ICE Bioscience
Innovative CRO+Explorer

Biomarker Discovery and Detection

At ICE Bioscience, we provide end-to-end biomarker discovery and detection services designed to accelerate drug development and enhance therapeutic decision-making. From sample collection and processing to biomarker validation and quantification, our advanced platforms and scientific expertise ensure the accurate identification of critical biomarkers. Whether you're in early-stage discovery or clinical development, our services support robust, data-driven insights for drug efficacy, safety assessment, and patient stratification. Partnering with us means gaining access to cutting-edge technologies that streamline your biomarker pipeline, delivering actionable results to advance your programs efficiently and confidently.

Biomarker Discovery and Detection Workflow

Sample Collection

Species: Human, mouse, rat, dog, rabbit, monkey. **Health Status:** Healthy vs. disease-state samples.

Sample Types: Blood, serum, plasma, tissue biopsies, urine, cerebrospinal fluid (CSF), and cellular samples (e.g., PBMCs).

Sample Processing & Storage

Processing: Isolation of key components (e.g., cells, plasma, proteins) based on the sample type.

Storage: Samples are stored under optimal conditions (e.g., cryopreservation) to preserve biomarker stability until analysis.

Biomarker Discovery & Profiling

Platform Selection: Identify relevant biomarkers using high-throughput screening, genomics/transcriptomics, proteomics, or epigenetics platforms, etc.

Technologies Used: qPCR, sequencing, LC-MS/MS, JESS, ELISA, MSD, etc. for discovery and initial validation of biomarkers associated with the disease or treatment response.

Biomarker Validation & Quantification

Validation: Confirmation of biomarker identity, specificity, and reproducibility.

Quantification: Accurate measurement of biomarker levels using multiplex assays (MSD, AlphaLISA, HTRF), Western Blot to assess biomarker expression in various conditions.

Cellular Functional Analysis (Optional)

Cellular Analysis: Flow cytometry or real-time imaging of cellular biomarkers using platforms like IncuCyte and High-Content Analysis (HCA) to monitor cell behavior, immune response, and drug effects.

In Vivo Imaging (Optional)

Non-invasive optical imaging of biomarkers in live animal models (e.g., tracking tumors, immune responses, or drug distribution). Longitudinal studies to observe disease progression and biomarker dynamics in live models.

Data Analysis & Reporting

Statistical Analysis: Analyze biomarker data to identify trends, correlations, and significant findings.

Interpretation: Data is interpreted in the context of the disease, therapeutic intervention, or biological process being studied.

Omics Technologies for Biomarker Discovery *(In collaboration with trusted partners)*

Omics Technology	Advantages for Biomarker Discovery	Ideal For
Genomics, Transcriptomics, Proteomics, Metabolomics, Epigenomics	- Comprehensive multi-layered insights into biological systems	- Discovering genetic, protein, or metabolic biomarkers for diagnostics or therapeutic targets
	- Detects genetic, transcript, protein, metabolite, and epigenetic changes	- Multi-omics integration for comprehensive disease profiling (e.g., cancer, neurodegenerative diseases, cardiovascular diseases, metabolic disorders)
	- High-throughput and scalable	- Pharmacogenomics and drug development
	- Integrative "multi-omics" approach improves understanding of complex diseases	- Biomarker discovery for precision medicine and patient stratification
	- Enables personalized medicine and targeted therapies	

Biomarker Detection Solutions: A Guide to Choosing the Right Technology

Technology	Key Strengths	Ideal For
qPCR	- High sensitivity and specificity for gene expression analysis.	- Gene expression profiling to discover and quantify transcriptional biomarkers.
	- Quantitative results with real-time monitoring.	- Validating RNA biomarkers.
Classic Western Blot (WB)	- Gold standard for protein validation.	- Protein biomarker validation and tracking changes in expression.
	- Detects protein size, isoforms, and post-translational modifications.	- Identifying specific isoforms in cancer studies.
Fluorescent WB	- Multiplex capability, detecting multiple biomarkers on the same membrane.	- Simultaneous detection of multiple proteins.
	- Wider dynamic range with high sensitivity.	- Pathway analysis (e.g., detecting multiple signaling proteins).
Simple Western (Jess)	- Automation and minimal hands-on time.	- High-throughput biomarker validation.
	- Fully quantitative with digital readouts for protein detection.	- Generating reproducible data in large sample sets.
In-Cell Western	- Quantitative protein detection directly in intact cells.	- Cell-based biomarker screening.
	- Allows analysis of specific biomarkers in a cellular context.	- Investigating the spatial distribution of biomarkers within cells.
ELISA & MSD	- Highly sensitive and specific detection of individual biomarkers.	- Cytokine profiling, protein quantification in blood/plasma, and large-scale biomarker screening in clinical studies.
	- MSD allows multiplexing for multiple analytes.	
AlphaLISA & HTRF	- Homogeneous, no-wash assays for high-throughput screening.	- High-throughput biomarker discovery.
	- Capable of multiplexing with high sensitivity.	- Drug discovery and compound screening using biomarker readouts.
Flow Cytometry	- Multi-parameter analysis of cellular biomarkers and immune cell populations.	- Immune cell profiling and functional biomarker detection.
	- High sensitivity for rare cells.	- Single-cell biomarker analysis.
High-Content Analysis	- Automated, high-throughput imaging for phenotypic screening.	- Cellular biomarker imaging.
	- Provides detailed information on cell morphology and biomarker expression.	- Multiplex analysis of protein expression and localization in high-content screening.
IncuCyte (Live-Cell Imaging)	- Real-time, continuous live-cell analysis.	- Dynamic tracking of biomarker responses.
	- Tracks cellular changes (e.g., proliferation, apoptosis) over time.	- Longitudinal studies in live cells.
LC-MS	- Quantitative, highly specific detection of proteins and small molecules (Fats, polysaccharides, amino acids, fatty acids and vitamins, etc.) .	- Highly suitable for analyzing metabolites and lipids.
	- Detects post-translational modifications and metabolites.	- Quantification of Peptides and Neurotransmitters.
In Vivo Imaging	- Non-invasive, real-time imaging of biomarkers in live animal models.	- Longitudinal biomarker tracking in cancer, inflammation, or drug efficacy studies.
	- Tracks biomarker dynamics over time and in response to treatments.	- Monitoring tumor growth or drug distribution.

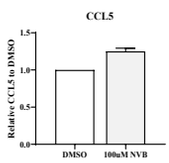
Key Features

Western Blot Services:

- √ We offer five types of Western Blot, including Traditional WB, Dot Blot, Jess (Simple Western), Fluorescent WB, and Chemiluminescent WB, providing versatile and high-throughput protein detection options.
- √ Extensive experience with hundreds of validated biomarker assays using classical WB, ensuring reliable results.
- √ Expertise in handling pharmacodynamic samples with both WB and Jess (Simple Western) technologies.
- √ Fast Turnaround Time: WB processing within 1-2 business days.
- √ High Throughput: Support for 96-well plate formats, optimizing efficiency.

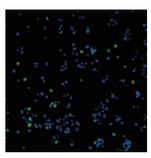
qPCR Assays:

- √ qPCR used to quantify the amount of a specific DNA or RNA molecule with high sensitivity, specificity and repeatability.
- √ Multiple ready-to-use biomarker assays, including assays for cells and tissue samples.



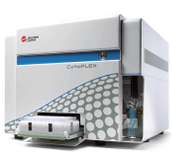
High-Content Imaging:

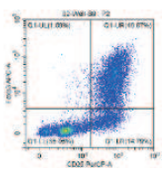
- √ High-content immunofluorescence assays for precise detection of key biomarkers, including protein translocation, total proteins and various forms of protein modification detection such as phosphorylated proteins, acetylated protein and methylated proteins, and involved several signaling pathways such as DNA damage response.



Flow Cytometry:

- √ Capable of processing tissue samples for flow cytometry analysis.
- √ Detection of cell surface markers, intracellular cytokines, transcription factors and some special markers like ROS.





ELISA:

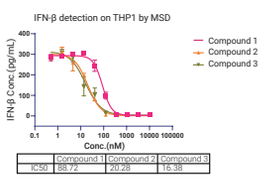
- √ Equipped with advanced instrumentation, including CLARIOstar PLUS and PHERAstar FSX for sensitive detection.
- √ Expertise in a variety of ELISA formats: direct, indirect, sandwich, competitive.
- √ Extensive experience in cytokine and protein level detection.

AlphaLISA:

- √ Use of commercial kits for detecting cytokines, total proteins and phosphorylated proteins.
- √ Ability to customize assays for specific proteins and measure activation or inhibition.
- √ Support for 384-well plates, enabling high-throughput screening.

MSD (Meso Scale Discovery):

- √ Support for 96-well plates and 384-well plates, with experience in detecting cytokine panel, total proteins and phosphorylated proteins like LRRK2 pSer935.



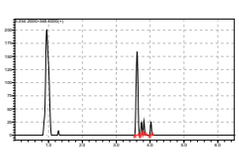
	Compound 1	Compound 2	Compound 3
IC50	88.72	20.28	16.38

Disease Models for PD Biomarker Detection:

- √ Expertise in disease model development, allowing for seamless PD biomarker detection.

LC-MS/MS:

- √ Extensive experience in detecting peptides and neurotransmitters, providing high specificity and sensitivity in biomarker analysis.



Bioinformatics Analysis:

- √ Comprehensive data analysis services across multiple omics fields, including genomics, transcriptomics, proteomics, and multi-omics approaches.
- √ Custom data mining and analysis tailored to client needs.

Biomarker Discovery in Neurological Research: LC-MS/MS Analysis of Neurotransmitters

Neurotransmitters such as dopamine, serotonin, and norepinephrine are critical biomarkers for neurological diseases. Using LC-MS/MS, we offer a highly sensitive, cost-effective method for detecting these neurotransmitters in plasma and tissues, enabling precise biomarker quantification with low sample volumes.

◇ Background:

Neurotransmitters are key chemical messengers synthesized by presynaptic neurons and released at nerve terminals to act on specific receptors on postsynaptic neurons or effector cells. These include monoamines such as dopamine (DA), epinephrine (E), norepinephrine (NE), and serotonin (5-HT); cholinergic neurotransmitters like acetylcholine (Ach); and amino acids like GABA and glutamate. Neurotransmitter levels in the brain are closely linked to behavior and various neurological diseases, and measuring them helps to understand the mechanisms of neuropsychiatric drugs.

◇ Problem and Solution:

A challenge in neurotransmitter analysis is low sensitivity, especially in small sample volumes. The use of derivatization reagents has significantly improved sensitivity, allowing for accurate detection of neurotransmitters at low concentrations.

◇ Advantages:

- Cost-Effective: No need for commercial kits.
- High Throughput: Multiple neurotransmitters can be measured in a single method.
- Low Sample Volume: Only 50 µL of sample required, much less than other methods.
- High Specificity: Increased accuracy in detecting neurotransmitters.

Neurotransmitters	CSF		Rat plasma		Rat brain homogenate	
	baseline[1] (ng/mL)	LLOQ (ng/mL)	baseline[2] (ng/mL)	LLOQ (ng/mL)	baseline[3] (ng/mL)	LLOQ (ng/mL)
GLY	/	5	3727.26±409.58	500	49836.1 ± 3651.0	5000
GLU	614±317	2	2855.74±114.26	500	90480.9 ± 6496.0	5000
GABA	35±18	5	3.13±1.68	2	28192.2 ± 2418.0	10000
HVA	16.4±2.2	1	/	1	164.9 ± 29.7	100
5-HT	0.45±0.2	0.5	30.81±4.23	1	976.8 ± 109.0	500
NE	0.8±0.26	0.5	54.32±1.75	2	609.2 ± 65.3	500
DA	/	2	23.89±0.08	2	551.5 ± 104.1	100
DOPAC	10.1±4.1	0.5	/	1	144.4 ± 44.1	100
5-HIAA	101.3±15.4	5	/	5	232.7 ± 31.6	200
Metanephrine	/	1	/	2	/	500
E	/	2	25.09±1.47	2	/	500
histamine	/	0.1	1.85±0.39	1.5*	34.3 ± 1.03	4
3-MT	/	1	/	1	/	200
Normetadrenaline	/	1	/	1	/	200
Ach	/	5	/	5	/	200

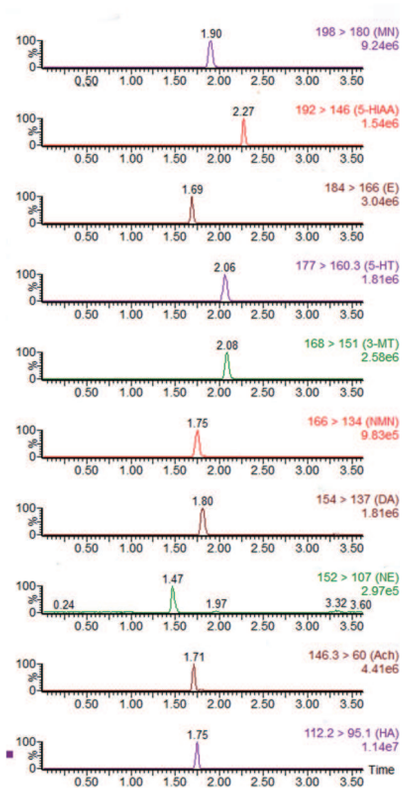


Figure: LC-MS/MS analysis of neurotransmitters and their metabolites in plasma and various tissues. The table presents retention times (Rt) and area counts for key analytes, including Dopamine (DA), Norepinephrine (NE), Serotonin (5-HT), and others. The chromatograms show clear separation and detection of each neurotransmitter, with m/z transitions and retention times labeled, demonstrating the method's sensitivity and specificity for each compound.

References:

1. Kovac, Andrej, et al. "Liquid chromatography–tandem mass spectrometry method for determination of panel of neurotransmitters in cerebrospinal fluid from the rat model for tauopathy." Talanta 119.1 (2014): 284-290. DOI: 10.1016/j.talanta.2013.10.027.
2. Jiahui, et al. "Target-based metabolomics for the quantitative measurement of 37 pathway metabolites in rat brain and serum using hydrophilic interaction ultra-high-performance liquid chromatography–tandem mass spectrometry." Analytical & Bioanalytical Chemistry (2016).
3. "Simultaneous determination of multiple neurotransmitters and their metabolites in rat brain homogenates and microdialysates by LC-MS/MS." Analytical Methods 7.9 (2015): 3929-3938.