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2019 NCI IMAT PI Meeting

20th Annual Innovative Molecular
Analysis Technologies
Principal Investigators Meeting

November 22-23, 2019

Cedars-Sinai Medical Center
Los Angeles, CA



IMAT

INNOVATIVE MOLECULAR
ANALYSIS TECHNOLOGIES

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2019 NCI IMAT PI Meeting

20th Annual

Innovative Molecular Analysis Technologies
Principal Investigators Meeting

Brought to you by Cedars-Sinai Medical Center

November 22-23, 2019

Cedars-Sinai Medical Center
Los Angeles, CA

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For CSSI Information and Resources: <https://cssi.cancer.gov>

The views expressed in the materials or by presenters or participants at the event do not necessarily reflect the official policies of Cedars-Sinai Medical Center, the U.S. Department of Health & Human Services, the National Institutes of Health, the National Cancer Institute, or any of their components.

Friday, November 22, 2019

8:30-9:00am

Welcome and Opening Remarks

Tony Dickherber, *National Cancer Institute*
Clive Svendsen, *Cedars-Sinai Medical Center*
Dan Theodorescu, *Cedars-Sinai Medical Center*

9:00-10:30am

9:00	TdT-dependent UTP DSB end labeling (TUDEL) and GSD-FRET for analysis of chromatin-level regulation of DNA repair Steve Kron, <i>University of Chicago</i>
9:20	Next-generation MOWChIP-seq for high-throughput epigenomic profiling using clinically relevant samples Chang Lu, <i>Virginia Polytechnic Institute and State University</i>
9:40	Droplet microfluidics for single cell RNA-sequencing Allon Klein, <i>Harvard Medical School</i>
10:00	Single-molecule counting of cancer biomarker miRNAs in human biofluids Nils Walter, <i>University of Michigan at Ann Arbor</i>
10:20	A molecular method to determine isoform frequencies in RNA-seq John Welsh, <i>Vaccine Research Institute of San Diego</i>

10:30-10:50am

Break

10:50-11:50am

Advancing Liquid Biopsy Technologies

10:50	Development and validation of nanoparticle-mediated microfluidic profiling approach for rare cell analysis Shana Kelley, <i>University of Toronto</i>
11:10	Rapid unbiased isolation and in situ RNA analysis of circulating tumor cells using a magnetic micropore-based diagnostic chip David Issadore, <i>University of Pennsylvania</i>
11:30	Maximum efficiency sequencing using nuclease-based mutation enrichment and digital barcodes Mike Makrigiorgos, <i>Dana-Farber Cancer Institute</i>
11:40	Measurable Residual Disease (MRD) Monitoring Using Error Corrected Sequencing Matthew Walter, <i>Washington University</i>

11:50-12:15pm

Poster Session 1 Highlights

11:50	Pro-Codes: A novel vector and cell barcoding technology Brian D Brown, <i>Icahn School of Medicine at Mount Sinai</i>
11:55	Single-molecule counting of cancer biomarker miRNAs in human biofluids Muneesh Tewari, <i>University of Michigan at Ann Arbor</i>
12:00	Advanced development and validation of microdevices for high-throughput in situ drug sensitivity testing in tumors Michael J Cima, <i>Massachusetts Institute of Technology</i>
12:05	Sorting by Adhesion Strength Separates Cells of Varying Metastatic Potential Adam Jeffrey Engler, <i>University of California, San Diego</i>
12:10	Determining treatment sensitivity in B cell lymphoma by novel microfluidics-based NK cell immunogenicity platform Tania Tali Konry, <i>Northeastern University</i>

12:15-1:30pm

Lunch

1:30-3:00pm

Poster Session 1

3:00-3:30pm

Cedars-Sinai Medical Center Speakers

3:30-4:40pm

Molecular Pathway Tools 1

3:30	Measurement of Aberrant Protein Folds in Malignant Cells with Proteomics and Mass Spectrometry Casimir Bamberger, <i>Scripps Research Institute</i>
3:50	Evolutionary approaches to probe and manipulate protein-protein interactions Bryan Dickinson, <i>University of Chicago</i>
4:10	Development of the Glycotyper - A novel biomarker platform for the early detection of HCC Anand S Mehta, <i>Medical University of South Carolina</i>
4:20	A Target-Directed Reagent Pipeline via Microfluidic mRNA Display Noah Malmstadt, <i>University of Southern California</i>
4:30	A novel time-resolved fluorescence-based high-throughput screening technology for discovering allosteric kinase inhibitors Nicholas Mark Levinson, <i>University of Minnesota</i>

4:40-5:00pm

Break

5:00-6:10pm

Molecular Pathway Tools 2

5:00	Monitoring Recurrent Bladder Cancer with Electro-Phage Biosensors Gregory A Weiss, <i>University of California, Irvine</i>
5:20	Single-molecule mechanical detection of cancer biomarkers Wesley Philip Wong, <i>Boston Children's Hospital</i>
5:40	High Resolution High Throughput Proteomics Platform using multi-level Structures for Lossless Ion Manipulations Yehia Ibrahim, <i>Battelle Pacific Northwest Laboratories</i>
5:50	uCoil NMR platform for robust and high-throughput analysis of in vitro metabolic flux on living cells Kayvan R Keshari, <i>Sloan-Kettering Institute of Cancer Research</i>
6:00	Exquisitely selective turn-on probes of kinase activation and localization Matthew B Soellner, <i>University of Michigan at Ann Arbor</i>

6:10-6:20pm

Break

6:20-7:10pm

Synthetic Biology-Driven Technologies

6:20	Engineered regulation of tyrosine phosphatase activity in living cells Andrei V Karginov, <i>University of Illinois at Chicago</i>
6:40	A molecular toolkit for the production of tyrosine phosphorylated proteins Kristen M Naegle, <i>University of Virginia</i>
6:50	The GOF Mutant p53 Beacon System Brad E Windle, <i>Virginia Commonwealth University</i>
7:00	High resolution cell lineage tracking and isolation Amy Brock, <i>University of Texas, Austin</i>

Saturday, November 23, 2019

8:30-8:40am

Perspectives from Cancer Patient Advocate

Brittany Avin McKelvey

8:40-9:50am

Biospecimen Science Technologies

8:40

The application of Enhanced Cavitation to enable DNA and Chromatin Extraction from Archived Tissues

Samantha Pattenden, *University of North Carolina Chapel Hill*

9:00

High-efficiency microfluidic-assisted single-cell DNA methylome sequencing

Hariharan Easwaran, *Johns Hopkins University*

9:20

Determining and enhancing metabolite fitness for metabolomics measurements

Aalim M Weljie, *University of Pennsylvania*

9:30

Validation of a disposable biospecimen collection system with integral refrigeration for preserving the phosphoproteome

Jacob Kennedy, *Fred Hutchinson Cancer Research Center*

9:40

Profiling of Pol II transcriptomes using small capped RNA sequencing

Sergei Nechaev, *University of North Dakota*

9:50-10:50am

Cancer Moonshot Technologies

9:50

Whole-Tissue Western Blotting for Enhanced Cancer Classification via Targeted Proteomic Analysis Preserving Tissue Context

Amy Elizabeth Herr, *University of California, Berkeley*

10:05

Molecular Beacon Based Extracellular mRNA and Protein Detection for Early Cancer Diagnosis

Ly James Lee, *Ohio State University*

10:20

3D Organotypic lumen-based models of renal cell carcinoma for precision oncology with anti-angiogenic drugs

David J Beebe, *University of Wisconsin, Madison*

10:35

Multi-Tracer Volumetric PET (MTV-PET) to Measure Tumor Glutamine and Glucose Metabolic Rates in a Single Imaging Session

David Mankoff, *University of Pennsylvania*

10:50-11:10am

Break

11:10-12:30pm

Cancer Modeling Approaches

11:10	LETSSGo: Lymphoma-on-chip Engineered Technology for Single-Organoid Sequencing and Genomics <i>Ankur Singh, Cornell University</i>
11:30	A Vascularized, In Vitro, Organotropic Metastasis Model to Generate Dormant Micrometastases <i>John Hundley Slater, University of Delaware</i>
11:50	Ex vivo culture platform validation for preservation of patient derived multiple myeloma cells <i>Woo Young Lee, Stevens Institute of Technology</i>
12:10	Advancing Cancer Biology, Diagnostics and Therapeutics Outside of the Patient: Creation of a Novel, Autologous, Ex Vivo, Vascularized Model of the Tumor Microenvironment <i>Ryan C Fields, Washington University</i>
12:20	Predicting Tumor Heterogeneity Evolution After Therapy In Patient-Derived Ex Vivo Glioblastoma Organoids <i>Aleksander Skardal, Wake Forest University of Health Sciences</i>

12:30-12:55pm

Poster Session 2 Highlights

12:30	A microreactor chip platform for quantitative analysis of unsaturated aldehydes in exhaled breath <i>Xiao-an Fu, University of Louisville</i>
12:35	Enzymatic Tools for 2D Tissue Localized and Deeper Proteomic Sequencing of Cancer Stromal Proteins <i>Peggi M Angel, Medical University of South Carolina</i>
12:40	EndoGenus Toolkit: A Biometric Method for Absolute Quantification of Tumor Markers by Massive Parallel Sequencing <i>Margaret L Gulley, University of North Carolina Chapel Hill</i>
12:45	Stimulated Raman scattering spectroscopic optical coherence tomography (SRS-SOCT) for label-free molecular imaging of brain tumor pathology <i>Francisco E Robles, Georgia Institute of Technology</i>
12:50	Development of a Tissue Type Specific Culture System <i>Tan A Ince, University of Miami School of Medicine</i>

12:55-2:00pm

Lunch

2:00-3:30pm

Poster Session 2

3:30-4:40pm

Novel Imaging Approaches

3:30

Brillouin confocal microscopy for biomechanical studies of metastatic cascade in 3D microenvironments

Giuliano Scarcelli, *University of Maryland, College Park*

3:50

High Content Screening of Multicellular Invasion with 3D Traction Force Microscopy

Ian Y Wong, *Brown University*

4:10

Cancer histology and QC via MUSE: Sample-sparing UV surface-excitation microscopy

Richard M Levenson, *University of California, Davis*

4:30

High-throughput super-resolution imaging of chromatin folding in early carcinogenesis

Yang Liu, *University of Pittsburgh*

4:40-5:30pm

Imaging Probes Advances

4:40

Tunable Fluorescent Organic Nanoparticles for Cancer Imaging Applications

Aaron M Mohs, *University of Nebraska Medical Center*

5:00

Cancer cell molecular analysis using quantum dots

Xiaohu Gao, *University of Washington*

5:10

Fluorescence lifetime-based single fluorophore biosensors of post-translational modification enzyme activity

Laurie L Parker, *University of Minnesota*

5:20

Developing FRET Biosensors to Visualize Kinases and Epigenetics in Live Cancer Cells

Yingxiao Wang, *University of California, San Diego*

5:30-5:45pm

NCI Closing Remarks

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Resources and Funding Opportunities

Resources

- The NCI Center for Strategic Scientific Initiatives (CSSI) [Data Coordinating Center \(DCC\) Portal](#) is a public repository of experiment-related information describing cancer research investigations. You can use the portal to browse, search, and access data generated through CSSI funded projects and other user uploaded data sets. This data is in ISA-Tab format.
- NCI's [Proteomics Data Portal](#) provides datasets of breast, ovarian, and tumor tissue that have been genomically characterized by TCGA datasets.
- The [Antibody Characterization Laboratory](#) provides access to a large number of reagents and accompanying characterization data. Antigens and antibodies are expressed, purified, and characterized using standard operating procedures, with all accompanying protocols and data.
- The Nanotechnology Characterization Laboratory ([NCL](#)) within Frederick National Laboratory for Cancer Research performs preclinical characterization of nanomaterials using a comprehensive battery of assays. The operation of NCL relies on collaboration with the Food and Drug Administration and the National Institute of Standards and Technology.
- The cancer Nanotechnology Laboratory ([caNanoLab](#)) data portal provides access to nanomaterial characterization data to expedite and validate the use of nanomaterials in biomedicine. Users can search and download cancer-relevant characterization data resulting from physico-chemical, *in vitro*, and *in vivo* assays, as well as associated protocols and publication information.
- NCI's Physical Sciences-Oncology Network and Cancer Systems Biology Consortium [Data Coordinating Center](#) on Synapse provides datasets of genomic characterization and physical characterization of numerous non-malignant and malignant cell lines (<https://www.synapse.org/#!Synapse:syn7248578/wiki/405995>).
- The NCI Physical Sciences-Oncology Network [Bioresource Core Facility \(PBCF\)](#) at American Type Culture Collection (ATCC) is a central resource that provides common stocks of authenticated non-malignant and cancerous cell lines, their derivatives, cell culture reagents, and related standard operating procedures (SOPs). The bioresources are available for the cost of shipping and handling only, not only for members of the Physical Sciences-Oncology Network and Cancer Systems Biology Consortium, but also all investigators who are willing to share data sets that are generated using the bioresources provided by the PBCF. Visit the website to view the list of available cell lines and derivatives, the SOPs, order form, and transfer agreements: <http://physics.cancer.gov/bioresources>.
- The Early Detection Research Network ([EDRN](#)) – A consortium that promotes discovery, development, and clinical validation of biomarkers for early detection of cancer. Investigators with promising biomarkers may request for core funds to validate their markers using reference sets and resources within the network.
- The NCI [SBIR Development Center](#) oversees all NCI Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) support programs, which includes all grant and contract funding opportunities, as well as a broad variety of additional resources aimed at supporting the innovations and commercial interests of small business entities against cancer.
- The [Cancer Genomics Cloud Pilots](#) are designed to explore innovative methods for accessing and computing on large genomic data. Three contracts were awarded to develop infrastructure and a set of tools to access, explore, and analyze molecular data, which are all being implemented through commercial cloud providers and adopting common standards. The three project teams have distinct system designs, data presentation, and analysis resources to serve the cancer research community, which will be made available to researchers in early 2016.
- [The Cancer Genome Atlas \(TCGA\) Data Portal](#) provides a platform for researchers to search, download, and

Resources and Funding Opportunities

analyze datasets generated by TCGA. It contains clinical information, genomic characterization data, and high-throughput sequencing analysis of the tumor genomes.

- The [Alliance of Glycobiologists for Cancer Research](#) – A consortium that investigates the molecular basis by which altered glycan expression leads to cancer progression and develop cancer biomarkers based on the aberrant expression of these glycans. Opportunities exist to collaborate in cancer relevant research with a number of experts in glycobiology.
- NCI [Best Practices for Biospecimen Resources](#) guiding principles that define state-of-the-science biospecimen resource practices, promote biospecimen and data quality, and support adherence to ethical and legal requirements. (<https://biospecimens.cancer.gov>)
- The Biospecimen Research Database ([BRD](#)) is a free and publicly accessible literature database that contains curated, peer-reviewed primary and review articles in the field of human biospecimen science. The database is searchable by various parameters including the biospecimen investigated (type and location, patient diagnosis), preservation method, analyte(s) of interest and technology platform(s) used for analysis. An original summary of relevant results is also provided for each article.
- The NCI offers the following two resources for research biospecimens:
 - [Specimen Resource Locator \(SRL\)](#) is a biospecimen resource database designed to help researchers locate resources that may have the samples needed for their investigational use. This publicly searchable database includes information about biospecimen banks and sample procurement services. The specimens and samples come from non-commercial, either NCI or non-NCI-funded resources. Investigators can search the database and gain access to thousands of specimens of various tumor, organ, and preservation methods.
 - The [Cooperative Human Tissue Network \(CHTN\)](#) is a resource developed and supported by the NCI that provides human tissues and fluids from routine procedures open to the scientific community to facilitate basic, early translation research, and assay/technology validation. Unlike tissue banks, the CHTN works prospectively with each investigator to tailor specimen acquisition and processing to meet their specific project requirements.
- The NCI [Comprehensive Data Resource \(CDR\)](#) is a distributed web-based system that manages and maintains multi-dimensional data models on biospecimens. CDR was developed and is currently utilized to collect biospecimen and clinical data on biospecimens collected from cancer patient donors and post-mortem donors, for the NCI's Biospecimen Pre-analytical Variables (BPV) and NIH Genotype-tissue Expression (GTEx) programs.
- NCI has developed the [Biobank Economic Modeling Tool \(BEMT\)](#), a publicly available web-based financial planning tool for biobanks. BEMT is designed to enhance the understanding of the economic considerations involved in initiating, operating and maintaining a biobank to assist with long term financial planning and cost recovery.
- The NIH Library of Integrated Network-based Cellular Signatures ([LINCS](#)) Program aims to create a network-based understanding of biology using computational tools into a comprehensive view of normal and disease states that can be applied for the development of new biomarkers and therapeutics. By generating and making public data that indicates how cells respond to various genetic and environmental stressors, the [LINCS project](#) will help us gain a more detailed understanding of cell pathways and aid efforts to develop therapies that might restore perturbed pathways and networks to their normal states.

Resources and Funding Opportunities

Active Research Funding Opportunities

Innovative Molecular Analysis Technology (IMAT) Program

Look out for new RFAs that will come out soon on the [IMAT website](#).

- [PAR-18-303](#): Innovative Molecular Analysis Technology Development for Cancer Research and Clinical Care (R43/R44 Clinical Trial Not Allowed). Expires Jan. 8, 2021.

Alliance for Nanotechnology in Cancer

- [PAR-17-240](#): Innovative Research in Cancer Nanotechnology (IRCN) (R01). 3 unique receipt dates per year. Expires May 22, 2020.

Academic-Industrial Partnerships

- [PAR-18-530](#): Academic-Industrial Partnerships for Translation of Technologies for Cancer Diagnosis and Treatment (R01 Clinical Trial Optional). Expires January 8, 2021.

NCI Cancer MoonshotSM Initiative

- [PAR-17-245](#): (R01) Research Projects to Enhance Applicability of Mammalian Models for Translational Research
- [PAR-17-244](#): (Collaborative R01) Collaborative Research Projects to Enhance Applicability of Mammalian Models for Translational Research
Standard due dates apply.
Expires May 8, 2020.
- [RFA-CA-19-033](#): Improving Outcomes for Pediatric, Adolescent, and Young Adult Cancer Survivors (U01 Clinical Trial Required)
Expires January 4, 2020
- [RFA-CA-19-049](#): Revision Applications for Mechanisms of Cancer Drug Resistance (R01 Clinical Trial Not Allowed)
Expires June 24, 2021
- [RFA-CA-19-046](#): Participant Engagement and Cancer Genome Sequencing (PE-CGS): Coordinating Center (U23 Clinical Trial Not Allowed)
Expires July 31, 2020
- [RFA-CA-19-045](#): Participating Engagement and Cancer Genome Sequencing (PE-CGS): Research Centers (U2C Clinical Trial Optional)
Expires July 31, 2020

NOTE: For all funding opportunities associated with the NCI Cancer Moonshot Initiative, please visit <https://www.cancer.gov/brp>

Resources and Funding Opportunities

Assay Validation for High Quality Markers for NCI-Supported Clinical Trials

- [PAR-18-317](#) (UH2/UH3 Clinical Trials Not Allowed)
- [PAR-18-310](#) (UH3 Clinical Trials Not Allowed)
3 unique receipt dates per year. Expires Oct. 9, 2020.

Informatics Technologies for Cancer Research (ITCR) Program

- [RFA-CA-19-042](#): Informatics Technology for Cancer Research Education Resource (UE5 Clinical Trial Not Allowed)
Expires August 1, 2020

New FOAs are anticipated soon. Please visit <https://itcr.cancer.gov> for updates.

Oncology Models

- [PAR-17-244](#): (Collaborative R01) Collaborative Research Projects to Enhance Applicability of Mouse Models for Translational Research
- [PAR-17-245](#): (R01) Research Projects to Enhance Applicability of Mouse Models for Translational Research.
Standard due dates apply.
Expires May 8, 2020.
- [PAR-19-101](#): Physical Sciences-Oncology Network (PS-ON): Physical Sciences-Oncology Projects (PS-OP) (U01 Clinical Trial Optional)
Expires July 31, 2020
- [PAR-19-113](#): Cancer Tissue Engineering Collaborative: Enabling Biomimetic Tissue-Engineered Technologies for Cancer Research (R01 Clinical Trial Optional)
Expires January 8, 2020
- [PAR-16-398](#): Engineering Next-Generation Human Nervous System Microphysiological Systems (R01)
Expires January 8, 2020

Other NCI Opportunities

- [PAR-18-841](#): Oncology Co-Clinical Imaging Research Resources to Encourage Consensus on Quantitative Imaging Methods and Precision Medicine (U24 Clinical Trial Optional).
Two unique receipt dates per year, expires Jun 15, 2021
- [PAR-18-913](#): Utilizing the PLCO Biospecimens Resource to Bridge Gaps in Cancer Etiology and Early Cancer Detection Research (U01 Clinical Trial Not Allowed)
Two unique receipt dates per year, expires August 12, 2021
- [PAR-18-947](#): Integrating Biospecimen Science Approaches into Clinical Assay Development (U01 Clinical Trial Not Allowed)
Three unique receipt dates per year, expires July 12, 2021

Resources and Funding Opportunities

- [PAR-18-951](#): Opportunities for Collaborative Research at the NIH Clinical Center (U01 Clinical Trial Optional)
Applications due April 15 in 2019, 2020, and 2021.
- [PAR-19-356](#): NCI Clinical and Translational Exploratory/Developmental Studies (R21 Clinical Trial Optional)
Expires July 21, 2022

General NIH Bioengineering Research Opportunities

- [PAR-18-205](#): NIBIB Biomedical Technology Resource Center. (P41 Clinical Trials Optional)
Standard due dates apply. Expires January 8, 2020.
- [PAR-19-254](#): Exploratory Research for Technology Development (R21 – Clinical Trial Not Allowed)
- [PAR-19-253](#): Focused Technology Research and Development (R01 – Clinical Trial Not Allowed)
Expires May 8, 2022
- [PAR-17-316](#): (P41) NIGMS Biomedical Technology Research Resource. Applications due: January 25, 2019; May 25, 2019; and January 25, 2020.
- [PAR-19-150](#): Exploratory/Developmental Bioengineering Research Grants (EBRG) (R21 Clinical Trial Optional)
- [PAR-19-158](#): Bioengineering Research Grants (BRG) (R01 Clinical Trial Not Allowed)
- [PAR-19-156](#): Bioengineering Research Partnerships (U01 Clinical Trial Not Allowed)
- [PAR-19-157](#): Bioengineering Research Partnerships (U01 Clinical Trial Required)
Expires January 8, 2022

Diet and Physical Activity Assessment Methodology

- [PA-18-856](#) (R01)
- [PAR-18-857](#) (R21)
Standard receipt dates, expiring September 8, 2021

Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative

Various funding opportunities can be found at <https://www.braininitiative.nih.gov>

Resources and Funding Opportunities

Training and Other Support

Ruth L. Kirschstein National Research Service Award (NRSA)

- [PA-18-396](#): (K25) Mentored Quantitative Research Development Award
- [PA-18-403](#): (T32) Institutional Research Training Grant
- [PA-18-404](#): (T35) Short-Term Research Training Grant
- [PA-18-666](#): (F31) Predoctoral Fellowship to Promote Diversity in Health-Related Research
- [PA-18-668](#): (F30) Fellowship for Students at Institutions With NIH-Funded Institutional Predoctoral Dual-Doctoral Training Programs
- [PA-18-670](#): (F32) Individual Postdoctoral Fellowship
- [PA-18-671](#): (F31) Individual Predoctoral Fellowship
- [PA-18-672](#): (F33) Individual Senior Fellowship.
- [PA-18-673](#): (F30) Fellowship for Students at Institutions Without NIH-Funded Institutional Predoctoral Dual-Doctoral Training Programs
- [PAR-18-467](#): (K22) The NCI Transition Career Development Award.

More information on NIH-supported training initiatives [here](#).



IMAT

INNOVATIVE MOLECULAR
ANALYSIS TECHNOLOGIES

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