

Director's Report

National Advisory Council
for Biomedical Imaging and Bioengineering

September 15, 2020

Bruce J. Tromberg, Ph.D.
Director

National Institute of Biomedical Imaging and Bioengineering



NIBIB Council Director's Report *09-15-2020*



Jill Heemsker
Deputy Director



David George
Associate Director



Richard Leapman
Scientific Director



Kris Kandarpa
Strategic Initiatives



Jason Ford
Executive Officer





Pam
Glikman



Alisha
Hopkins



Julia
Ringel



Asha
Storm



Ahmad El
Hendawy

NIBIB Council Director's Report *09-15-2020*



Remembering Sanjiv “Sam” Gambhir

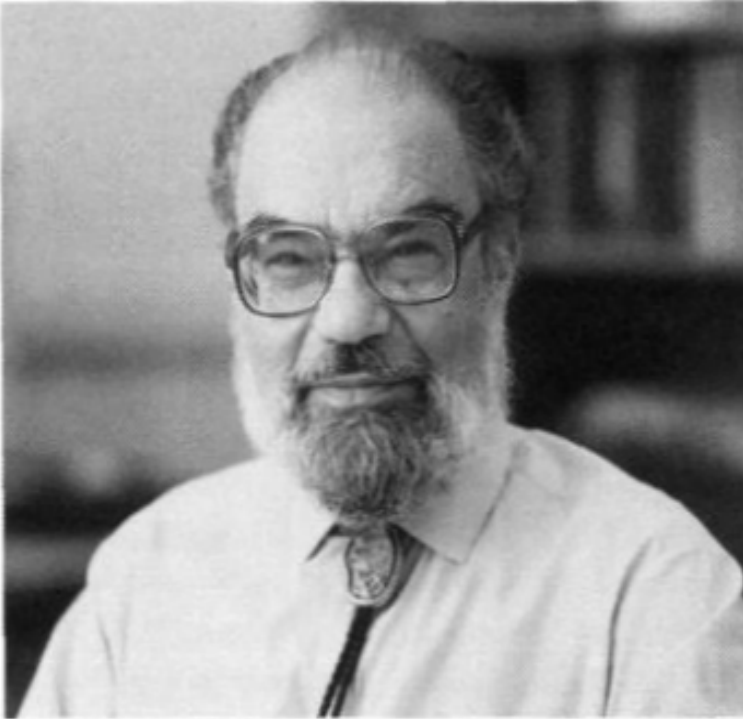


Sam Gambhir, M.D., Ph.D.
1962-2020

- Pioneer in the field of Molecular Imaging.
- Developed reporter gene technologies for PET and multi-modality imaging, NAM member
- Virginia and D.K. Ludwig Professor in Cancer Research and Chair of the Department of Radiology at Stanford University.
 - Director of the Molecular Imaging Program, Director of the Canary Center for Cancer Early Detection, and Director of the Precision Health and Integrated Diagnostics Center.
- NIBIB grantee for over 10 years
- NIBIB Advisory Council since 2018.



Remembering Murray Eden



Murray Eden, Ph.D.
1920-2020

- Professor Emeritus, Massachusetts Institute of Technology.
- Led NIH Biomedical Engineering and Physical Science Program, 1976-1994 (which became “BEIP” and principal initial component of NIBIB’s new IRP).
- Program’s many collaborative firsts included:
 - Applications of wavelets to computed tomography.
 - Multiple analytical methods--including biological electron energy loss spectroscopy (EELS)
 - Systems to implement laser capture microdissection
 - Serial block-face scanning electron microscopy

Incoming Council Member



Dr. Gilda Barabino

- Second President of Olin College of Engineering and Professor of Biomedical and Chemical Engineering.
- Noted investigator in areas of sickle cell disease, cellular and tissue engineering, member NAE.
- Internationally recognized thought leader and consultant on race/ethnicity and gender in science and engineering.
- Founder and Executive Director of the National Institute for Faculty Equity.

Incoming Council Member



Dr. Simon Cherry

- Distinguished Professor of Biomedical Engineering at UC, Davis; Editor in Chief, Phys Med Bio
- Develops novel technologies and methods for quantitative biomedical imaging, member NAE.
- His lab focuses on molecular imaging using positron emission tomography (PET) scanning, developing faster and more sensitive detection technology.
- Co-leads the EXPLORER project, a collaboration to develop the world's first total-body PET scanner.

Incoming Council Member



Dr. Kathryn R. Nightingale

- Theo Pilkington Distinguished Professor of Biomedical Engineering, Duke University.
- Laboratory is investigating and improving ultrasonic imaging methods for clinically-relevant problems through theoretical, experimental, and simulation methods.
- Main focus is on the development of novel, acoustic radiation force impulse (ARFI)-based elasticity imaging methods to generate images of the mechanical properties of tissue.

Former AAAS Fellows Turned NIBIB Staff

2019 AAAS



Ilana Goldberg, Ph.D.
Program Director
Division of Discovery Science and Technology
(SBIRs, P41 Centers)

2018 AAAS



Patricia Wiley, Ph.D.
Health Science Policy Analyst
Office of Science Policy and Public Liaison

New NIBIB Staff



Shravani Bobde
Senior Program Analyst
Division of Health Informatics Technologies
Ph.D. Candidate, GMU



Rosemary Wong, Ph.D.
Program Director
Division of Health Informatics Technologies

Moving On



Shawn Chen, Ph.D.

- Recruited from Gambhir Lab, Stanford, 2009
- Created NIBIB's Lab of Molecular Imaging and Nanomedicine
 - Imaging
 - Molecular probes with high specificity, optimized pharmacokinetics
 - "Theranostic" Nanomedicine
 - Personalized, novel nanomaterials
 - Targeted delivery of genes, therapeutics
 - Monitoring of treatment responses
- Over 800 peer-reviewed publications, H=115

Thank You!



Jacklyn Ebiasah



National Institute of
Biomedical Imaging
and Bioengineering

Scientific Program Analyst
Division of Discovery Science and Technology



Saltanat Satabayeva, MSc, PMP



National Institute of
Biomedical Imaging
and Bioengineering

Scientific Program Analyst
Division of Health Informatics Technologies



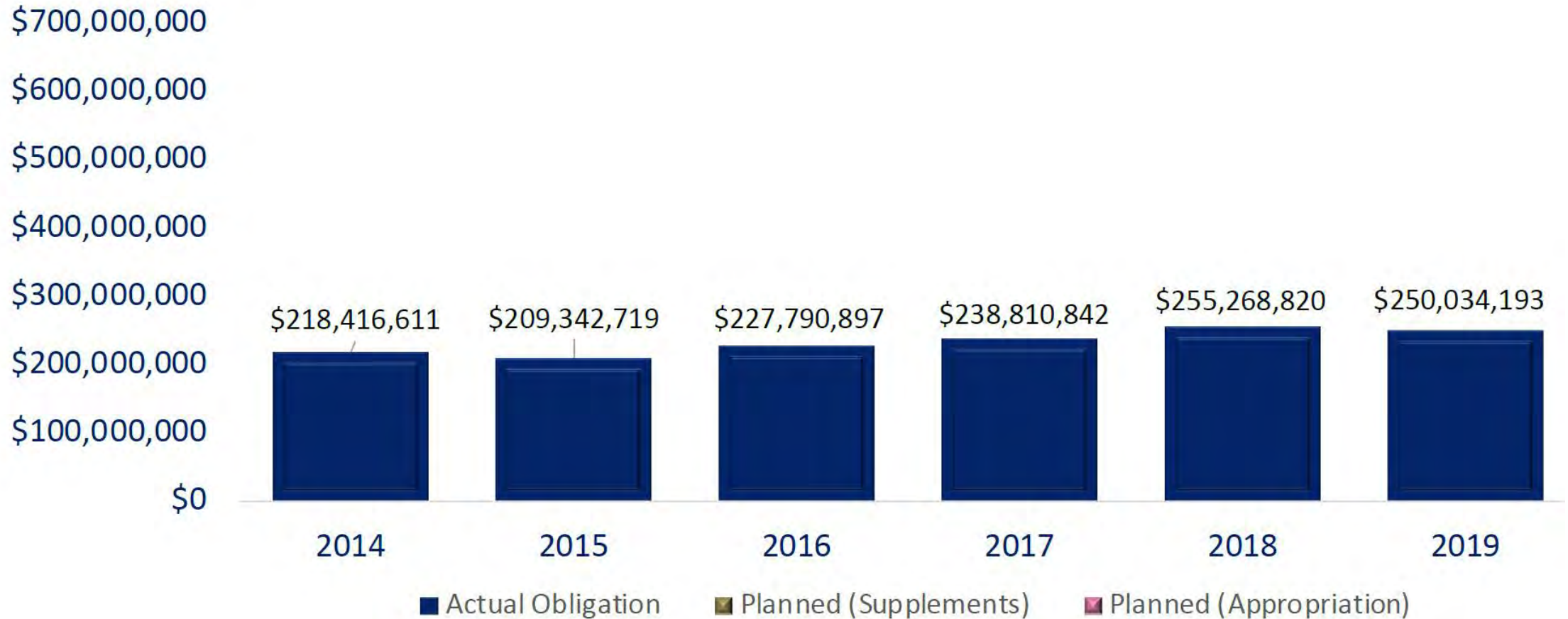
EHR Consultant
Defense Health Agency



Scientific Program Manager
NIH STOPS Contract

Budget Update

May-Sept Obligations 2014 - 2020

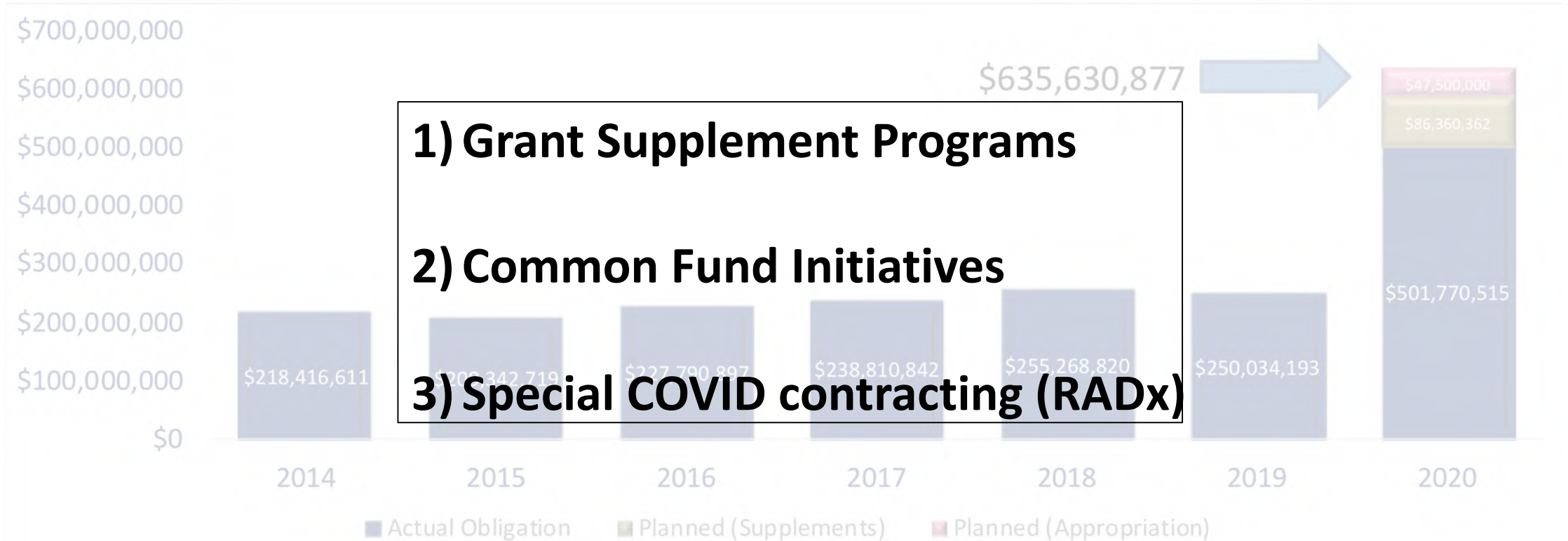


Budget Update

May-Sept Obligations 2014 - 2020

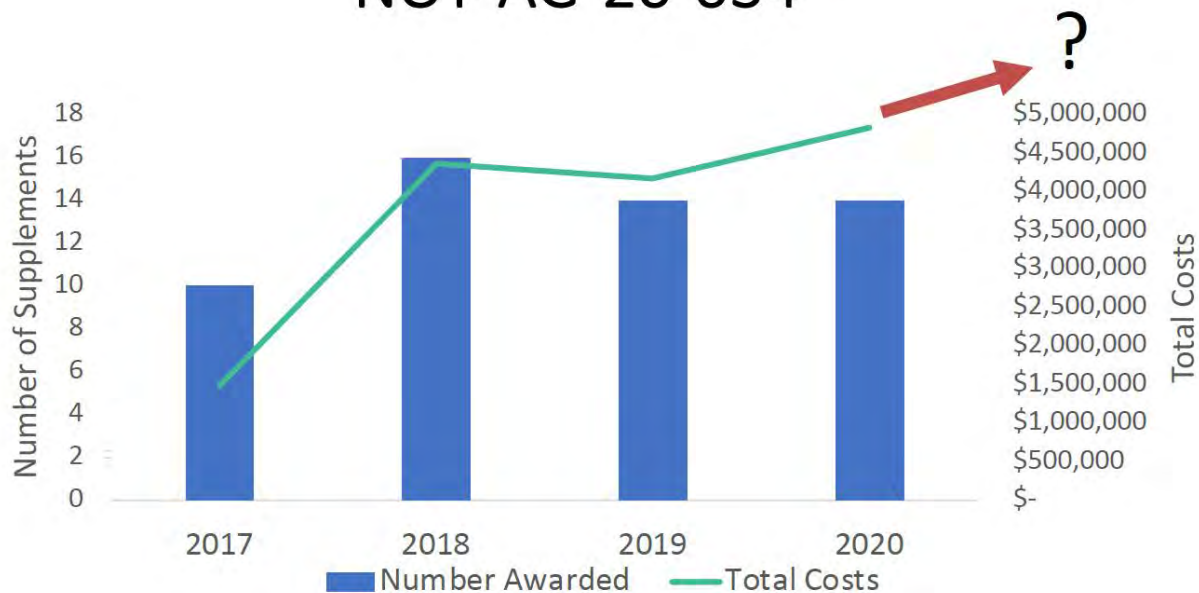
Budget Update

May-Sept Obligations 2014 - 2020



Alzheimer's Supplements: *NIA Program*

NOT-AG-20-034



Randy King, Ph.D.
Program Director



NIA has released a Notice of Special Interest to fund Alzheimer's-focused supplements for projects that are not focused on Alzheimer's disease.



NIBIB participated in the pilot program in 2017 and helped start this partnership by funding the first round of supplements.



The partnership has expanded to involve 21 Institutes and Centers in 2020.



Supplements allow PIs to investigate the applications of technologies to Alzheimer's and Related Dementias.



Applications due October 17, 2020.

COVID-19 Supplements: *NIBIB Program*

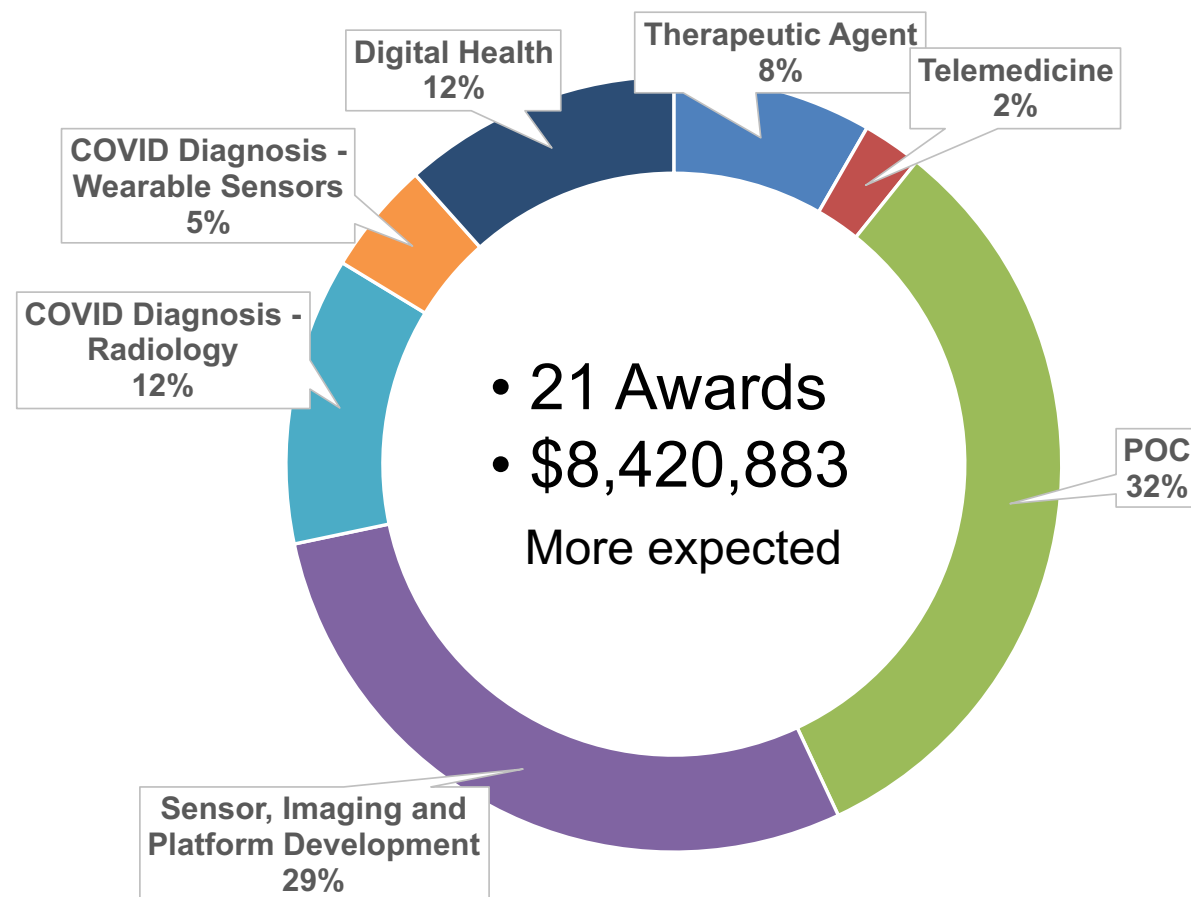
Strong response to 3 NOSIs issued 4/10 (~5 mos, **now expired**)

Applicant(s)	NOSI Number	Contact
Current Grantees (most mechanisms)	NOT-EB-20-008	Program Director on existing award
SBIR/STTR (R41, R42, R43, R44)	NOT-EB-20-006	NIBIB-SBIR@mail.nih.gov
RPGs (R01, R21, R03)	NOT-EB-20-007	COVID19NIBIB@mail.nih.gov

For more information:

<https://www.nibib.nih.gov/nibib-response-covid-19>

NOSI Budget Distribution



Harnessing Data Science for Health Discovery and Innovation in Africa

Common Fund Due Dates: 11/24, 12/1, 12/3, 12/8



Tiffani Lash, PhD

2-Week Kickoff Symposium: Aug 10-13; 17-21
 >1650 participants, 54% Africa, 40% US, 6% ROW



DS-I Africa



FIC, NBIB, NLM, NIMHD

1. Research Hubs focused on key health problems

2. DS-I Training Programs

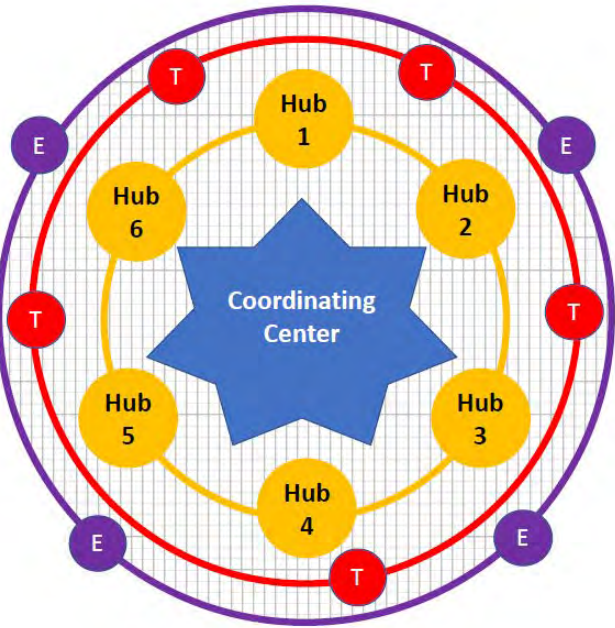
3. Ethical, Legal and Social Implications of DS-I Research

4. Open Data Science Platform and Coordinating Center

5. Symposia (years 1 and 6)

RFA-RM-20-015, 016, 017, 018

Date	Upcoming Session Topics
Sept 23	Leveraging Data Science Approaches to Address Environmental Health Challenges in Africa
Sept 30	Biomedical Informatics and Data Sciences in Africa
Oct 7	Innovative Approaches to Improve Maternal and Child Health
Oct 13	Infectious Diseases
Oct 14	COVID-19
Oct 21	Innovations in Health Metrics Sciences: Measuring, Mapping, and Monitoring Morbidity and Mortality at the Regional, National, and Local Levels in Africa



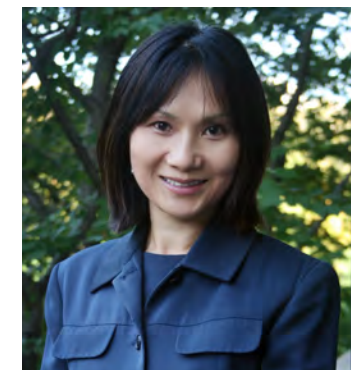
NIH HEAL Initiative Workshop on MYOFASCIAL PAIN



Joint NCCIH/NIBIB Heal Workshop on Quantitative Evaluation of Myofascial Pain

September 16-17, 2020

This workshop is sponsored by HEAL and co-organized by NCCIH and NIBIB with partners from NIAMS, NICHD/NCMRR, NIDCR, and NINDS.



Guoying Liu

Register at: <http://conference.novaresearch.com/MyofascialPain/index.cfm>

Artificial Intelligence for Biomedical Excellence (AIBLE)

Vision: To Propel Progress in Biomedical Research through **NEXT-GENERATION AI** (beyond Narrow AI to Broad AI)

Culture Change: → AI designed for biomedical experiments*

Goals/Outcomes after 7 years (FY21-27, ~\$160M):

- Design Framework Resources for the Biomedical Community
- New “Gold Data” that can be mined with future AI methods
- Ability to “stitch” Gold Data with existing data (across sites, protocols, processing methods)
- Next generation discoveries for biomedical research, powered by next-gen AI



Grace Peng, Ph.D.



Immediate Timeline:

October 26-29, 2020: Community Workshop in partnership with DARPA Synergistic Discovery and Design (SD2) program

Fall 2020: Release of Funding Opportunities for AIBLE Design Centers inspired by Biomedical Grand Challenges

Fall-Winter 2021: Formation of Multidisciplinary Teams, Grand Challenge Ideas
→ Online breakout groups for each Grand Challenge idea

NIH Technology Accelerator Challenge (NTAC)



Tiffani Lash



**NIH TECH ACCELERATOR
CHALLENGE**
FOR GLOBAL HEALTH

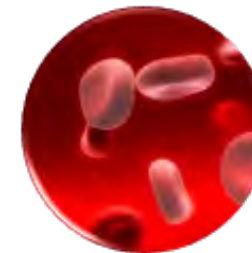
\$1,000,000 Challenge:
NIBIB, OD, NIAID, NIDDK, FIC



MALARIA



**SICKLE CELL
DISEASE**



Jill Heemskerck

6 winners announced
Sept 10, 2020!

<https://www.nibib.nih.gov/ntac-challenge-winners>



Behrouz
Shabestari

**BILL &
MELINDA
GATES**
foundation

BMGF POC team: *Dan Wattendorf, Andrew Trister, Arunan Skandarajah, Jessica Lee*



Taylor Gilliland,
NIH OD

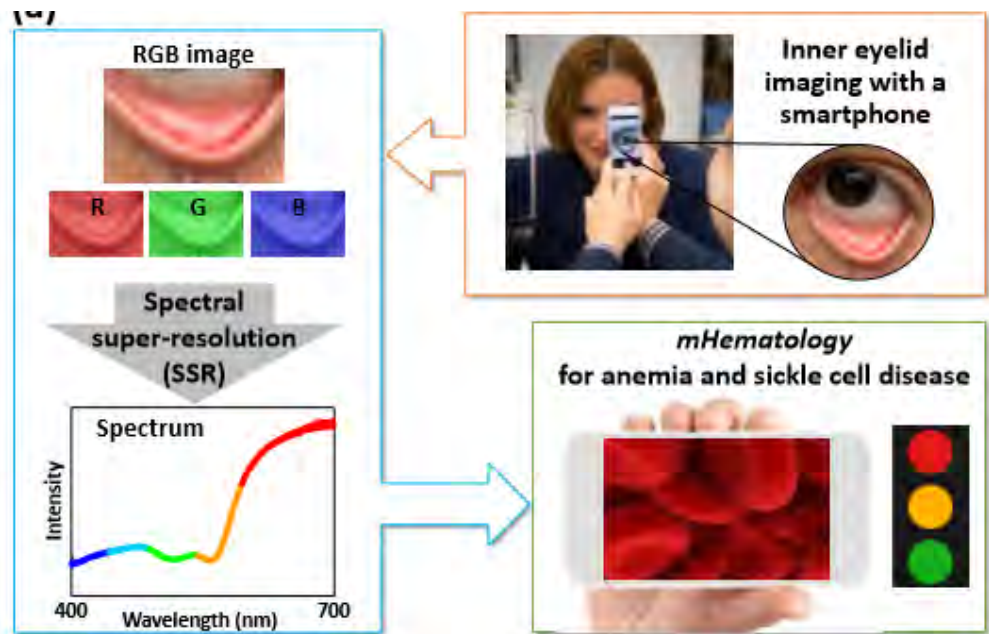
NIH Technology Accelerator Challenge (NTAC)

1st Prize: \$400,000

Young Kim, Purdue University, Indiana.

Intravital mHealth spectroscopy of microvascular blood analysis for anemia and sickle cell disease.

A non-invasive, smartphone-based spectroscopy platform to detect anemia and SCD by analyzing photos of the microvasculature of the inside eyelid.



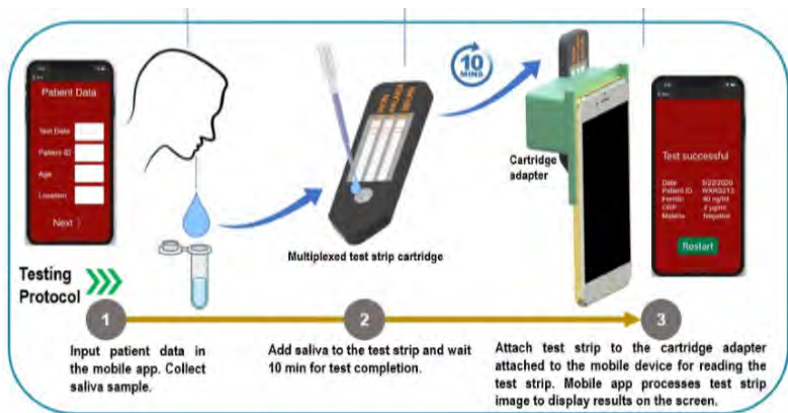
2nd Prize: \$200,000

Bala Raja, Luminostics, San Jose, California.

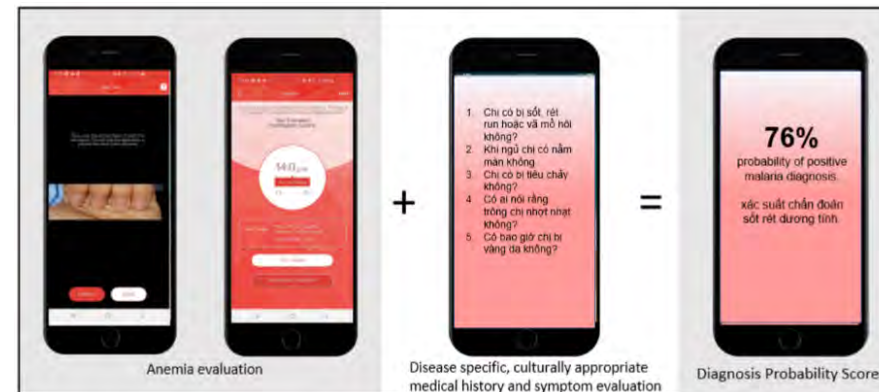
Rapid, smartphone-based salivary diagnostics for malaria, anemia, and COVID-19.

A multiplex lateral flow saliva test to detect SARS-CoV-2 antigens, ferritin (a marker of iron deficiency), and a malaria parasite protein, PSSP17.

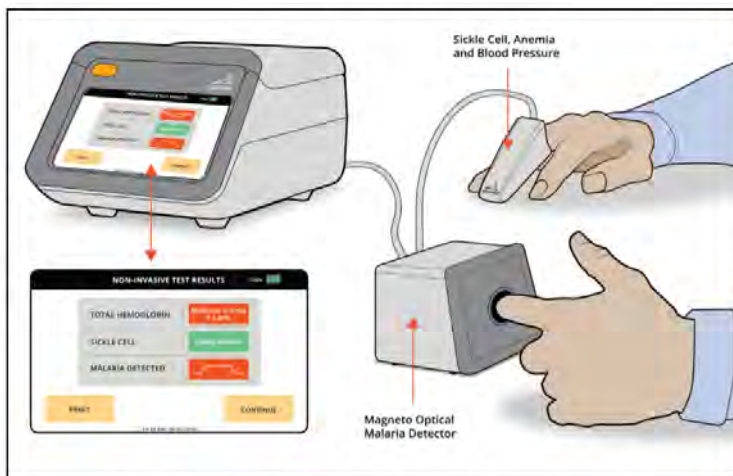




Saurabh Mehta, Cornell University. *Mobile-based assessment of iron deficiency, inflammation, and malaria infection in saliva.*

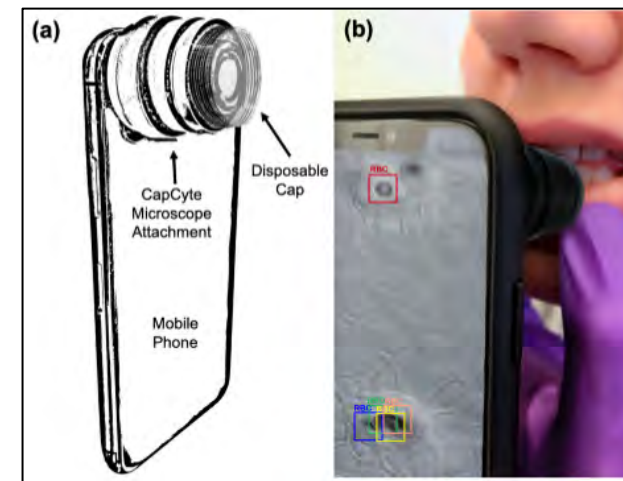


Erika Tyburski, Sanguina, Inc., Peachtree City, Georgia. *AnemoCheck Mobile: noninvasive smartphone app for anemia.*



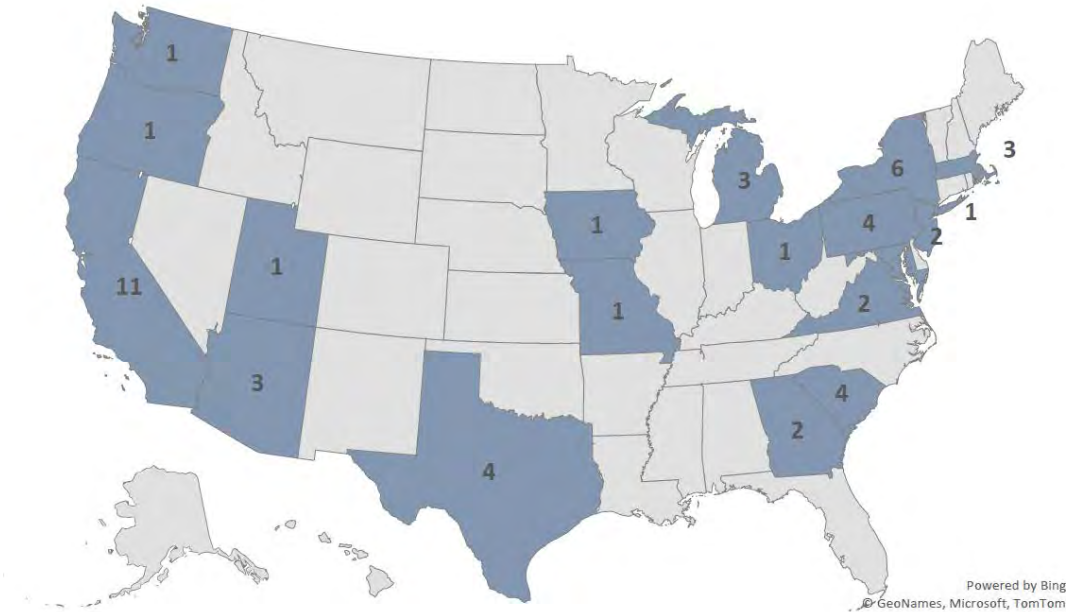
3rd Prize: \$100,000 (4-way tie)

Peter Galen, HEMEX; Medtronic; Case Western Reserve University, University of Nebraska. *Non- and minimally invasive diagnosis of anemia, malaria, and sickle cell disease.*



Nicholas Durr, Johns Hopkins University. *CapCyte: mobile phone capillaroscopic cytometer for non-invasive blood analysis.*

2019



52 applications from 32 universities in 18 states

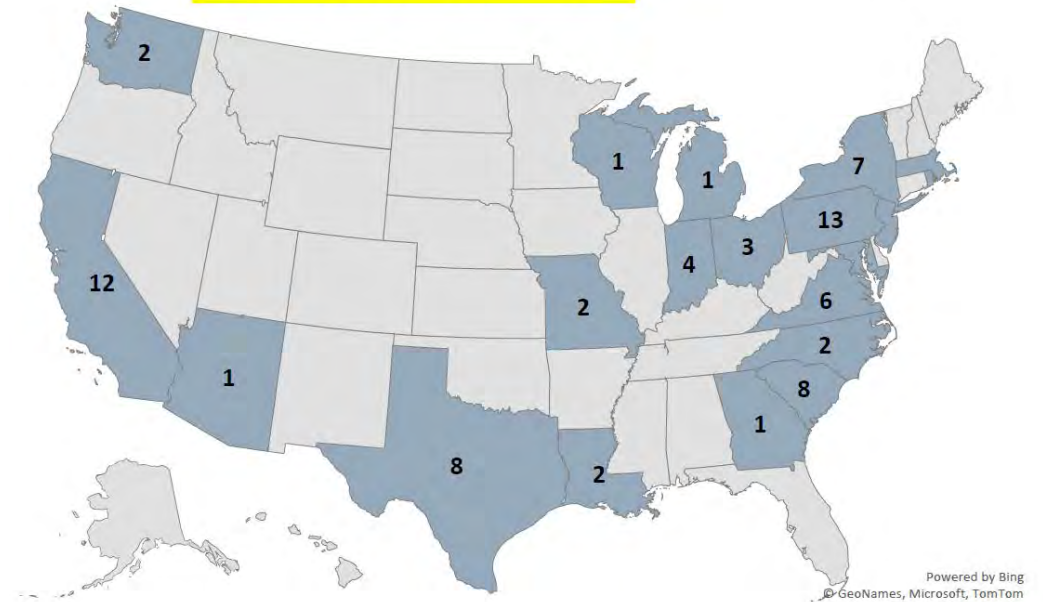
Total of 250 students engaged



Zeynep Erim Ph.D.

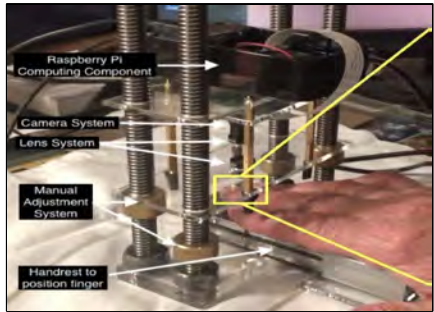
\$100,000 Awards

2020



86 applications from 46 universities in 20 states

Total of 410 students engaged



The Steven H. Krosnick Prize- \$20,000
The Onchoscope (*Stanford University*)

Nailfold Capillaroscopy for Onchocerciasis Diagnosis

Award ceremony at

- Biomedical Engineering Society (BMES) Annual Meeting
- October 15, 2020; Virtual
- Dedicated parallel session featuring DEBUT winners



Second Place- \$15,000
Osmotic Concentrator for Urinary Biomarkers (*University of Washington*)

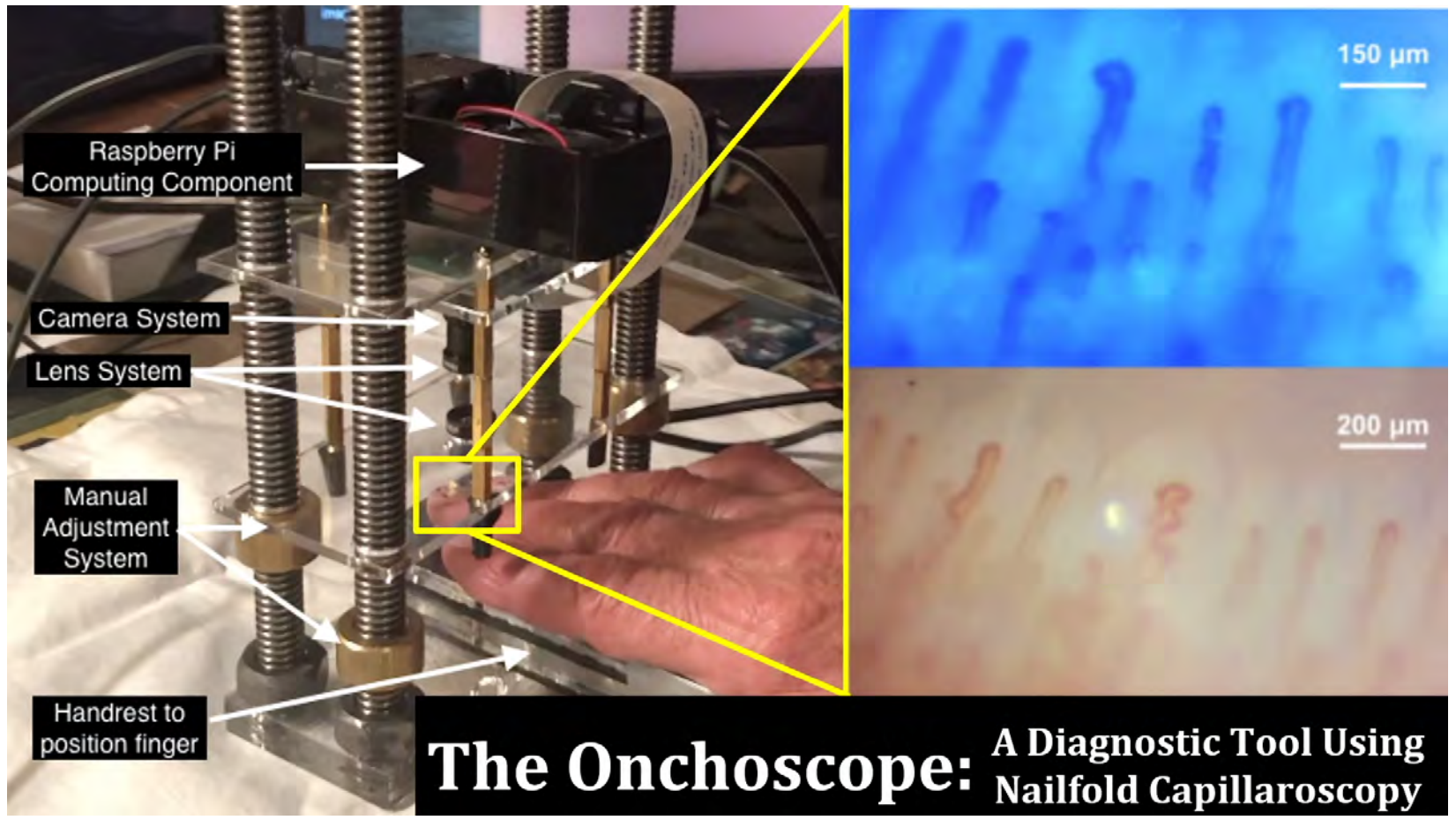
Urine-based test to detect tuberculosis biomarker



Third Place- \$10,000
Saving Intestines at Birth (*Duke University*)

Gastroschisis Silos for Sub-Saharan Africa



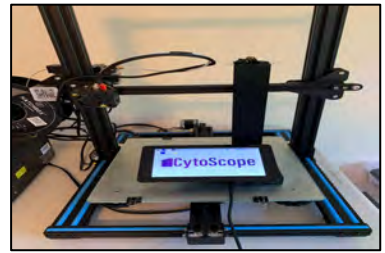


- Award ceremony at
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HIV/AIDS Prize- \$15,000
CytoScope (*Johns Hopkins University*)
 The Future of HIV Monitoring: CD4 estimator



CytoScope

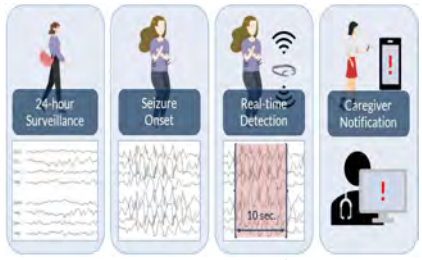


NEW! Health Care Technologies for Low Resource Settings Prize- \$15,000
At Your Cervix: Universal Obturator for Brachytherapy (*Rice University*)
 A low-cost, 3D printed device that helps treatment of late-stage cervical cancer to administer brachytherapy.



Universal Obturator for Brachytherapy

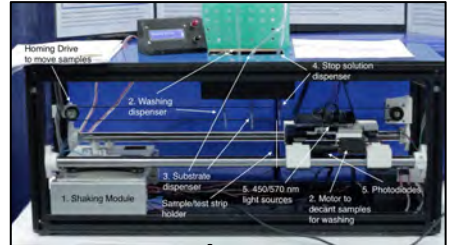
Venture Well Winners



NeuroTrak

Venture Prize- \$15,000
NeuroTrak (*Columbia University*) – A device designed to consistently collect EEG data in real time to monitor Focal with Impaired Awareness (FIA) seizures

Design Excellence Prize- \$5,000
Nephrogen (*Stanford University*) – A urine dipstick test to detect acute kidney injuries



Nephrogen

COVID-19 Pandemic



Bio-Engineering



- 1) Imaging and AI
- 2) Digital Health Platforms
- 3) Diagnostic Test Technologies

Medical Imaging and Data Resource Center (MIDRC)



Kris Kandarpa
Chair



Guoying Liu
Scientific Program Lead



Behrouz Shabestari
NIBIB National Technology Center Program Director



Maryellen Giger (PI)
AAPM, University of Chicago

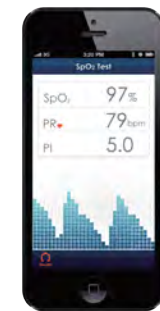


- Two-year, \$20M contract: Medical Imaging/Data Science
- Thoracic imaging and clinical data repository for COVID 19
- Develop, validate machine learning algorithms for detection, diagnosis, Tx



Digital Health Solutions for COVID-19

- Tools for managing **population health** and **individuals' lives** during the pandemic
- **Eight** digital health contracts awarded
- **~\$25M** budget over **1 year**
- **De-identified data** will be shared with the research community



Andrew Weitz, Ph.D.

Rapid Acceleration of Diagnostics (RADx)



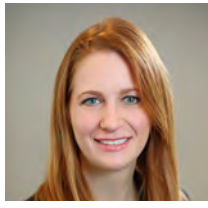
Francis Collins



Rachael Fluerance



Rick Bright



Tara Schwetz



Larry Tabak



Jill Heemskerk

RADx Tech – \$500M

Highly competitive, rapid three-phase challenge to identify the best candidates for at-home or point-of-care tests for COVID-19

RADx Advanced Technology Platforms (RADx-ATP) – \$230M

Rapid scale-up of advanced technologies to increase rapidity and enhance and validate throughput – create ultra-high throughput machines and facilities

RADx Underserved Populations (RADx-UP) – \$500M

Interlinked community-based demonstration projects focused on implementation strategies to enable and enhance testing of COVID-19 in vulnerable populations

RADx Radical (RADx-Rad) – \$200M

Develop and advance novel, non-traditional approaches or new applications of existing approaches for testing



The NEW ENGLAND
JOURNAL of MEDICINE

SPECIAL REPORT

Rapid Scaling Up of Covid-19 Diagnostic Testing in the United States — The NIH RADx Initiative

Bruce J. Tromberg, Ph.D., Tara A. Schwetz, Ph.D., Eliseo J. Pérez-Stable, M.D., Richard J. Hodes, M.D., Richard P. Woychik, Ph.D., Rick A. Bright, Ph.D., Rachael L. Fleurence, Ph.D., and Francis S. Collins, M.D., Ph.D.

The first reports of an unusual cluster of pneumonia cases in the city of Wuhan, China, emerged in December 2019, heralding a global pandemic. As of July 13, 2020, more than 3.3 million cases of COVID-19 have been reported. This report provides an overview of RADx and their goals, and we end with a review of the challenges ahead. On April 24, 2020, Congress appropriated \$1.5 billion, from the \$25 billion provided in the

\$1.5B to NIH; \$500 Million to NIBIB

<https://www.nih.gov/research-training/medical-research-initiatives/radx/radx-programs>

Rapid Acceleration of Diagnostics (RADx)



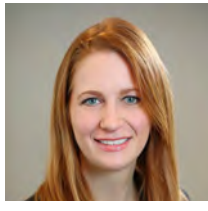
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<https://www.nih.gov/research-training/medical-research-initiatives/radx/radx-programs>

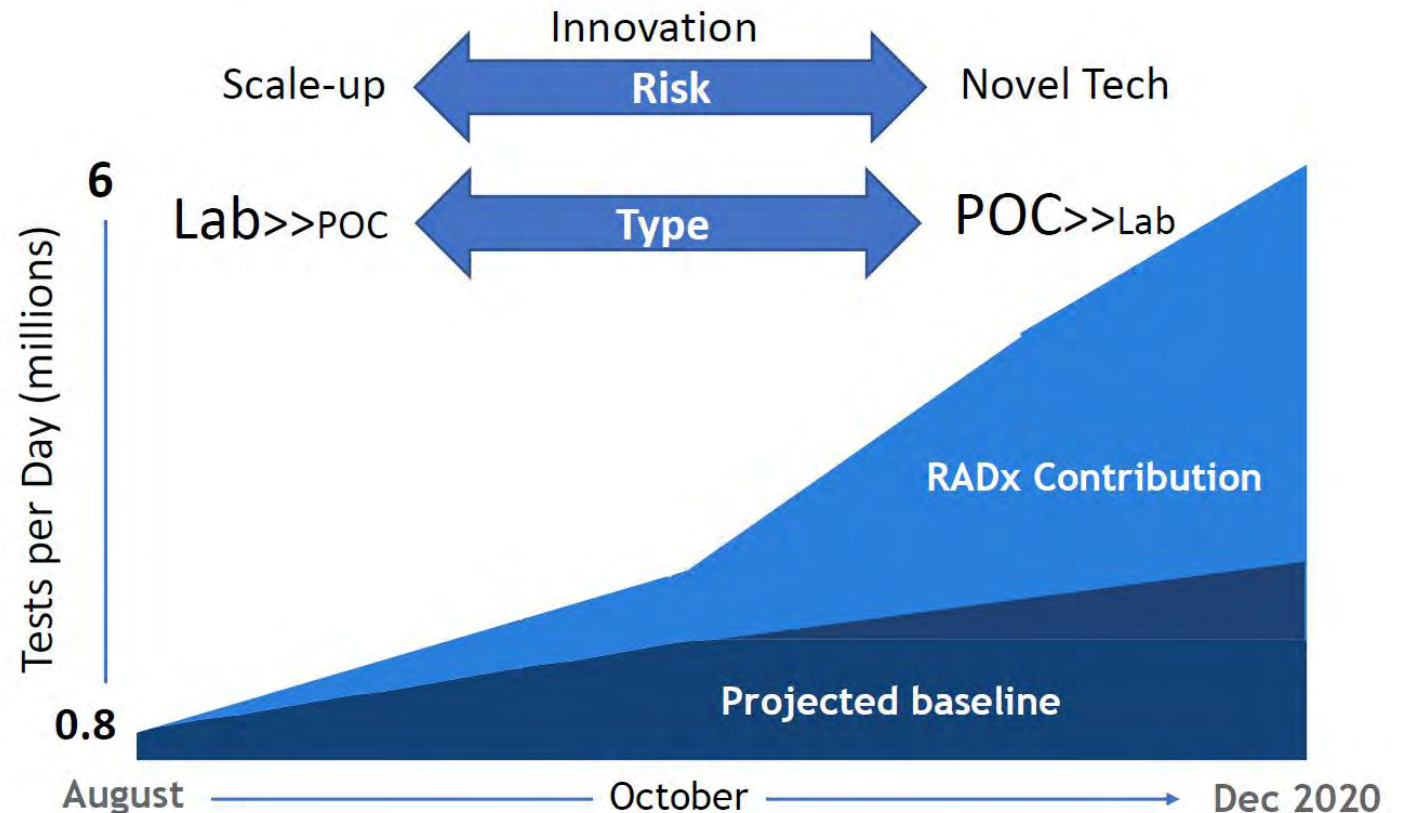
RADx Tech & ATP Goals

1) **Expand COVID-19 Testing Technologies:** *Number, Type and Access*

2) **Optimize Performance:** *Technologic and Operational; Match Essential “Use Cases”*

Test Settings

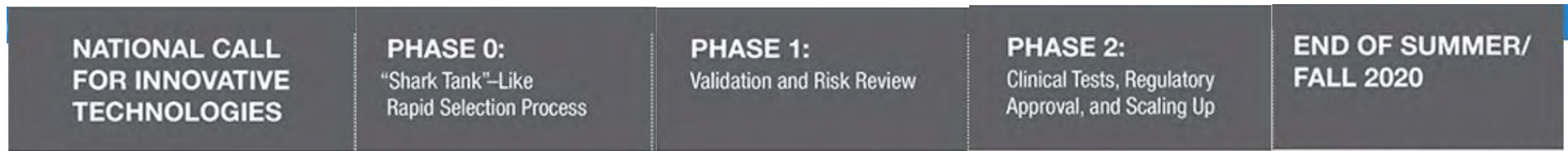
- Home-based
- Point of Care (POC)
- Laboratory (CLIA, research)



RADx Innovation Funnel

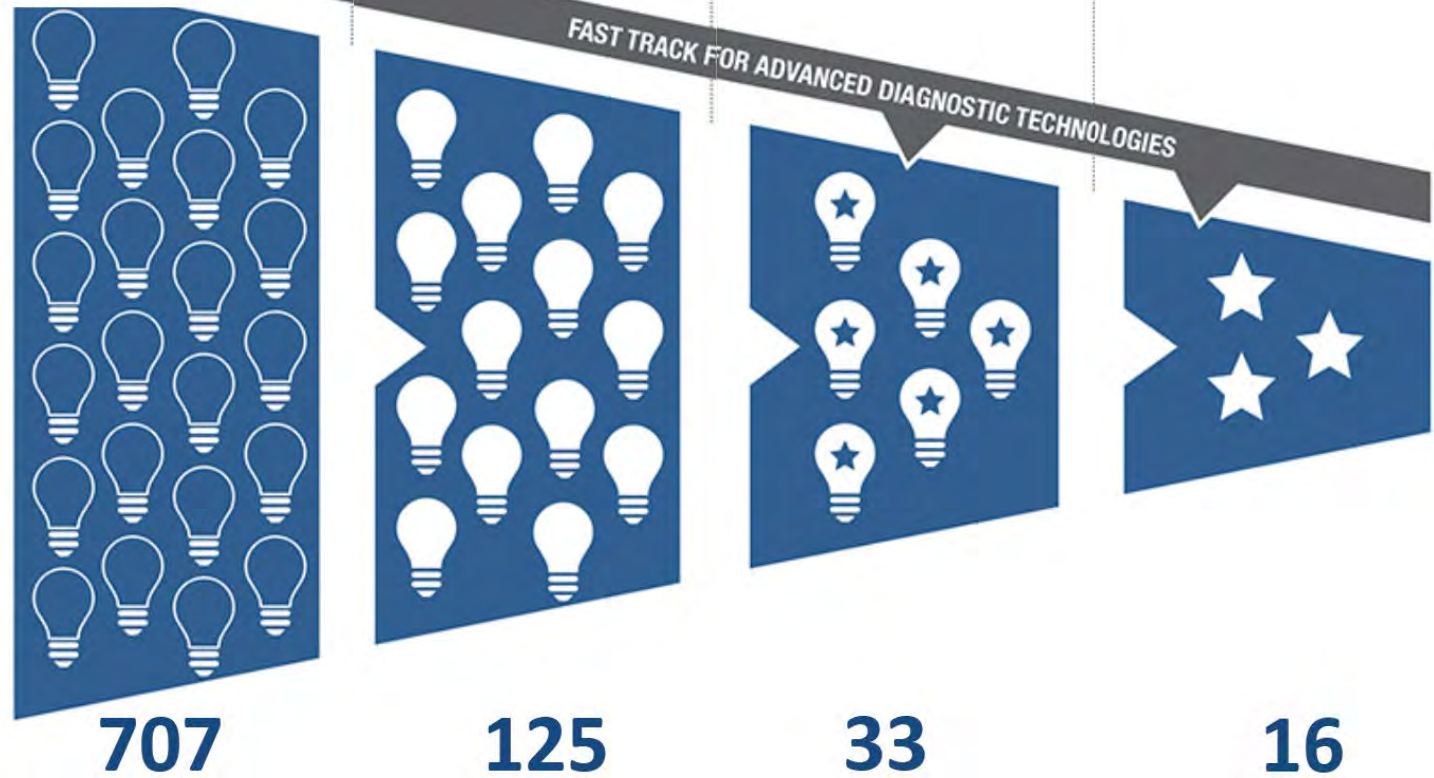
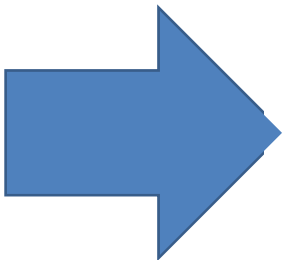


Todd Merchak Tiffani Lash



Rolling submission open April 29 → 5-6 Months

Applications Started
~3000



DEPLOY MILLIONS of tests per week

Validation, Scale-up, Clinical Testing, Regulatory, Manufacturing, Distribution

Projects in each Phase

Point-of-Care Technologies Research Network (POCTRN)

NIBIB National Network: **5-6 years for new POC technologies**

Established 2007, Expanded 2020: >1000 RADx experts & contributors

<https://www.poctrn.org>



GaTech/Emory

- ✓ Engineering
- ✓ Design/Prototype
- ✓ Clinical Validation
- ✓ Biobank samples
- ✓ In-Home Validation

Johns Hopkins

- ✓ Public Health/STD
- ✓ Global Health
- ✓ Clinical Validation
- ✓ Biobank samples
- ✓ Validation in LMICs

CIMIT/MGH

- ✓ Coordinating Center
- ✓ Collaboration/Management Platform
- ✓ Business/Commercialization

Northwestern

- ✓ HIV/AIDS
- ✓ Engineering
- ✓ Global Health
- ✓ Clinical Validation
- ✓ Validation in LMICs

UMass

- ✓ Heart, lung, blood
- ✓ Engineering
- ✓ Clinical Validation
- ✓ Biobank samples
- ✓ Clinical Trials
- ✓ Business/Commercialization



Validation Core



Clinical Studies Core

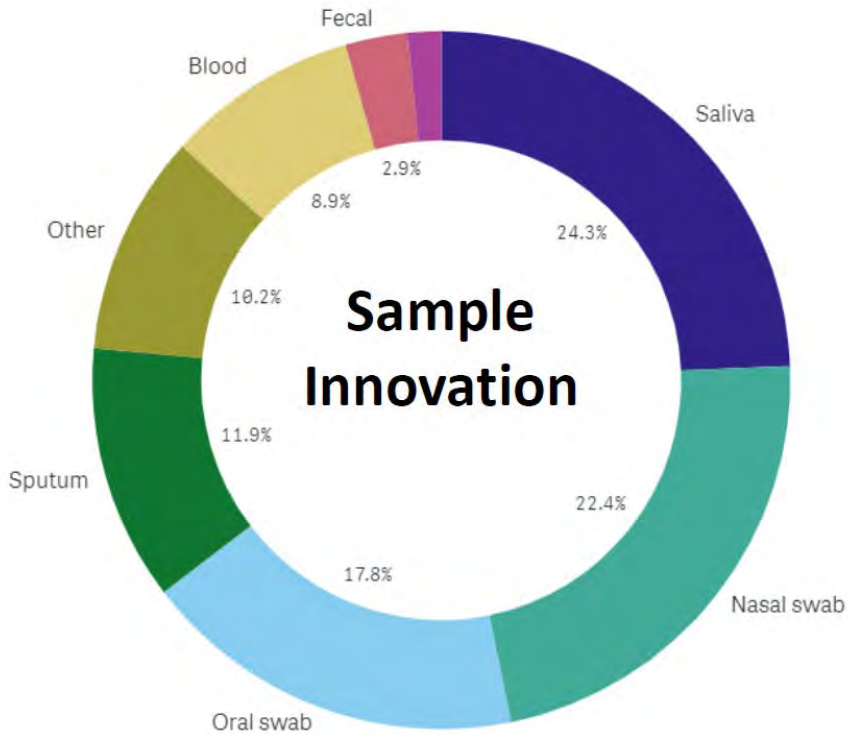


Scale up Core

Project Tech:

- 1) Review
- 2) Funding
- 3) Expertise
- 4) Testing

Landscape of RADx Tech Proposals

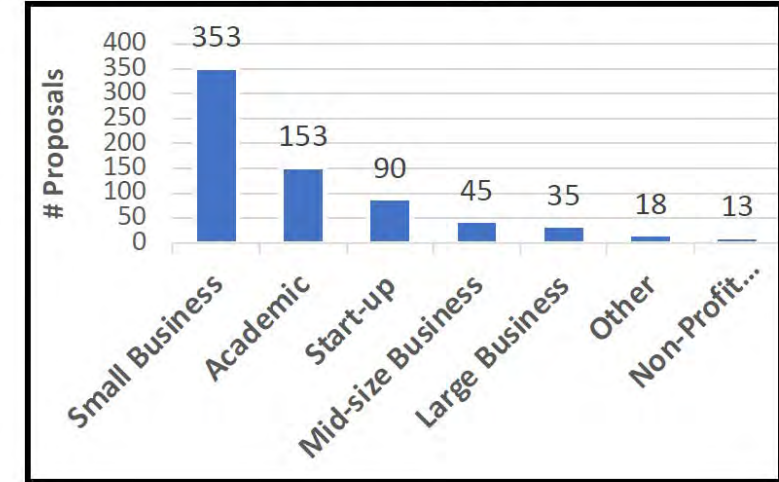


Assay Types:
Nucleic Acid
Viral Antigen

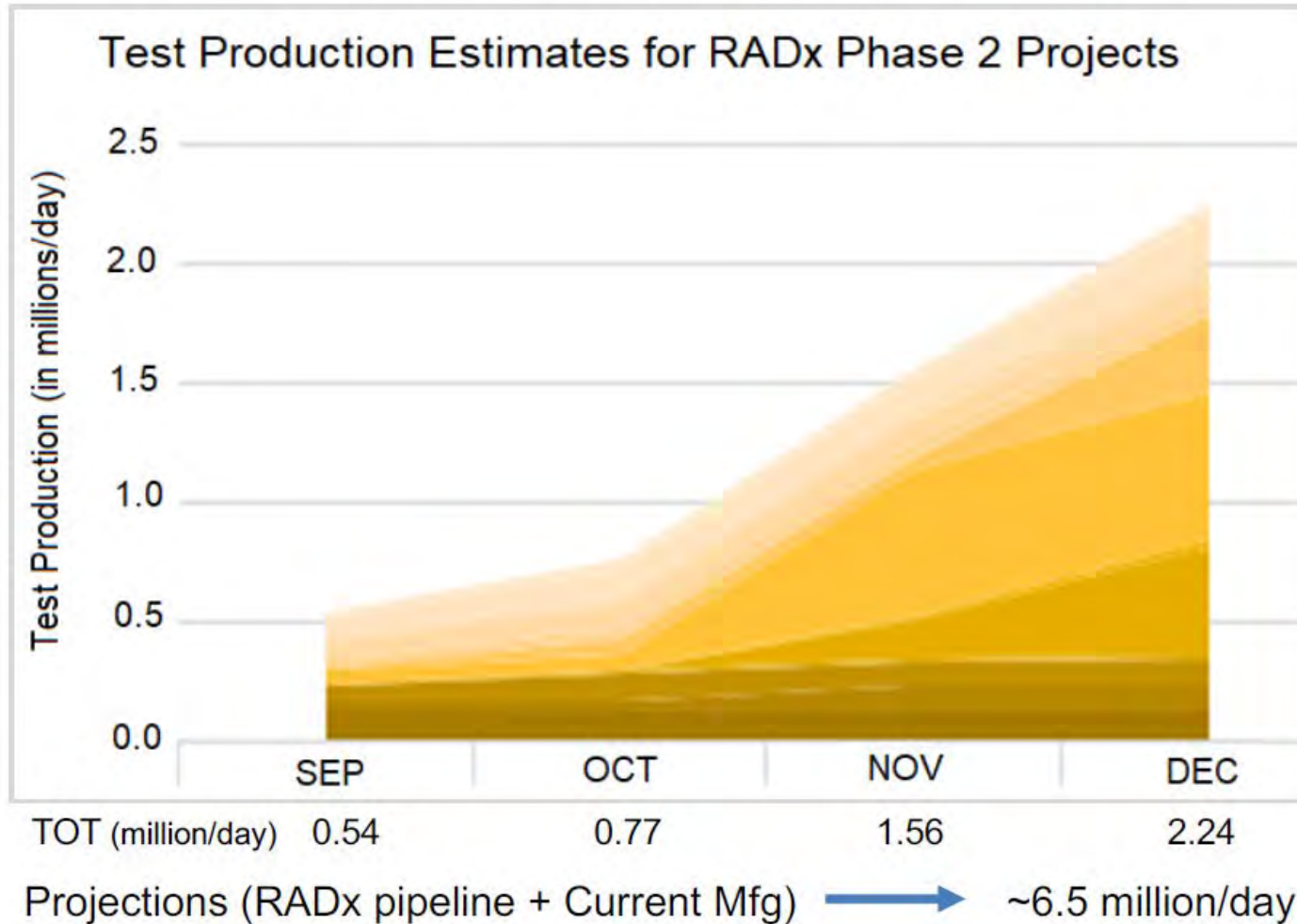
Technology Innovation:

- 1) Separation/concentration
- 2) Fluidics
- 3) Chemistries, e.g. CRISPR
- 4) Labels, Reporters
- 5) Readout Tech
- 6) Miniaturization
- 7) Automation

Broad Response



RADx (Tech/ATP) 16 Phase 2 Awards: \$378 Million



Point-of-care tests

- MatMaCorp, Lincoln, NE
- Maxim Biomedical Inc, Rockville, MD
- Mesa Biotech, San Diego, CA
- MicroGEM International, Charlottesville, VA
- Quidel, San Diego, CA
- Talis Biomedical, Menlo Park, CA

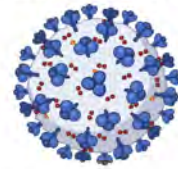
Lab-based tests

- Aegis Sciences, Nashville, TN
- Broad Institute, Cambridge, MA
- Ceres Nanoscience Inc, Manassas, VA
- Fluidigm, San Francisco, CA
- Ginkgo Bioworks, Boston, MA
- Helix OpCo, San Mateo, CA
- Illumina, San Diego, CA
- Mammoth Biosciences, Inc, South San Francisco, CA
- PathGroup, Nashville, TN
- Sonic Healthcare USA, Austin, TX

Intramural Update - Trans-NIH National COVID19 Serosurvey

SARS-CoV-2 Serosurvey Studying the Evolution of a Pandemic

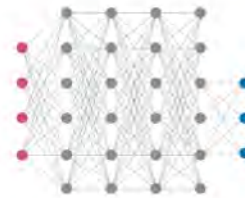
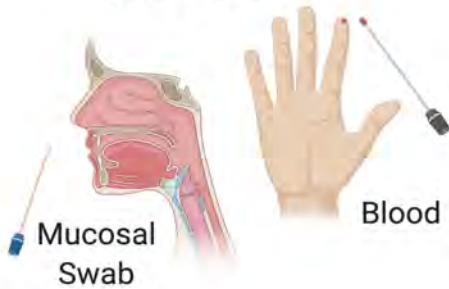
NIBIB NIAID NCATS FNLCR



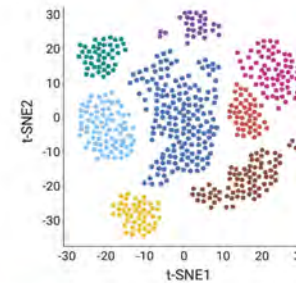
Time = Peak first wave (Summer 2020)
6 and 12 month follow-up



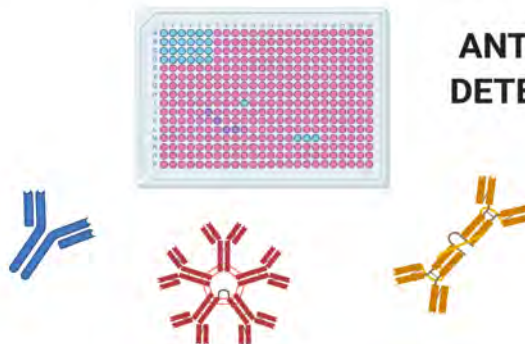
REMOTE SAMPLING



DATABASE DEVELOPMENT



ANTIBODY DETECTION



ASSAY AUTOMATION



Kaitlyn Sadtler, PhD
NIBIB Intramural PI

- 10,000 US donors
- Trans-IC Effort:
NIBIB, NIAID, NCATS, FNLCR
- Received and analyzed 8600 samples, Submitted EUA
- Completed enrollment of 11,300 donors as of 08/14/2020
- Examining mucosal immunity

Diversity, Equity and Inclusion: *NIBIB* Community

Science
\$15
13 SEPTEMBER 2020
science.org
MAAS

Systemic equity in education

Too often in higher education, the legacy of laws, policies, and practices that have systematically denied educational opportunities to Blacks is ignored, thereby perpetuating racial inequities. In the United States, higher education is a key route to career success and upward socioeconomic mobility. Unfortunately, this path is increasingly becoming most accessible to privileged communities. As the new president of Olin College of Engineering in Massachusetts, and as a woman of color, I am in a position to help unburden higher education from systemic racism and promote positive change that extends beyond academic boundaries.

My parents instilled in me the importance of education for personal and familial uplifting as well as a means

of helping other Black Americans to achieve success. They reminded me that all people are created equal and have inalienable rights—a right to education among them. At a young age, I realized why they tried to enforce this notion. I vividly recall that as a third grader in 1963, I had to walk past a newly built all-white school to be picked up and bused to a dilapidated all-Black school in another part of Panama City, Florida. I wondered what it was like inside. Surely the pristine brick exterior and the well-appointed playground were indicators that, within those walls, white students had new and current textbooks, unlike the worn and outdated ones in my Black

to obtain advanced

educated Black
I eventually
doctorate in c
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gree; and the f
a tenure-track
is discouraging
my journey ren
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ogy, engineering
of diversity am
schools. This c
and feeds a vic
models and me



Gilda Barabino, Ph.D.

to achieve a sense of belonging and limit career choices and opportunities for Black students and faculty, further perpetuating the persistent underrepresentation. Today, 3.9% of students in the United States who graduate with a bachelor's degree in engineering are Black. And only 4.1% of students who graduate with a Ph.D. in engineering in the nation are Black.

Dismantling systemic racism in higher education will require efforts to think and operate in new ways beyond existing programs that support students of color; these efforts are

“It’s time to abandon the myth that students and faculty of color can’t be found.”

Perspectives | Expert Voices in Health & Health Care

NATIONAL ACADEMY OF MEDICINE

Engineering Better Medicine for Public Health Crises and the Future

Roderic I. Pettigrew, PhD, MD, Chief Executive Officer of Engineering Health (EnHealth), Executive Dean for Engineering Medicine, Texas A&M University and Houston Methodist Hospital

July 27, 2020

When my brother told me he had been diagnosed with COVID-19, I was scared. I immediately jumped to visions of his coma, which he described as a chain around his chest. I saw COVID-19 patients at so many hospitals and all of the patients who had died. As we now know, African American brothers are several times more likely to die from COVID-19 than someone who is white [1].

In my home state of Georgia, for example, 80 percent of all patients hospitalized due to COVID-19 in March 2020 were Black people. Nationally through June, American Indians, Native Alaskans, and Black people have had a hospitalization rate that is five times more than whites. For Hispanic people it is four times higher



“...while our nation fights the pandemic, it must simultaneously work on addressing systemic inequities and the social marginalization of minority communities that is making the pandemic worse for everyone.”

care that is effective and immunomodulatory drugs, and highly effective vaccines with simple - even self-administered - delivery systems. Engineers are critical to further enhance tele-

Diversity, Equity and Inclusion: *NIBIB Community*



Gilda Barabino, Ph.D.



Roderic Pettigrew, Ph.D., MD

NIBIB Community:

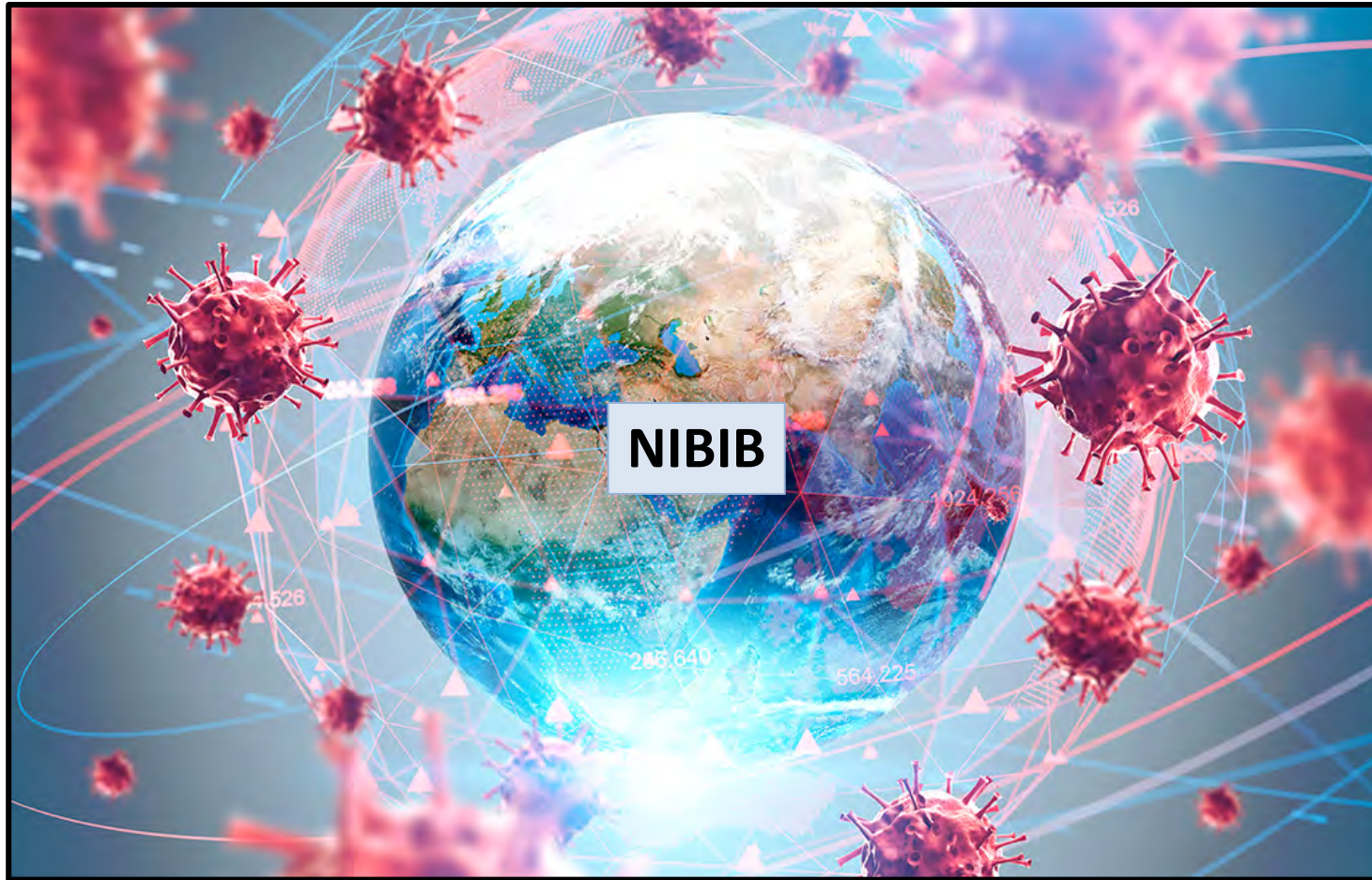
- Intellectually Diverse and Embracing of New Ideas
- Problem Solvers: Blend Technology and Altruism
- Diversity Essential For Growth, Success

Co-Chairs of New Advisory Council Working Group

- Developing Diverse, Inclusive Workforce and Leadership
- Addressing Structural and Systemic Barriers, Bias
- Advancing Technology for Reducing Disparities, Improving Access

Action Item:
Council volunteers

COVID-19 Pandemic



“Super-Bowl” for Our Field (2nd Quarter)

- Expand Budget, Visibility
- Implement Vision & Mission
- Galvanize Community
- *Opportunity for Broader Societal and Health Impact via Technology*