NATIONAL CANCER INSTITUTE

INNOVATIVE MOLECULAR ANALYSIS TECHNOLOGIES

Request for reissuance of four Request for Application (RFA) solicitations

November 2013

IMAT Program Overview

- ***Technology-focused***. Projects lacking a sufficient focus on early-stage technology development are administratively withdrawn

- Emphasis on supporting development and validation of ***high-risk/high-impact*** molecular and cellular analysis technologies ***to advance cancer research and clinical care***

- ***100% Investigator initiated*** *r*esearch project grants, utilizing the R21 and R33 award mechanisms for phase-1 and phase-2 levels of support

- ***Trans-divisional***, cooperative initiative focused on technological innovation with specific inclusions to minimize overlap or duplication with other programs/initiatives

IMAT FOA & Evaluation History

IMAT PAR Released
- 1 R21/R33
- 1 R41/R42
- 1 R43/R44

IMAT PAR Renewed
- 2 R21/R33
- 1 R41/R42
- 1 R43/R44

IMAT PAR Renewed
- 2 R21/R33
- 2 R41/R42
- 2 R43/R44

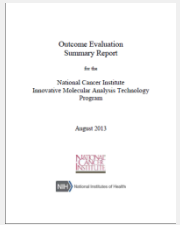
IMAT RFAs Approved
- 3 R21/R33
- 2 R41/R42
- 2 R43/R44

RFAs Renewed
- 3 R21 (3 yr awards)
- 3 R33
- 2 R41/R42
- 2 R43/R44

Full Program Evaluation

Evaluative Update

RFAs Renewed
- 2 R21 (3 yr awards)
- 2 R33

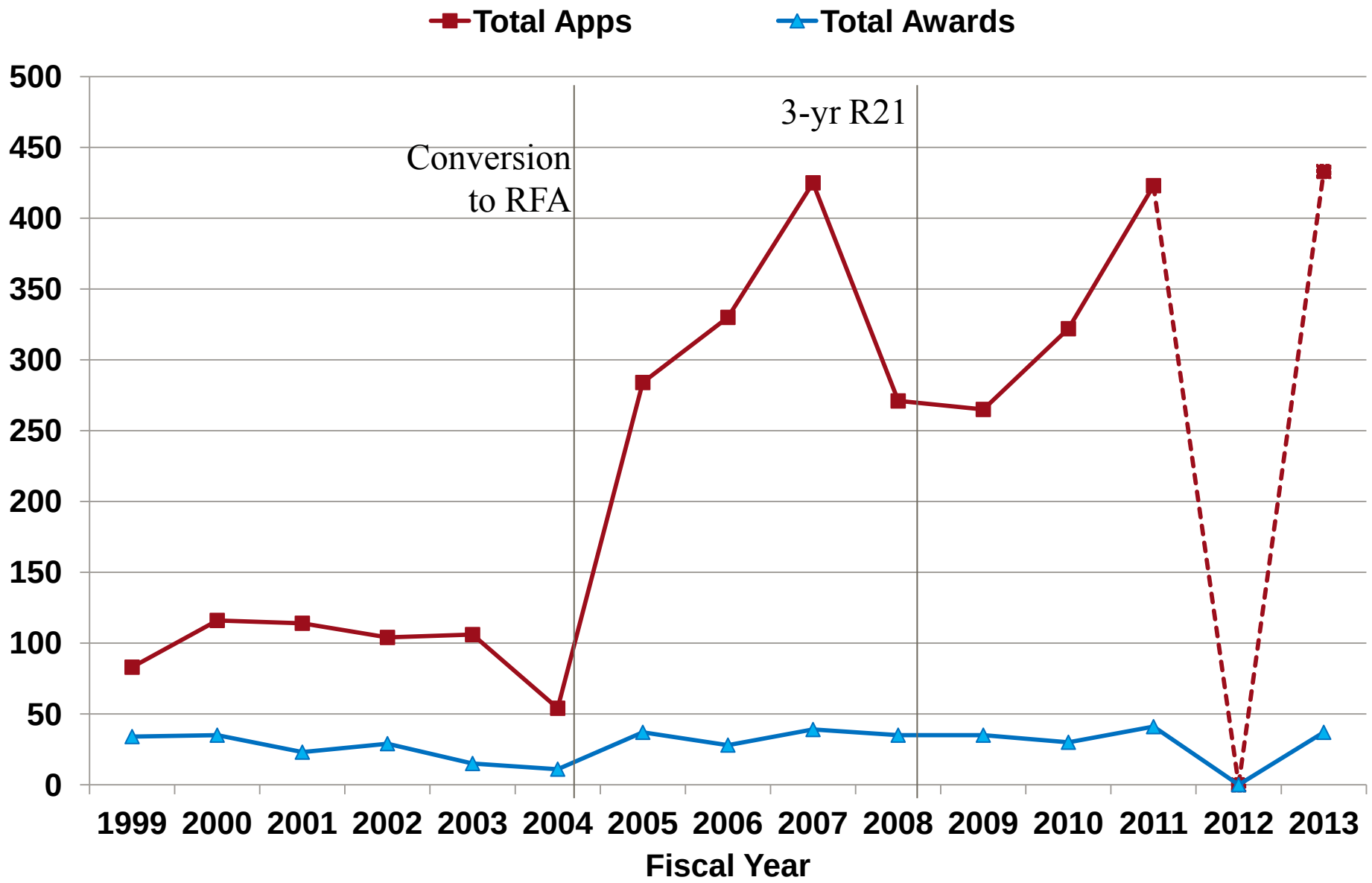


Targeted Evaluation

Ongoing Evaluation

1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

IMAT Application & Award History



Graph is inclusive of all R21 and R33 applications and awards only

Sampling of successful IMAT Technologies

Proteomics

- Dynamic Range Enhancement Applied to Mass Spec (**DREAMS**) (Smith CA081654)
- **Gateway** ORF Cloning Tool (Vidal CA081658)
- Multi-Dimensional Protein Identification Technology (**MuDPIT**) (Yates CA081665)
- Isotope-Coded Affinity Tags (**ICAT**) (Aebersold CA084698)
- **Synchrotron Footprinting** (Chance CA084713)
- Nanowire field effect transistors (**NWFETs**) (Lieber CA091357)
- Deuterium exchange Mass Spec (**DXMS**), (Woods CA099835)
- Nucleic Acid Programmable Protein Array (**NAPPA**) (LaBaer, CA099191)

Genomics

- **Digital Optical Chemistry** (Garner CA081656)
- **Rolling Circle Amplification** (Lizardi CA081671)
- Representational Oligonucleotide Microarray Analysis(**ROMA**) (Wigler CA081674)
- Multi-photon Intravital Imaging (**MPIVI**) (Condeelis CA089829)
- **Recombomice** (Engelward CA084740)
- Pyrophosphorolysis Activated Polymerization (**PAP**) (Sommer CA094334)
- **Pair-end Sequencing** to screen structural rearrangements (Collins CA103068)
- **Digital Transcriptome Subraction** (Moore CA120726)
- **Zinc Finger Nucleases** for targeted double-strand breaks (Porteus CA120681)
- **COLD-PCR** (Makrigiorgos, CA138280)

Epigenomics

- Differential Methylation Hybridization (**DMH**) (Huang CA084701)
- Chromatin Immunoprecipitation with next gen Sequencing (**ChIP-Seq**) (Ren CA105829)

Clinical Diagnostics

- Paramagnetic chemical exchange saturation transfer (**ParaCEST**) (Sherry CA084697)
- **Near IR Probes** for *in vivo* diagnostics (Tung CA088365)
- MicroSOL IEF (Invitrogen as **Zoom IEF Fractionator**) (Speicher CA0943600)
- Microfluidic Genetic Analysis (**MGA**) chip (Landers CA16115)
- **Oncomap** (Garraway CA126674)

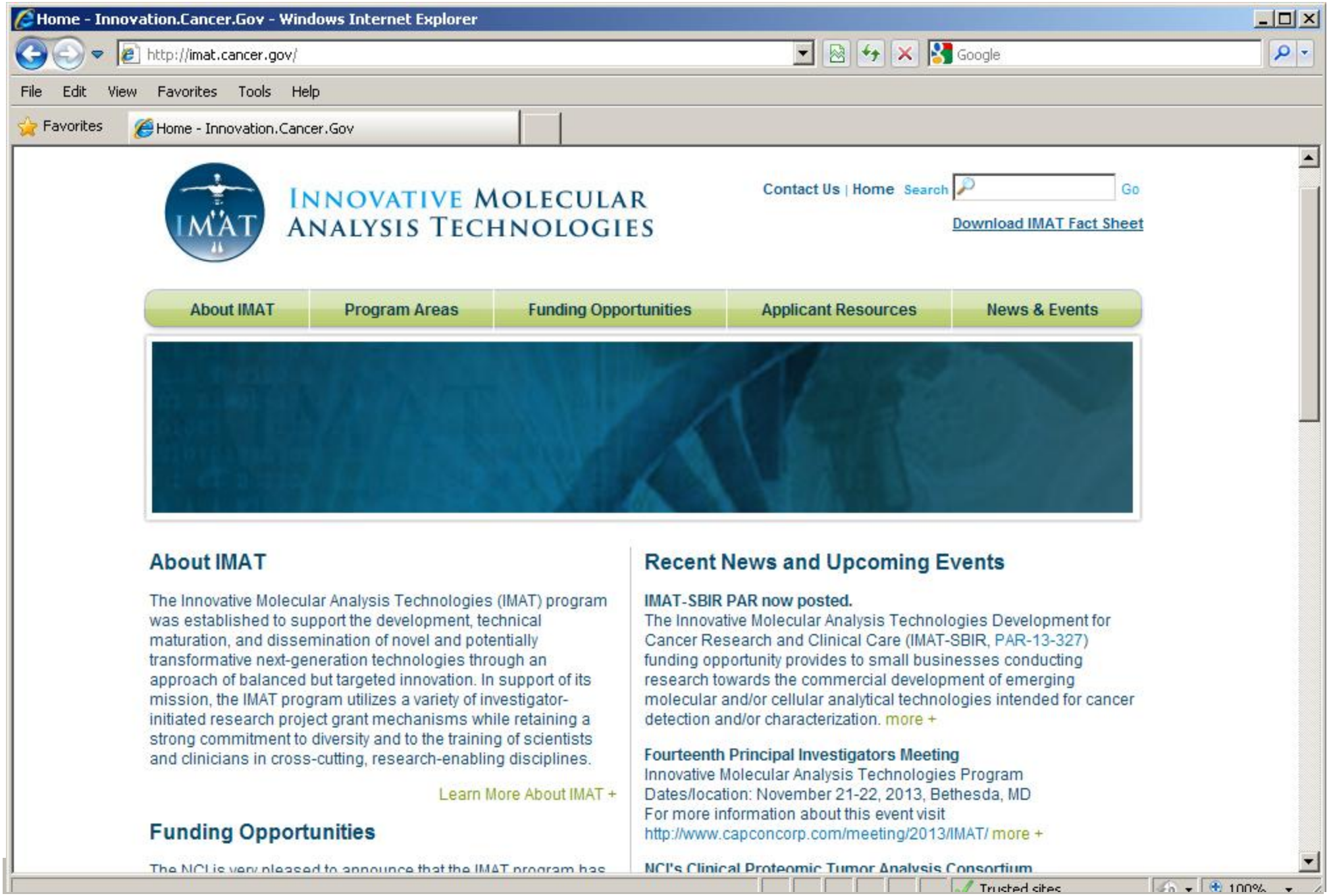
Sample preparation

- **Magnetic Cell Sorting**, now available from Ikotech (Chalmers CA081662)
- Dielectrophoresis Field Flow Fractionation (**DEP-FFF**) available as ApoStream™ system from ApoCell (Gascoyne CA088364)
- Cryopreservation followed by culturing of CML cells (Sims CA105514)
- **RainDance** Oil Droplet Microfluidics (Link CA125693)
- **NanoVelcro** (Tseng CA151159)

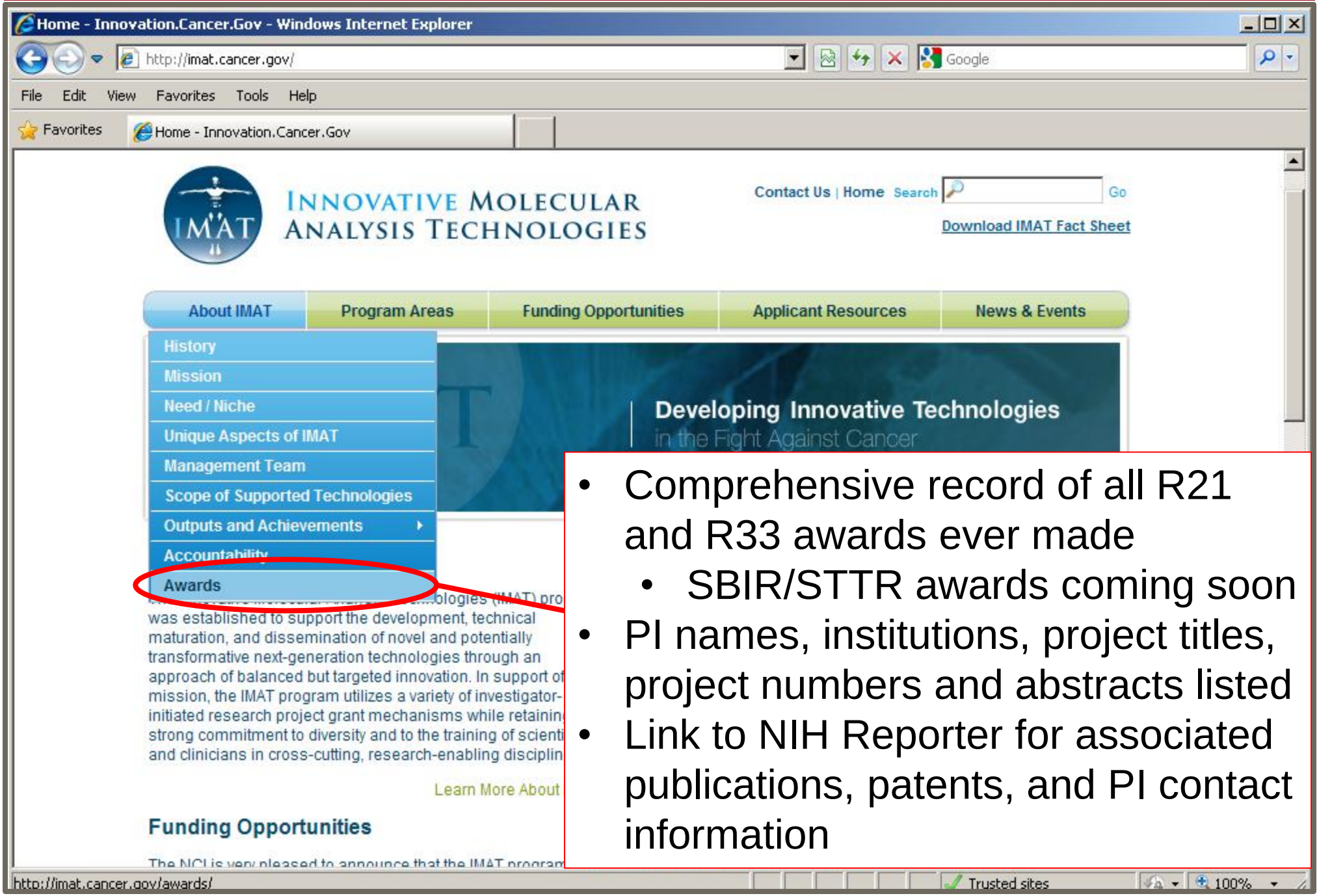
Drug Screening or Delivery

- One Bead One Compound (**OBOC**) (Lam CA086364)
- Genetically modified T-cells for acute lymphoblastic leukemia treatment (Cooper CA116127)

http://innovation.cancer.gov



http://innovation.cancer.gov



- Comprehensive record of all R21 and R33 awards ever made
  - SBIR/STTR awards coming soon
- PI names, institutions, project titles, project numbers and abstracts listed
- Link to NIH Reporter for associated publications, patents, and PI contact information

Motivation for Request for Reissuance

1. IMAT program continues to account for the majority of NCI's support for investigator-initiated technology development, addressing an area unmet by other FOAs

2. IMAT solicitations continue to receive a substantial number of high-scoring applications

3. A significant record of success, as verified by multiple external program outcome evaluations

Recent Outcome Evaluation

- An evaluation is required for any reissuance of an RFA program at NCI
- 2013 outcome evaluation focuses on recent successes only
- Evaluation Objectives
  1. Are submissions to and awards from the IMAT program unique within the NCI portfolio?
  2. Does the program work to support technology development appropriately?
  3. Does the program support technologies useful to the cancer research community?

Translation of IMAT technologies into hypothesis driven research

- 60 applications submitted to NIH leveraging IMAT-supported technology for hypothesis-driven research (32 to NCI directly, and 51 with focus on advancing cancer research)
  - 24 R01 applications (10 submitted to NCI), with 22 focused on cancer research
    - 6 successful (3 to NCI)
  - 75% of all applications drew specific enthusiasm from primary reviewers for the IMAT-supported technology component

Reissuance Request

Request to reissue 4 RFAs

1. Early-Stage Innovative Molecular Analysis Technology Development for Cancer Research (**IMT R21**)
2. Advanced Development and Validation of Emerging Molecular Analysis Technologies for Cancer Research (**EMT R33**)
3. Early-Stage Innovative Technologies for Cancer Biospecimen Sciences (**BSP R21**)
4. Advanced Development and Validation of Emerging Technologies for Cancer Biospecimen Sciences (**BSP R33**)

Table. History of applications and awards for each FOA

RFA Series	IMT R21 Apps	IMT R21 Awards	EMT R33 Apps	EMT R33 Awards	BSP R21 Apps	BSP R21 Awards	BSP R33 Apps	BSP R33 Awards
CA05	102	17	36	5	33	4	6	1
CA06	144	9	27	3	32	4	2	0
CA07	248	29	57	6	65	8	13	1
CA08	125	16	42	3	24	5	7	0
CA09	174	14	34	4	33	4	8	1
CA10	223	16	51	9	30	3	10	2
CA12	276	19	100	11	44	3	13	3
Total	**1478**	**120**	**428**	**41**	**288**	**31**	**77**	**8**

Advantages of the RFA Mechanism

- Assurance of NCI interest in technology development
  - Designed to address a specific need that other NCI initiatives are not currently meeting
  - Investigators at every stage of their career, but especially young investigators, do not consider the NIH and NCI as interested in supporting technology development

- Control over responsiveness and review
  - Administrative responsiveness determination, controlling the locus of review, and ability to work with DEA Scientific Review Officers seen as critical to managing the program
  - Without the RFA mechanism, use of these elements are at the discretion of NIH/CSR

IMAT Core Program Team

Officer	DOC	Contact
Chuaqui, Rodrigo	DCTD	chuaquir@mail.nih.gov
Dickherber, Tony	OD/CSSI	dickherberaj@mail.nih.gov
Divi, Rao	DCCPS	divir@mail.nih.gov
Knowlton, J. Randy	DCB	knowltoj@mail.nih.gov
Ossandon, Miguel	DCTD	ossandom@mail.nih.gov
Rahbar, Amir	SBIR DC	rahbaram@mail.nih.gov
Sorbara, Lynn	DCP	lynns@mail.nih.gov
Wagner, Paul	DCP	wagnerp@mail.nih.gov

Summary of Reissuance Request

- Innovative and emerging molecular & cellular analysis technology development for cancer research
  1. IMT R21: $5M set aside to support approximately 20 new R21 grants per year
  2. EMT R33: $4M set aside to support approximately 12 new R33 grants per year

- Innovative and emerging technologies for cancer-relevant biospecimen sciences
  3. BSP R21: $0.8M to support approximately 3 new R21 grants per year
  4. BSP R33: $0.7M to support approximately 2 new R33 grants per year

QUESTIONS?

Extra Slides

Extended IMAT Network

DCB

Structural Biology & Molecular Applications Branch

- **Randy Knowlton**
- Jerry Li
- Jennifer Couch (Chief)

DCCPS

Epidemiology & Genetics Research Program – Methods & Technologies Branch

- **Rao Divi**
- Mukesh Verma (Chief)

DCP

Cancer Biomarkers Program

- **Paul Wagner**
- **Lynn Sorbara**
- Karl Krueger
- Jacob Kagan
- Christos Patriotis
- Sudhir Srivastava (Director)

CSSI

- **Tony Dickherber**
- Jerry Lee

SBIR DC

- **Amir Rahbar**
- Andy Kurtz (Team Lead)

DCTD

Cancer Diagnosis Program

Diagnostic Biomarkers & Technology Branch

- **Miguel Ossandon**
- Brian Sorg
- Tawnya McKee
- Jim Tricoli (Chief)

Pathology Investigation and Resources Branch

- **Rodrigo Chuaqui**
- Ani Ganguly
- Irina Lubensky (Chief)

Diagnostics Evaluation Branch

- Kim Jessup(Chief)

Biorepositories & Biospecimen Research Branch

- Lokesh Agrawal
- Helen Moore (Acting Chief)

BSA Subcommittee Questions

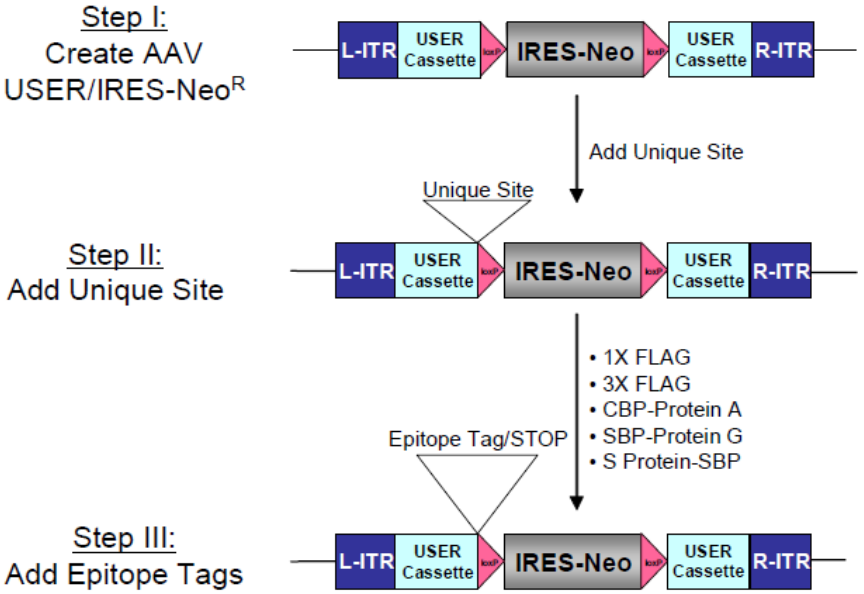
1. From a historical perspective, what has this program accomplished in terms of technological advances?
2. How has this initiative advanced cancer research?
3. Would the newly developed technologies have occurred without this initiative?
4. Other than publications and patents, what evaluation measures/criteria are being used to determine success?
5. What were the specific accomplishments during the last 5 years?
6. Provide a list of issued patents – include the inventors, title, abstract, and issue date.
7. Why are you using the RFA/Cooperative Agreement mechanism to continue this initiative?
8. Could the same outcomes occur if this was a SBIR and/or STTR supported initiative?

Endogenous Epitope Tagging (EET)

- Process for adding epitope tags to endogenous human genes in human cells and use these for generating endogenous interactomes via immunoprecipitation followed by mass spec
  - Subplants need to create new polyclonal antibodies in less time
  - Recently awarded R01 (w/ perfect score) to explore differential mechanistic and phenotypic activity of cdk4 and cdk6 in GBM using EET

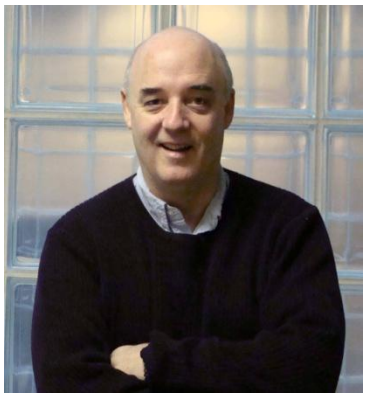
PI: Todd Waldman, MD, PhD
Professor, Molecular Oncology
Georgetown University

Georgetown | Lombardi
COMPREHENSIVE CANCER CENTER

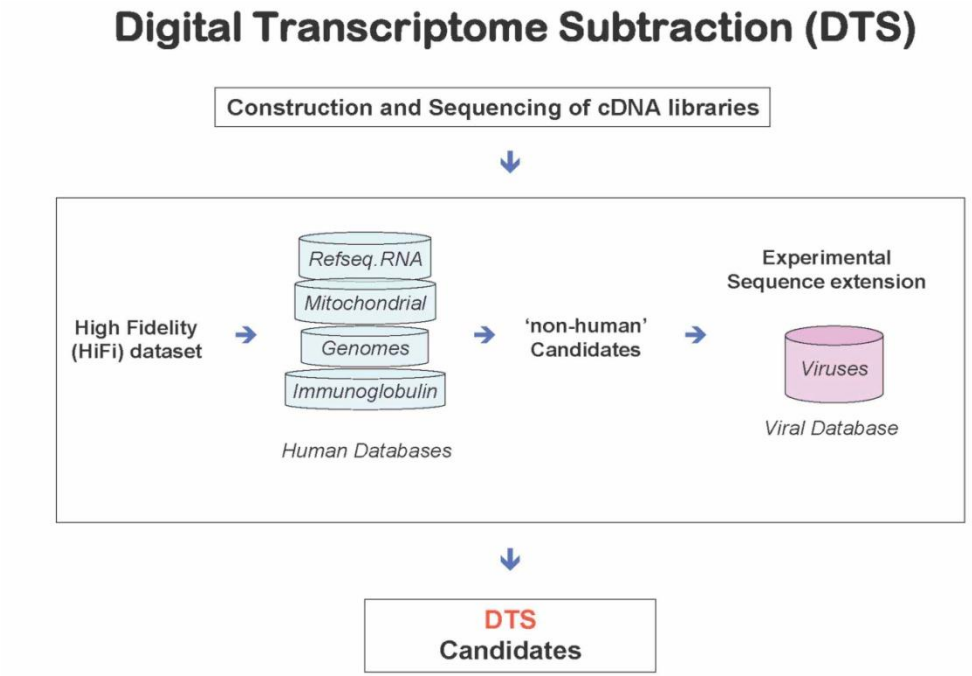


Digital Transcriptome Subtraction

- Viral screening protocol leveraging NGS
  - Discovered Merkel cell polyomavirus as part of the funded project, the 7th known human cancer virus (Shuda *et al*, PNAS 2008; Feng *et al* Science 2008)
- Predominantly informatics-based technique for isolating non-human sequences from NGS data by subtracting known human sequences (GenBank)



PI: Patrick Moore, MD, MPH
Director, Cancer Virology Program
UPCI Professor, Molecular Genetics & Biochem
University of Pittsburgh, Pittsburgh



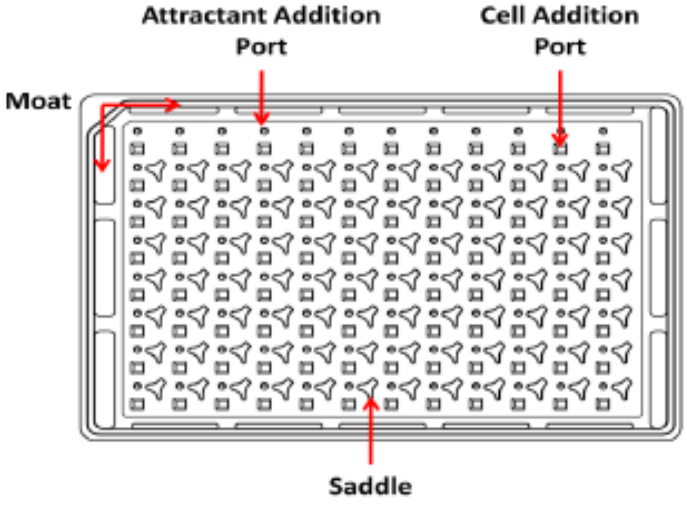
Feng et al. J Virol. 2007;81:11332-40

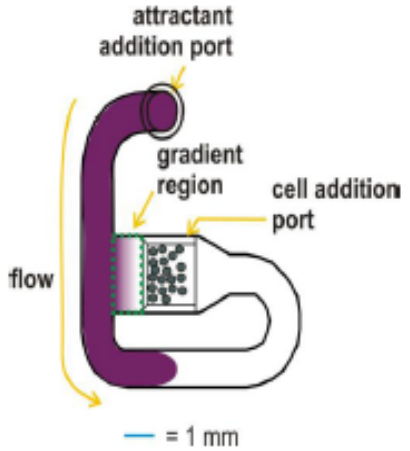
Image from http://www.tumorvirology.pitt.edu/

Iuvo™ Platform

- Microchannel cell-based assay for chemotaxis-based isolation and culturing of tumor cells for high-content analysis
  - Advantages are that platform enables standardized, automated cell sorting with quantification and high-content screening at low cost
- Commercialized by Bellbrook Labs [2008] and exclusively licensed by Thermo Fisher Scientific [2012] for use with their Cellulomics instruments

PI: David Beebe, PhD
Professor of Bioengineering
University of Wisconsin-Madison

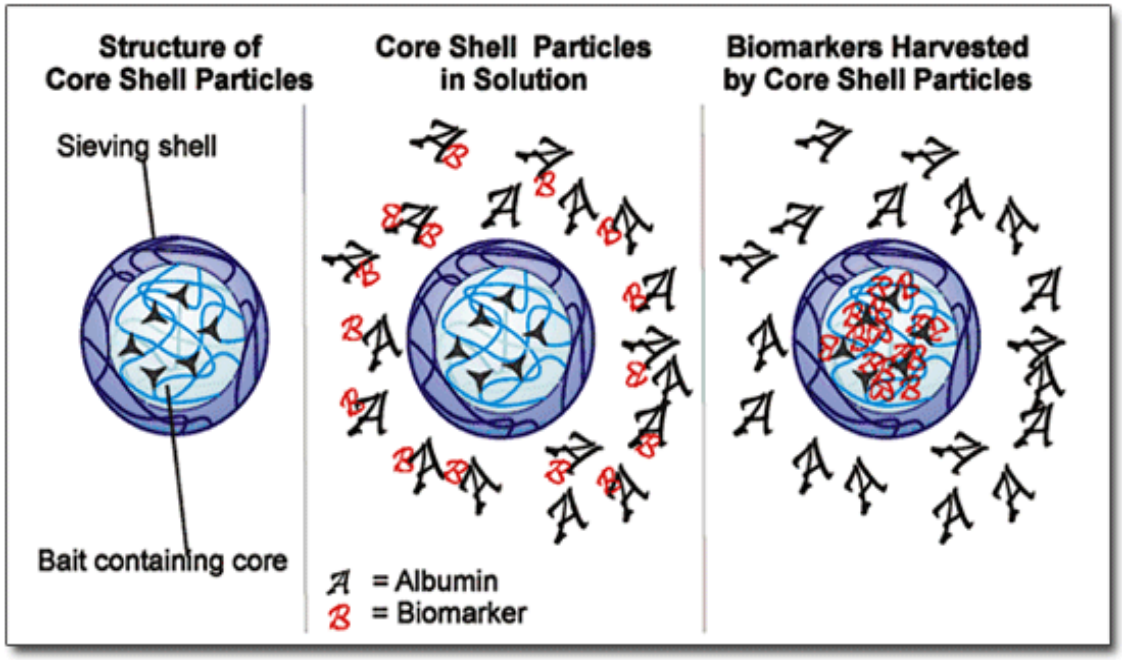




NanoTrap® Biomarker Discovery Platform

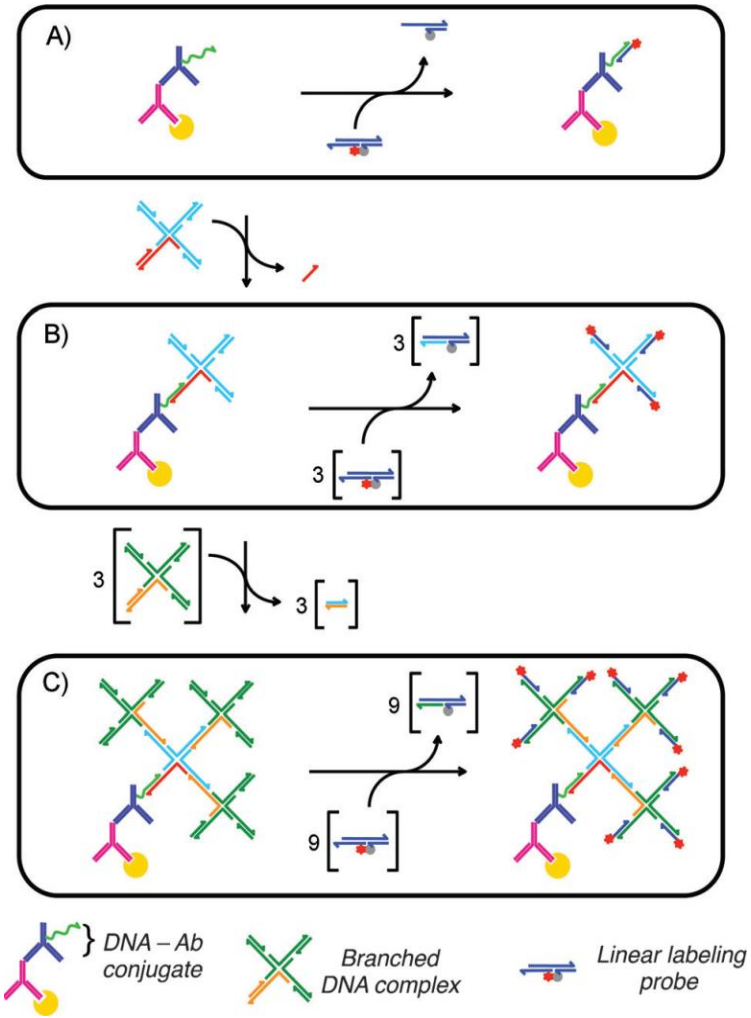
- Porous core shell hydrogel nanoparticles with affinity via “bait chemistry” and size exclusion for selection of biomolecular target
- Allows for immediate preservation and conservation of low-abundance target biomarkers in complex solutions, including whole blood
- Licensed by Shimadzu Scientific [2010] and made available in partnership with Ceres Nanosciences and Nonlinear Dynamics

PI: Lance Liotta, MD, PhD
Co-Director, Center for Applied Proteomics and Molecular Medicine
George Mason University



DNA-Catalyzed Molecular Biomarker Imaging Amplification (DC-MBIA)

- Dynamic DNA based programmable imaging probes
  - Highly multiplexed and reiterative immuno-fluorescence imaging capability for *in situ* studies
- Enzyme-free, isothermal, programmable, and regenerative system uses no harsh chemicals
- Multiplex imaging with 10-min to label and 10-min to erase



Diehl *et al*, ChemBioChem 2012, 13, 2722-8

PI: Michael Diehl, PhD
Asst. Professor of Bioeng/Chemistry
Rice University

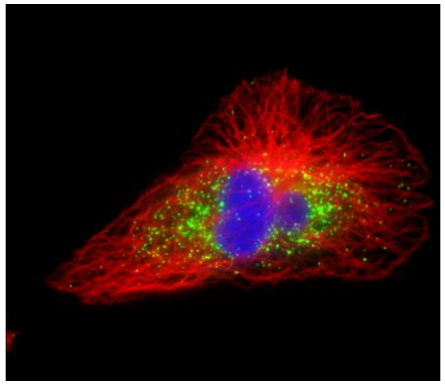
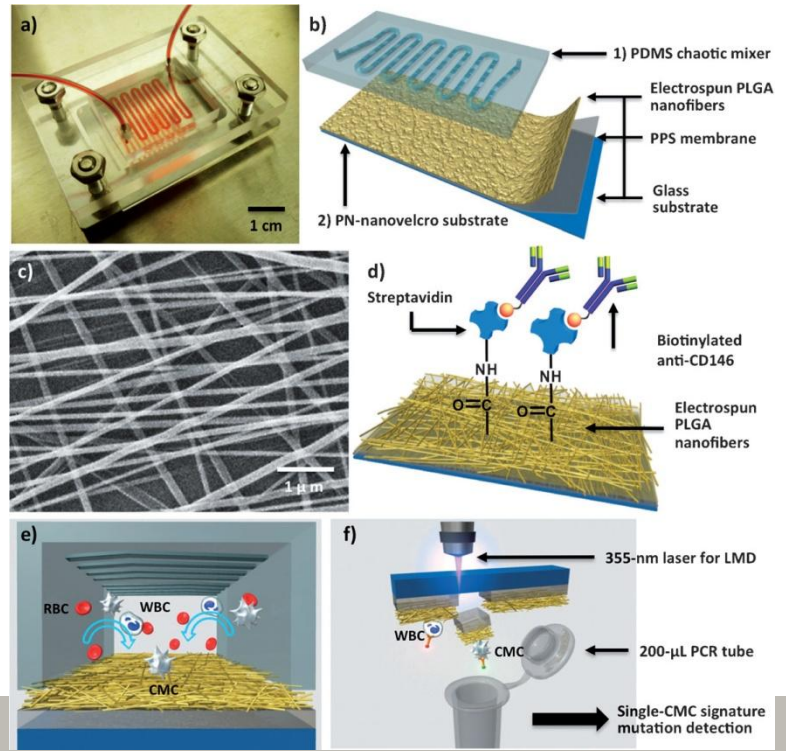


Image from http://diehllab.rice.edu

NanoVelcro: Circulating Tumor Cell Capture

- PLGA nanofibers to form NanoVelcro for high-purity isolation of circulating tumor cells from blood.
- Herringbone structures provide “chaotic mixing” to improve interaction frequency with substrate
  - Cells remain viable for laser capture microdissection and exome sequencing
- Applying platform to study therapeutic efficacy

PI: Hsian-Rong Tseng, PhD
Ass Prof Molecular & Medical Pharmacology, UCLA

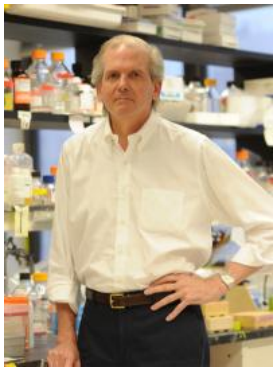


Hou *et al*, Angw Chem 2012, 52(12)

Methyl-MAPS

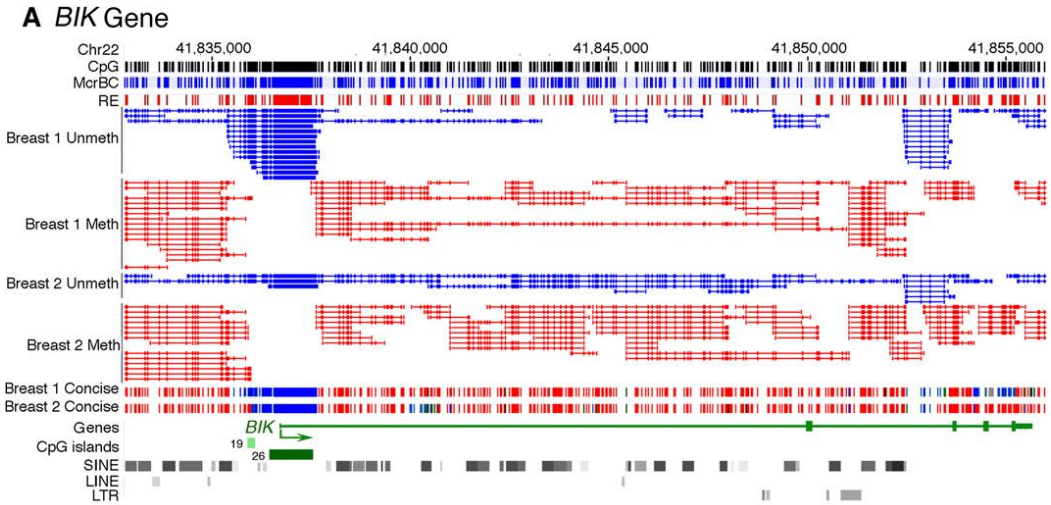
- Methylation MApping by Pair-end Sequencing (Methyl-MAPS) is novel methylation detection technique that allows fractionation of the whole genome into methylated and unmethylated pools, combined with ultra high-throughput sequencing.

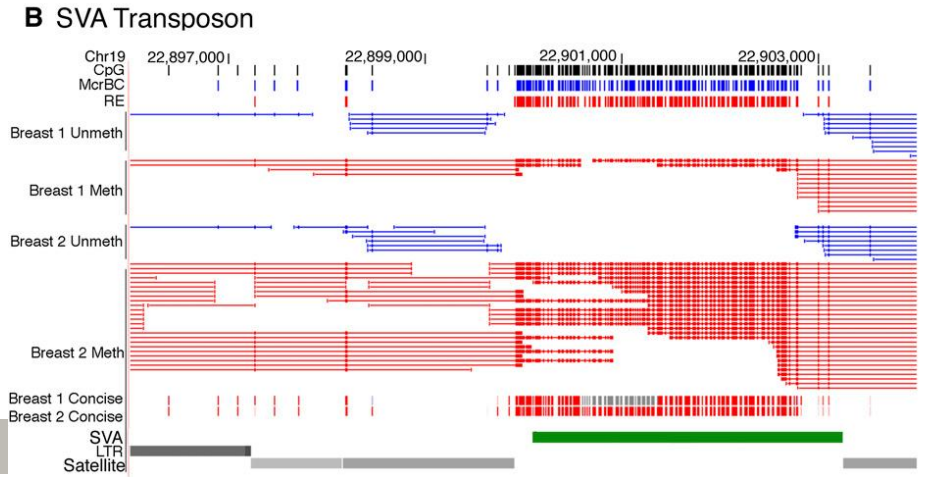
- Awarded new PQ-R01 to investigate methylation patterns and their role in tumorigenesis



PI: Timothy Bestor, PhD
Professor, Dept of Chemistry
Columbia University

Columbia University Medical Center
Department of Genetics & Development





RNA QC Models: SNAQ & STAR-Seq

- Developed a broad array of internal standard materials and mixtures available to the public for RNA analysis.
  - Standardized Nucleic Acid Quantification (SNAQ) and Standardized RNA-Seq (StaR-Seq) are RNA quality assessment/quality control protocols and materials, licensed by Accugenomics as internal standards for array of molecular diagnostic assays.
- Work is highlighted by Nature Methods Technology Report (May 2013)

AccuGenomics

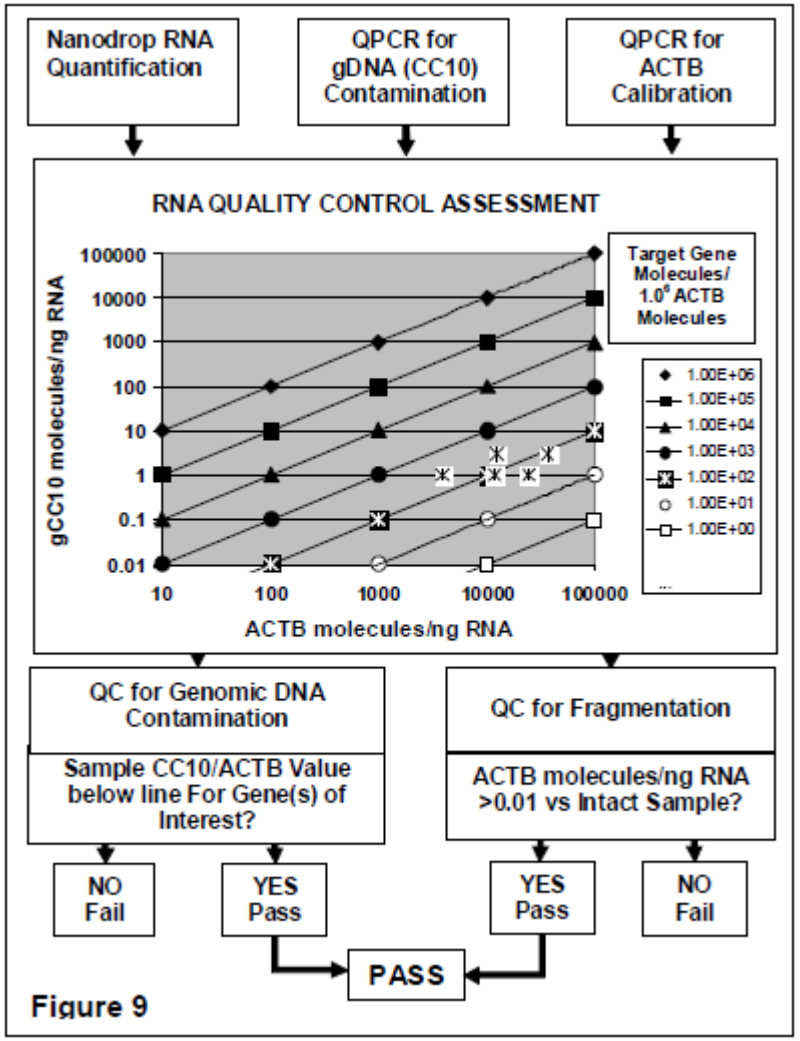


Figure 9

PI: James Willey, MD
Professor of Medicine & Pathology
University of Toledo

Outcome Summary of IMAT FY2010 Awards

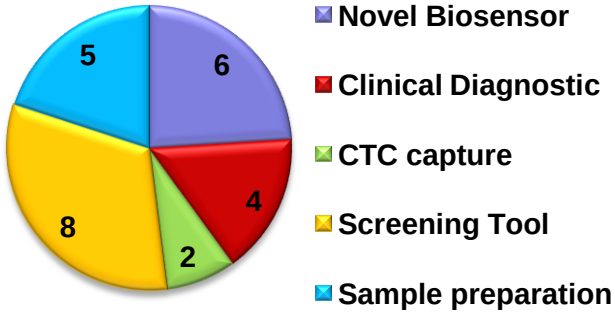
Concept → Proof of Principle → Development → Testing & Validation → Scale Up → Dissemination

Technology Development Pipeline

280 R21 Applications
→25 Awards

R21

19 projects completed milestones (as of June 2013)



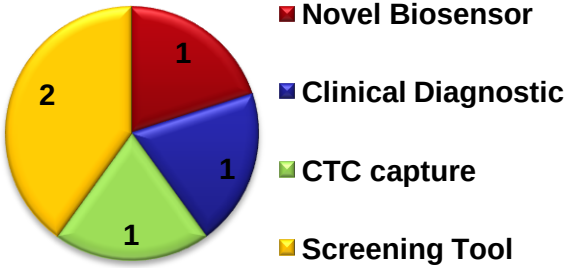
- 53 new NIH applications (11 awarded, 8 pending) indicate use of technology (27 submitted to NCI)
  - 10 applications for IMAT R33 (+1 for IMAT R21), with 2 awarded and 3 pending
- 32 patent applications submitted (3 awarded)
  - Several licensures in progress
- 114 publications in refereed journals
  - Upper quartile cited by ~28 on average (max 57)

42 R33 Applications
→5 Awards

R33

- 7 new NIH applications (1 awarded, 2 pending) indicate use of technology (5 submitted to NCI)
- 5 patent applications submitted (1 awarded)
  - 2 licensed (Cytomag, LLC, NewCo), and others in process
- 14 publications in refereed journals

3 completed all aims with evidence of success (as of June 2013)



Cancer Technology RFI responses

- 16 responses
  - 5 group responses, the rest individuals
- 38 suggestions
  - 23 suggestions within the scope of IMAT
    - 2 suggestions for which we have no active projects (targeted immunotherapies)
  - 15 suggestions out of scope
    - Therapeutic efficacy
    - Bioinformatics
    - *In vivo* imaging tools

Applications Submitted

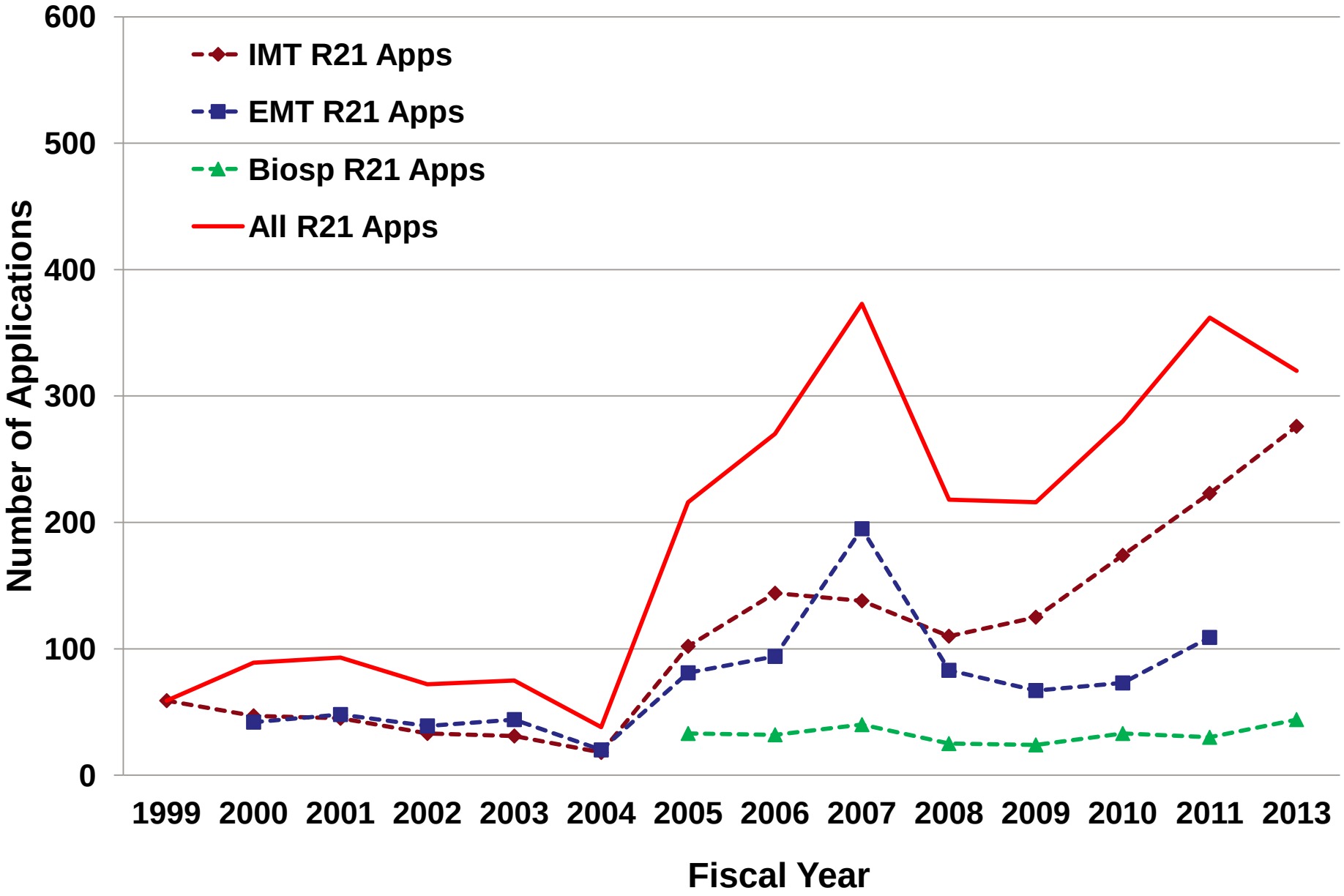
	FOA series	R21 Base Award: PAR98	PAR99	PAR01	CA05	CA06	CA07	CA08	CA09	CA10	CA12	Total	All R33 Apps Rec'd	% of R33 Apps Received
R33 Apps w/ base R21 awd	PAR98	0										0	24	0%
	PAR99	4	0									4	48	8%
	PAR01	6	4	1								11	79	14%
	CA05	2	4	2								8	68	12%
	CA06	1	0	3	1							5	60	8%
	CA07	1	7	7	5	1						21	105	20%
	CA08	0	0	0	0	5	3					8	49	16%
	CA09	0	0	1	2	1	5	0				9	42	21%
	CA10	0	0	1	0	2	5	6	1			15	61	25%
	CA12	0	0	2	2	0	2	5	9	2		22	112	20%
	CA13*	0	1	3	1	0	2	2	6	4	0	19	94	20%
	Total # Apps	14	16	20	11	9	17	13	16	6	0	122	742	16%
	# Resub's	3	2	5	5	3	4	4	4	1	0	31		4%
	Total # R21 awds made per FOA	25	44	38	29	21	60	32	25	30	22			
	% of R21 awds from base FOA seeking trans'n	**44%**	**32%**	**39%**	**21%**	**29%**	**22%**	**28%**	**48%**	**17%**	0%			

Awards Granted

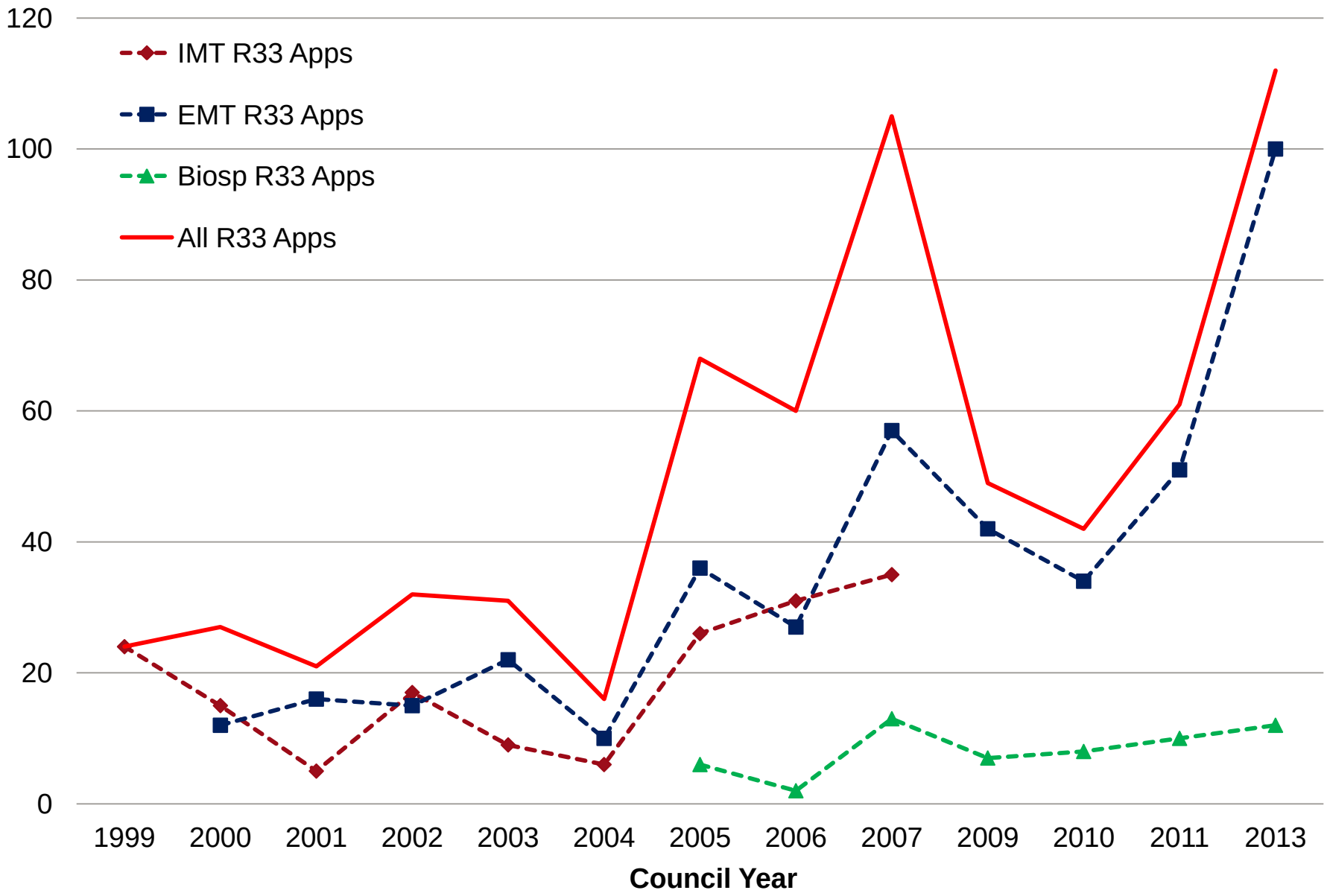
	FOA series	R21 Base Award: PAR98	PAR99	PAR01	CA05	CA06	CA07	CA08	CA09	CA10	CA12	Total	success rate per R33 FOA	**All R33 Awds**	% of R33 Awards Given
Successful R21 -> R33 Transition	PAR98	0										0		9	
	PAR99	1	0									1	25%	14	7%
	PAR01	1	0	1								2	18%	17	12%
	CA05	0	2	0								2	25%	8	25%
	CA06	1	0	0	0							1	20%	7	14%
	CA07	1	0	1	2	0						4	19%	14	29%
	CA08	0	0	0	0	1	1					2	25%	3	67%
	CA09	0	0	0	1	0	0	0				1	11%	5	20%
	CA10	0	0	0	0	1	2	2	1			6	40%	11	55%
	CA12	0	0	0	1	0	0	2	1	0		4	18%	14	29%
	CA13*	0	0	0	0	0	0	0	1	0	0	1*	5%*	5*	
	Total	4	2	2	4	2	3	4	3	0	0	24			
	Success Rate per attempt for base R21 FOA	**29%**	**13%**	**11%**	**36%**	**22%**	**19%**	**33%**	**19%**	0%					

*1 of 3 rounds accounted for. 11 applications still pending review

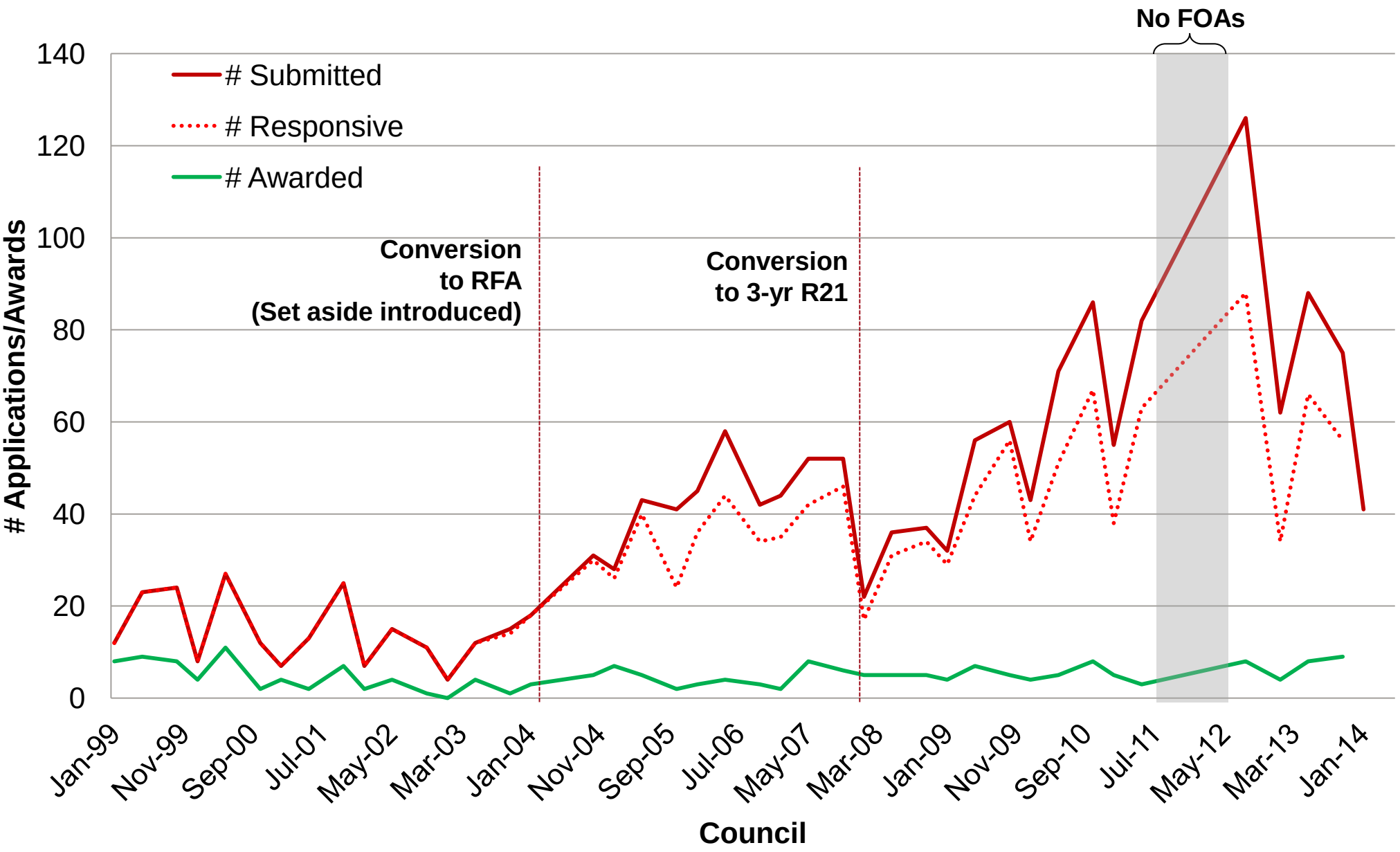
IMAT R21 Application History



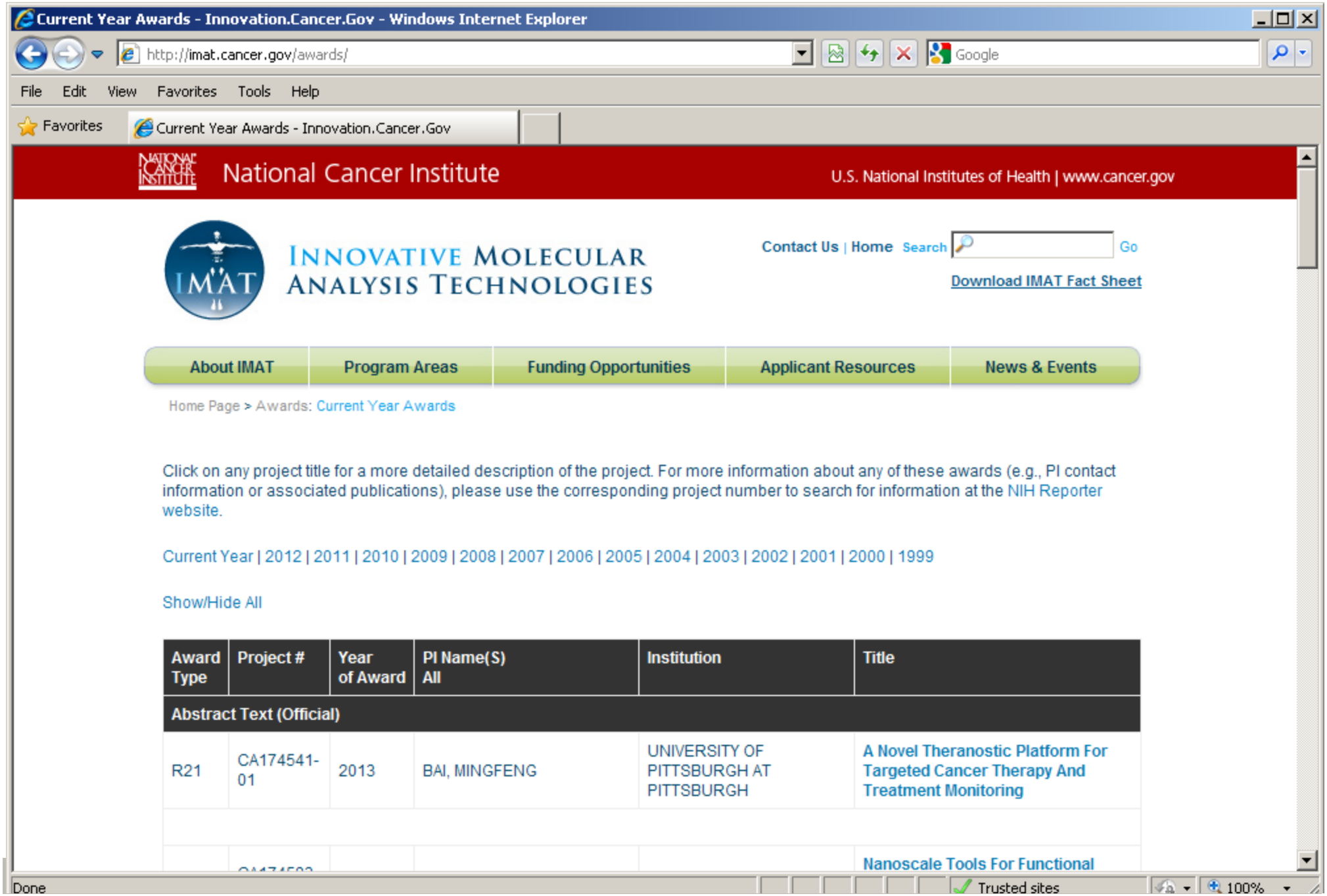
IMAT R33 Application History



IMT R21 Applications Submitted/Awarded per round of receipt



http://innovation.cancer.gov



Noteworthy IMAT SBIR Platforms

- **GeneChip® CustomSeq®** resequencing arrays from Affymetrix (Oliner CA081949)
- **BeadArray** gene expression assay system from Illumina (Chee CA081952)
- **BeadChip** arrays, **BeadLab** and **BeadStation** enabling NGS from Illumina (Chee CA083398)
- **PI 3K inhibitor screening** platform from Echelon Biosciences (now Aeterna Zentaris) (Drees CA81835)
- **ActivePipettes** used in Rainmaker microarray dispenser from Engineering Arts (Wiktor CA083390)
- **TRIO** multspectral diagnostic imaging from CRi, now Perkin Elmer (Levenson CA088684)
- Functionalization of **Quantum Dots** from Quantum Dot Corporation (Bruchez (CA088391)
- Mass Spec ImmunoAssays (**MSIA**) from Intrinsic Bioprobes (Nedelkov CA099117)
- **Light Activation System** from Syntrix, now SuperNova Life Sciences (Zebala CA099333)
- **PhosphScan®** kits from Cell Signaling Technology, Inc (Rush CA101106)
- **ONIX** microfluidic perfusion cell toxicity screening system by CELLASIC Corp (Lee CA120619)

FY2013 Award Summary

- IMT R21 [CA12-002/CA13-001]
  - 225 applications submitted, 156 reviewed
  - 21 awards
    - Overall Success Rate = 9%
- EMT R33 [CA12-003/CA13-002]
  - 98 applications submitted, 82 reviewed
  - 12 awards
    - Overall Success Rate = 12%
- Biosp R21 & R33 [CA12-004&5/CA13-003&4]
  - 53 applications submitted, 49 reviewed
  - 4 awards
    - Overall Success Rate = 8%
- 1st year Total Costs = $10.1M

Q1: Uniqueness of Applications

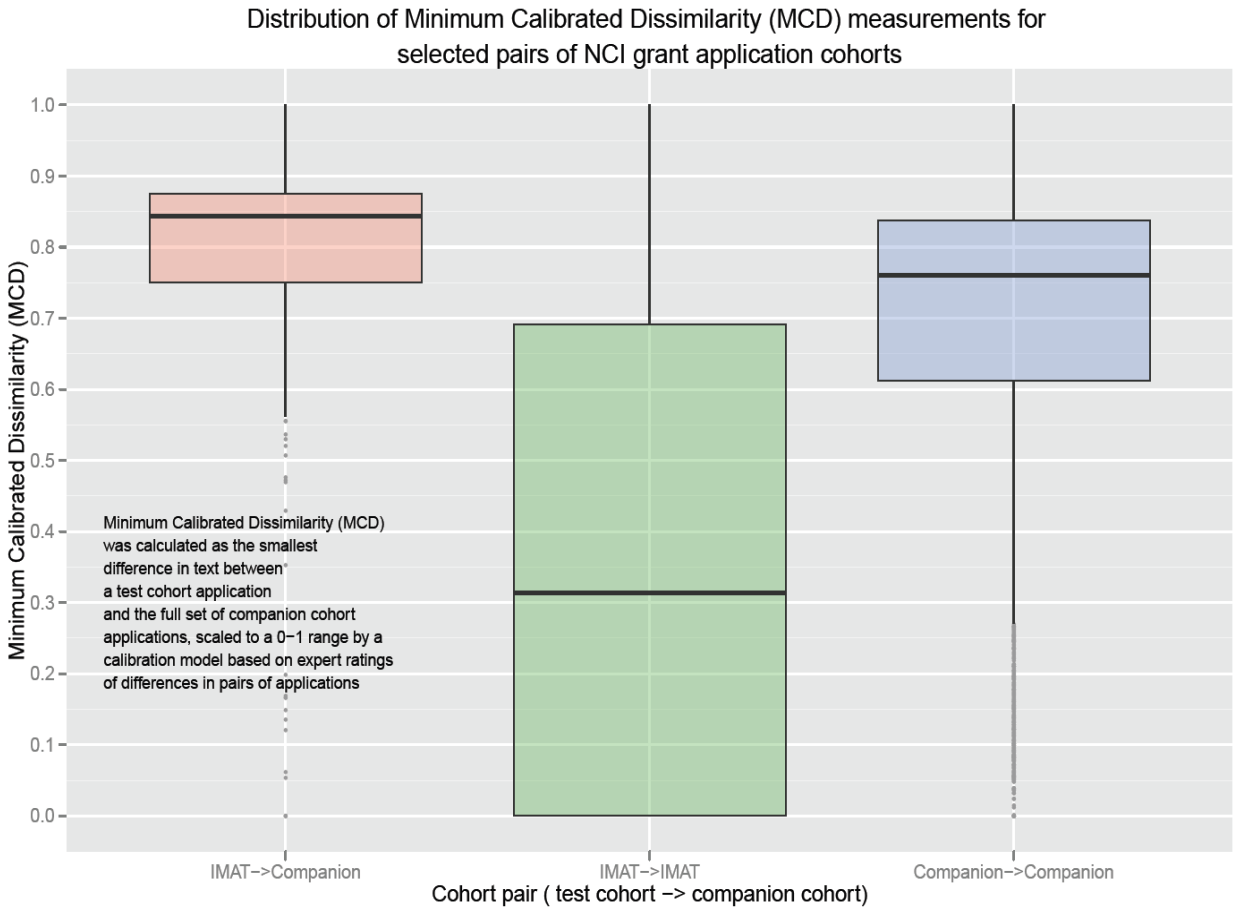
- **Scope**: CA12-00X submissions alone as most recent record with evidence
  - 432 applications [320 R21, 112 R33]
  - 316 responsive [222 R21, 94 R33]
  - 36 awards [22 R21, 14 R33]

- **Metrics**
  - Text mining of IMAT applications in comparison to other relevant NCI & NIH applications
  - Breakdown of non-cancer research applicants
  - Interviews with investigators

Q1: Unique applications for NCI

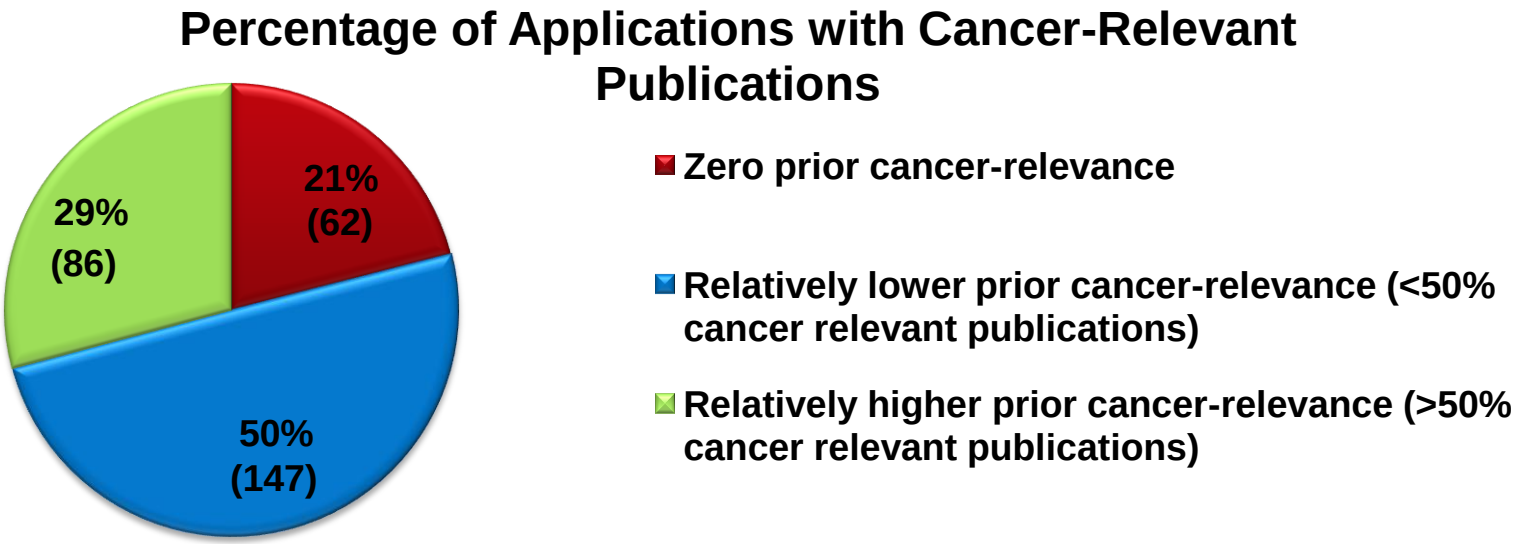
- Experience of program directors across the NCI confirms uniqueness of IMAT applications
- Experience of applicants confirms uniqueness of IMAT applications

- Text screening comparison analysis shows statistically significant difference between IMAT and other biotechnology and bioengineering applications to NCI



Q1: Unique applications for NCI

- Drawing applicants with non-traditional cancer research backgrounds
  - 21% of applicants (62) had no publication history in the last 5 years indicating cancer relevant research. 3 of the 35 awards (9%) made these rounds went to this group.
  - 50% of applicants (147) had less than half of their publications in the last 5 years indicating cancer-relevant research. 20 of the 35 awards (57%) made these rounds went to this group.



Q2: Effectiveness for Tech Dev

- **Scope**: Awards to CA09 [25 R21 and 5 R33 awards]

- **Metrics**:
  - Milestones met for R21
  - Responsiveness record
  - Patents submitted/awarded
  - Peer-reviewed publications
  - Transition from R21→R33

Q3: Usefulness of technologies supported

- **Scope**: Awards to CA09 [25 R21 and 5 R33 awards]

- **Metrics:**
  - Bibliometrics
  - Subsequent applications for NIH supported research (with and without the PI)
  - Commercialization activity (licensing, patent awards)

Example Projects for FY10 Award Categories

- **Novel Biosensor technologies**
  - Mitochodrial potential chips (MiP-Chips) (Burke, R21)
  - 3D nanocavity array (Chiles, R21)
  - Dynamic DNA: erasable molecular imaging probes (Diehl, R21)
  - FRET-based intracellular redox probes (Kenis, R33)
- **Screening Tools**
  - Targeted Genomic Circularization Sequencing (TGC-Seq) (Ji, R21)
  - Global PTK profiling microarrays (Turk, R21)
  - Capillary isotachophoresis (CITP) for isolation of low abundance protein (Lee, R21)
  - Methyl-MAPS (Mapping Analysis by Pair-End Sequencing) (Bestor, R33)
- **Clinical Diagnostics**
  - Application of Spatial Light Interference Microscopy (SLIM) to remote label-free blood smear-based Dx (Popescu, R21)
  - Metallic Phosphate/Apoferritin Nanoparticle Array (MPNA) hand-held immunosensor (Liu, R21)
- **Sample preparation**
  - Endogenous Epitope Tagging (Waldman, R21)
  - Methods for extracting DNA suitable for NGS from small FFPE samples (Barrett, R21)
  - STARSEQ & SNAQ: RNA quality assessment standards (Willey, R21)

Q2(&3): Successful development of technology

- Publication record indicates useful contributions to the field across all award types
- Citations by cancer-focused research papers indicate early indicator of interest and potentially uptake

	2-yr R21 (15 projects)	3-yr R21 (10 projects)	R33 (5 projects)	Total (30 projects)
All Publications*	**53**	**43**	**12**	**116**
Average Publications per Project (Max)	**3.5 (17)**	**4.3 (14)**	**2.4 (5)**	**3.6 (17)**
Average Total # of Citations per Project (Max)	**28 (123)**	**40 (216)**	**9 (24)**	**29 (216)**
Average Cancer-Relevant Citing Publications (Max)	**4 (21)**	**3 (11)**	**1 (5)**	**3 (21)**
Average Prestige Ratio (Max)	**29% (69%)**	**40% (77%)**	**18% (50%)**	**31% (77%)**
Median Impact Factor Quartile (Min)	**1 (1)**	**1 (1)**	**2 (1)**	**1 (1)**

*These publications are indexed in Web of Science with citation data available.

Q3:Evidence of Utility – Commercialization

- 37 US patent applications directly resulting (+32 international)
- 4 patents granted (applications filed before IMAT award)
- 6 licensing agreements in place or in negotiation on unique platforms
- 1 commercially available platform (Oris Pro™ migration kit from Platypus Technologies)

Method to Identify Application/Award	Provisional Patent Application	Patent Application	Patent Award	Licensure
Acknowledgement of IMAT Grant Number in Patent Record	0	1	0	0
Match by Technology Short Name and Investigator Name	0	31	2	0
PI Reporting	4	45	2	6
Distinct Total	**3**	**37**	**4**	**6**

Original RFA Evaluation Criteria

In order to properly monitor the effectiveness of the NCI Innovative Molecular Analysis Technologies (IMAT) program, and maximize its utility for the broad cancer continuum of researchers, clinicians and ultimately patients, it is important to engage in on-going evaluation of the IMAT portfolio and assess progress on the intended mission and goals of the program. Upon approval for reissuance of IMAT solicitations in 2011, the following list of evaluation criteria were approved by both NCI leadership and the NCI Board of Scientific Advisors:

- the number of publications that cite a specific IMAT award number;
- the number of patent applications submitted to the USPTO that cite a specific IMAT award number in one of four government interest fields;
- the number of patent applications granted or approved by the USPTO based on patent applications that cite a specific IMAT award number in one of four government interest fields;
- the number of IMAT-funded technologies now used in other NCI and NIH strategic initiatives; and
- a series of follow-up case studies on previously funded technology development projects and platforms, including their current use by and utility to the extramural scientific and clinical communities.