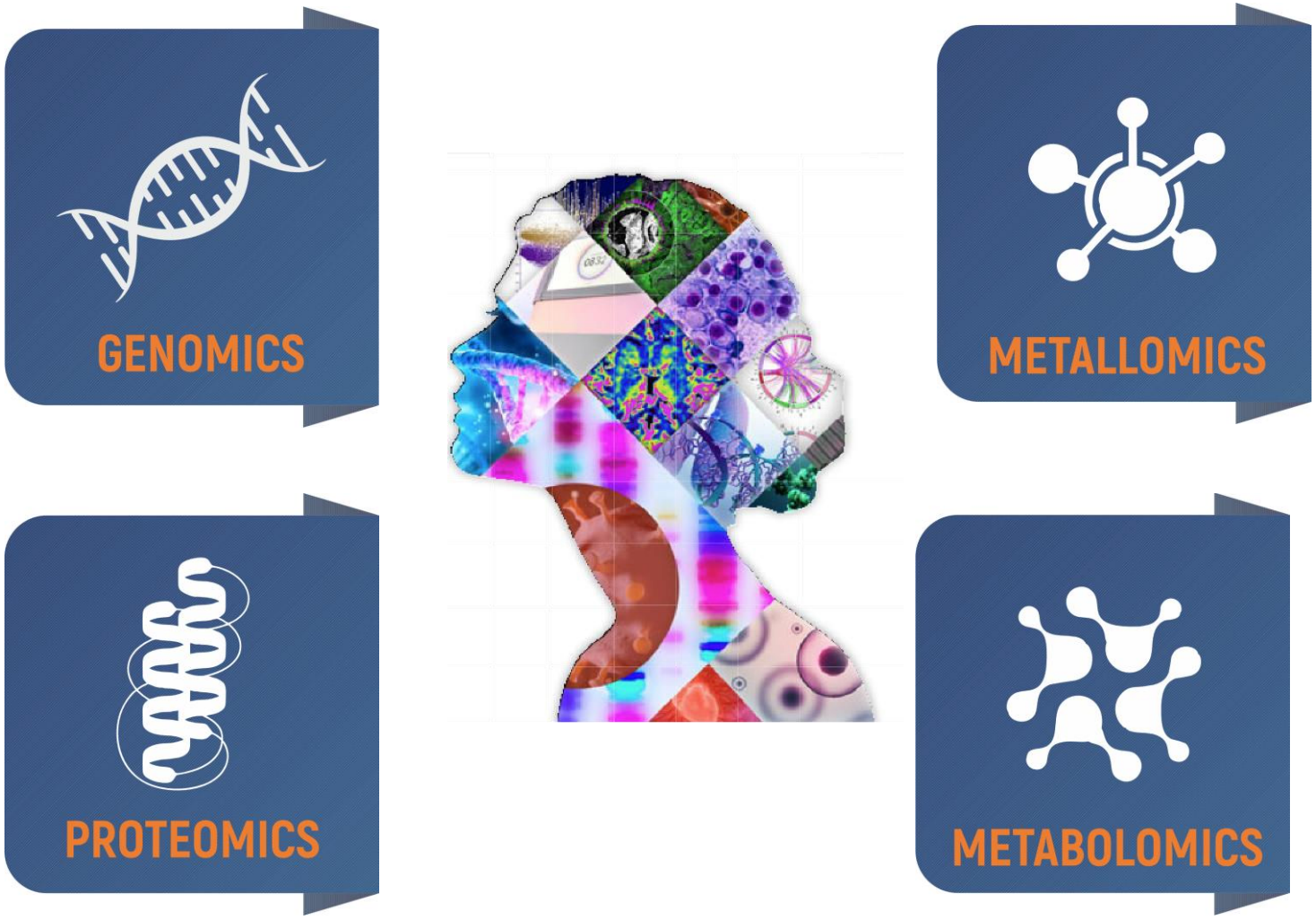
UNIVERSITY
OF WARSAW

HealthOmix:
Advanced Multiomics and Integrative Technologies for personal and precision medicine

Biological and Chemical Research Centre
University of Warsaw
Prof. dr hab. Ewa Bulska

HealthOmix:

Understand biological context - Combine omics datasets



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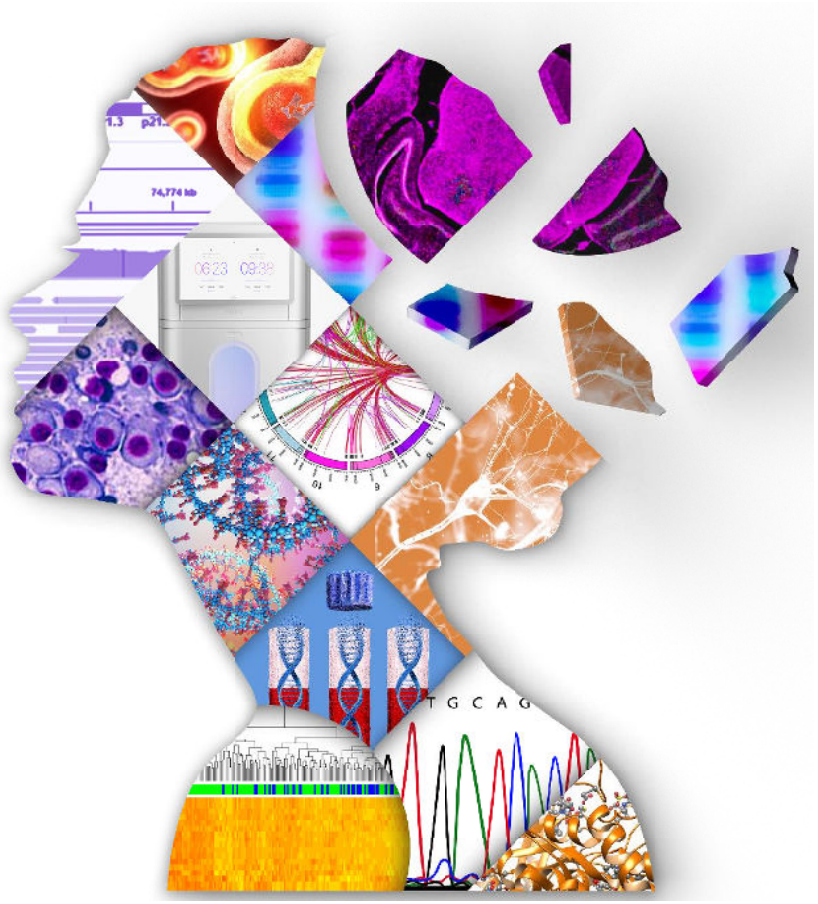

Multiomics: a holistic view of human health

OMICS SCIENCES

- The utilization of multiple omics technologies to study life in an integrated manner, aiming to identify coherent relationships or geno-pheno-environmental associations.
- A biological analysis approach in which datasets span multiple domains, such as the genome, transcriptome, proteome, and metabolome.

A comprehensive understanding of human health and disease requires the interpretation of molecular complexity and variability across multiple levels, including the genome, transcriptome, proteome, and metabolome.

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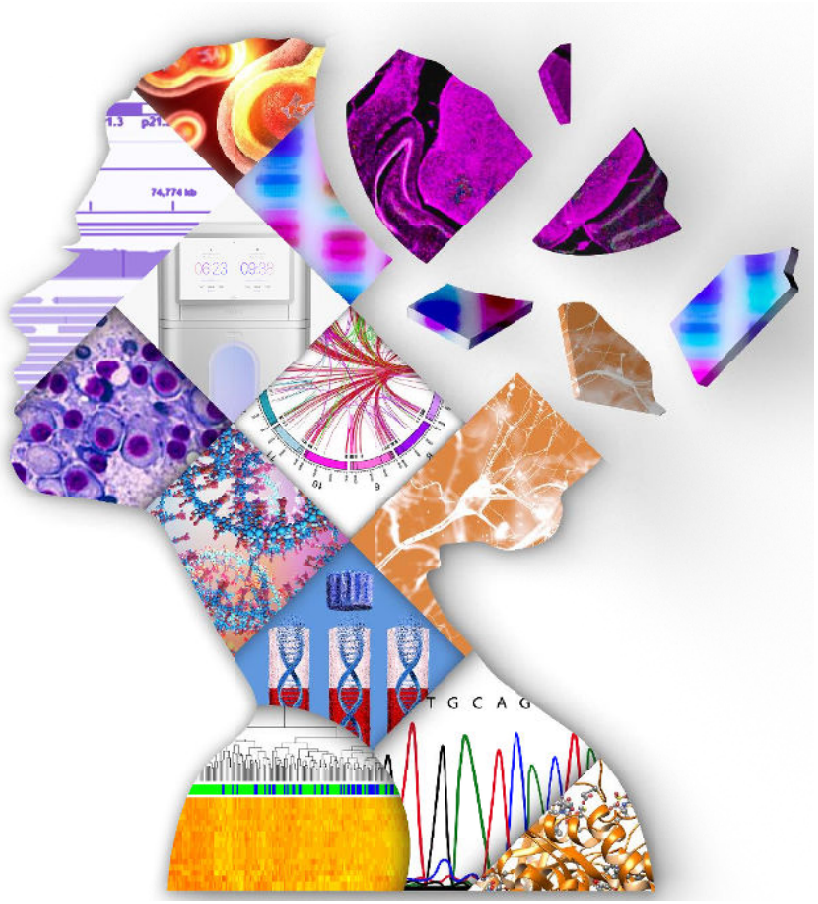

Multiomics: a holistic view of human health

Main research areas in omics studies:

- ❑ Understanding host-pathogen interaction.
- ❑ Gaining deeper insights into the molecular basis of infectious diseases and the causes of cancer.
- ❑ Investigating the underlying mechanisms of chronic and complex non-communicable diseases.
- ❑ Identifying novel biomarkers for disease diagnosis and treatment.
- ❑ Advancing personalized medicine.

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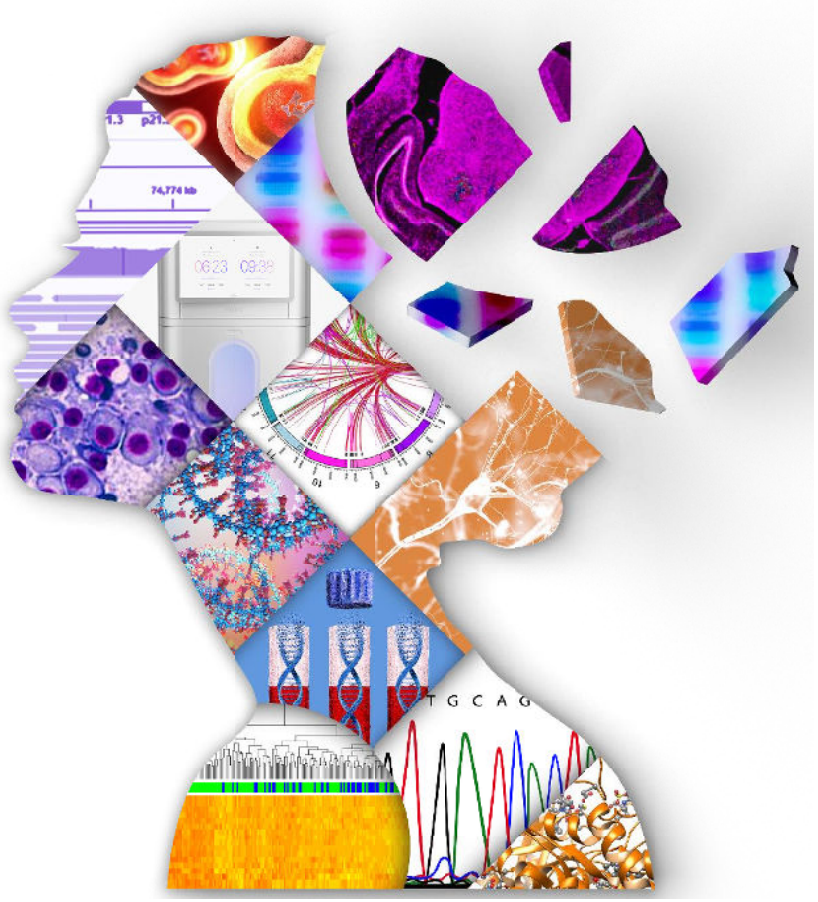

Multiomics: a holistic view of human health

GENOMICS

TRANSCRIPTOMICS

A scientific discipline focused on **the study of genes**,
including their structure, function, and interrelationships within the genome.

PROTEOMICS

A scientific discipline dedicated to **the study of proteins**,
including their structure, function, and interactions within biological systems.

METABOLOMICS

GLYCOMICS LIPIDOMICS

A scientific discipline focused on **the study of metabolites**,
including their structure, function, and interactions within metabolic pathways.

METALLOMICS

A scientific discipline focused on **the study of metals**,
including their structure, biological functions, and interactions within living systems.

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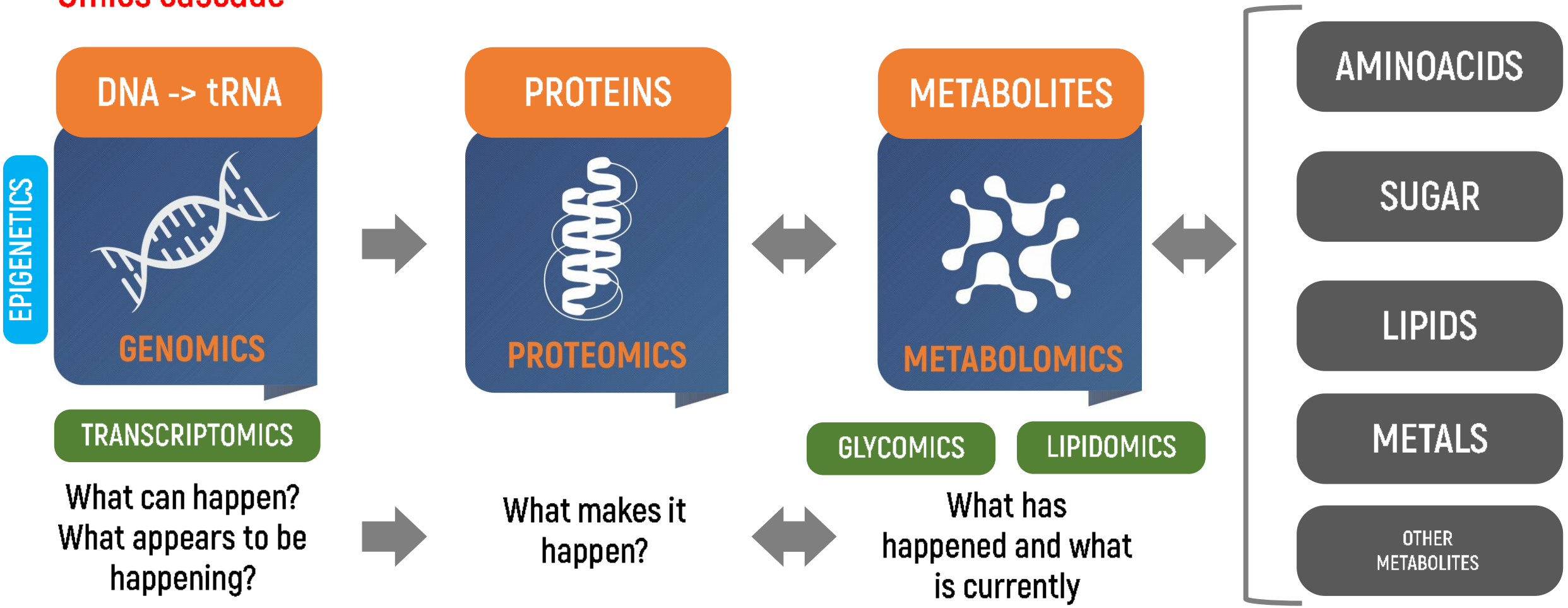
Omics cascade



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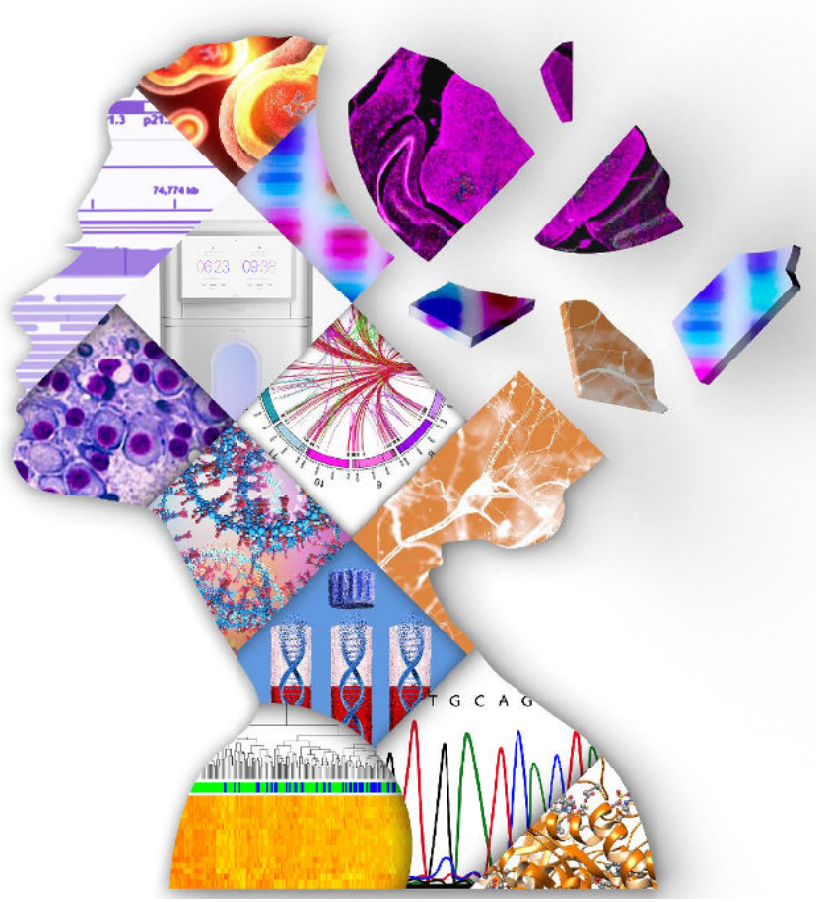
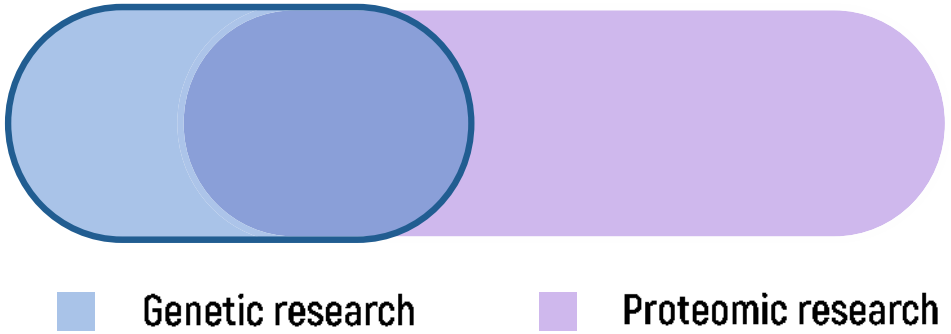


Multiomics: a holistic view of human health

Genomics + Proteomics

63% of researchers focusing on genetic studies also use proteomic methods.

38% of researchers focusing on proteomic studies also use genetic methods.



Percepta Associates, Inc.
Cell Biology Market Research. 2020.

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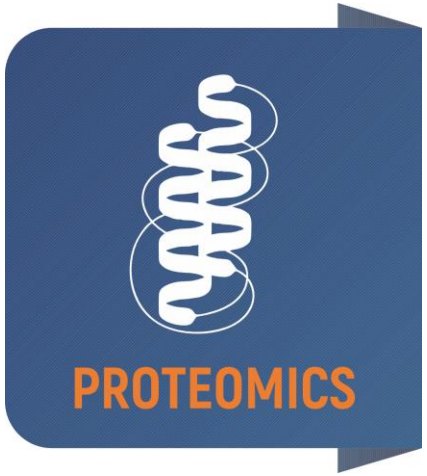
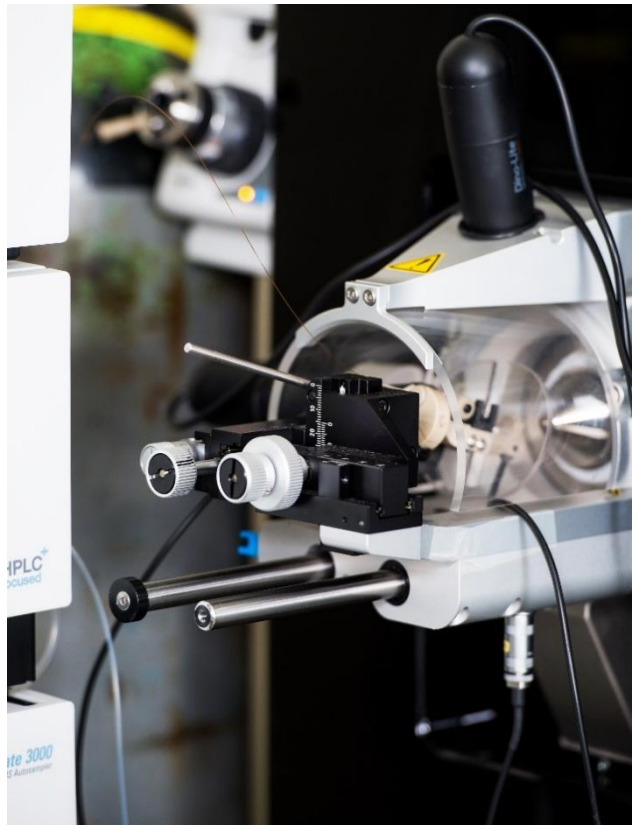


- Identification and quantitative analysis of proteinsIdentification of post-translational modifications
- Changes in protein expression under the influence of external factors (e.g., drugs, diseases, diets)
- Identification of new protein biomarkers
- Proteomic studies of drug mechanisms and toxicity
- Proteomic studies of disease mechanisms
- Bioinformatics analysis of proteomic data and the biological significance of the results
- Complementary analyses for other "omics" studies



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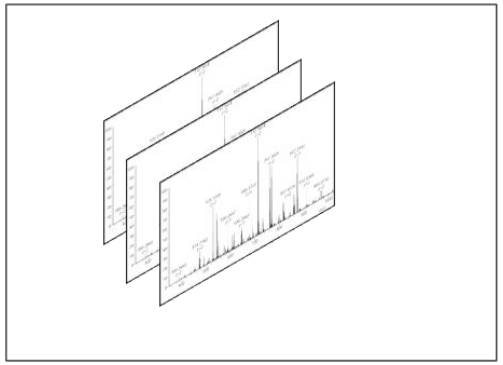
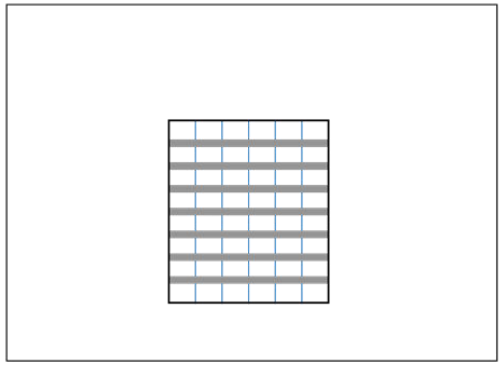
PROTEOMICS

Protein identification
Bioinformatics analysis

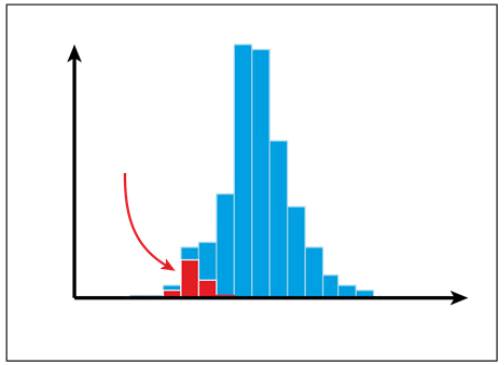
(A) Mass spectrometry data preparation



MS signal registration

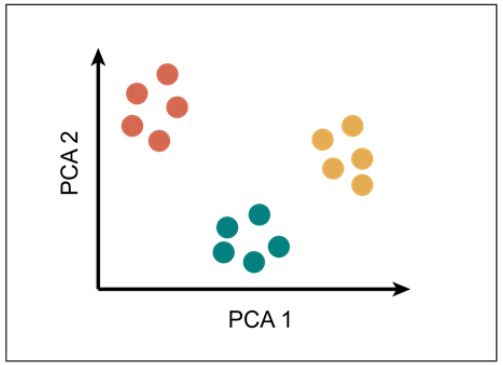


MS data introduction

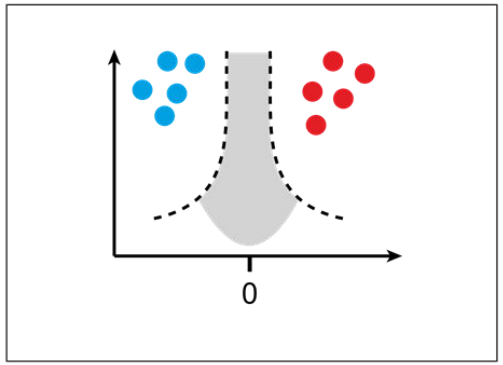


Preliminary data processing

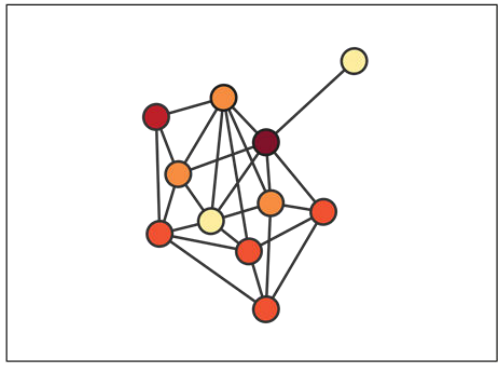
(B) Statistical analysis and biological interpretation of results



Statistical analysis



Differential analysis



Assigning biological significance

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PROTEOMICS

MEDICAL SCIENCE MONITOR

ANIMAL STUDY

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Label-Free Mass Spectrometry-Based Quantitative Proteomics to Evaluate the Effects of the Calcium-Sensing Receptor Agonist Cinacalcet on Protein Expression in Rat Brains and Livers

Authors' Contribution: Study Design A, Data Collection B, Statistical Analysis C, Data Interpretation D, Manuscript Preparation E, Literature Search F, Funds Collection G

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animals

MDPI

Article

Label-Free Mass Spectrometry-Based Proteomic Analysis in Lamb Tissues after Fish Oil, Carnosic Acid, and Inorganic Selenium Supplementation

Andrzej Gawor [1], Anna Ruszczyńska [1], Anna Konopka [1], Grzegorz Wryk [1], Marian Czauderna [2] and Ewa Bulska [1,*]

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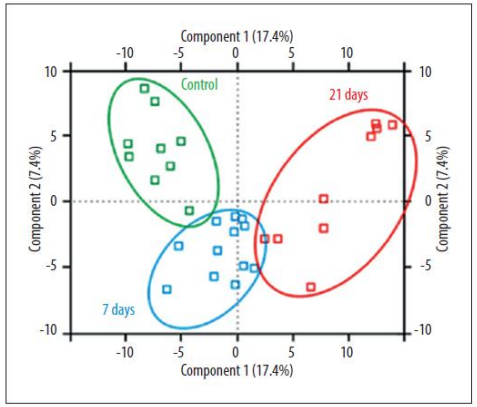
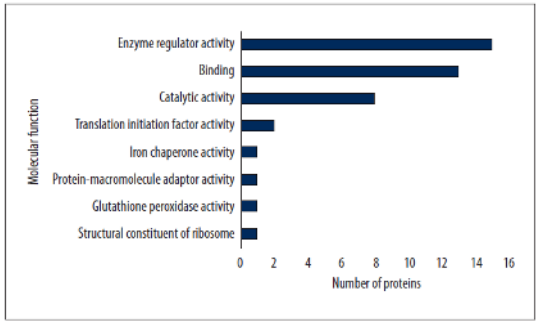
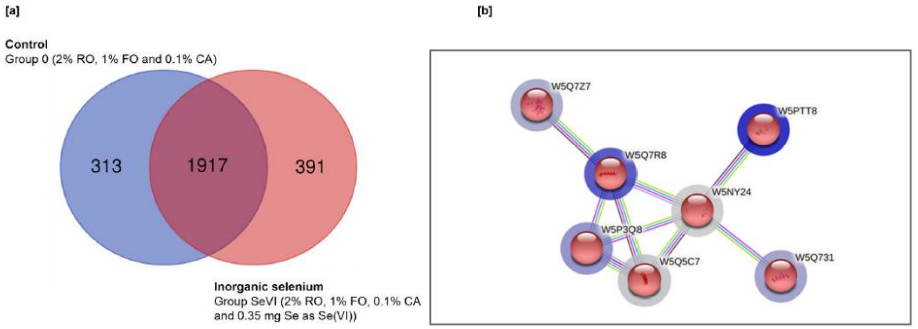




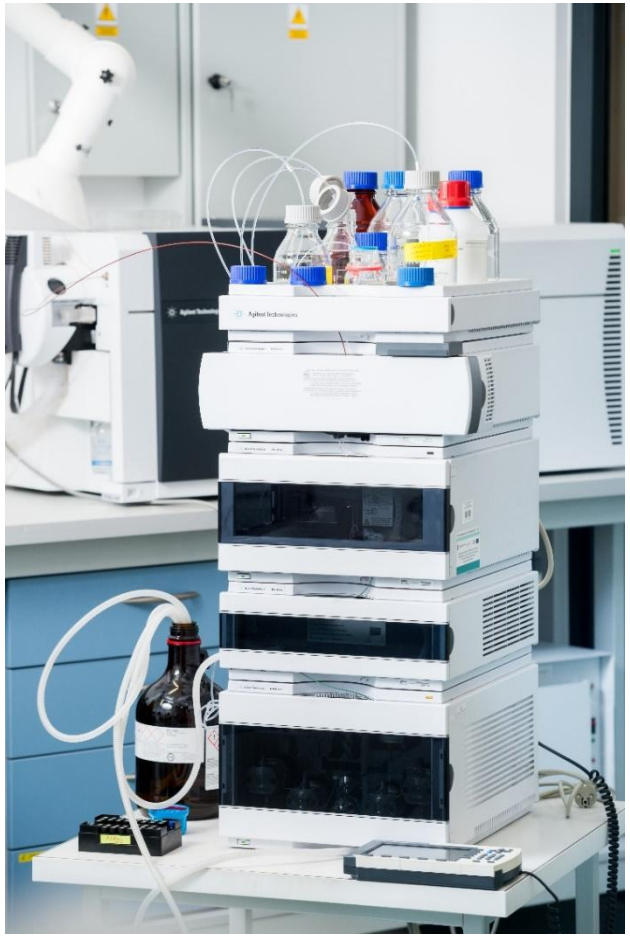


HealthOmix:

Understand biological context - Combine omics datasets

METABOLOMICS

- Identification and quantitative analysis of metabolites (including vitamins, amino acids, carbohydrates, lipids) – targeted and untargeted analyses
- Identification of new metabolomic biomarkers
- Metabolomic studies of drug mechanisms and toxicity
- Metabolomic studies of disease mechanisms
- Bioinformatics analysis of obtained results



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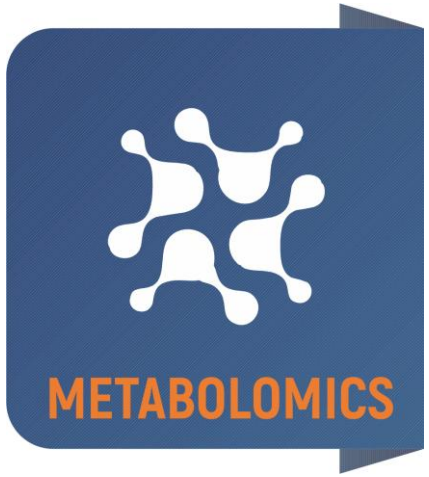

Talanta 202 (2019) 572–579

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Urinary metabolomic signature of muscle-invasive bladder cancer: A multiplatform approach

Julia Jacyna[a], Renata Wawrzyniak[a], Stéphane Balayssac[b], Véronique Gilard[b], Myriam Malet-Martino[b], Aleksandra Sawicka[a], Marta Kordalewska[a], Łukasz Nowicki[c], Eliza Kurek[d], Ewa Bulska[d], Małgorzata Patejko[a], Marcin Markuszewski[e], Piotr Gutknecht[f], Marcin Matuszewski[e], Janusz Siebert[f], Roman Kaliszan[a], Michał J. Markuszewski[a,*]

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Information on metabolites significantly differentiating urinary profiles from BCa patients and healthy volunteers.

Metaboslite	Analytical technique	*p*-value	VIP value	Regulation (cancer *vs* contr
S-adenosylmethionine	HILIC LC-MS +	2.9×10^{-6}	1.4	↓
Benzenediol (catechol)	GC-MS	9.2×10^{-3}	1.7	↓
2-deoxy-ribonic acid	GC-MS	1.5×10^{-5}	1.1	↑
Diacetylspermine	HILIC LC-MS +	1.4×10^{-2}	1.6	↑
meso-Erythritol	GC-MS	9.2×10^{-3}	1.8	↑
Glutamine	RP LC-MS-	4.4×10^{-7}	1.1	↑
Glycolic acid	NMR	5.0×10^{-5}	2.2	↓
Hippuric acid	NMR	8.3×10^{-6}	2.5	↓
	HILIC LC-MS-	1.1×10^{-3}	2.1	
	HILIC LC-MS +	5.5×10^{-4}	1.1	
	RP LC-MS +	5.7×10^{-1}	1.1	
Lactic acid	NMR	7.0×10^{-6}	2.7	↑
	GC-MS	2.1×10^{-6}	2.3	
Pentanedioic acid (glutaric acid)	GC-MS	5.3×10^{-3}	1.7	↑
Phenylacetylglutamine	RP LC-MS-	6.4×10^{-7}	1.0	↑
Pipecolic acid	HILIC LC-MS +	10^{-6}	1.3	↓
Propanoic acid	GC-MS	3.9×10^{-4}	1.9	↑
Threonic acid	GC-MS	2.1×10^{-4}	2.3	↑
Tyrosine	HILIC LC-MS-	4.4×10^{-2}	1.5	↑
Uric acid	RP LC-MS-	3.3×10^{-10}	1.3	↑
	RP LC-MS +	9.5×10^{-1}	1.1	
Uridine	RP LC-MS-	2.6×10^{-7}	1.4	↑

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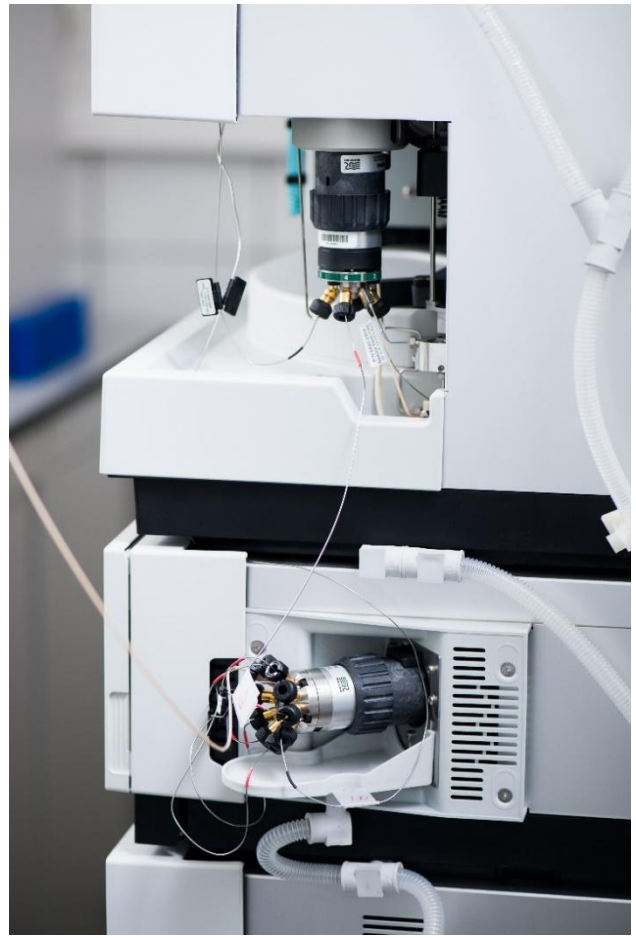
METALLOMICS

- Elemental signatures
- Studies on the biotransformation of selected elements
- Studies on the distribution of selected elements in biological tissues
- Studies on the binding potential of selected metals to proteins



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METALLOMICS

Article

Laser Ablation ICP-MS Analysis of Chemically Different Regions of Rat Prostate Gland with Implanted Cancer Cells

Anna Ruszczyńska [1], Dorota Skrajnowska [2], Agata Jagielska [1,*], Barbara Bobrowska-Korczak [2] and Barbara Wagner [1]

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[2] Department of Bromatology, Faculty of Pharmacy with the Laboratory Medicine Division, Medical University of Warsaw, Banacha 1, 02-097 Warsaw, Poland; dskrajnowska@wum.edu.pl (D.S.); barbara.bobrowska@wum.edu.pl (B.B.-K.)
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Article

Investigation of the Impact of L-Phenylalanine and L-Tyrosine Pre-Treatment on the Uptake of 4-Borono-L-Phenylalanine in Cancerous and Normal Cells Using an Analytical Approach Based on SC-ICP-MS

Emilia Balcer [1,2], Joanna Giebułtowicz [2,*], Małgorzata Sochacka [2], Anna Ruszczyńska [3], Magdalena Muszyńska [3,4] and Ewa Bulska [3]

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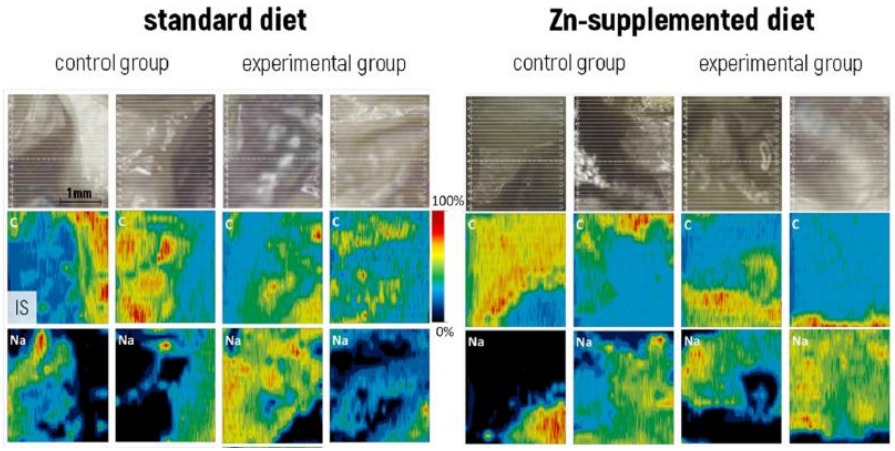
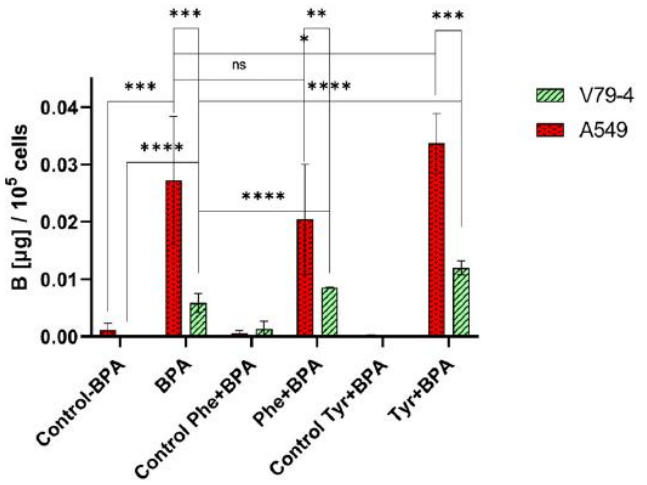
* Correspondence: joanna.giebultowicz@wum.edu.pl; Tel.: +48-22-5720630





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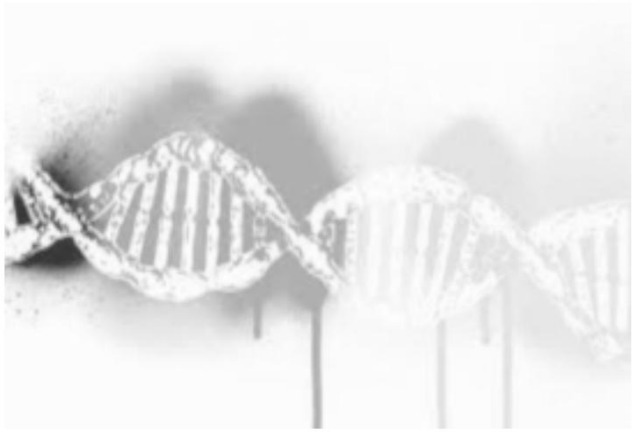
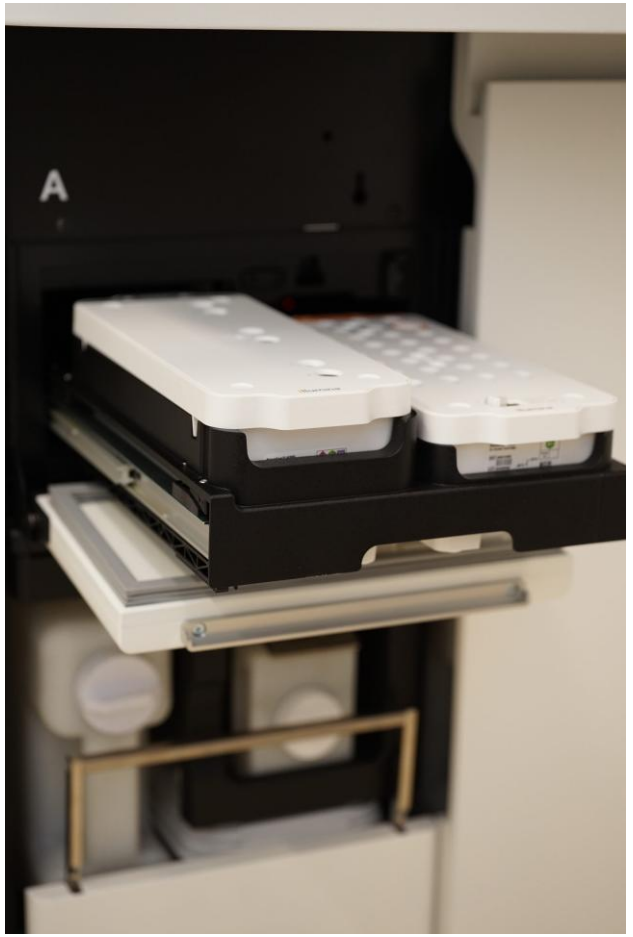
GENOMICS



Genomics Core Facility

CeNT

Centre of New Technologies UW
S. Banacha 2c
02-097 Warszawa



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Quality of Research

The laboratory conducting the HealthOmix project is accredited by the Polish Centre for Accreditation (PCA) since 2014, ensuring adherence to the highest quality standards.

AB 1525

It operates in compliance with ISO/IEC 17025:2017 for testing laboratories and ISO 15189:2022 for medical laboratories, guaranteeing competence and precision in all research activities.

The University of Warsaw's medical laboratory is registered with the National Chamber of Laboratory Diagnosticians, with registry number 4085, further affirming its commitment to professional and regulatory excellence.

University of Warsaw:
Biological and Chemical Research Centre
Analytical Chemistry Expert Centre

https://cnbch.uw.edu.pl/en/analytical-chemistry-expert-centre/
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