

Accelerating Cancer Research: Cancer Moonshot, Technology Development, Data Science...

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Overall Goals of the Cancer Moonshot

- **Accelerate progress** in cancer, including prevention & screening from cutting edge research to wider uptake of standard of care
- Encourage **greater cooperation and collaboration** within and between academia, government, and private sector
- Enhance **data sharing**

The Process



Vice President's Office



Federal Task Force



NIH/NCI

National Cancer Advisory Board

Blue Ribbon Panel (BRP)

BRP Working Groups (WG)

Cancer Immunology WG

Tumor Evolution and Progression WG

Pediatric Cancer WG

Blue Ribbon Panel Goals

- Identify major scientific opportunities that are poised to be accelerated by additional emphasis and funding
 - Identify major scientific and regulatory hurdles that can be overcome with additional emphasis and funding
 - Develop recommendations of opportunities that would be pursued through the Cancer Moonshot
- Final recommendations at www.cancer.gov/brp



Blue Ribbon Panel Recommendations

- A. Network for **Direct Patient Engagement**
- B. Cancer **Immunotherapy** Clinical Trials Network
- C. Therapeutic Target Identification to **Overcome Drug Resistance**
- D. A National Cancer **Data Ecosystem** for Sharing and Analysis
- E. Fusion Oncoproteins in **Childhood Cancers**
- F. **Symptom Management** Research
- G. **Prevention and Early Detection**: Implementation of Evidence-Based Approaches
- H. Retrospective **Analysis of Biospecimens** from Patients Treated with Standard of Care
- I. Generation of **Human Tumor Atlases**
- J. Development of New Enabling **Cancer Technologies**



Cancer Moonshot Implementation Teams

- A. Network for Direct Patient Engagement
- B. Cancer Immunotherapy Translational Science Network
 - Bi. Pediatric Implementation Team
 - Bii. Adult Implementation Team
- C. Therapeutic Target Identification to Overcome Drug Resistance
- D. A National Cancer Data Ecosystem for Sharing and Analysis
- E. Fusion Oncoproteins in Childhood Cancers
- F. Symptom Management Research
- G. Prevention and Early Detection: Implementation and Evidenced-Based Approaches
 - Gi. High Risk Cancers Implementation Team
 - Gii. Cancer Prevention and Screening Implementation Team
- H. Development of New Enabling Cancer Technologies
- I. Retrospective Analysis of Biospecimens from Patients Treated with Standard of Care
- J. Generation of Human Tumor Atlases

FUNDING OPPORTUNITIES

BLUE RIBBON PANEL RECOMMENDATIONS

CANCER MOONSHOT

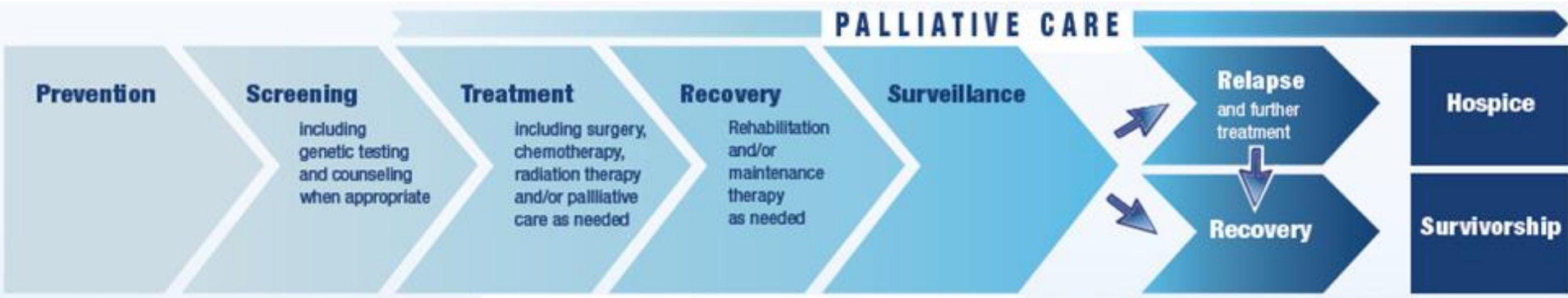
cancer.gov/brp

BRP Recommendation	Title	Announcement Number	Opening Date	Expiration Date
Cancer Immunotherapy Translational Science Network	Research Projects to Enhance Applicability of Mammalian Models for Translational Research (R01)	PAR-17-245	5/5/2017	5/8/2020
	Collaborative Research Projects to Enhance Applicability of Mammalian Models for Translational Research (Collaborative R01)	PAR-17-244	5/5/2017	5/8/2020
	Metabolic Reprogramming to Improve Immunotherapy (R21)	PAR-16-229	9/16/2016	9/8/2019
	Metabolic Reprogramming to Improve Immunotherapy (R01)	PAR-16-228	9/5/2016	9/8/2019
Prevention and Early Detection: Implementation Science	Improving Smoking Cessation in Socioeconomically Disadvantaged Populations via Scalable Interventions (R01)	PAR-16-202	9/11/2016	6/14/2019
	Improving Smoking Cessation in Socioeconomically Disadvantaged Populations via Scalable Interventions (R21)	PAR-16-201	9/11/2016	6/14/2019
	Dissemination and Implementation Research in Health (R21)	PAR-16-236	5/16/2016	5/8/2019

Moonshot Cross-Cutting Themes

- Complexity
- Heterogeneity
- Inclusivity
- Partnering/Leveraging
- Accelerate...

Cancer Moonshot and Health Equity: where can technology help?



Improved Risk Stratification

Bring Screening to the Communities

Enable Same-Day Diagnosis

Affordable and Portable

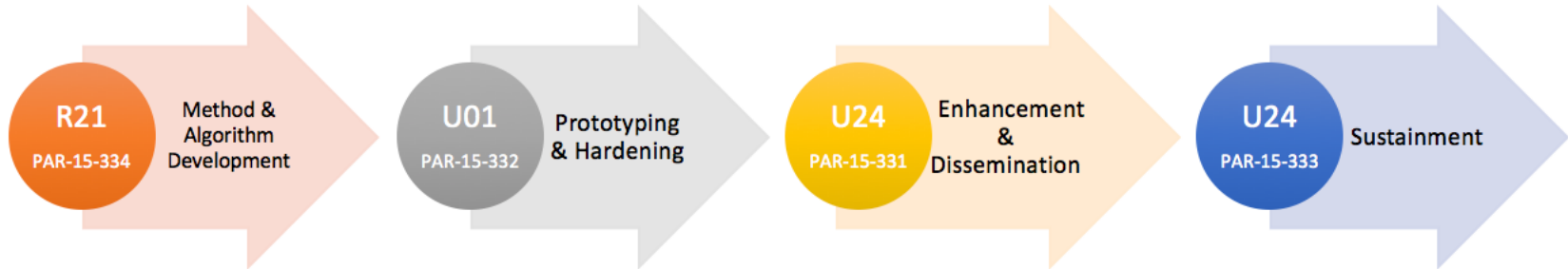
Simple to Use: Low Expertise Requirements



Accelerating Cancer Research:
Technology Development
Data Science
Complexity Research

Informatics Technologies for Cancer Research (ITCR)

- Support informatics technology development driven by cancer research
- Develop open-source, interoperable software tools and resources
- Promote broad dissemination of user-friendly resources
- Collaborative set-aside funds to promote tool interoperability
- Introductory videos and tool catalog on the program website



INTRODUCTORY VIDEOS

ITCR supports a wide range of informatics tools to serve current and emerging needs across the cancer research continuum. Short introductory videos for many of the ITCR Tools are available below.



[List All Videos >>](#)

Learn more [@itcr.cancer.gov](https://itcr.cancer.gov)

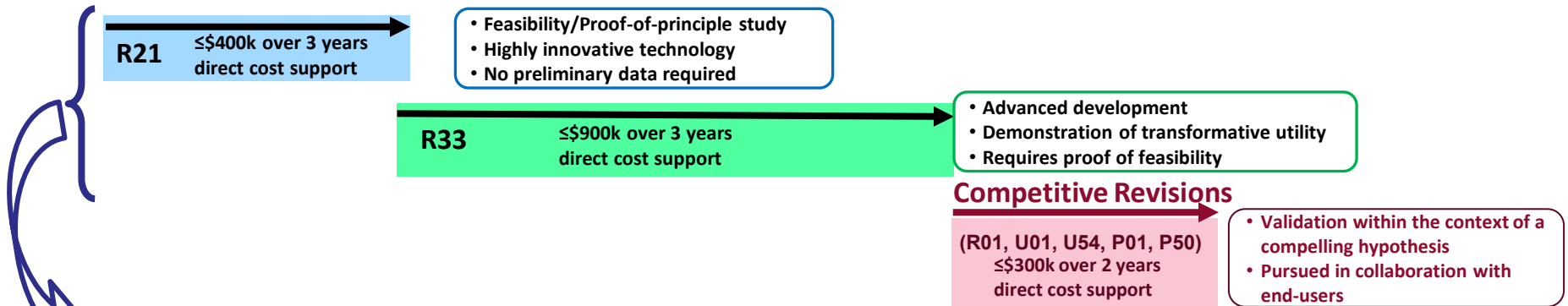
Innovative Molecular Analysis Technologies (IMAT) Program



INNOVATIVE MOLECULAR
ANALYSIS TECHNOLOGIES

Program Mission:

To support the development, maturation, and dissemination of novel and potentially transformative next-generation technologies through an approach of balanced but targeted innovation in support of clinical, laboratory, or epidemiological research on cancer.



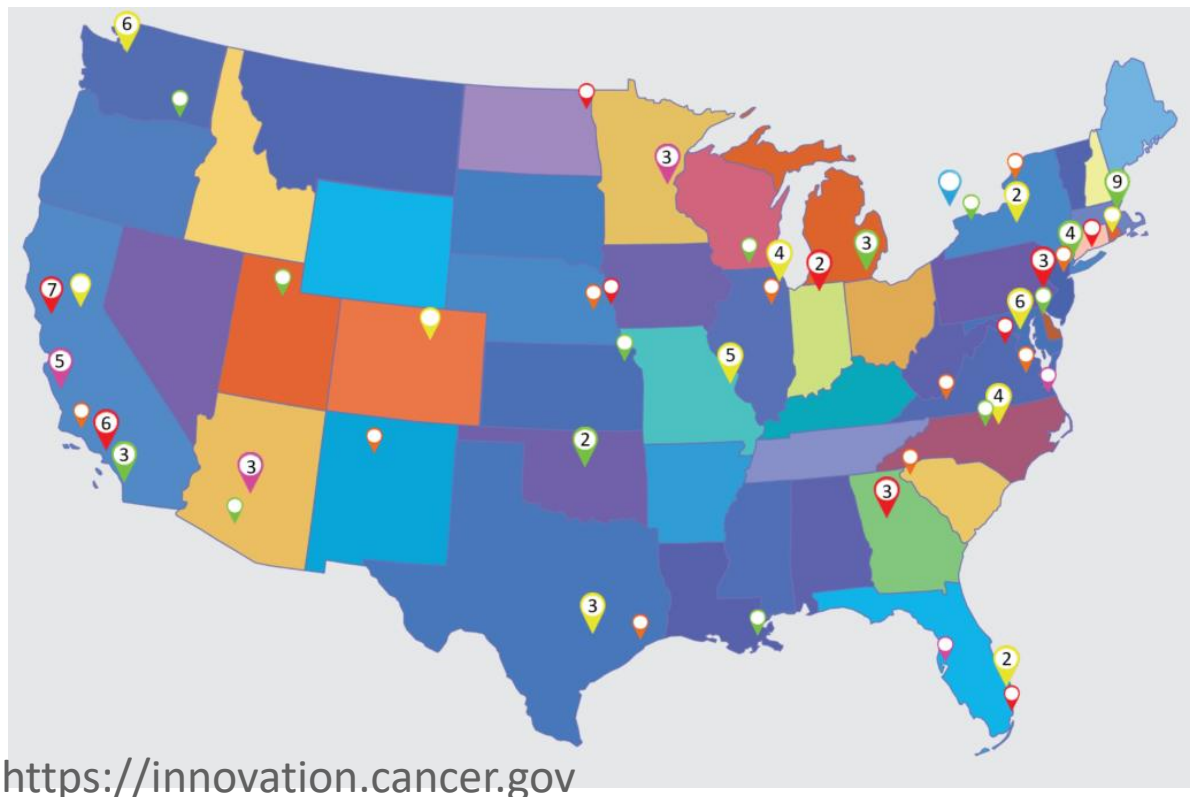
- Two Tracks:**
1. Molecular/Cellular Analysis Technologies (MCA)
 2. Biospecimen Science Technologies (BST)

Diversity of the IMAT Portfolio

115 Active Projects (70 R21 & 45 R33)

2017 PI Meeting Agenda

1. Novel Biosensors
2. Epigenetics Tools
3. Advancing Treatment
4. Clinical Diagnostics
5. Cell Sorting
6. Single Cell Tools
7. Advanced Imaging
8. Exosome Technologies
9. Cancer Modeling
10. Clinical Imaging
11. Advancing Mass Spec



<https://innovation.cancer.gov>

Addressing Cancer Complexity



PHYSICAL SCIENCES —
in ONCOLOGY

PSO: physical dynamics and spatio-temporal organization

CSBC: experimental biology + mathematical models

Dissemination of tools, methods

Outreach and training

Tumor-Immune

Heterogeneity

Drug Resistance/Sensitivity

Metastasis

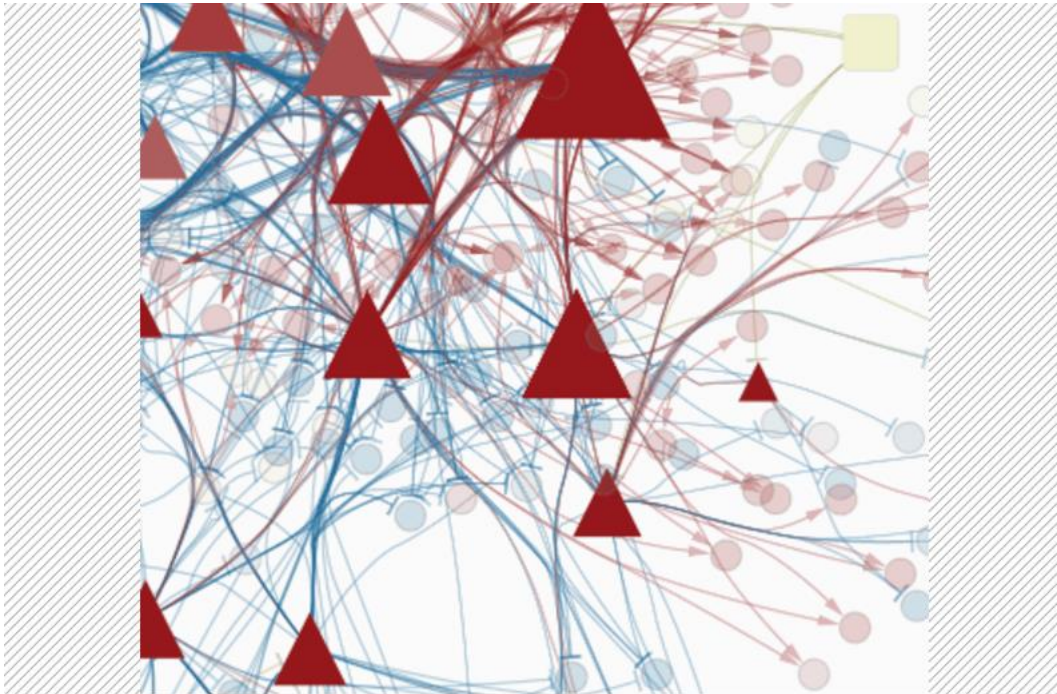
Microenvironment

Tumor Evolution

Metabolism



CANCER SYSTEMS —
BIOLOGY CONSORTIUM



SYSTEMS APPROACHES TO CANCER BIOLOGY

November 7-10, 2018

Woods Hole, MA

Organized by AECCSB & NCI

Scientific Co-chairs:

Sylvia Plevritis, Stanford University

Sandy Anderson, Moffitt Cancer Center

Doug Lauffenburger, MIT

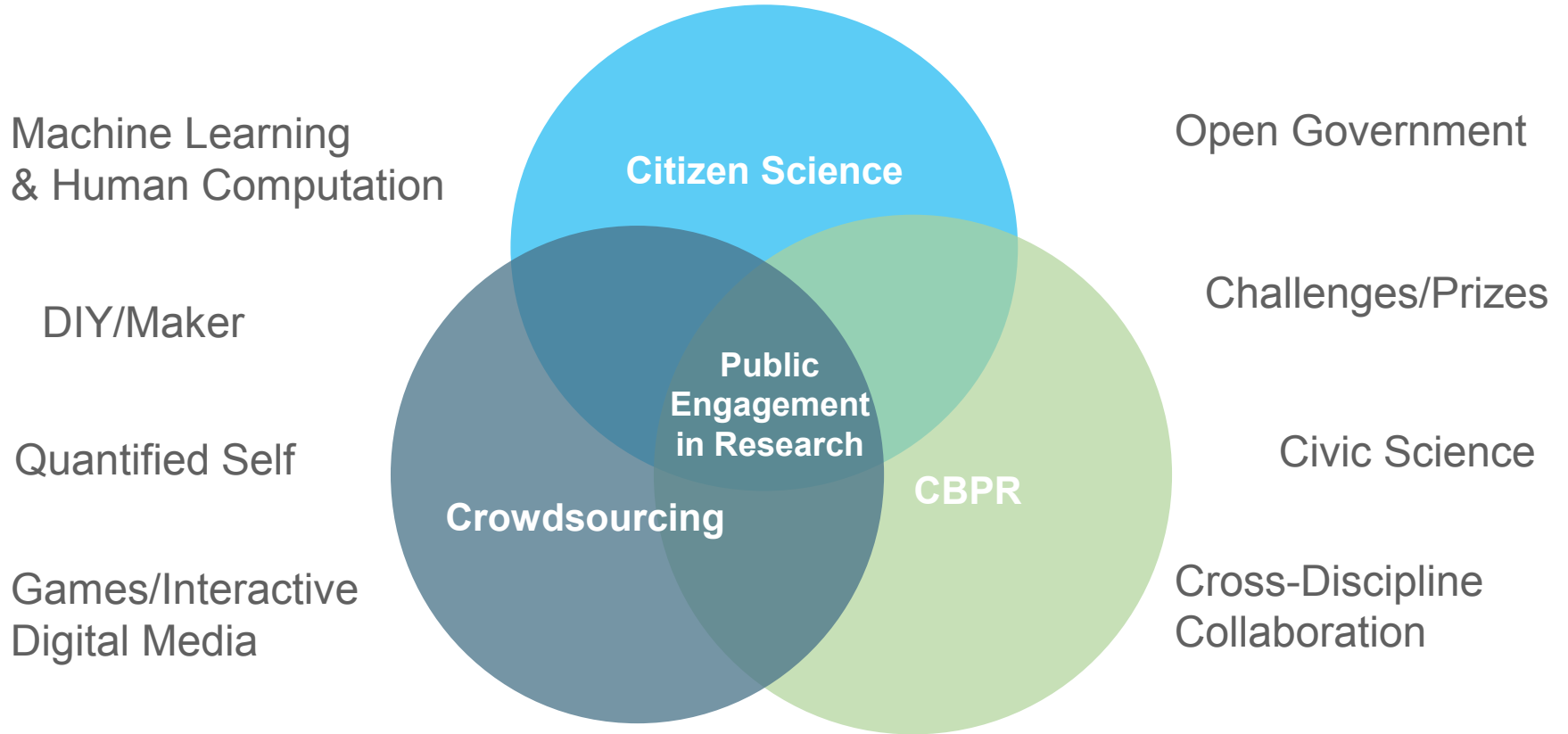
See previous speaker line-up:

www.sacbmeeting.org

Follow @CancerSysBio for updates

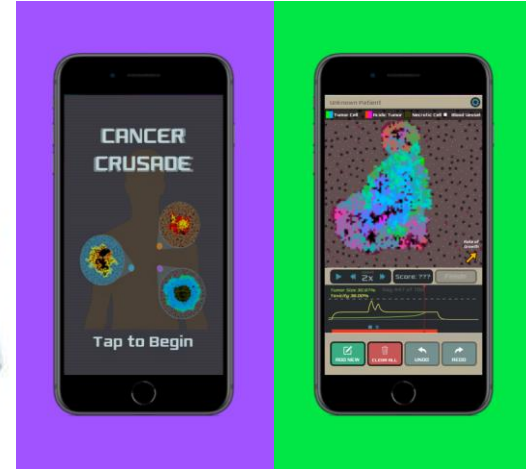
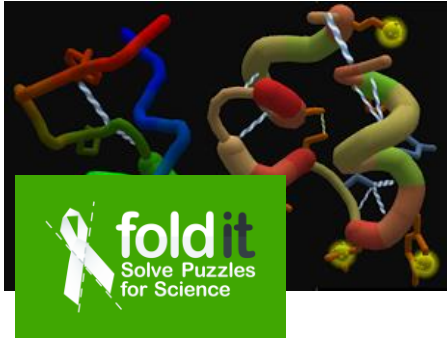
Accelerating Cancer Research: Emerging Methods, Casting a Broader Net, Engaging Creativity and Innovation

Open Innovation



Crowdsourcing Biomedical Research

Through Games



Personal Health, Wearable Tech, Quantified Self, Makers, and DIYBio



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bioCURI@US

“the World’s First
Hackerspace for Bio”
<http://biocurious.org/>



“Central to our mission is the belief that biotechnology and greater public understanding about it has the potential to benefit everyone.”



MakerNURSE
Powered by MakerHealth

Citizen Science Resources



<https://scistarter.com/>



FAB LAB

<https://www.fablabs.io/>



Connecting DIYbio Worldwide

<http://sphere.diybio.org/>



<https://www.zooniverse.org/>



<https://citscibio.org/>

Public Lab

<https://publiclab.org/>



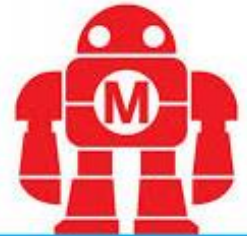
CITIZEN SCIENCE
ASSOCIATION

<http://citizenscience.org/>



**NATION OF
MAKERS**

<http://nationofmakers.us/>



Maker Faire

<https://makerfaire.com/>

A Bit of Advice...

Think big, think different

But then...bite of a small piece you can start with

Assemble the "right" team

Start with the problem/opportunity

Write a compelling proposal; consider who you're it writing to

Talk to us!

Questions?

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Multi-pronged approach to cancer data science at NCI:

- The Cancer Genome Atlas ([TCGA](#))
- Clinical Proteomics Tumor Analysis Consortium ([CPTAC](#))
- The Cancer Imaging Archive ([TCIA](#))
- Surveillance, Epidemiology, and End Results Program ([SEER](#))
- Cancer Target Discovery and Development ([CTD²](#))
- Informatics Technology for Cancer Research ([ITCR](#))
- Cancer Intervention and Surveillance Modeling Network ([CISNET](#))
- Physical Science in Oncology Network ([PS-ON](#))
- **Cancer Systems Biology Consortium (CSBC)**

We don't yet know the best data, but it is sure to be multi-dimensional

Medical imaging modalities (radiomics); Perturbing factors

Histology; Highly multiplexed 2D and 3D imaging

Metabolomics (Mass spec, MALDI imaging, etc.)

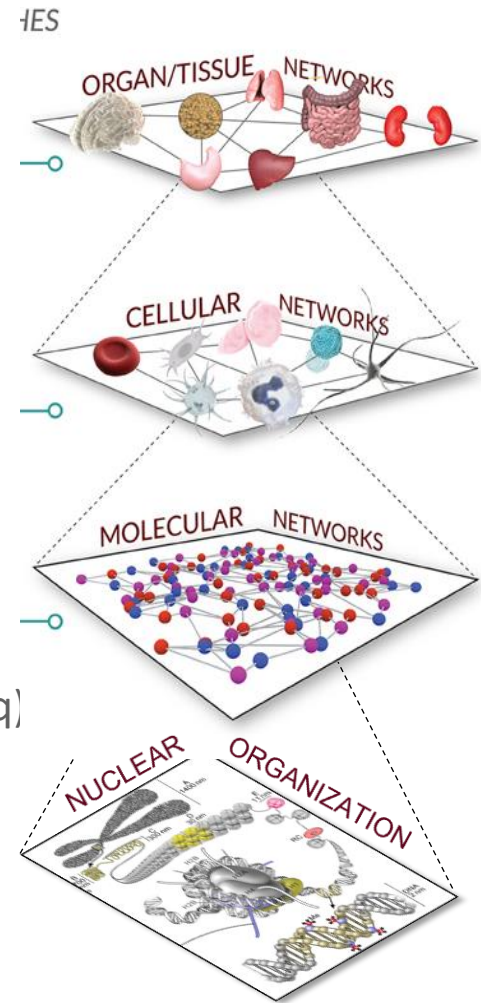
Proteomics (many biochemical and imaging approaches)

Transcriptomics (RNA-Seq, smFISH, etc.); Epigenomics (ATAC-Seq)

Whole genome, whole exome, targeted DNA seq

Chromatin conformation (4C, Hi-C, etc), EM imaging

Many at single cell resolution



Summary of the BRP Recommendations

A. Network for direct patient engagement

- Enlist patients in federated network that includes patient tumor profiling data and “pre-registers” patients for clinical trials.

B. Cancer immunotherapy translational science network

- Organize networks to discover and evaluate novel immune-based approaches for pediatric and adult cancers, and eventually develop vaccines.

C. Therapeutic target identification to overcome drug resistance

- Launch interdisciplinary studies to delineate mechanisms that lead cancer cells to become resistant to previously effective treatments.

D. Creation of a national cancer data ecosystem

- Create an ecosystem to collect, share, and interconnect datasets.

Summary of the BRP Recommendations

E. Fusion oncoproteins in pediatric cancer

- Improve understanding of the abnormal fusion proteins that result from chromosomal translocations and drive many pediatric cancers

F. Symptom management research

- Support research to accelerate development of guidelines for management of patient-reported symptoms to improve quality of life and adherence to treatment regimens

G. Precision prevention and early detection

- Implementation of evidence-based approaches. Conduct implementation science research to encourage broader adoption of HPV vaccination, colorectal cancer screening, and tobacco cessation

Summary of the BRP Recommendations

H. Retrospective analysis of biospecimens from patients treated with standard of care

- Analyze biopsies to learn which features predict outcome to better plan treatment for future patients

I. Creation of human tumor atlas

- Catalog the evolution of genetic lesions and cellular interactions in tumor/immune/other cells in tumor microenvironment from the earliest detected lesions to metastasis

J. Development of new enabling technologies

- Support development of technologies to accelerate testing of therapies and tumor characterization

Spectrum of Cancer Research Opportunities

