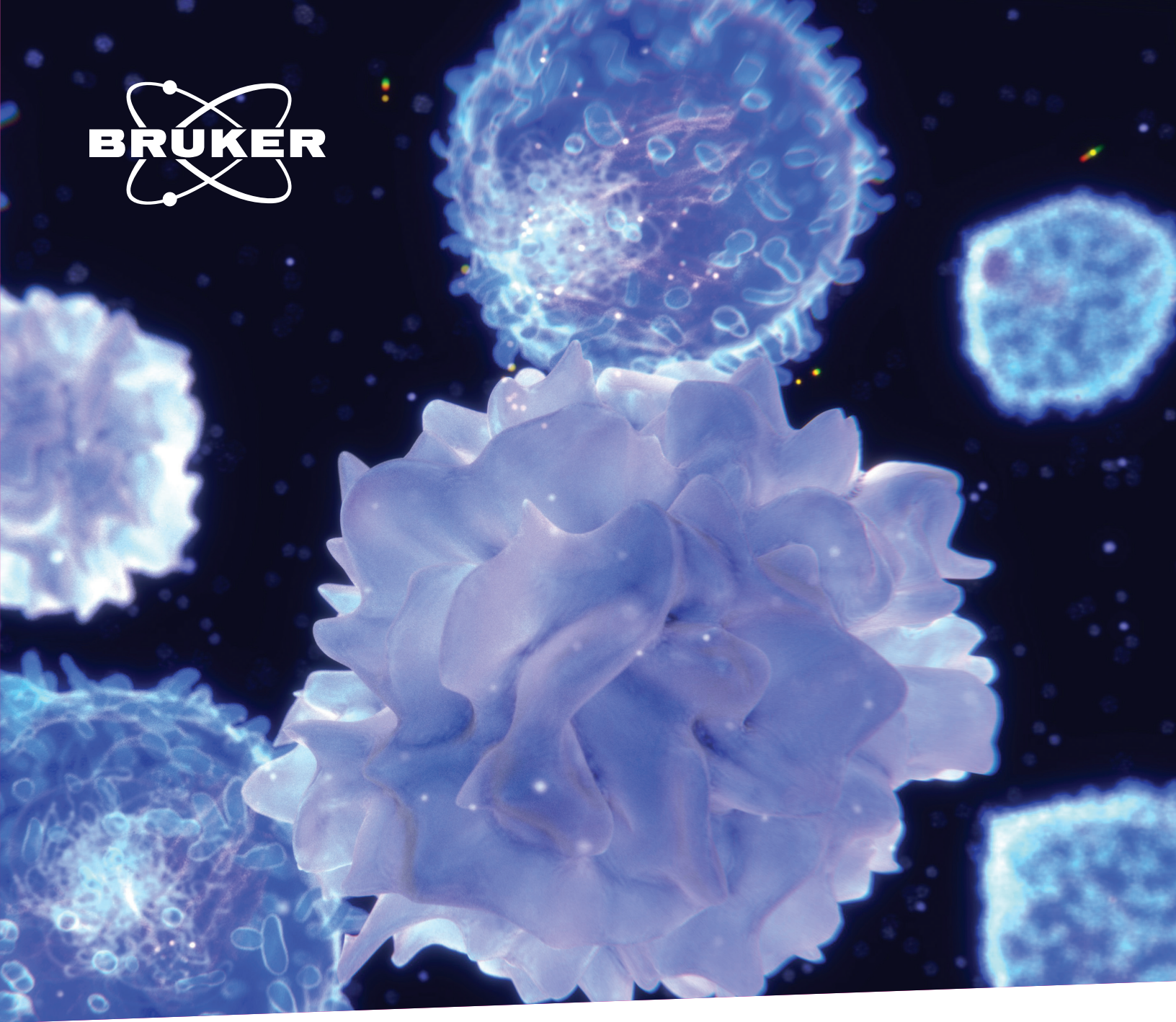
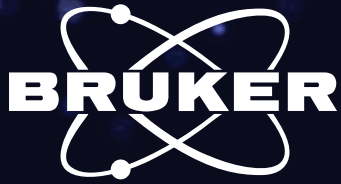




BRUKER SPATIAL BIOLOGY

Immunology and Infectious Disease Solutions

Autoimmune Disease • Organ Transplant
Immuno-Oncology • Infectious Disease

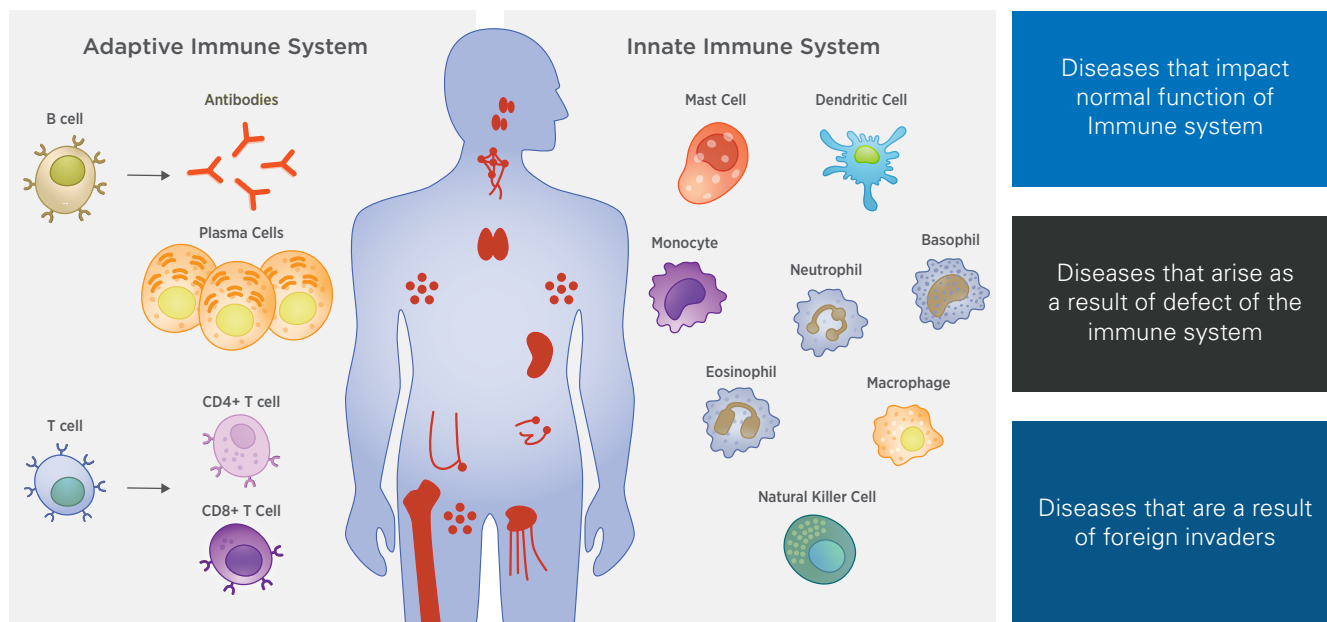


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Creating a Framework

Supporting Immunology Research

The study of the immune system involves a deep understanding of the fine balance between self and non-self recognition. Nearly all diseases can be characterized by the type of immune response that is involved, whether it is a disease that impacts the normal function of the immune system, a disease that arises as a result of a defect of the immune system, or a disease that is the result of invasion by a foreign pathogen. Recently, much attention has been given to immune checkpoints, receptor-ligand pairs that are involved in the activation or suppression of the immune response, and manipulation of these checkpoints has given rise to the field of immunotherapy. A keen understanding of the different cell types involved in the adaptive and innate immune response is key as is the ability to detect rare cell types and discover new types of immune cells.



Our integrated, multiomic research solutions allow you to study the dynamic and complex nature of the immune response from the level of single cells to multicellular tissue compartments and patient cohorts.

Wherever you are headed with your immunology research, we can get you actionable insights from FFPE, fresh frozen tissue, cell lysates, and biofluids.

- Profile the expression of 800+ genes from a single sample with the nCounter® Analysis System.
- Spatially profile the whole transcriptome and hundreds of protein targets within distinct tissue compartments and cell populations with the GeoMx® Digital Spatial Profiler (DSP).
- Profile the immune response at the single cell and subcellular level with the CosMx® Spatial Molecular Imager (SMI).
- Achieve quantitative immuno-phenotyping with high dynamic range and precision optics using the CellScape™ Precise Spatial Proteomics platform.

Creating Novel Solutions

One suite of tools. Unlimited potential.

The ideal platform for immunology research lets you profile both the systemic and localized immune response and combines expression analysis with tissue imaging to consider the spatial heterogeneity of the immune infiltrate.

Whether you are looking to discover biomarkers using gene expression profiles to understand disease onset, progression, localized immune response or treatment response or characterize tumor heterogeneity at single-cell resolution, Bruker Spatial Biology has you covered.

Uncover the complexities of the immune response with research tools that allow you to profile gene and protein expression in a variety of sample types at the scale and plex that supports your unique research.

nCounter[®] Analysis System



Rapid, reproducible gene expression and multiomics insights for translational research

- Identify predictive and prognostic biomarkers for patient stratification
- Track disease- and treatment-associated markers in clinical trial samples
- Profile RNA and protein from the same sample without amplification
- Support regulatory submissions with robust, standardized assay performance

CellScope[™] Precise Spatial Proteomics Platform



Straightforward, flexible quantitative spatial proteomics with best-in-class resolution

- Track engineered cell infiltration and persistence in tissue
- Resolve immune cell phenotypes and spatial localization of protein markers
- Maximize use of limited samples with iterative re-staining and analysis
- Design custom panels for tissue-specific or rare biomarker targets

CosMx[®] Spatial Molecular Imager



High fidelity spatial exploration of the whole transcriptome with subcellular resolution

- Map cell type-specific responses to gene and cell therapies
- Uncover cell-cell interactions and niche-specific expression patterns
- Define spatial gene signatures associated with treatment response
- Investigate dynamic changes in cell states across time points or treatment arms

GeoMx[®] Digital Spatial Profiler

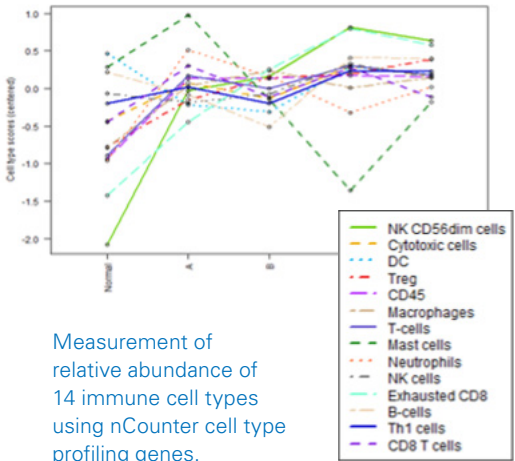


Regionally customized high plex multiomics for high throughput spatial insights

- Define spatial biomarker signatures across heterogeneous tissue landscapes
- Profile immune and stromal compartments in preclinical samples
- Quantify treatment-associated changes in specific regions of interest
- Scale translational studies with automated, high-throughput tissue analysis

Immune Cell Type Profiling

Select nCounter panels feature genes that provide unique cell profiling data to measure the relative abundance of different immune cell types. To date, 14 different immune cell types have been identified by their gene signatures for inclusion in nCounter panels. The genes were qualified through biostatistical approaches and selected literature in the field of immunology. The panels can be run downstream of flow cytometry to profile specific immune cell populations.



Measurement of relative abundance of 14 immune cell types using nCounter cell type profiling genes.

Cell Type	Gene(s)	Cell Type	Gene(s)w
B Cells	BLK, CD19, FAM30A, FCRL2, MS4A1, PNOC, SPIB, TCL1A, TNFRSF17	Mast Cells	CPA3, HDC, MS4A2, TPSAB1/B2
CD45	PTPRC	NK CD56dim Cells	IL21R, KIR2DL3/4, KIR3DL1/2
CD8T Cells	CD8A, CD8B	NK Cells	NCR1, XCL1/2
Cytotoxic Cells	CTSW, GNLY, GZMA, GZMB, GZMH, KLRB1, KLRD1, KLRK1, NKG7, PRF1	Neutrophils	CEACAM3, CSF3R, FCAR, FCGR3A/B, FPR1, S100A12, SIGLEC5
Dendritic Cells	CCL13, CD209, HSD11B1	T Cells	CD3D, CD3E, CD3G, CD6, SH2D1A, TRAT1
Exhausted CD8	CD244, EOMES, LAG3, PTGER4	Th1 Cells	TBX21
Macrophages	CD163, CD68, CD84, MS4A4A	Tregs	FoxP3



SPOTLIGHT ON SUCCESS

"For the first time ever, we were able to see what is happening immunologically in defined regions of the tissue. This vital data, enabled by Bruker Spatial Biology platforms and an Allo-Xeno gene expression repository, allowed us to understand both the similarities and the novel aspects underpinning organ rejection in xenograft transplantation compared to human organ transplantation. The nCounter and GeoMx instruments harmonized to create a holistic view of the immune response."

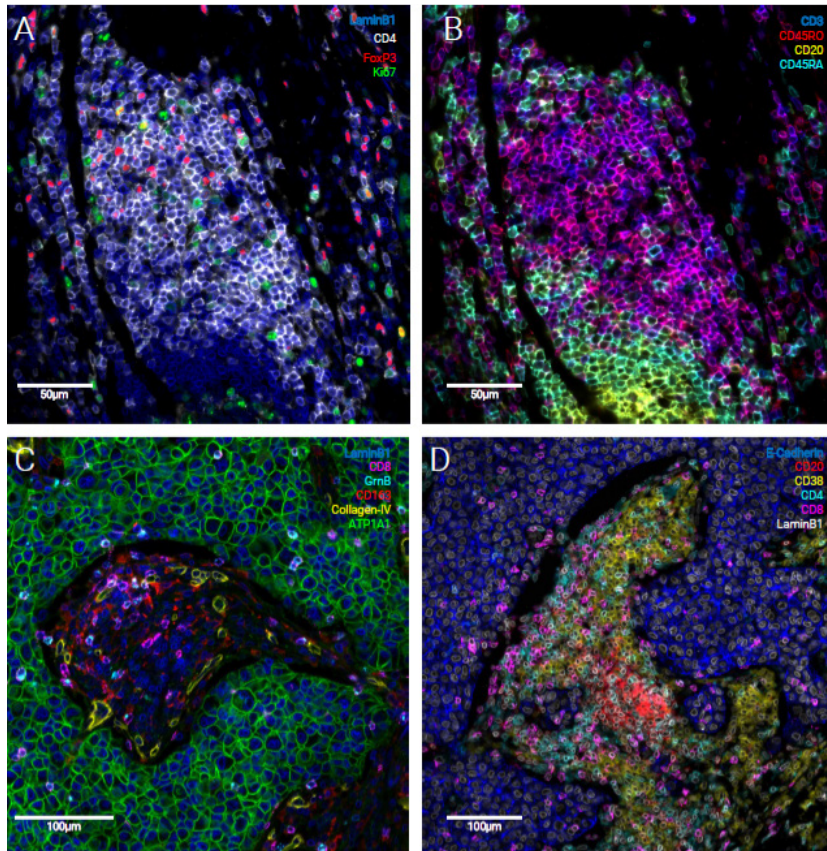
Alex Loupy, MD, Ph.D,

Paris Institute for Transplantation and Organ Regeneration, INSERM

Immune Cell Type Profiling is also available for GeoMx RNA expression data from the Cancer Transcriptome Atlas or the Human Whole Transcriptome Atlas. The SpatialDecon script can be downloaded through the [GeoScript Hub](#) on [nanosttring.com](#) and estimates the abundance of 18 different immune cell types within an area of interest. The algorithm can quantify immune cell populations defined by single cell sequencing. The immune cell abundance estimates are spatially resolved, granular and paired with highly multiplexed gene expression data.

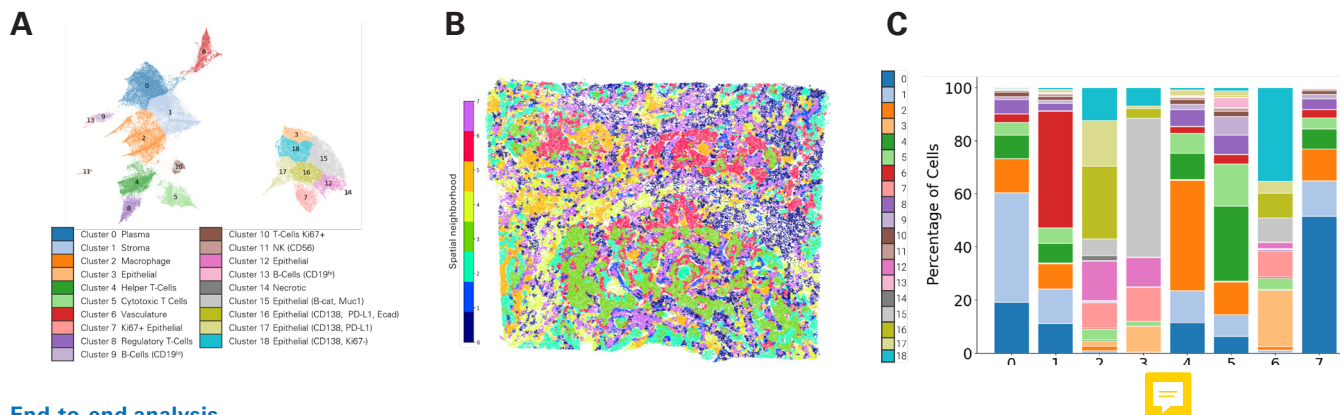
Spatial Immune Cell Profiling

The CosMx and CellScape platforms both support spatial immune cell profiling—the mapping of immune cell distribution within their native tissue environments. Spatial profiling reveals not only which immune cells are present but also where they reside in relation to other cells and structures in the tissue. Combining biomarker expression with precise segmentation enables accurate cell typing by gating and/or unsupervised clustering as well as more complex neighborhood analyses.



Spatial Immune Profiling with CellScape

Deep immune profiling using VistaPlex panels for the CellScape platform. The Spatial Immune Profiling kit captures complex CD4+ phenotypes with differential FoxP3 and Ki67 expression (**A**) and differential CD45RA/CD45RO expression in CD3+ and CD20+ cell populations (**B**) in human colorectal cancer. Combining the Spatial Immune Profiling Kit with the Tissue Architecture Kit enables detection of CD8+ T-cell activation by expression of GrnB (**C**) and broad immune infiltrate categorization in breast cancer (**D**).



End-to-end analysis

High quality segmentation, phenotyping, and spatial analyses using data generated from the CellScape platform. Precise segmentation enabled accurate phenotyping by unsupervised clustering (**A**), which allowed for the downstream characterization of spatial neighborhoods (**B**) containing multiple cell types of interest in the context of the surrounding microenvironment (**C**).

nCounter

Analysis System

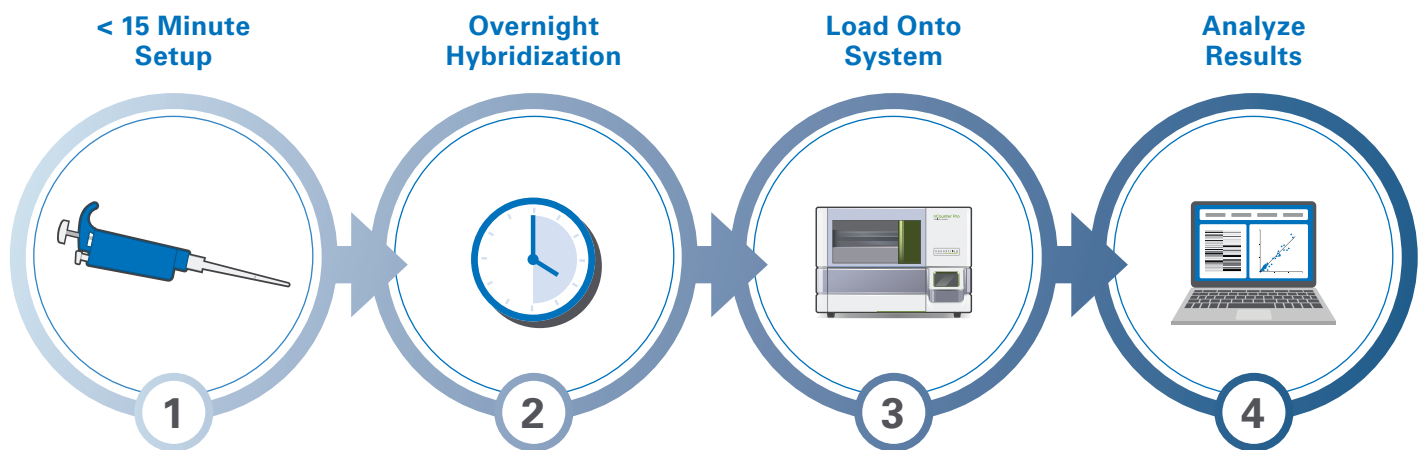


Rapid, reproducible gene expression and multiomics insights for translational research

Accelerate your biomarker discovery and development with confidence and peace of mind. With robust performance on even the most difficult sample types (FFPE, peripheral blood) and unparalleled flexibility in multiomics content and throughput, you can rapidly translate discoveries into actionable clinical insights.

- **Multomics capabilities:** RNA and protein sample-to-answer in 3 days from even the most challenging sample types with integrated data analysis
- **Robust RNA + protein detection up to 800 plex each:** panels assemble relevant pathways and processes known to play a role in disease, addressing important biological questions and delivering actionable biology
- **Rapid sample to answer:** minimal hands-on time, easy data analysis
- **Direct detection:** bypass amplification bias and elimination workflow errors with a no-enzyme, automated workflow
- **Broad sample compatibility:** Use any sample, including challenging archival FFPE tissues, biofluids, and lysates

Four Simple Steps Produce a Huge Amount of Data

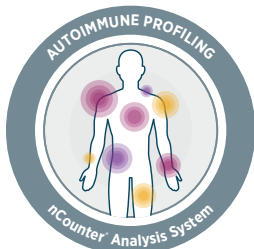


Gene Expression Workflow

nCounter Immunology Panels

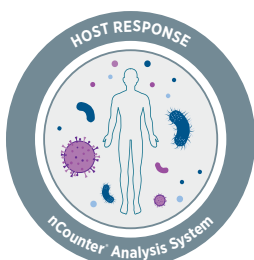
A [broad portfolio of expression panels](#) with carefully curated content delivers insights into the role of the immune system in autoimmune disorders, organ transplant rejection, cancer, and infectious disease.

Select nCounter Immunology Panels



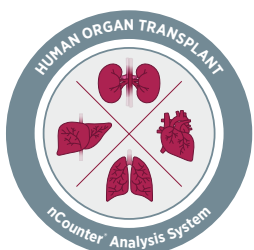
nCounter Autoimmune Profiling Panel

- Rapidly gain insights into immune dysfunction by profiling 770 human or mouse genes across 35 pathways
- Evaluate the pathways, processes and cell types involved in autoimmune disease, chronic inflammatory disease and immunotherapy-related adverse events
- Cell type profiling feature measures the relative abundance of 14 different immune cell types



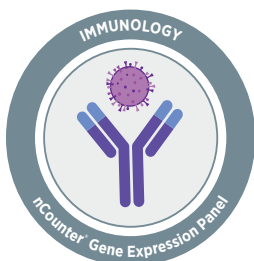
nCounter Host Response Panel

- Rapidly advance your knowledge of emerging infectious disease by profiling 785 genes in human or mouse samples across 50+ pathways
- Identify and evaluate disease severity biomarkers
- Evaluate the effects of vaccines and therapies
- Cell type profiling feature measures the relative abundance of 14 different immune cell types



nCounter Human Organ Transplant Panel

- Comprehensively profile 770 genes across 37 pathways involved in immune response to transplanted tissue
- Identify biomarkers for rejection, uncover the mechanisms of tissue damage and study toxicities brought on by immunosuppressive drugs
- Cell type profiling feature measures the relative abundance of 14 different immune cell types



nCounter Immunology Panel

- Profile over 500 general immunology genes in human or mouse samples
- Includes major classes of cytokines and their receptors, enzymes with specific gene families such as the major chemokine ligands and receptors, interferons and their receptors, the TNF-receptor superfamily, and the KIR family genes
- Includes 84 genes involved with the anti-fungal immune response

Naming Signatures

Tumor Inflammation Signature (TIS)	PAM50	Lymphoma Subtyping Test (LST)
An 18-gene signature that measures a pre-existing but suppressed adaptive immune response within the tumor	An 50 gene signature that distinguishes between breast cancer intrinsic subtypes—Luminal A, Luminal B, HER2-enriched and Basal-like	An 20 gene signature that determines the Cell-of-Origin (COO) molecular subtypes in diffuse large B-cell lymphomas, activated B-Cells and germinal center B-Cells

GeoMx

Digital Spatial Profiler



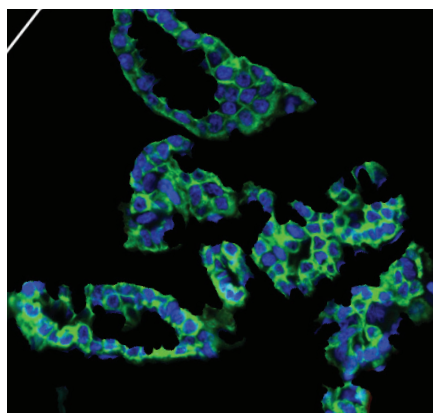
Confidently advance your multiomic discovery.

Spatially Profile The Immune Infiltrate With Biology-Driven Segmentation

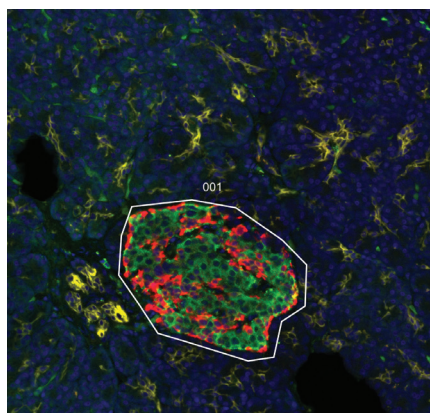
Bridging the gap between tissue imaging and bulk molecular profiling technologies such as RNA-Seq, the [GeoMx Digital Spatial Profiler \(DSP\)](#) allows you to unlock novel biological insights with spatial multiomics in morphologically intact tissue compartments. Detect and add spatial context to biomarkers obscured by bulk expression analysis, spatially profile the immune response to infectious disease, autoimmune disorders, cancer, and transplanted organs, and spatially map the expression patterns and cellular makeup of the immune response in tissue.

Biology-Driven Profiling

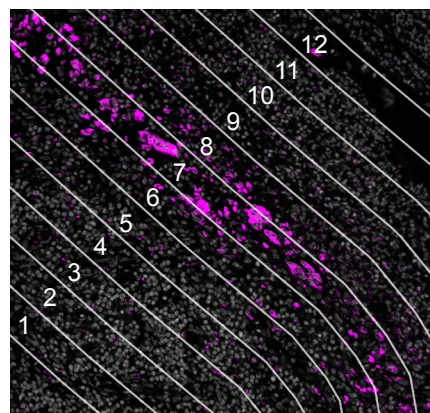
Spatially resolve gene and protein expression from FFPE or fresh frozen tissue sections with flexible profiling strategies that focus on the biology and areas of the tissue that are most relevant to your research questions. Using immunofluorescence staining as a guide to select specific regions and areas of interest, spatially profile the whole human or mouse transcriptome, select RNA and protein targets, or RNA and protein simultaneously.



Segmentation



Geometric Profiling

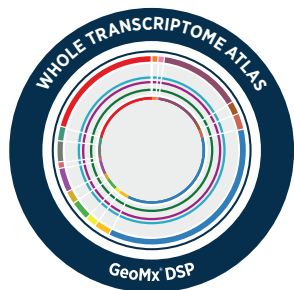


Contour

GeoMx Assays for Immunology

Flexible, Pre-Validated Content For Spatial Profiling

[GeoMx RNA](#) and [protein](#) assays can be performed separately or together on the same tissue section and include content curated for neuroscience research.



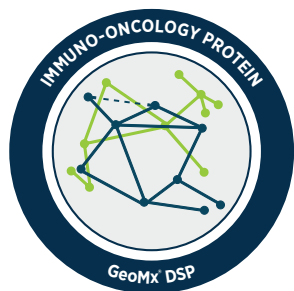
GeoMx Human and Mouse Whole Transcriptome Atlas

- Comprehensively spatially profile all protein-coding genes from human or mouse samples
- Spike-in up to 400 custom RNA targets including non-coding RNAs, exogenous sequences, and/or viral/bacterial transcripts 
- Superior sensitivity: not reliant on poly-A pulldown
- Uses an Illumina NGS system for readout 



GeoMx IO Proteome Atlas

- Profile 570+ human proteins involved in the immune response to cancer using virtually all of Abcam's catalog of IHC-compatible antibodies for immuno-oncology research
- Spike-in probes for up to 40 proteins to customize your experiment
- Run as a standalone panel or in conjunction with the GeoMx Human Whole Transcriptome Atlas using our Spatial Proteogenomics workflow



GeoMx Immuno-Oncology Protein Panels

- Take advantage of curated content that includes up to 96 probes for protein targets involved in immune activation, MAPK signaling, PI3K/AKT signaling, cell death, and the mechanism of action for immuno-oncology drugs 
- Use a universal human or mouse core module and add-on up to 6 modules each containing probes for up to 10 protein targets
- Customize by adding 5-10 targets
- Readout using the nCounter Analysis System (up to 96 plex)



GeoMx Discovery Proteome Atlas

- Profile over 1200 human proteins with the highest-plex spatially resolved proteomics assay ever developed
- Detect over 130 post-translational modifications
- Pathways targeted include those relevant to oncology, immunology, neuropathology, and neuroinflammation

CellScape

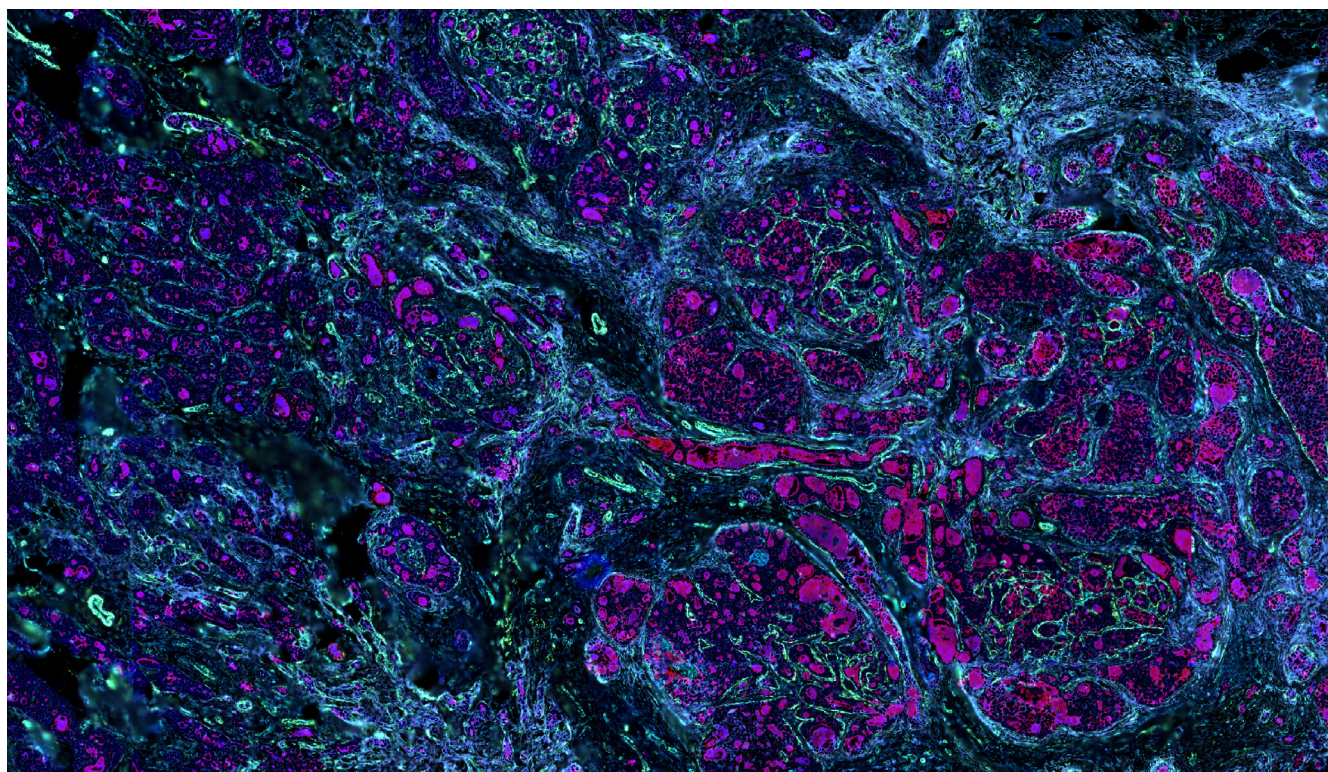
Precise Spatial Proteomics Platform



Quantitative, high-resolution imaging of spatial proteomics

CellScape features high-quality optical performance, integrated fluidics for walk-away automation, and flexibility in assay design. Supported by high dynamic range imaging, the CellScape platform can detect both high- and low-expressing biomarker targets simultaneously.

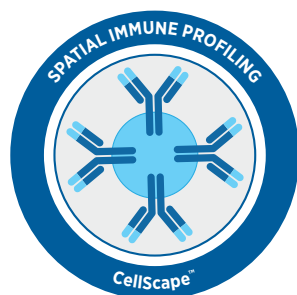
Sample preparation is simple: the [CellScape™ Whole-Slide Imaging Chamber](#) converts a standard microscope slide into a microfluidic device for staining, imaging, and safe sample storage. The CellScape staining and imaging technology is compatible with commercially available fluorescently labeled antibodies, circumventing the need for proprietary antibody conjugation and complex assay validation.



Learn more about CellScape at www.brukerspatialbiology.com/cellscape

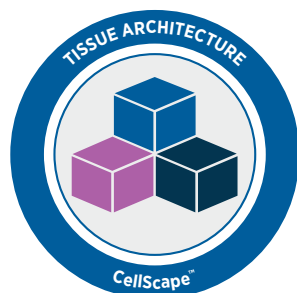
VistaPlex Assays for Immunology Research

Biomarker detection can be jumpstarted using [VistaPlex™ Multiplex Assay Kits](#): modular antibody panels with optimized protocols. Combine the assay kits together or add your own antibodies to conveniently investigate your sample with the right biomarkers for your immunology research needs. The assay kits are rigorously validated to ensure consistent performance across samples.



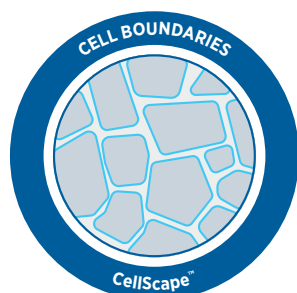
Spatial Immune Profiling Assay Kit

The Spatial Immune Profiling Kit enables detection of 14 phenotypic biomarkers that define key immune cell populations and subpopulations in human FFPE samples. This panel is optimized for ease of use and throughput in immuno-oncology research. This assay kit consists of antibodies targeting CD20, CD3, CD279, CD274, FoxP3, CD4, CD45, CD19, Granzyme B, CD8, CD45RO, CD38, Ki-67, CD68, CD45RA, PanCK, and CD163.



Tissue Architecture Assay Kit

Providing a modular building block for identification of key structural features of human FFPE samples, the Tissue Architecture Assay Kit includes a panel of antibodies targeting epithelial, lymphatic, lamina, vasculature and connective tissue biomarkers and can be expanded by pairing with additional VistaPlex assay kits. This panel consists of antibodies targeting CD138, SMA, CD31, Collagen IV, Podoplanin, Beta-catenin, CD34, E-Cadherin, Vimentin, MUC1, CD105 and EpCAM.



Cell Boundaries Assay Kit

Enable robust delineation of cell boundaries across diverse tissue types and improve accuracy of segmentation and downstream quantitative spatial phenotyping with these markers. This panel includes antibodies against ATP1A1 (plasma membrane), Lamin B1 (nuclear envelope), and B2M (cytoplasm), along with the nuclear dye Sytox™ Orange.



Fresh Frozen Immune Profiling Assay Kit

Achieve fundamental spatial immunophenotyping of the tumor microenvironment in human fresh frozen tissue sample using the Fresh Frozen Immune Profiling Assay Kit. This panel consists of antibodies targeting HLA-DR, CD56, CD45RA, CD8, CD123, CD14, CD20, CD4, CD27, CD45, Pan-cytokeratin, CD11c, CD3, and nuclear counterstain.

CosMx

Spatial Molecular Imager

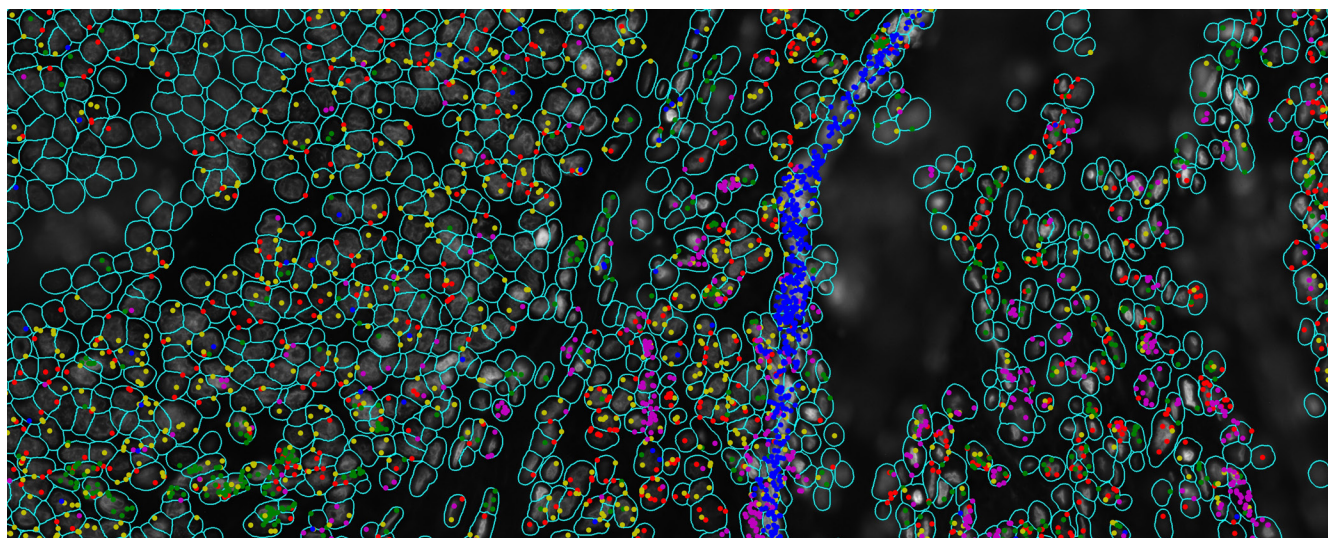


High-fidelity, single-cell spatial exploration at the highest plex.

Single-cell spatial analysis, facilitated by the [CosMx SMI](#), allows researchers to delve deeper into the function and behavior of individual cells, paving the way for groundbreaking discoveries and new therapies in the field of immunology. The CosMx SMI enables the comprehensive mapping of the expression of 50+ proteins and the [whole human transcriptome](#) to individual cells in their native environment, extracting profound biological insights and allowing you to study the cellular and molecular basis for health and disease.

Uncover Single-cell and Subcellular Insights

With superior cell segmentation utilizing multi-analyte markers and a machine learning algorithm, the CosMx SMI visualizes immune infiltration and corresponding changes within cells leading to immune evasion. This technology supports cell typing and pathway analysis, resolving cell state, function, ligand-receptor interactions, and cell signaling. Additionally, this technology provides a deeper understanding of the proteomic landscape of tissue samples, identifying new biomarkers and therapeutic targets for numerous disorders.

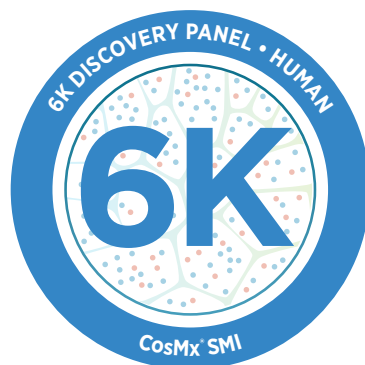


CosMx Assays for Immunology Research



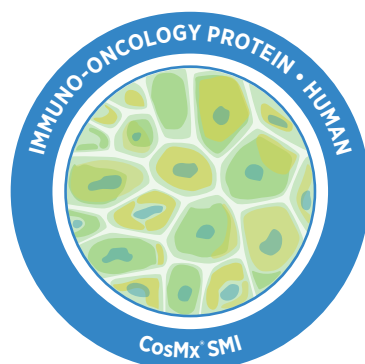
CosMx Human Universal Cell Characterization Assay

Get robust cell typing data and analyze cell-cell interactions with the CosMx Human Universal Cell Characterization Assay. Spatially profile the expression of 1000 highly curated targets at subcellular resolution and customize with up to 50 custom targets. Identify up to 100 unique ligand-receptor pairs that contribute to all aspects of tumorigenesis.



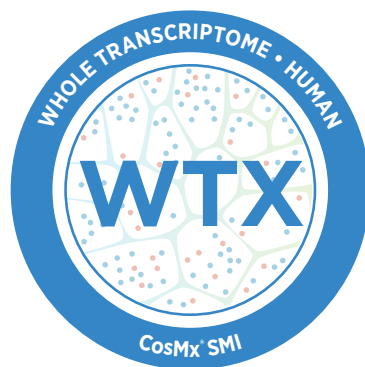
CosMx 6K Human Discovery Assay

Accelerate your single cell spatial transcriptomics with this fully validated, 6K plex RNA Assay, with simple sample preparation, an easy-to-use and reliable spatial multiomics platform and streamlined data analysis.



CosMx Protein Assays

Get a complete picture of the expression changes that occur in cancer with the CosMx Protein Assays and single cell, high-plex analysis of up to 68 proteins from a single FFPE slide. Gain a deeper understanding of the proteomic landscape of tumor biopsies and identify new disease indicators and therapeutic targets.



CosMx Human Whole Transcriptome Assay (WTX)

Reveal complete biology with subcellular whole transcriptome imaging for uncharted discoveries. With CosMx WTX, project complete pathway biology in space, map every cell-to-cell interaction at the individual transcript level, and discover the unknown and unexpected—all with best-in-class sensitivity and genomic breadth within a single intact FFPE tissue section.

Integrating Platforms

Across the Immunology Research Continuum



By offering a portfolio of complementary solutions that span the entire [immunology research continuum](#), Bruker Spatial Biology provides innovative tools that enable a multiomic, holistic view of immunology. This deeper understanding of both the systemic and local immune response of the innate and adaptive immune response and the impact of different immune cell expression programs can be applied to multiple stages of immunology research, from discovery to pre-clinical models, translational research, and clinical trials.

Key Applications

Immune Response to Disease	Translational Research	Clinical Studies	Mechanisms of Infection	Preventing Organ Rejection
- Understand innate and adaptive immune cell activation, function and malfunction - Understand essential checkpoints involved in immune response - Uncover new ways to modulate the immune response - Dampen the overactive immune response in autoimmune disorders (T1D, RA, MS, Lupus) and/or allergens	- Define mechanisms of disease and the cell types involved - Study signaling pathways involved in disease - Develop vaccines - Discover targets for therapeutics - Explore how to reverse disease - Understand the onset of an immunotherapy-induced adverse event	- Monitor clinical samples - Stratify patients for clinical trials - Evaluate vaccine effectiveness - Develop signatures to predict responders to therapies - Monitor/mitigate treatment toxicities - Assess risk factors	- Understand disease progression and severity - Understand mechanisms of infection (e.g., COVID, HIV, EBV) - Neutralize and eliminate foreign invaders - Develop biomarkers of disease severity - Study the effects of co-morbidity - Understand disease progression and severity	- Understand mechanisms of organ rejection - Understand mechanisms of tissue damage - Develop biomarkers and signatures pre- and post- transplant - Study immune checkpoints involved in organ rejection - Understand the difference between viral infection and organ rejection

Data Analysis

Options for Discovery and Decision Making

Having access to a comprehensive range of analysis tools and services transforms your valuable data to bring test hypotheses, and deliver publication-quality results. Expedite analysis and accelerate discoveries with on-system data analysis tools, secure cloud-based platforms, expert bioinformatics support, and data analysis services.



nSolver Analysis Software

- On-premises analysis tool
- Available at no charge
- Advanced Analysis Module for additional statistics



GeoMx DSP Data Analysis suite (DSPDA)

- On-instrument
- Data visualization and analysis

GeoScript Hub Open-Source Software

- Developed by Bruker Spatial Biology R&D
- Supplements capabilities of DSPDA



- A cloud-based, integrated informatics platform for spatial biology
- Analyze and visualize, large amounts of spatial multiomics data
- Preset analysis modules and pipelines
- Advanced analytics support global data sharing and collaboration

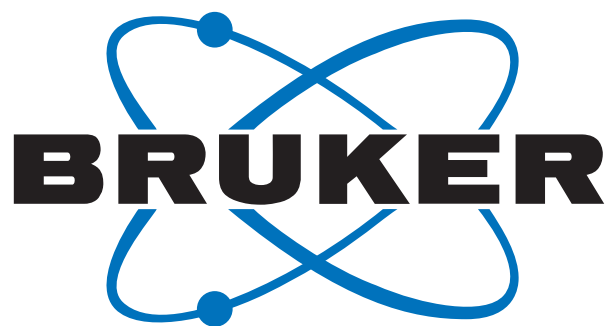


Data Analysis Service

- nCounter differential gene expression data fully analyzed
- Interpreted by a Bruker scientist inclusive of a consultative reportout.

Spatial Data Analysis Service (sDAS):

- Work one-on-one with Bruker Spatial Biology computational biologists
- Fully interpreted GeoMx data to answer biological questions.



Bruker Spatial Biology | For more information, visit nanosttring.com/immunology

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