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# **EXTERNAL CORE LABS**

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Explore our core lab shared resources: advancing science to improve human health

optic neuritis    rheumatoid arthritis    juvenile idiopathic arthritis    complex regional pa  
ndrome    IgA vasculitis    amyloidosis    bullous pemphigoid    Hashimoto's disease    hidradenit  
suppurativa    chronic Lyme disease    inclusion body myositis    allergies    sarcoidosis    interstiti  
vstitis    IgA nephropathy    stiff-person syndrome    vasculitis    Behcet's disease    autoimmun  
polyglandular syndrome type 3    psoriatic arthritis    retroperitoneal fibrosis    autoimmune orchit  
autoimmune pancreatitis    sympathetic ophthalmia    relapsing polychondritis    Raynaud's diseas  
ANDAS syndrome    acquired hemophilia    undifferentiated connective tissue disease    multifoc  
otor neuropathy    psoriasis    lupus    paroxysmal nocturnal hemoglobinuria    Vogt-Koyanag  
arada disease    leukocytoclastic vasculitis    autoimmune angioedema    ankylosing spondylit  
omerulonephritis    narcolepsy    transverse myelitis    polyarteritis nodosa    Graves' disease



Visit BRI's facility profile on The  
CoreMarketplace by scanning the  
QR code to the left or visiting  
[bri-news.short.gy/4Ssl1u](https://bri-news.short.gy/4Ssl1u).

➤ [benaroyaresearch.org](https://benaroyaresearch.org)

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# ABOUT BENAROYA RESEARCH INSTITUTE

At Benaroya Research Institute (BRI), we study the immune system and the wide range of diseases that affect it – including autoimmune diseases, allergies, asthma and cancer. We create detailed pictures of the immune system in health and disease, aiming to understand how disorders start and how to rebalance the immune system back to health.

As a nonprofit research institute within Virginia Mason Franciscan Health, we collaborate with doctors and patients to accelerate the path from innovative lab discoveries to life-changing patient care.

## OUR MISSION

Advance the science to predict, prevent, reverse and cure diseases of the immune system

## OUR VISION

A healthy immune system for everyone

## OUR MOTIVATION

Immunology to change lives

## OUR APPROACH

Together we discover

## OUR IDENTITY

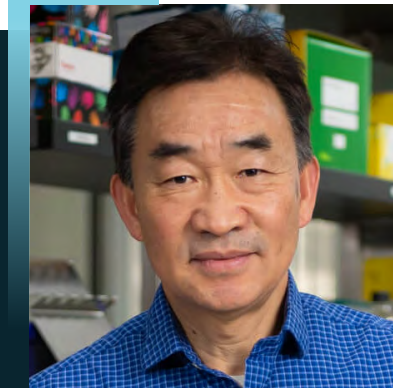
World leaders in human immunology

# BUSINESS DEVELOPMENT AT BRI

Benaroya Research Institute (BRI) collaborates with external organizations worldwide, such as life science research institutions and pharmaceutical and biotechnology companies, to provide access to our tools, technologies and expertise. This includes partnership in the conduction of clinical trials and mechanistic studies, usage of advanced scientific equipment and biological samples from our biorepositories, and more.

Our business development team oversees our intellectual property portfolio, research collaborations, technology licensing, and material transfers as well as reviews all related agreements and contracts necessary to facilitate these activities.

To learn more about opportunities to collaborate with BRI, please contact our business development team via email at [bizdev@benaroyaresearch.org](mailto:bizdev@benaroyaresearch.org). We look forward to working with you!



### Bolong Cao, PhD, MBA

Chief of business development, BRI

Dr. Cao joined BRI's business development team in 2011 and has served in his current role as chief of business development since 2023. Previously, Dr. Cao has worked with the University of Washington, Cerep, and Molecumetics. He holds a doctorate in chemistry and structural biology and a Master of Business Administration from the University of Washington.



### Laurie Sheahan

Business development associate, BRI

Laurie has been a member of BRI's business development team since 2020. Previously, she has served in financial and operations roles across biotechnology, manufacturing, and software as a service (SaaS) start-ups. Laurie holds a bachelor's degree in mathematics.

# BRI BIOREPOSITORIES

Email contact: [bizdev@benaroyaresearch.org](mailto:bizdev@benaroyaresearch.org)

BRI is home to 11 vigorously maintained biorepositories containing blood and tissue samples donated by people with and without immune-mediated diseases. We employ careful and consistent sample processing and storage protocols to ensure sample integrity, enabling investigators to gather as much data as possible from each and every sample.

Our specimens allow scientists to advance research that is providing insights into the causes of immune-mediated diseases; making progress toward predicting, preventing, reversing and curing these conditions; and informing better diagnostic and treatment options for patients living with them.

**Contact our business development team today to learn more about opportunities to collaborate.**



## Cate Speake, PhD

Associate member and scientific director, BRI Center for Interventional Immunology

Dr. Speake, alongside BRI's Sandra Lord, MD, oversees the processing and storage of the hundreds of thousands of samples currently stored within BRI's biorepositories. She also leads the BRI Experimental Medicine Unit, which conducts small clinical trials to investigate the mechanistic drivers of type 1 diabetes (T1D). Using her expertise in analyzing large datasets, Dr. Speake's work is focused on translating findings from the laboratory to help answer clinical questions. Many of her studies have focused on novel methods to identify biomarkers that predict T1D disease progression both before and after clinical diagnosis.

## How do our biorepositories work?

- 1 Bio-specimens are collected from donors living with and without immune-mediated diseases.
- 2 Samples and health information are coded with a number for confidentiality.
- 3 Samples are kept whole or separated into their building blocks (i.e., fluid, cells, molecules).
- 4 Samples are readily available to researchers with approved scientific questions.
- 5 Samples help scientists work quickly to make discoveries that have the potential to improve patient care.

## BRI's biorepositories:



### Allergies and Asthma

Principal investigator:  
Rahool Davé, MD



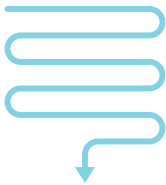
### Cancer

Principal investigator:  
Christopher Gault, MD, PhD



### Down Syndrome

Principal investigator:  
Rebecca Partridge, MD



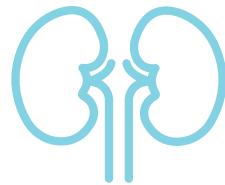
### Gastrointestinal Disease

Principal investigator:  
James Lord, MD, PhD



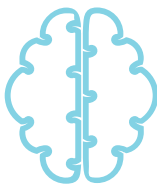
### Healthy Control

Principal investigator:  
Jane Buckner, MD



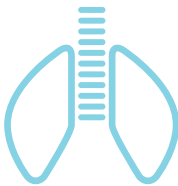
### IgA Nephropathy

Principal investigator:  
Bernard Khor, MD, PhD



### Neurologic Disease

Principal investigator:  
Mariko Kita, MD



### Pulmonary Disease

Principal investigator:  
Carmen Mikacenic, MD



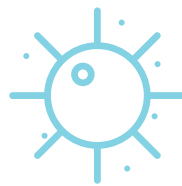
### Rheumatic Disease

Principal investigator:  
Jeffrey Carlin, MD



### Type 1 Diabetes

Principal investigator:  
Sandra Lord, MD



### Vaccine and Infectious Disease

Principal investigator:  
Uma Malhotra, MD

## By the numbers:

**350,000+**

total samples

**16,000+**

active participants

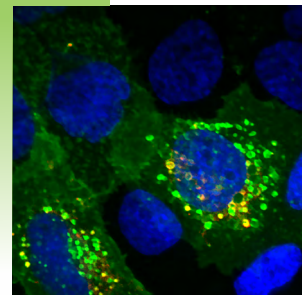
**1,400+**

samples distributed annually to external collaborators

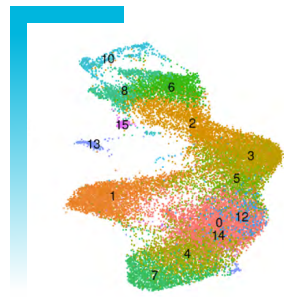
# ABOUT BRI'S CORE LABS

Email contact: [bizdev@benaroyaresearch.org](mailto:bizdev@benaroyaresearch.org)

BRI's core labs support scientists both inside and outside our institute, have unique staff and technologies, and share roots in BRI's work to advance science to predict, prevent, reverse and cure diseases of the immune system:



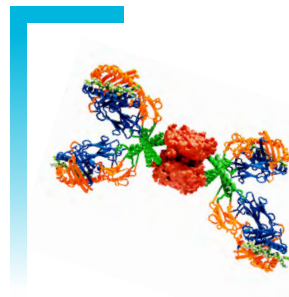
Cell and Tissue  
Analysis Group



Genomics Core



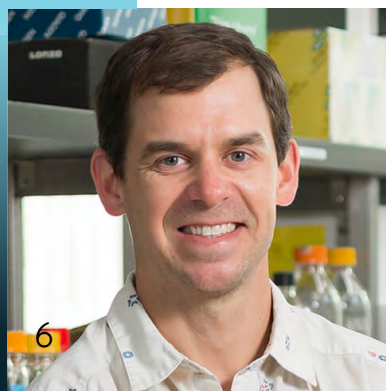
Human  
Immunophenotyping  
Core



Tetramer Core



Animal Resources  
Core



## Adam Wojno, PhD

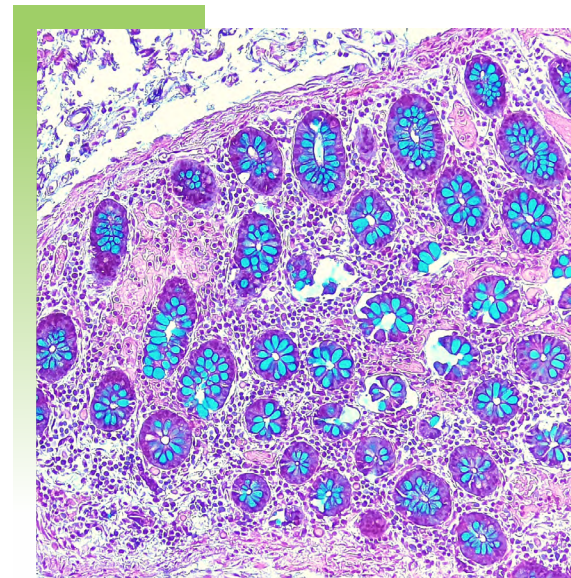
Director, BRI Immunology Shared Resources; manager, BRI Cell and Tissue Analysis Group

Dr. Wojno has been with BRI since 2019, with previous experience directing and helping to build a flow cytometry facility at Cornell University and working with a biotechnology start-up.

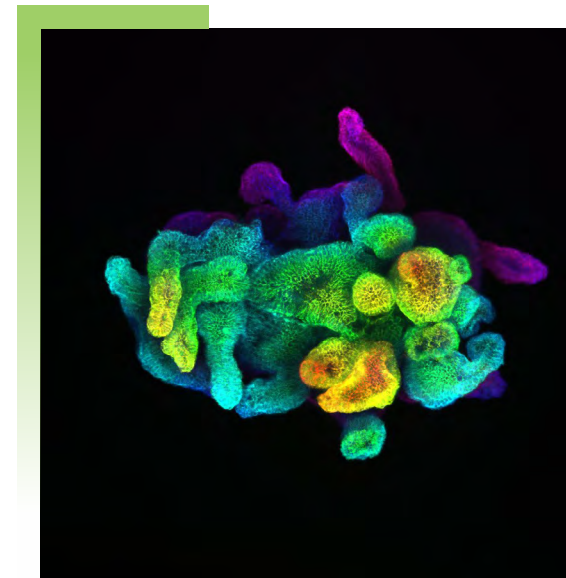
# BRI CELL AND TISSUE ANALYSIS GROUP

Email contact: [cata@benaroyaresearch.org](mailto:cata@benaroyaresearch.org)

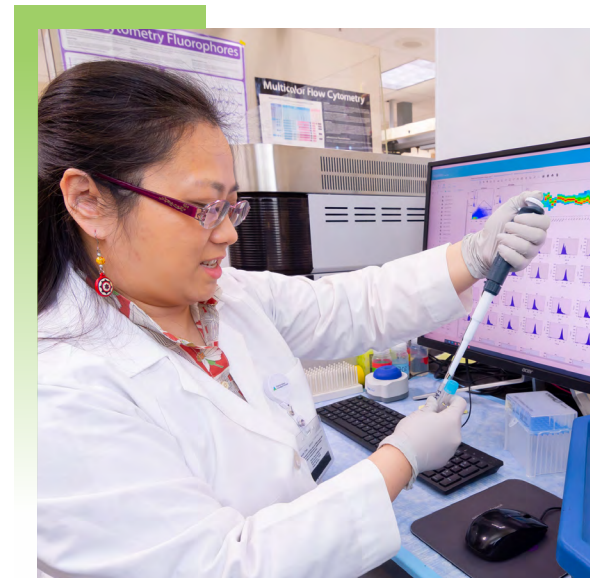
BRI's Cell and Tissue Analysis (CATA) Group provides investigators with consistent and dependable access to cutting-edge technologies. We offer the physical space and machines to carry out research projects as well as critical support through every step – from hands-on training to experiment design to data analysis:



Histology Core



Imaging Core



Flow Cytometry Core



Visit the BRI CATA Group facility on The CoreMarketplace by scanning the QR code to the left or visiting [bri-news.short.gy/o0nGPu](https://bri-news.short.gy/o0nGPu).

# **BRI CATA GROUP | HISTOLOGY CORE**

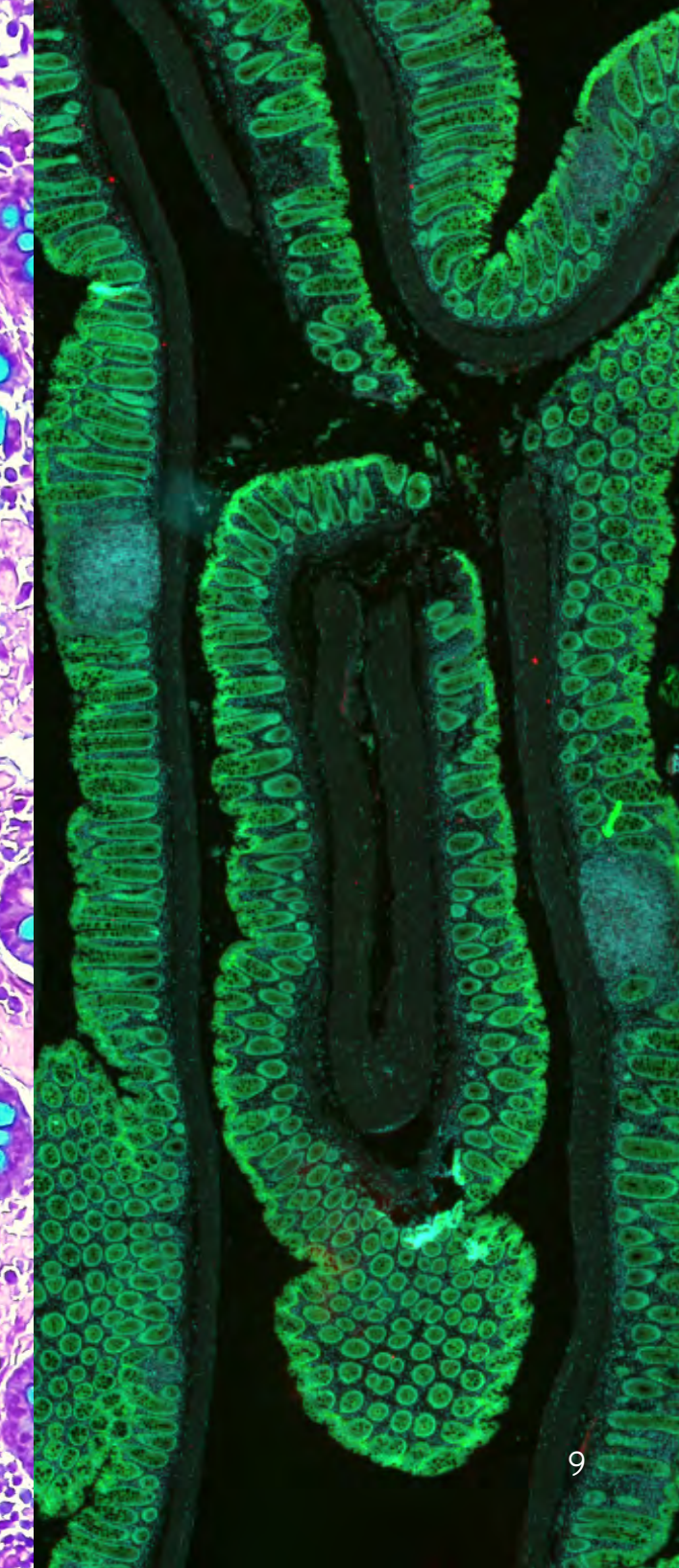
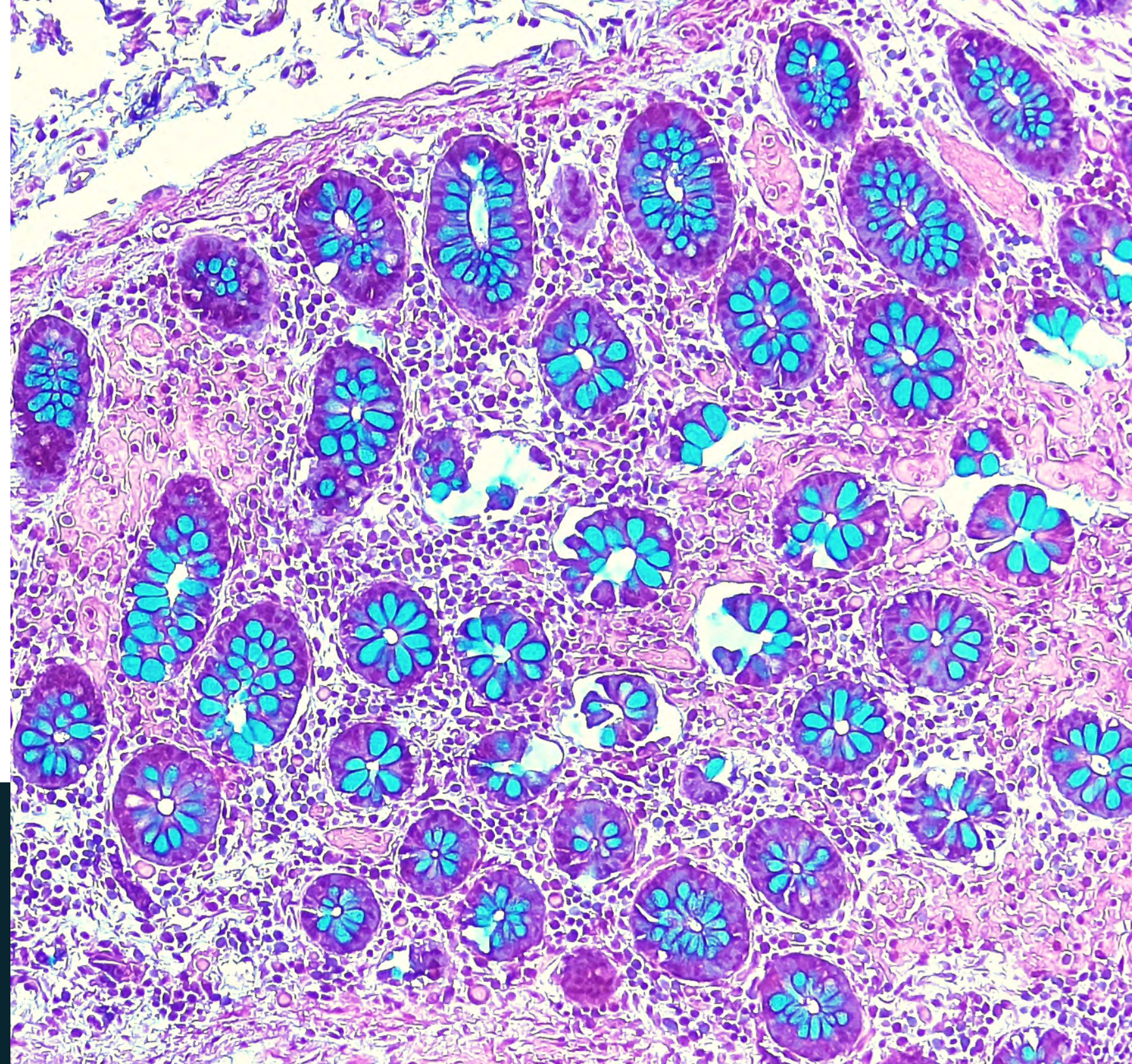
Email contact: [cata@benaroyaresearch.org](mailto:cata@benaroyaresearch.org)

The BRI Histology Core offers comprehensive services utilizing a suite of high-throughput automated equipment, including:

- Dye-based and immunohistochemical staining
  - › Special stains
  - › Immunohistochemistry
  - › Immunofluorescence
  - › Coverslipping
- Tissue processing, infiltration, embedding and sectioning
- Spatial transcriptomics and tissue matrix array
- Whole slide imaging

Image (left): Movat's stain of mouse colon

Image (right): intestinal structure and EpCAM protein (green) localization, highlighting epithelial cells along a mouse colon



**Pamela Johnson, PhD**  
Manager, BRI Histology Core

With more than 25 years of histology experience, Dr. Johnson specializes in protocol development and emerging technologies. She and her dedicated staff accept projects ranging from a single slide to hundreds and will customize their services to meet the needs of your project. Dr. Johnson has managed BRI's Histology Core since 2014.



# BRI CATA GROUP | IMAGING CORE

Email contact: [cata@benaroyaresearch.org](mailto:cata@benaroyaresearch.org)

The BRI Imaging Core offers a sophisticated, full-service imaging platform to internal and external clients.

Available equipment includes:

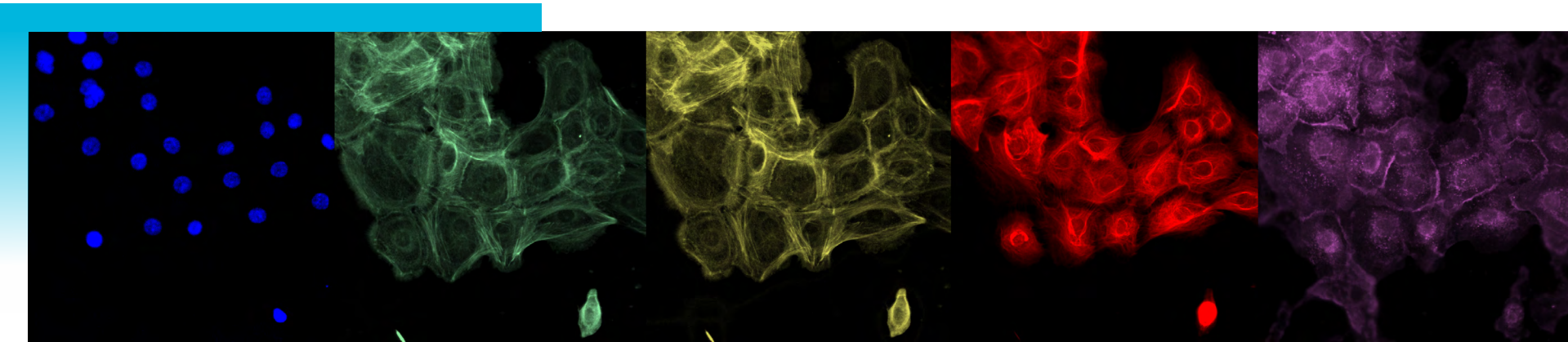
- Molecular Devices ImageXpress HT.ai (spinning disk confocal, plate reader, and seven lasers)
- Leica TCS SP5 Confocal
- ECHO Revolve Microscope
- Vive virtual reality headset
- Looking Glass 3D holographic display
- NanoEntek JuLI Stage
- BioTek Cytation 3 Multimode Reader
- Diverse brightfield and fluorescence microscopes and macroscopes

Services offered include:

- Consultation on study design
  - › Experiment planning
  - › Panel development
  - › Analysis tools
- Image analysis
  - › High-content and morphological pipeline development
  - › Chemotaxis analysis, staining quantification, and co-localization
  - › Access to the BRI Bioinformatics Group
- Full-service screening
- Microscopy training
- Live imaging (short- and long-term)
  - › Chemotaxis and migration
  - › Intracellular protein trafficking
- Multiplex imaging .....
  - › Morphological changes analysis
  - › Cell painting
- Three-dimensional (3D) imaging .....
  - › Virtual reality (VR)
  - › Confocals
- High-throughput imaging .....
  - › RNA interface (RNAi)
  - › CRISPR screening
  - › Transposon screening
  - › Drug screening

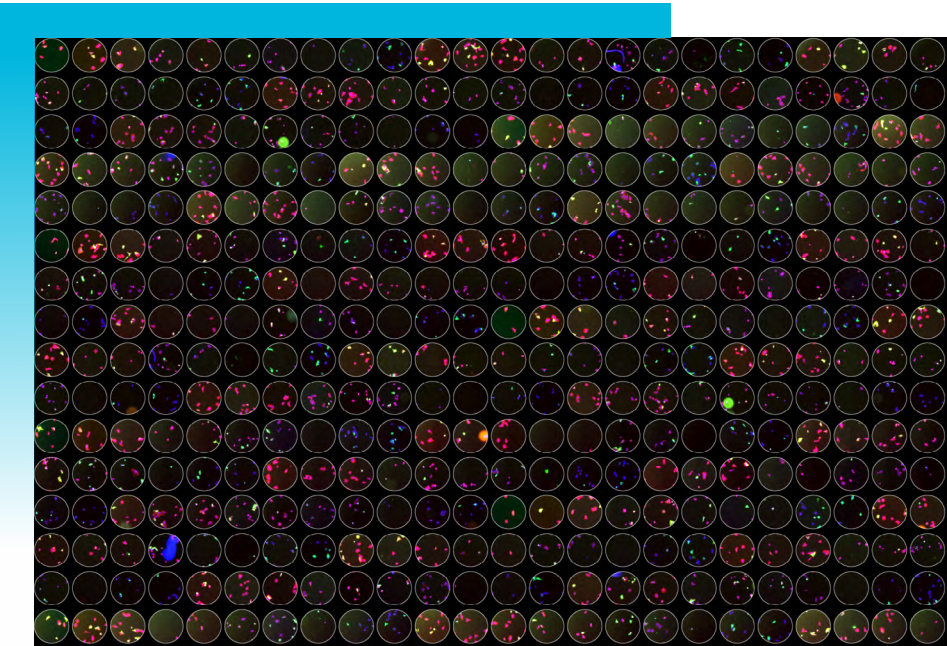
... Multiplex imaging

Image (below): taken using ImageXpress HT.ai 20X objective – keratinocytes stained for nucleus (blue), filamentous actin (green), phalloidin (yellow), mitochondria (red), and WGA (magenta)



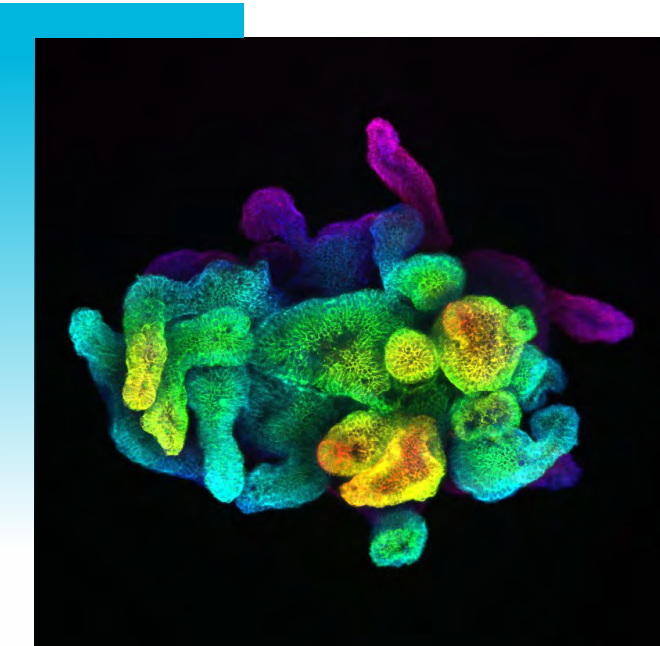
... High-throughput imaging

Image (below): taken using ImageXpress HT.ai 10X objective – 384 wells containing human cancer cells treated with various drugs



..... Three-dimensional (3D) imaging

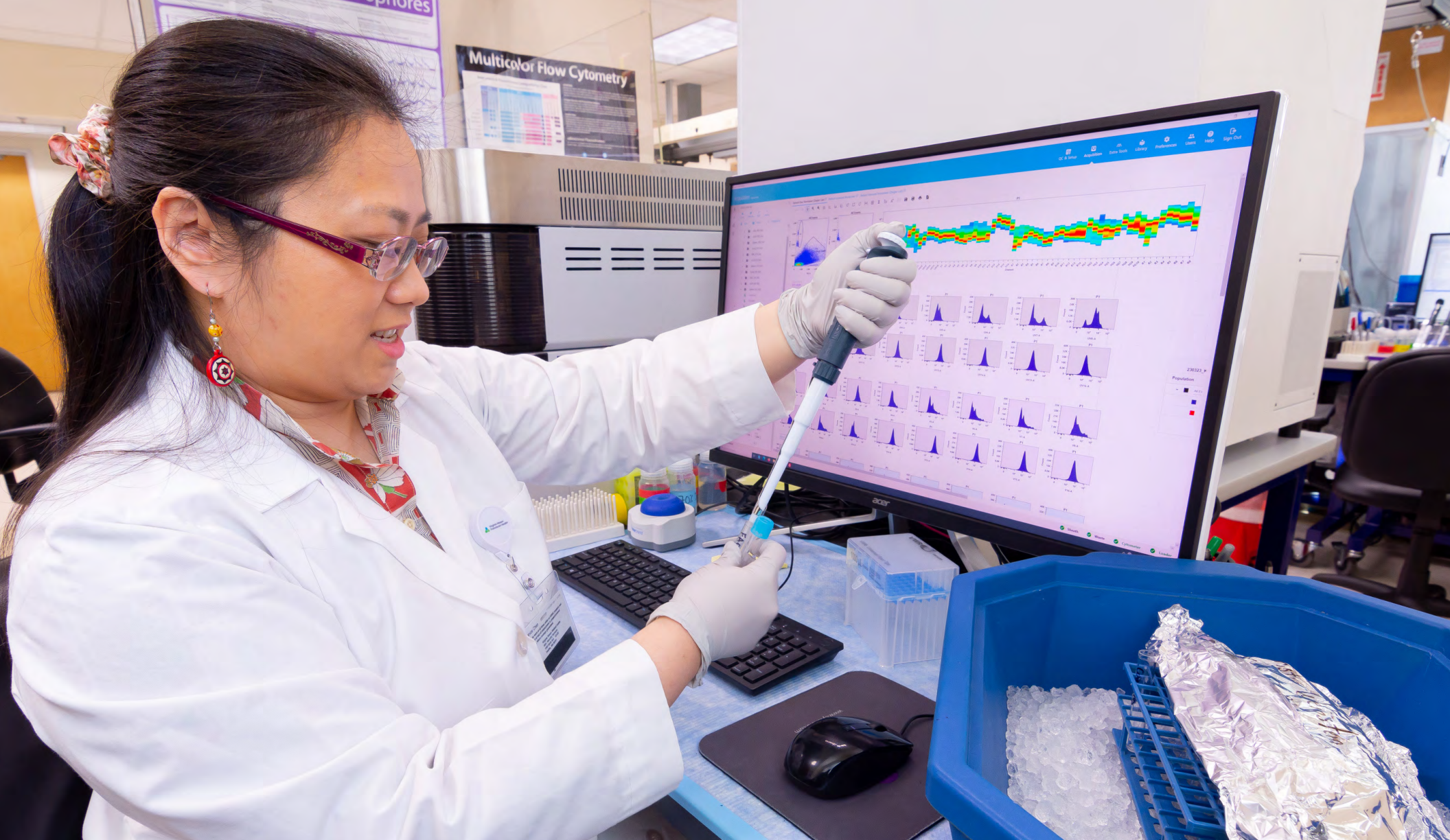
Image (below): mouse gut organoids stained for EpCAM – color represents 3D levels (Z-Stack) with a rainbow scale



Caroline Stefani, PhD

Manager, BRI Imaging Core; research assistant member, BRI Center for Systems Immunology

Dr. Stefani is a pioneer in the use of virtual reality as a three-dimensional visualization tool for fluorescence images. She leverages her background in confocal microscopy, large imaging-based screening experiments, and image analysis pipeline development to keep the BRI Imaging Core at the forefront of advanced technologies.



# **BRI CATA GROUP | FLOW CYTOMETRY CORE**

Email contact: [cata@benaroyaresearch.org](mailto:cata@benaroyaresearch.org)

## **Consultation**

- Panel and experiment design
- Troubleshooting

## **Training**

- Introductory sessions to cutting-edge analysis and sorting platforms
- Educational opportunities and advanced technology seminars

## **Capabilities**

- Independent, assisted and full-service use options
- High-parameter, traditional or spectral flow cytometry
- BSL2+ sorting, including coordination with the BRI Genomics Core to ensure special care of sensitive samples

Resources in the BRI Flow Cytometry Core include multiple high-parameter analyzers and cell sorters. With a dedicated, highly-trained staff, our facility is well-positioned to offer a spectrum of support, from training external users on these technologies to full-service analysis and cell sorting.



Close proximity to and coordination with other BRI core labs ensures continuity of service as sorted cells are prepared for downstream applications, such as those within the BRI Imaging Core or BRI Genomics Core.

# BRI GENOMICS CORE

Email contact: [genomics@benaroyaresearch.org](mailto:genomics@benaroyaresearch.org)

The BRI Genomics Core offers genomics analysis from sample processing through data generation. Whether you have one sample or hundreds, we can apply our expertise to assist in your experiment. We specialize in project design and workflow optimization, ensuring quality data is generated from every sample. In addition, we work closely with the BRI Bioinformatics Group, offering our clients access to cutting-edge analysis and visualization platforms.

## Services

## Capabilities

## Equipment

- Library construction and sequencing for profiling bulk populations or single cells; epigenetics and spatial transcriptomics
- Nucleic acid extraction and quality control
- RNA sequencing from as little as one nanogram of purified RNA or sorted bulk populations of 50-1000 cells; profiling of plate-sorted single cells, including V(D)J recombination
- Single-cell profiling using 10x Genomics, including gene expression, V(D)J recombination, cell surface proteins, and chromatin accessibility
- Spatial transcriptomics
- ATAC-seq, CUT&RUN and CUT&Tag
- Illumina sequencers
  - › NextSeq 2000: two sequencers with patterned flow cell technology; flexible flow cell sizes of 100M, 500M, 1300M or 1800M reads with XLEAP technology
  - › MiSeq: 1M to 25M reads; up to 2x300bp
- 10x Genomics Chromium X: live cells or fixed cells; new GEM-X chemistry



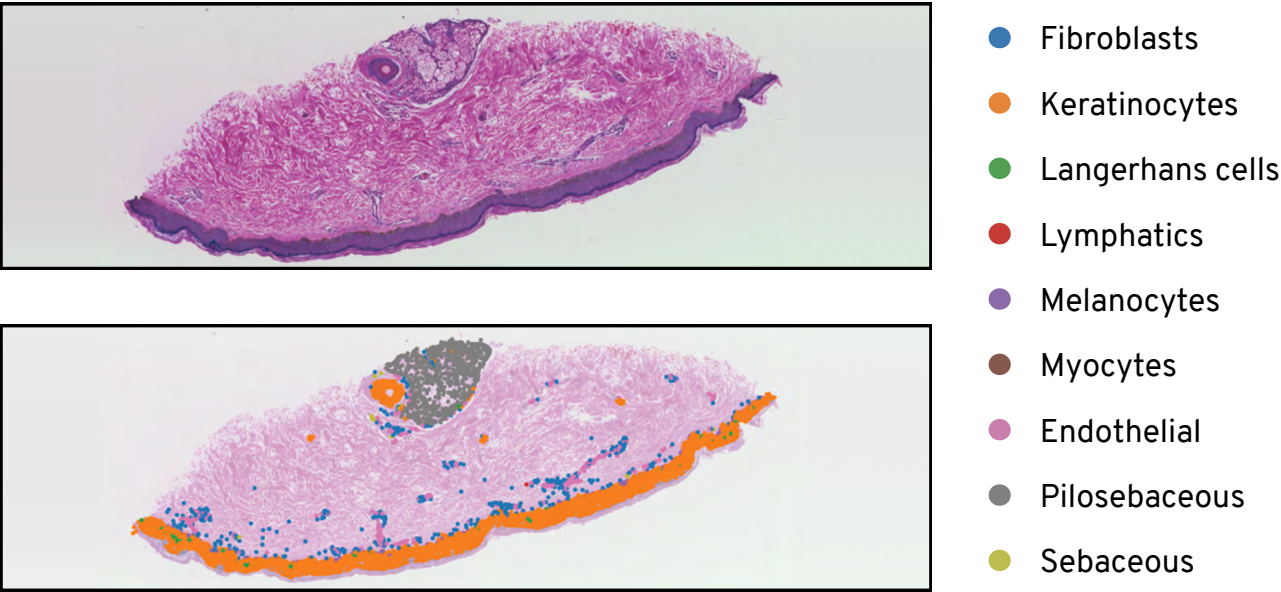
Visit the **BRI Genomics Core** facility on **The CoreMarketplace** by scanning the QR code to the left or visiting [bri-news.short.gy/31Jij9](http://bri-news.short.gy/31Jij9).



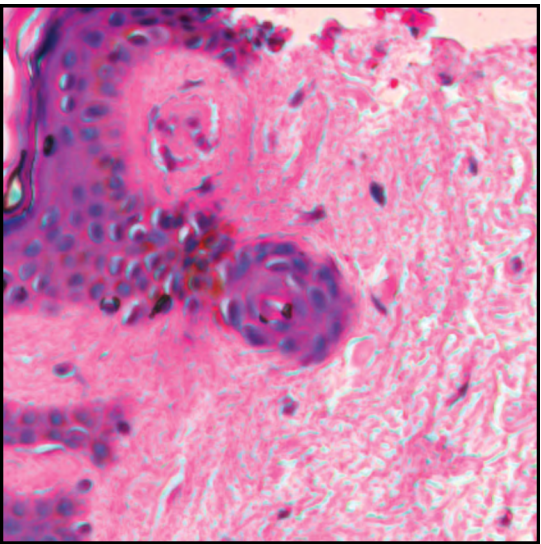
Learn more about the **BRI Bioinformatics Group** by scanning the QR code to the left or visiting [bri-news.short.gy/sijHJRx](http://bri-news.short.gy/sijHJRx).

## Mapping scleroderma skin tissue with spatial transcriptomics

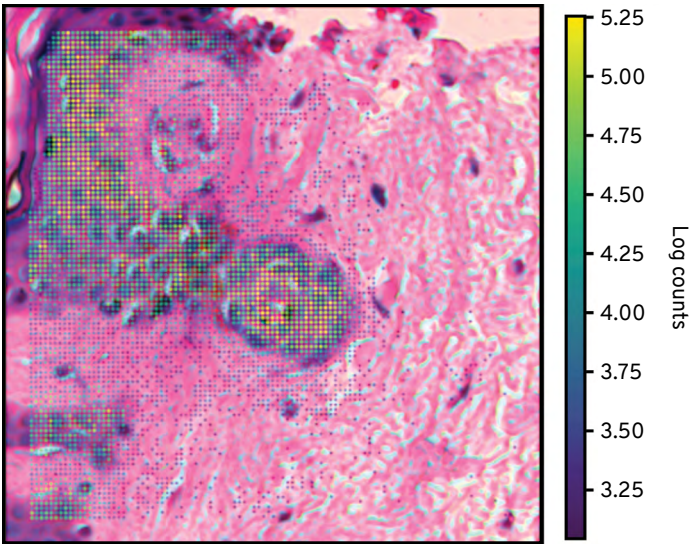
Data generated by the BRI Bioinformatics Group:



Close-up view of feature from section:



Number of RNA plotted over tissue:



**Vivian Gersuk, PhD**  
Manager, BRI Genomics Core

Dr. Gersuk brings a background of more than 30 years in molecular biology and immunology to her role as manager of the BRI Genomics Core. She and her team are experienced in using cutting-edge approaches to generate data and advance your scientific aims.

# BRI HUMAN IMMUNOPHENOTYPING CORE

Email contact: [hip-core@benaroyaresearch.org](mailto:hip-core@benaroyaresearch.org)

The BRI Human Immunophenotyping (HIP) Core specializes in robust, reproducible assays for application to human samples. Our team offers a full spectrum of support, from guidance on study design and training on new technologies to execution, data analysis and interpretation, as well as expertise in human immunology, innovative assays, and state-of-the-art technology. We provide robust, high-parameter single-cell assays utilizing conventional, spectral and mass cytometry (CyTOF), which can be paired with sophisticated genomic and bioinformatic analyses through other BRI core labs.

### Flow cytometry assays

- Immunophenotyping
- Functional assays
- Antigen-specific T and B cells
- Peripheral blood mononuclear cells (PBMC), whole blood, BAL, bone marrow
- Bespoke panels and assays

### Data analysis and interpretation

CyTOF panels and instrument training and use

### Short-term in vitro assays

- Proliferation
- Activation
- Cytokine secretion
- Antigen-specific cells
- Immune cell killing assays

### Soluble factor quantification

- Enzyme-linked immunosorbent assay (ELISA)
- Multiplex technologies (Luminex)

### Preparation for BRI Genomics Core

- Cell sorting/isolation
- In vitro stimulation
- CITE-seq labeling of cells
- Cell preservation for RNA-seq

### Consultation on study design

- Experimental plan
- Panel development
- Analysis tools and approach

Examples of our cutting-edge work in immunology and commitment to robust assays:

### Robust assays

Impact On In-Depth Immunophenotyping of Delay to Peripheral Blood Processing

Clinical and Experimental Immunology, 2024

Guidelines for Standardizing T Cell Cytometry Assays To Link Biomarkers, Mechanisms and Disease Outcomes in Type 1 Diabetes

European Journal of Immunology, 2022

A Simple Strategy for Sample Annotation Error Detection in Cytometry Datasets

Cytometry Part A, 2021

### Clinical trial mechanism

A First-In-Human, Open-Label Phase 1B and a Randomized, Double-Blind Phase 2A Clinical Trial in Recent-Onset Type 1 Diabetes With AG019 As Monotherapy and in Combination With Teplizumab

Diabetologia, 2023

### Disease etiology/outcome

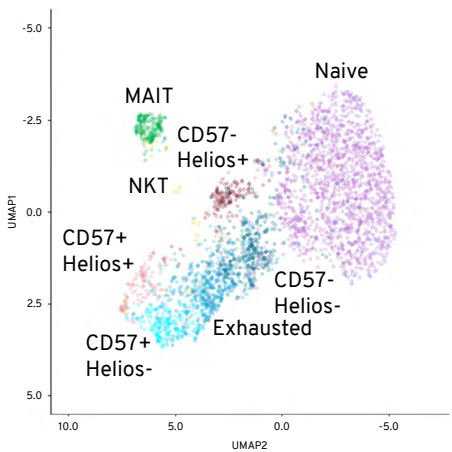
Deep Immune Phenotyping Reveals Similarities Between Aging, Down Syndrome and Autoimmunity

Science Translational Medicine, 2022

Inflammatory Bone Marrow Signaling in Pediatric Acute Myeloid Leukemia Distinguishes Patients With Poor Outcomes

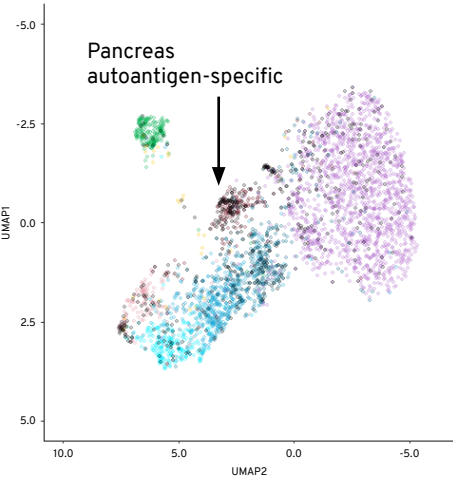
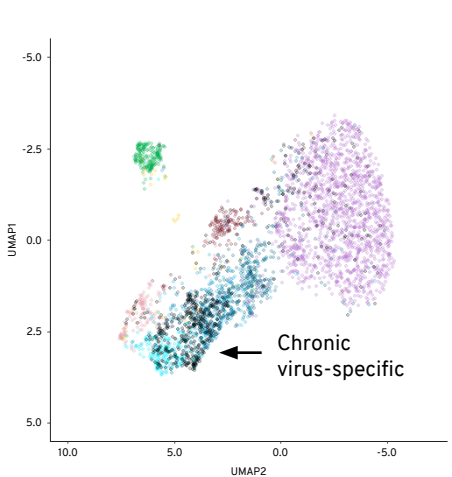
Nature Communications, 2022

### CD8 T Cells



Visit the **BRI Human Immunophenotyping Core facility on The Core Marketplace** by scanning the QR code to the left or visiting [bri-news.short.gy/vicEOM](https://bri-news.short.gy/vicEOM).

### Antigen-specific overlay



Peripheral blood mononuclear cells from healthy controls and people living with type 1 diabetes were assayed with a 40-parameter CyTOF panel, including tetramers to identify chronic virus (CMV, EBV)-specific and pancreas autoantigen-specific CD8 T cells. Pictured above are Uniform Manifold Approximation and Projection (UMAP) images of CD8 T cell subsets identified using our DISCOV-R clustering analysis pipeline and their annotations as well as overlays of antigen-specific CD8 T cells. Chronic virus-specific cells primarily exhibited an exhausted phenotype, whereas autoantigen-specific CD8 T cells were enriched among Helios+ early memory.



### Alice Wiedeman, PhD

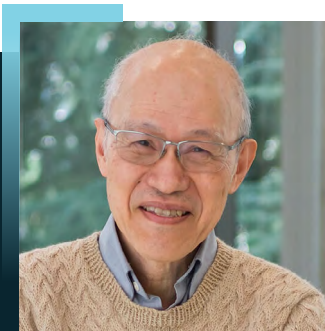
Manager, BRI Human Immunophenotyping Core

Dr. Wiedeman has studied the human immune system for nearly two decades, working with scientists across a range of fields and taking advantage of the latest technologies to develop innovative assays tailored to meet researchers' needs.

# BRI TETRAMER CORE

Email contact: [tetramercore@benaroyaresearch.org](mailto:tetramercore@benaroyaresearch.org)

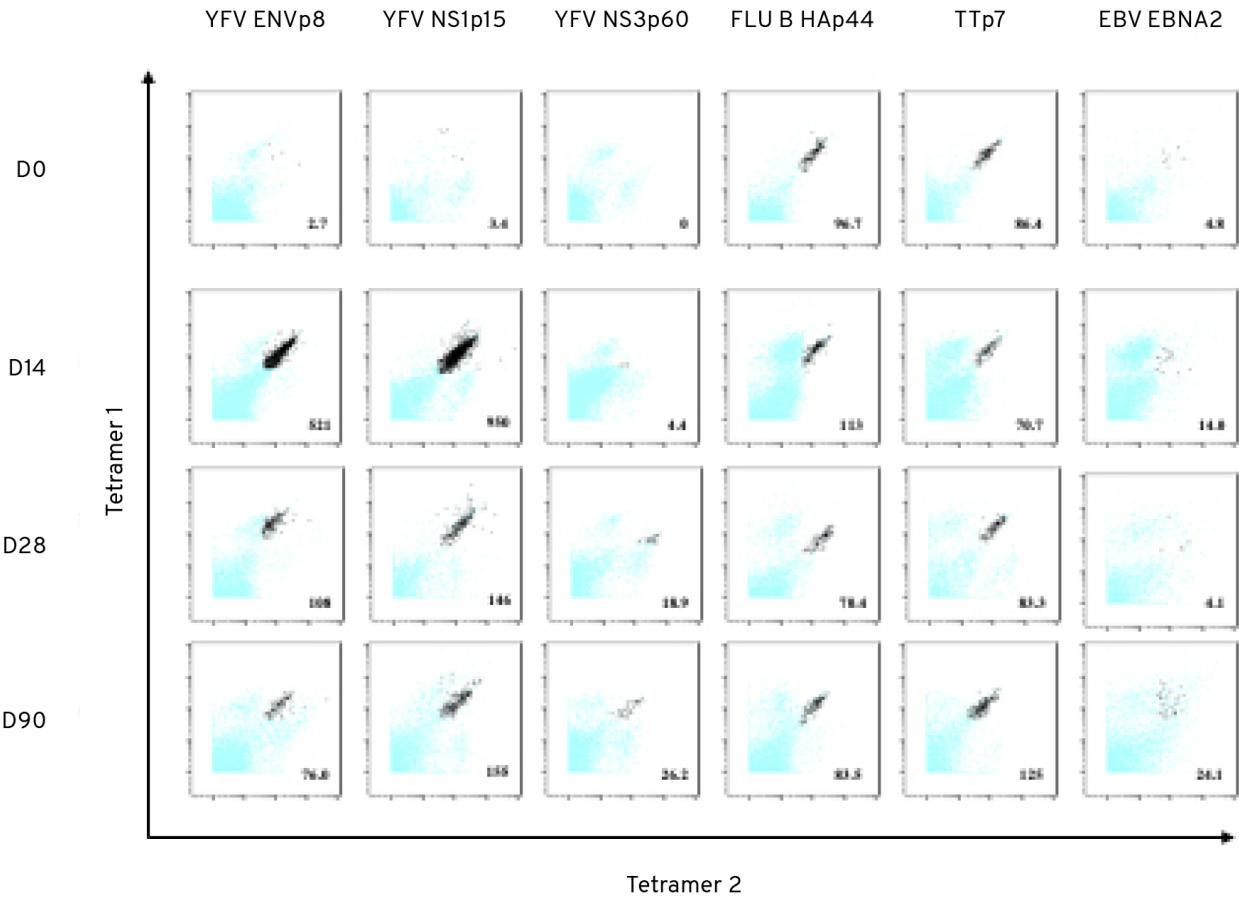
The BRI Tetramer Core has expertise in developing tetramers – synthetic protein conjugates that can be used to directly label T cells. Tetramers are used in studies of autoimmune disease, cancer, infectious disease, vaccine response, and allergies. Our team produces custom tetramers for use in detecting antigen-specific CD4+ T cells and has experience working with groups and projects of all sizes, including academic institutions and multinational and local biotechnology firms.



**Bill Kwok, PhD**  
Director, BRI Tetramer Core; member, BRI Center for Translational Immunology

Dr. Kwok is one of the original developers of class II tetramers, a flow cytometry reagent that can be used to identify and study CD4+ T cells (“helper T cells”) with exquisite sensitivity and specificity. Research projects in his lab are focused on understanding the behavior of human helper T cells and developing technologies that will support the next generation of tetramer reagents and new approaches to interrogating epitope-specific T cells. He brings over 30 years of experience in his field to his role as director of the BRI Tetramer Core.

## Staining for epitope-specific T cells with class II tetramers developed by the BRI Tetramer Core pre- and post-vaccination



Combinatorial ex vivo class II tetramers staining of yellow fever virus (YFV)-specific, influenza B (FLU B)-specific, torque teno (TT) virus-specific, and Epstein-Barr virus (EBV)-specific CD4+ T cells at four different time points pre- and post-vaccination. Combinatorial tetramer staining was carried out in peripheral blood mononuclear cells from the same subject at day zero (D0) pre-vaccination and days 14 (D14), 28 (D28) and 90 (D90) post-vaccination. The tetramer for each epitope specificity was conjugated to two different tags. Staining for specific T cells of different epitope specificities at each time point was carried out in a single tube. Dark dots represent epitope frequencies of epitope-specific CD4+ T cells per million CD4+ T cells.

## Examples of tetramers used in immunology research:

Longitudinal Single Cell Profiling of Epitope-Specific Memory CD4+ T Cell Responses to Recombinant Zoster Vaccine

Nature Communications, 2025

Cross-Reactive and Mono-Reactive SARS-CoV-2 CD4+ T Cells in Pre-Pandemic and COVID-19 Convalescent Individuals

PLOS Pathogens, 2021

Evaluating Responses to Gluten Challenge: A Randomized, Double-Blind, 2-Dose Gluten Challenge Trial

Gastroenterology, 2021

Ontogeny of Different Subsets of Yellow Fever Virus-Specific Circulatory CXCR5+ CD4+ T Cells After Yellow Fever Vaccination

Scientific Reports, 2020

A Phenotypically and Functionally Distinct Human TH2 Cell Subpopulation Is Associated With Allergic Disorders

Science Translational Medicine, 2017

# BRI ANIMAL RESOURCES CORE

Email contact: [aburich@benaroyaresearch.org](mailto:aburich@benaroyaresearch.org)

With expertise in breeding, handling, and general animal health needs, the BRI Animal Resources Core is committed to the highest ethical standards of animal care while supporting research activities.

Our facility, staffed seven days per week, offers:

- Routine husbandry care.
- Basic colony management, including animal identification, tissue sample procurement for genotyping, and litter weaning.

Our [state-of-the-art vivaria](#) provide housing for pathogen-free mice and include:

- Individually-ventilated caging systems.
- Procedure and Animal Biosafety Level 2 (ABSL-2) rooms.
- New X-Rad320 x-ray irradiator with OptiMAX imaging.
- Portable isoflurane anesthetic machines.
- Electronically-monitored systems (e.g., temperature, humidity, room pressure differential, light).



**Andrew Burich, DVM**  
Director, BRI Animal Resources Core

Dr. Burich has served as director of BRI’s Animal Resources Core since 2005. As a full-time veterinarian, he provides

oversight of the health and welfare of all animals housed at BRI, emergency care to our animals after hours and on holidays, and guidance and support to our researchers. He also holds an appointment as an affiliate instructor in the University of Washington (UW) Department of Comparative Medicine.

Previously, Dr. Burich worked for Oregon Health and Science University (OHSU) as a senior clinical veterinarian and assistant professor in the OHSU Department of Comparative Medicine. He completed a postdoctoral fellowship in laboratory animal medicine at the UW and holds a doctorate in veterinary medicine and bachelor’s degree in zoology from the University of Wisconsin – Madison as well as a master’s degree in comparative medicine from the UW.

immune thrombocytopenic purpura   polymyositis   autoimmune inner ear disease  
xerodermagangrenosum   hemolytic anemia   anti-GBM disease   Crohn’s disease   celiac  
disease   antiphospholipid syndrome   type 1 diabetes   autoimmune dysautonomia  
Takayasu’s arteritis   IgG4-related sclerosing disease   vitiligo   ulcerative colitis  
reactive arthritis   autoimmune hepatitis   autoimmune oophoritis   autoimmune  
polyglandular syndrome type 1   eosinophilic granulomatosis with polyangiitis  
palindromic rheumatism   pure red cell aplasia   asthma   adult-onset Still’s disease  
autoimmune polyglandular syndrome type 2   pernicious anemia   autoimmune  
retinopathy   primary biliary cholangitis   Kawasaki disease   cold agglutinin disease  
polymyalgia rheumatica   cancer   chronic idiopathic urticaria   alopecia areata

➤ [benaroyaresearch.org](http://benaroyaresearch.org)



Visit BRI’s facility profile on [The CoreMarketplace](#) by scanning the QR code to the left or visiting [bri-news.short.gy/4Ssl1u](http://bri-news.short.gy/4Ssl1u).

# WHY BRI?

About

**1 IN 10**

Americans are living with a food allergy

*United States Department of Agriculture, Food Safety and Inspection Service, 2024*

About

**1 IN 14**

Americans are living with asthma

*United States Centers for Disease Control and Prevention, 2023*

About

**1 IN 22**

Americans are living with an autoimmune disease

*The Journal of Clinical Investigation, 2024*

Over

**2,000,000**

Americans are estimated to be diagnosed with cancer in 2025

*American Cancer Society, 2025*

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