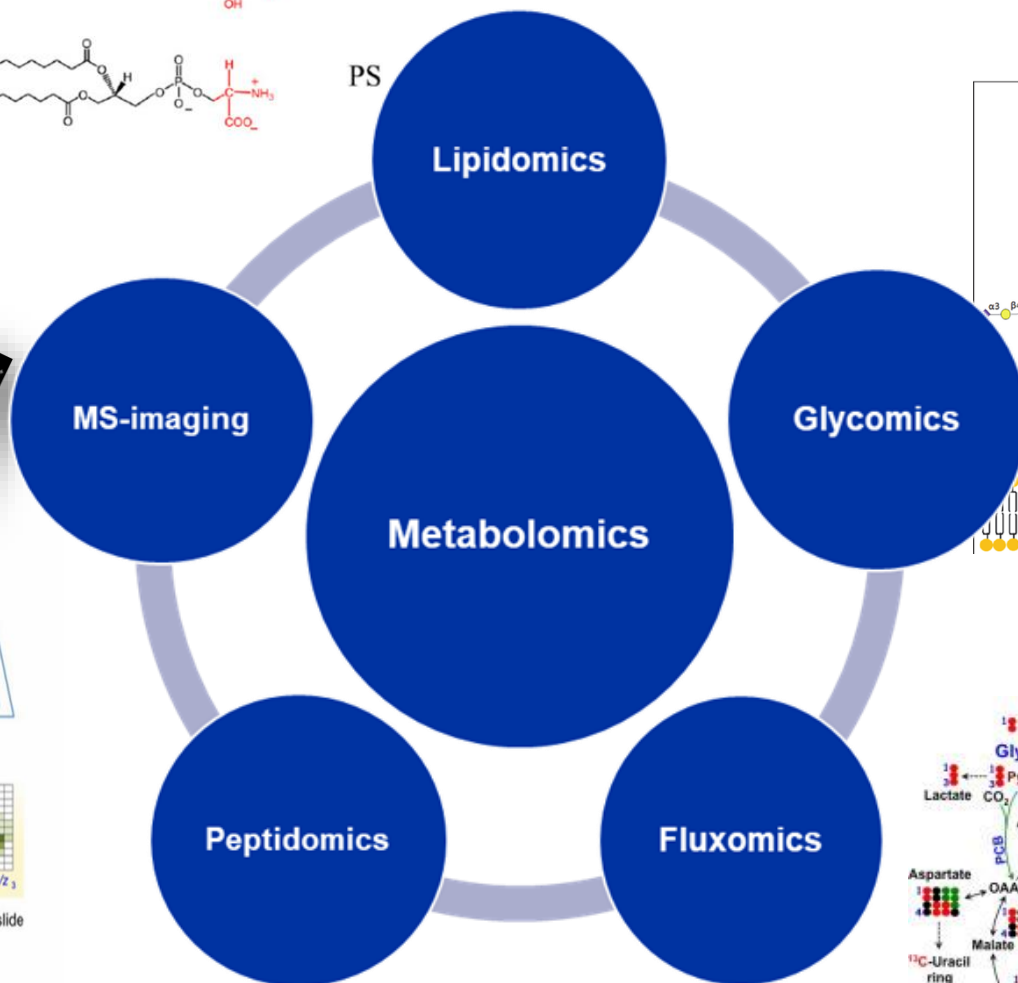
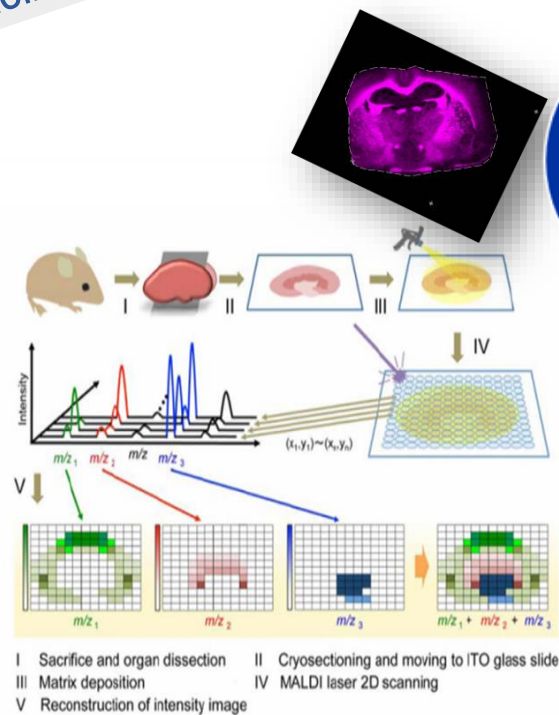


LC-MS chromatogram, Features detected and HRMS spectrum for a selected metabolite

*Offering*



The figure shows the chemical structures of PI and PS lipids. PI (Phosphatidylinositol) consists of two fatty acid chains (one saturated, one monounsaturated) linked to a glycerol backbone, which is further linked to an inositol ring. PS (Phosphatidylserine) consists of two fatty acid chains (one saturated, one monounsaturated) linked to a glycerol backbone, which is further linked to a serine residue. The structures are labeled PI and PS on the right.

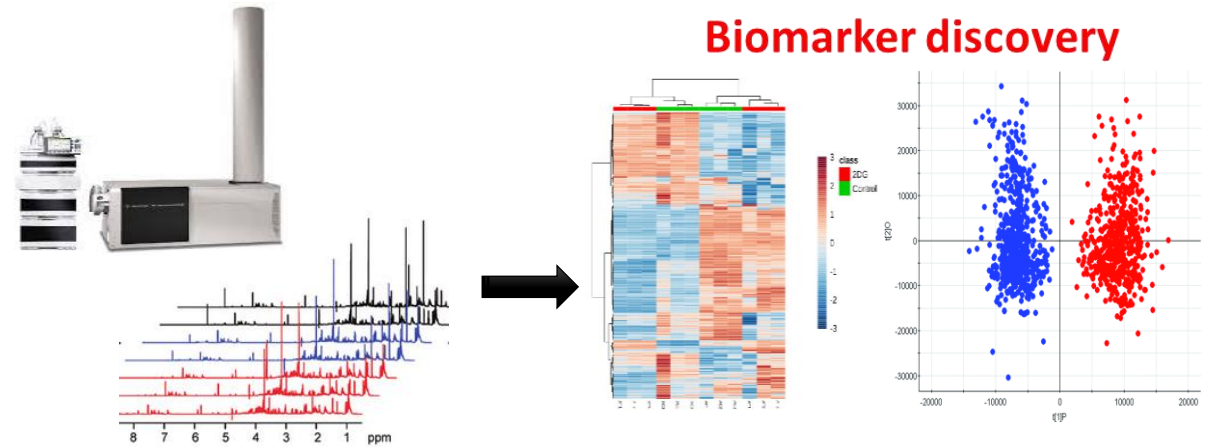




## Untargeted omics approach



aims for a quick and reliable **identification** of small molecule biomarkers characteristic for a particular **physiological state**



Multivariate Data analysis

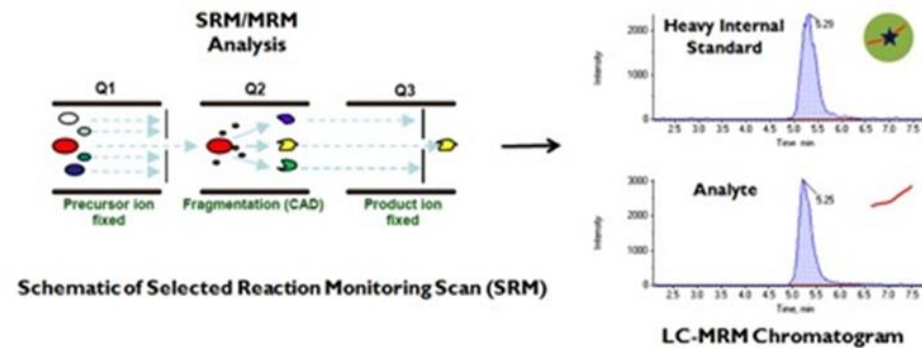
## Targeted omics approach

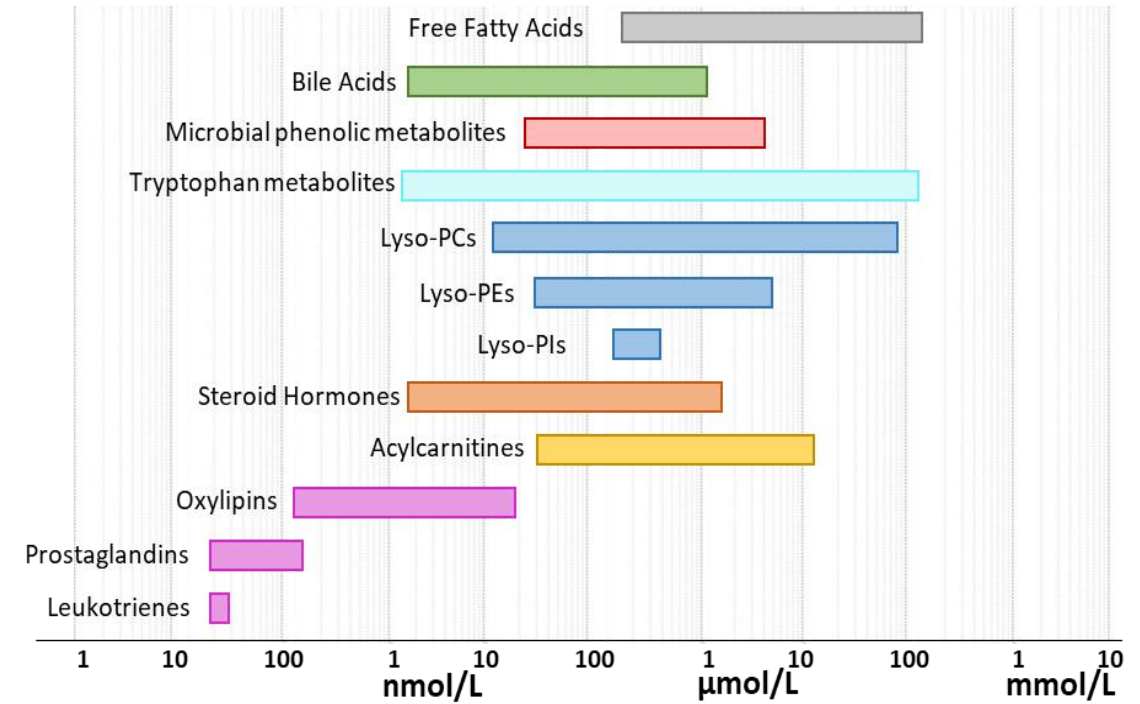
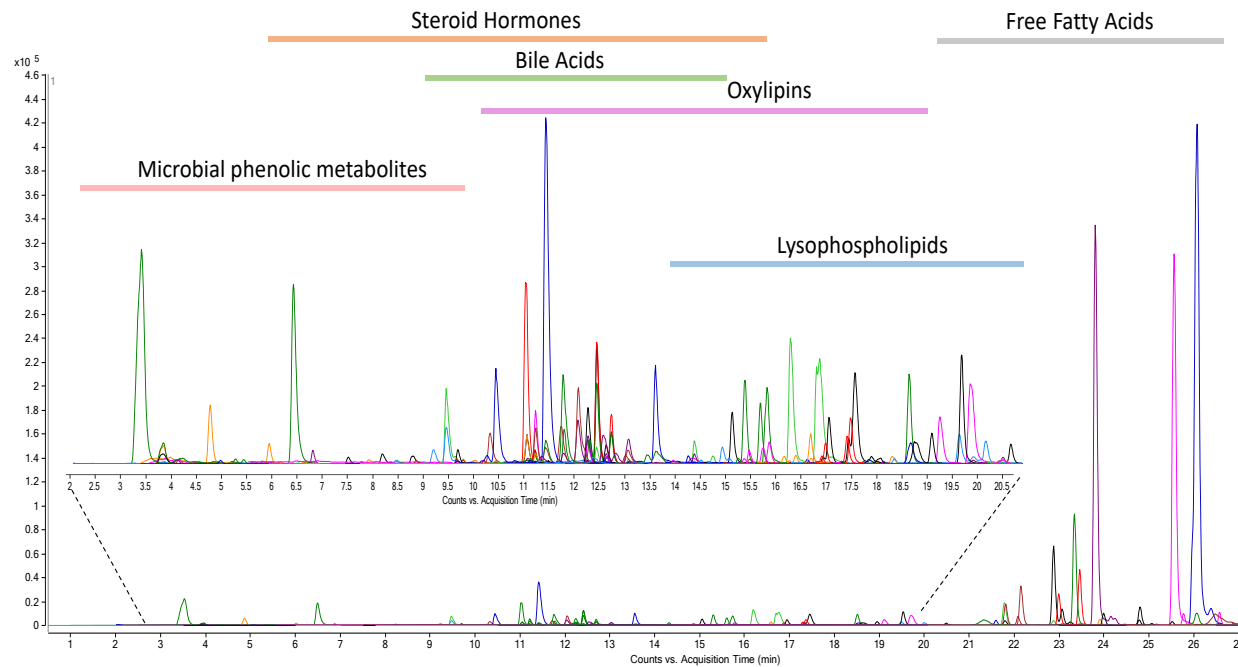


Validate **biomarker** candidates and analyze known target compounds

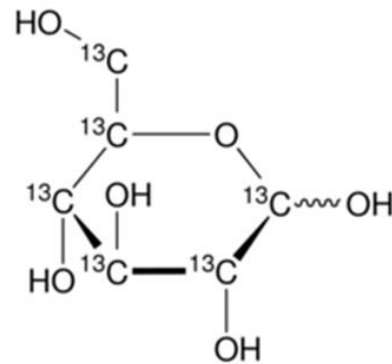
- Amino Acid Extend
- Acylcarnitine
- Bile Acids
- Short Chain Fatty Acids
- Oxylipins
- Polyamines
- Methylamines
- Energy Metabolism
- Fatty Acids
- Customized analysis

## Biomarker Valiation/Quatification





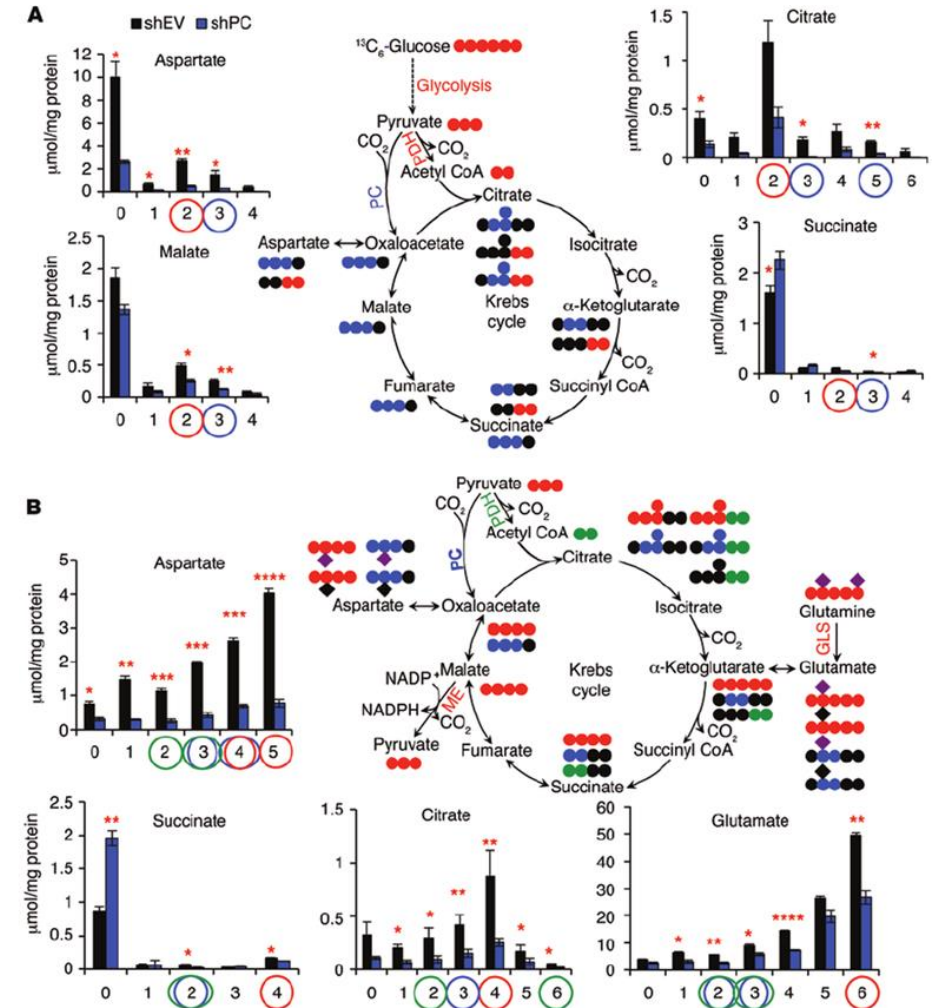


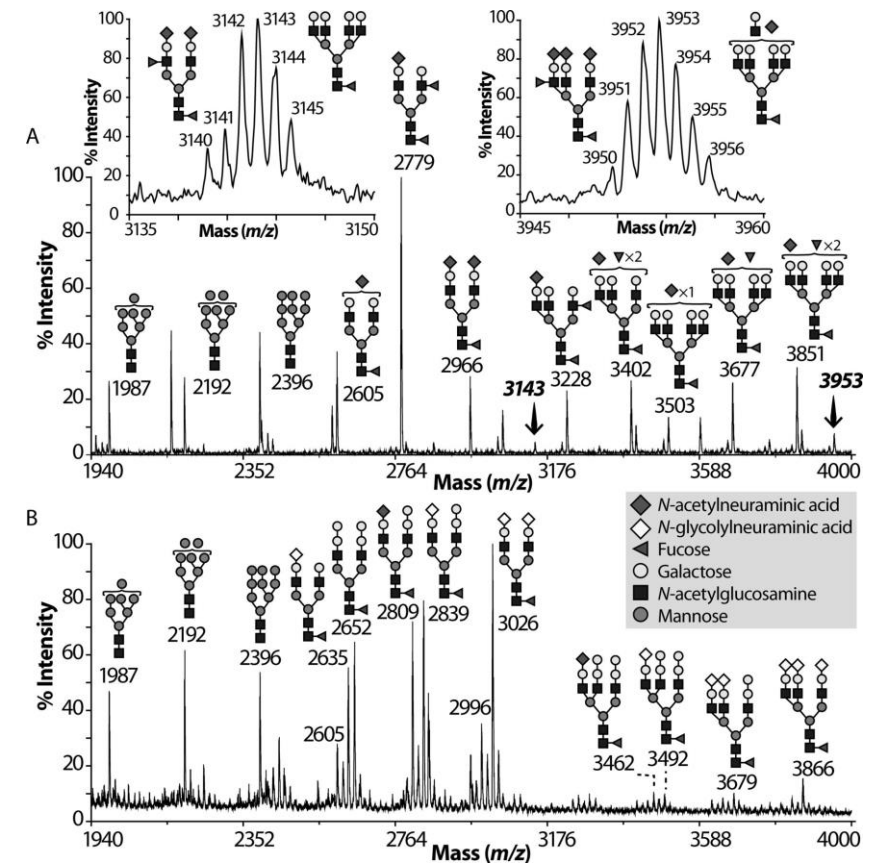
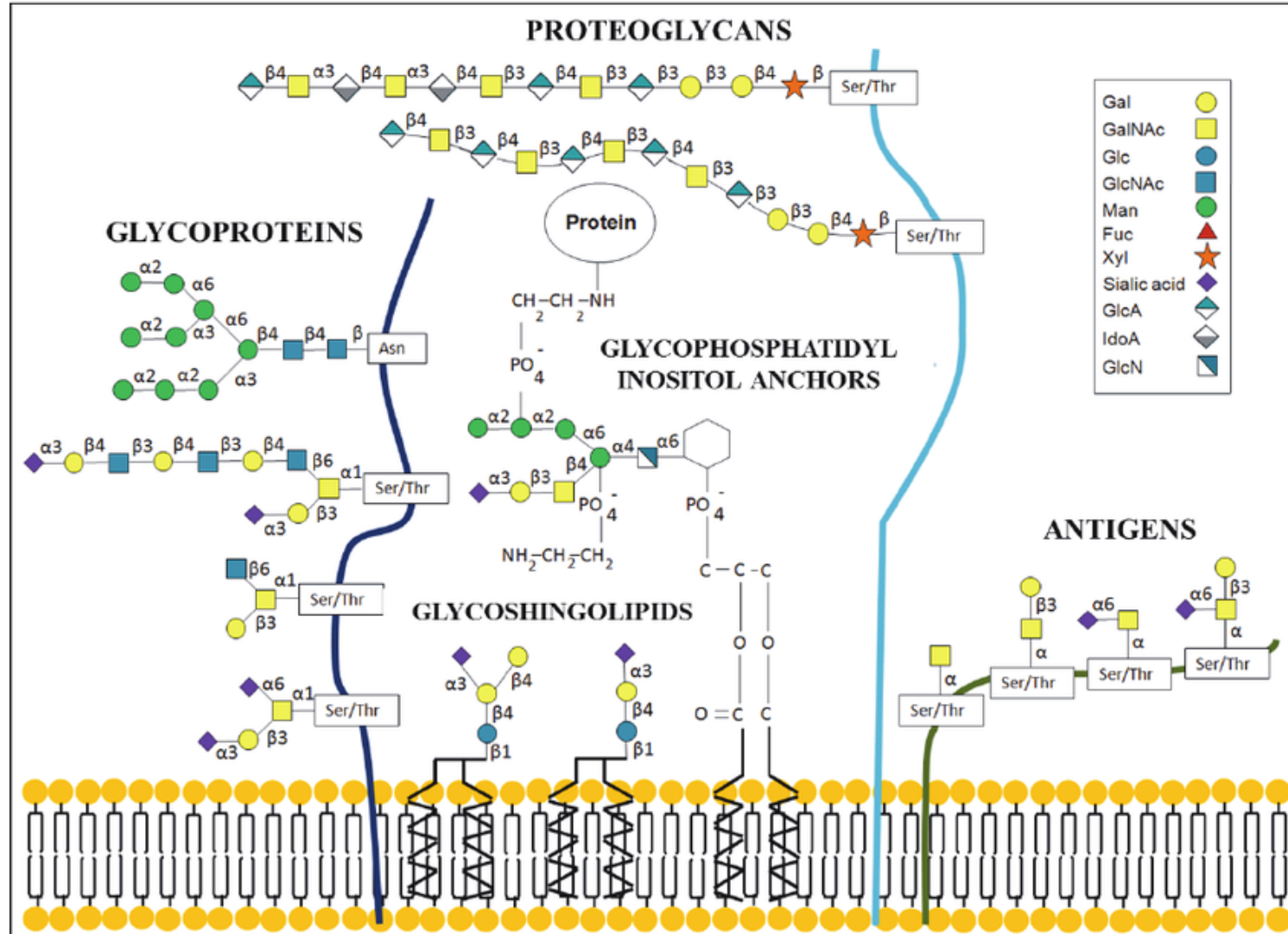


Fluxomics describes the various approaches that seek to determine the **rates of metabolic reactions** within a biological entity



In  $^{13}\text{C}$ -fluxomics, metabolic precursors are enriched with  $^{13}\text{C}$  before being introduced to the system







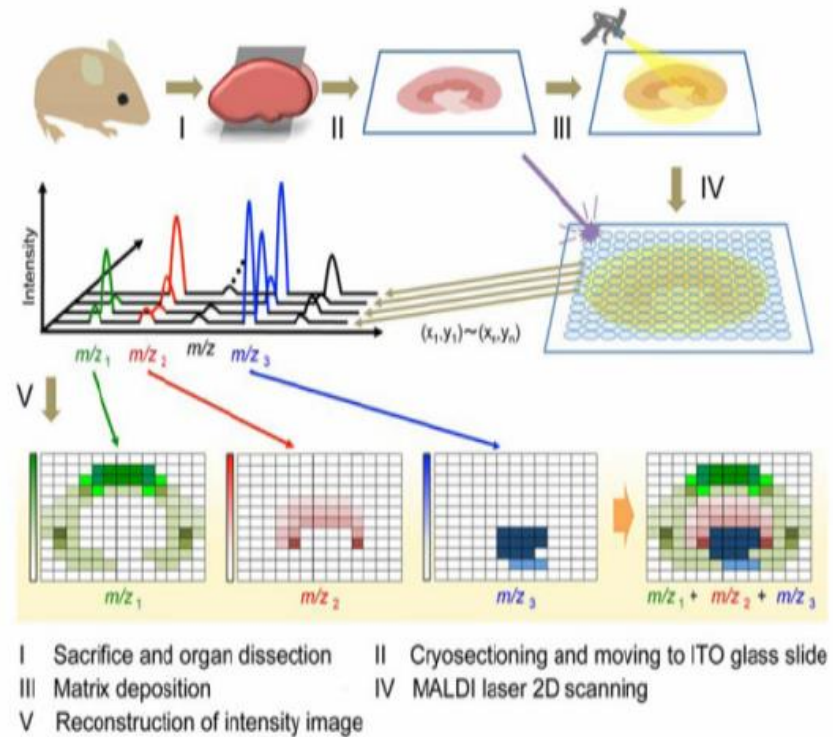


Figura 1. Flux de l'anàlisi mitjançant MALDI-MSI

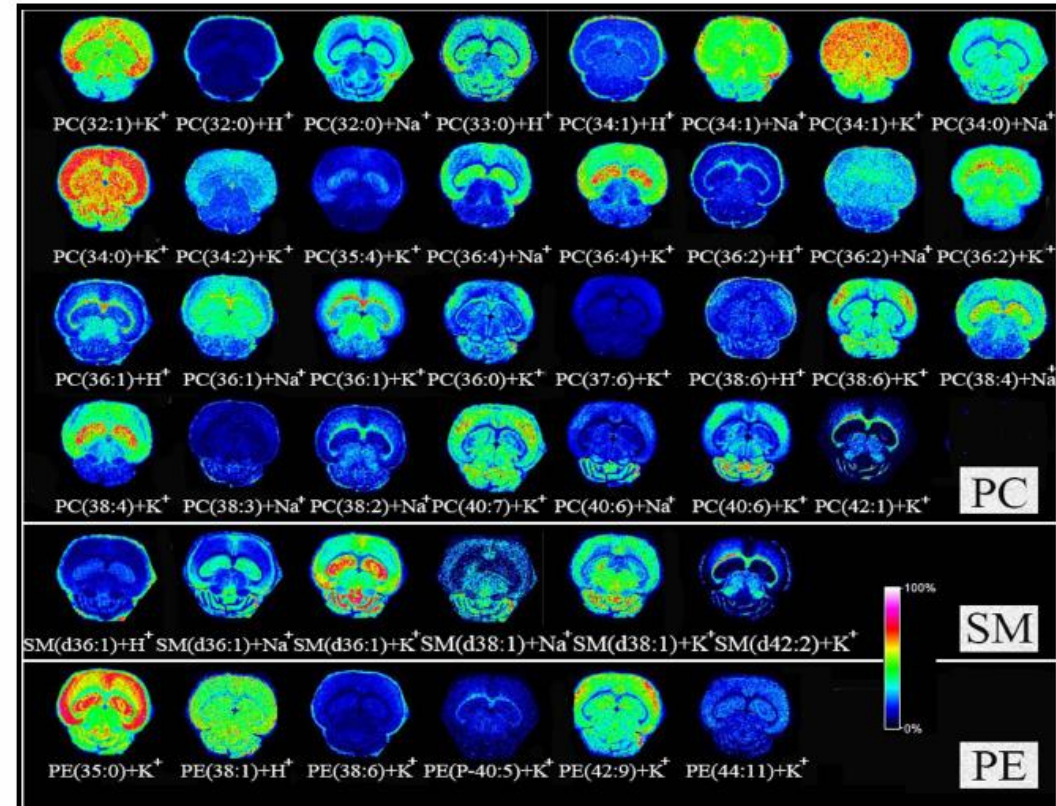


Figura 2. Distribució de lípids en seccions de cervell de rata. PC: fosfatidilcolines, SM: esfingomielines, PE: fosfatidiletanolamines [16]

A blue-tinted background image showing a complex molecular structure with various atoms and bonds, typical of a chemical or biological molecule.

*Projects & applications*





Organ on a  
chip, Omics,  
Machine  
Learning

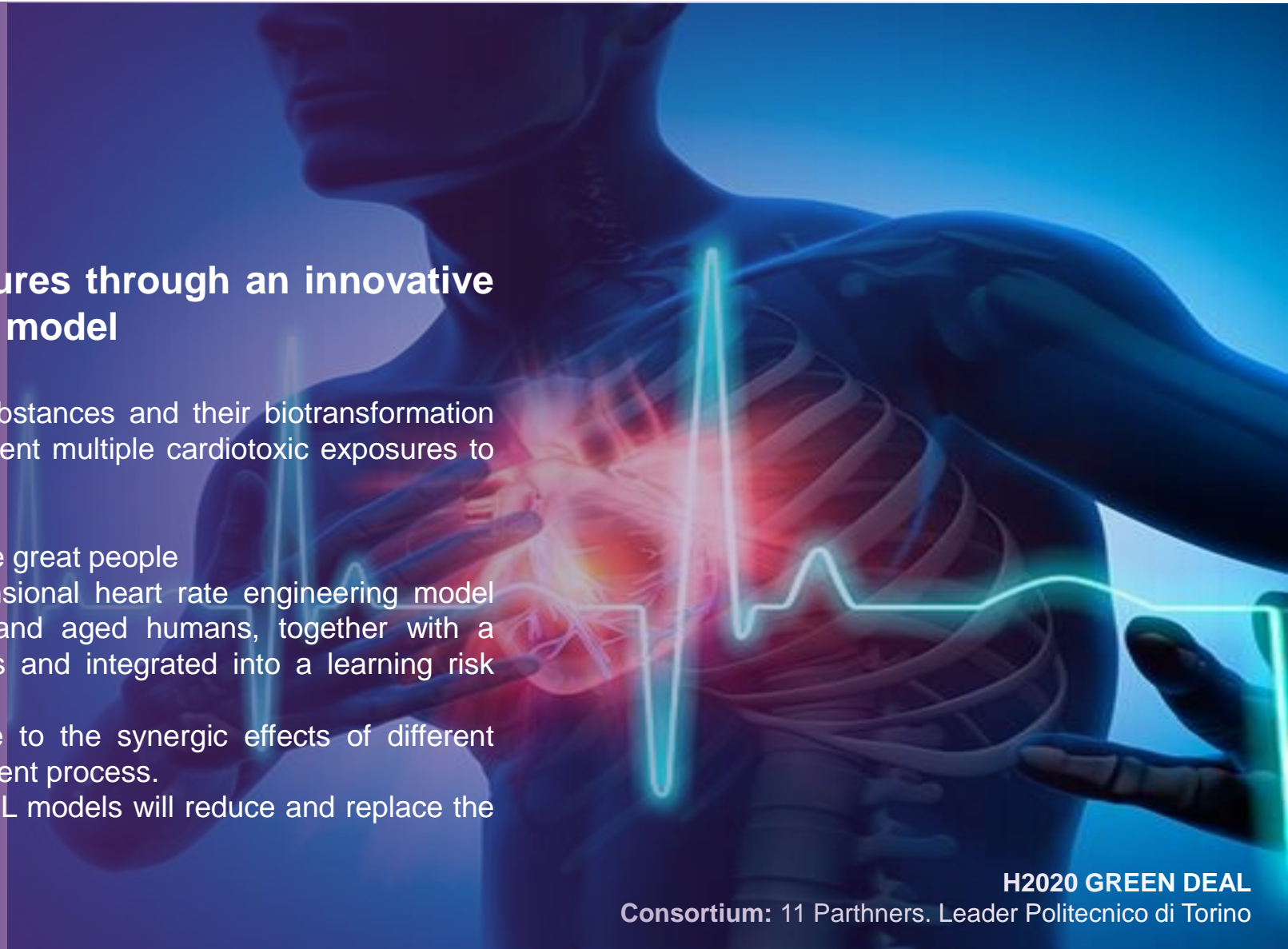
## Environmental Toxicity chemical mixtures through an innovative platform based on aged cardiac tissue model

Platform to detect the cardiotoxicity of chemical substances and their biotransformation products that will allow to identify, quantify and prevent multiple cardiotoxic exposures to chemical and pharmaceutical products.

The project is focused on the cardiotoxic effects in the great people  
The platform will consist of an in vitro three-dimensional heart rate engineering model (OCC) that will imitate the heart rate of young and aged humans, together with a monitoring system based on multichemical analysis and integrated into a learning risk assessment queen automatic (ML).

It allows to evaluate the unpredictable toxicity due to the synergic effects of different chemical substances, added by the human envelopment process.

The combination of an in vitro cardiac system and ML models will reduce and replace the need for animal testing.



**H2020 GREEN DEAL**

Consortium: 11 Parthners. Leader Politecnico di Torino

Precision  
fermentation

**Super-producing bacterial cultures to improve the performance of the production of biodegradable plastics, biofuels, drugs, nutrients,...**

**Precision fermentation:** we are working on altering the genome of different microorganisms through gene editing via CRISPR/cas9 to improve the production of microbial enzymes.

Some parameters of the bacterial cultures need to be optimized such as pH, temperature, enzyme concentration, substrate concentration, reaction time and for this, modifications can be made at the genetic level to manipulate the enzymes and promote an increase in the yield of its activity, generating a higher yield in obtaining the product, with higher quality.

Application of biotechnology in organic waste treatment processes on an industrial scale to obtain bioplastics, biofuels, nutrients,..

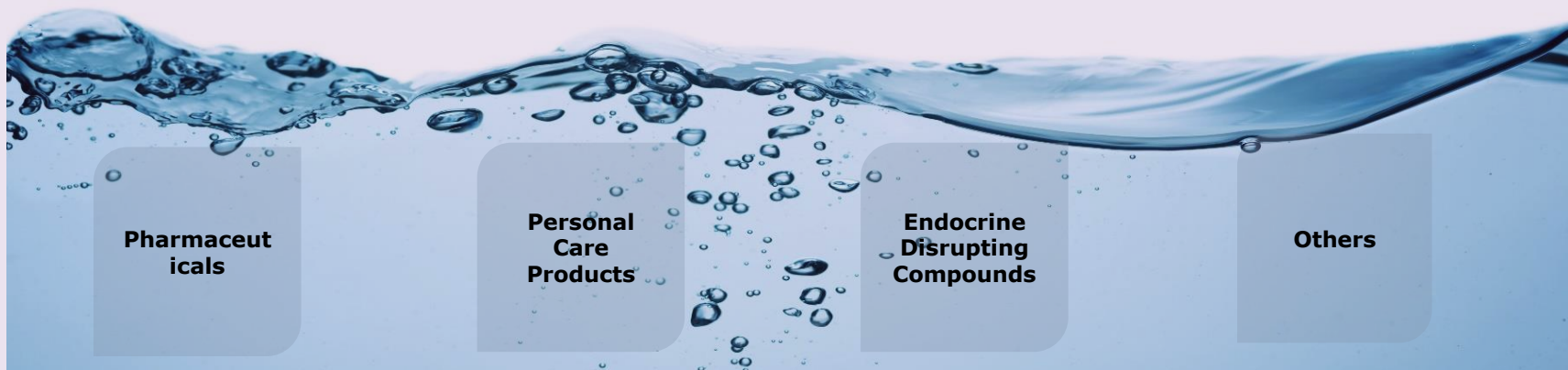




## Environment

### Water Organic Contaminants Analyses

- Over 1,000 toxic chemicals, pesticides, and pathological organisms may be into our drinking water because of human behaviors. Based on experience on water quality analysis and a state-of-the-art metabolomics platforms containing sensitive and accurate liquid and gas chromatography coupled to mass spectrometry instruments, COS can provide services to help you with water quality analysis.
- **Emerging pollutants:** pollutants that are currently not included in routine monitoring programmes at the European level and which may be candidates for future regulation, depending on research on their (eco)toxicity, potential health effects and public perception and on monitoring data regarding their occurrence in the various environmental compartments.
- For many compounds, **no analytical methods are available and no analytical standards**



With our professional team and platforms, we provide flexibility to screen for both non-targeted and targeted organic contaminants at once.

## Environment

### ANALYSIS OF EMERGING CONTAMINANTS AT COS



**Gas  
chromatography**



**Liquid  
chromatography**



**RMN**

**WATH LIST  
COMPOUNDS**

**COMMISSION  
IMPLEMENTING  
DECISION (EU)  
2018/840  
of 5 June 2018**

**DESINFECTION  
BY-PRODUCTS IN  
DRINKING  
WATER**

**PLASTIFIERS**

**CYANOTOXINS**

**CONTAMINANT  
SOLVENTS**

Alpha-ethinylestradiol (EE2)  
17-Beta-estradiol (E2)  
Estrone (E1)  
Macrolide antibiotics  
Methiocarb  
Neonicotinoids  
Metaflumizone  
Amoxicillin  
Ciprofloxacin

**THM:** chloroform, bromoform, chlorodibromoform, dichlorobromoform  
**HAA:** cloroacetic acid, dichloroacetic acid, trichloroacetic acid, bromoacetic acid, dibromoacetic acid, tribromoacetic acid, dichlorobromoacetic acid, bromodichloroacetic acid, chlorobromoacetic acid  
**Others:** chlorate, bromate

Bisphenol A  
Phtalates

Microcystin LR  
Nodularin  
Cylindrospermopsin  
Anatoxin A  
Saxitoxin

1,2-dioxane



Article

#### Erythromycin Abatement from Water by Electro-Fenton and Peroxyelectrocoagulation Treatments

Anna Serra-Clusellas <sup>1,\*</sup>, Luca Sbardella <sup>1</sup>, Pol Herrero <sup>2</sup>, Antoni Delpino-Rius <sup>2</sup>, Marc Riu <sup>2</sup>, María de Lourdes Correa <sup>1</sup>, Anna Casadellà <sup>1</sup>, Núria Canela <sup>2</sup> and Xavier Martínez-Lladó <sup>1</sup>

Water 2021, 13, 1129. <https://doi.org/10.3390/w13081129>



## Global omic data integration on animal, vegetal and environment sectors

Platform based on Big Data (BDA) and artificial intelligence (AI) techniques, integrating pre-existing omic data sets into databases, literature, and experimental data.

- The main result will be a multi-omic data analysis tool applicable to different domains.
- It is hoped to improve the understanding of biological systems by going beyond current data-based tools in the industry.
- 3 industrial sectors: animal production, agriculture and water treatment.

<https://glomicave.eu/>

15 partners/ 6 countries  
Coordinator: EURECAT - COS

