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





National Institute of Biomedical Imaging and Bioengineering





NIBIB Council Director's Report 09-15-2020

Jill Heemskerk Deputy Director



David George Associate Director



Richard Leapman Scientific Director



Kris Kandarpa Strategic Initiatives





Pam Glikman

NIBIB Council Director's Report 09-15-2020





Ringel









Ahmad El Hendawy



Remembering Sanjiv "Sam" Gambhir



- 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.





H National Institute of Biomedical Imaging and Bioengineering

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

lational Institute o

- 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

National Institute of

Biomedical Imaging and Bioengineering

NIF



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



Shawn Chen, Ph.D.

Moving On

- Recruited from Gambhir Lab, Stanford, 2009
- Created NIBIB's Lab of Molecular Imaging and Nanomedicine
 - o Imaging
 - Molecular probes with high specificity, optimized pharmacokinetics
 - o "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



Saltanat Satabayeva, MSc, PMP



National Institute of Biomedical Imaging and Bioengineering



National Institute of Biomedical Imaging and Bioengineering

Scientific Program Analyst Division of Discovery Science and Technology



EHR Consultant Defense Health Agency



National Institute of Biomedical Imaging and Bioengineering

Scientific Program Analyst Division of Health Informatics Technologies



Budget Update

May-Sept Obligations 2014 - 2020





Budget Update

May-Sept Obligations 2014 - 2020



National Institute of Biomedical Imaging and Bioengineering

Budget Update

May-Sept Obligations 2014 - 2020





Alzheimer's Supplements: NIA Program





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.



Biomedical Imaging and Bioengineering

https://grants.nih.gov/grants/guide/notice-files/NOT-AG-20-034.html

COVID-19 Supplements: NIBIB Program

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

NOSI Budget Distribution





National Institute of Biomedical Imaging and Bioengineering

Harnessing Data Science for Health Discovery and Innovation in Africa

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



DS-I Africa

National Institutes of Health Office of Strategic Coordination - The Common Fund



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



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

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

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NIH

https://commonfund.nih.gov/africadatasymposium/events-schedule



NIH HEAL Initiative Workshop on MYOFASCIAL PAIN

NIH · Helping to End Addiction Long-term

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

September 16-17, 2020

National Institute of Biomedical Imaging and Bioengineering

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

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



Guoying Liu



New NIH Common Fund Initiative (led by NIBIB, NLM and NHGRI):

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



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Grace Peng, Ph.D.
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Biomedical Imaging

and Bioengineering

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

ightarrow Online breakout groups for each Grand Challenge idea

NIH Technology Accelerator Challenge (NTAC)



Tiffani Lash



TECH ACCELERATOR CHALLENGE FOR GLOBAL HEALTH

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





Jill Heemskerk



Behrouz



6 winners announced Sept 10, 2020!

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



Taylor Gilliland, NIH OD



National Institute of Biomedical Imaging and Bioengineering

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

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.*

DEBUT Design by Biomedical Undergraduate Teams Challenge



52 applications from **32** universities in **18** states

Total of 250 students engaged

National Institute of Biomedical Imaging and Bioengineering



86 applications from 46 universities in 20 statesTotal of 410 students engaged



2020

DEBUT Design by Biomedical Undergraduate Teams Challenge



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

Nailfold Capillaroscopy for Onchocerciasis Diagnosis



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

Urine-based test to detect tuberculosis biomarker



National Institute of Biomedical Imaging and Bioengineering Third Place- \$10,000 **Saving Intestines at Birth** (Duke University)

Gastroschisis Silos for Sub-Saharan Africa

Award ceremony at

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



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NIH National Institute of Biomedical Imaging and Bioengineering

DEBUT Design by Biomedical Undergraduate Teams Challenge



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



National Institute of **Biomedical Imaging** and Bioengineering

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





COVID-19 Pandemic



Bio-Engineering



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



Medical Imaging and Data Resource Center (MIDRC)

NORTH

DAKOTA

SOUTH

MONTANA

23 Institutions

NEW MEXICO

OLas Vegas

ARIZONA

University of Washingt.

San F

Stanford University



Kris Kandarpa *Chair*



Guoying Liu Scientific Program Lead



Behrouz Shabestari NIBIB National Technology • Center Program Director



Maryellen Giger (PI) AAPM, University of Chicago

National Institute of Biomedical Imaging and Bioengineering • Two-year, \$20M contract: Medical Imaging/Data Science

Dalla

MD Anderson Cancer

TEXAS

• Thoracic imaging and clinical data repository for COVID 19

FDA - Silver Spring

Emory University

Moffitt Cancer Center ..

• Develop, validate machine learning algorithms for detection, diagnosis, Tx



Radiological Society of North America





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)





Tara Schwetz

Larry Tabak

Jill Heemskerk

RADx Tech – \$500M

Highly competitive, rapid three-phase challenge to identify the best candidates for athome 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 pneu- of RADx and their goals, and we end with a remonia cases in the city of Wuhan, China, view of the challenges ahead. emerged in December 2019, heralding a global On April 24, 2020, Congress appropriated pandemic. As of July 13, 2020, more than 3.3 \$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)





Tara Schwetz Larry Tabak



Jill Heemskerk

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RADx Tech & ATP Goals

Expand COVID-19 Testing Technologies: Number, Type and Access Optimize Performance: Technologic and Operational; Match Essential "Use Cases"



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

RADx Innovation Funnel



NIH National Institute of Biomedical Imaging and Bioengineering

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



Landscape of RADx Tech Proposals



Assay Types: Nucleic Acid Viral Antigen

Broad Response



Technology Innovation:

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

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

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www.nibib.nih.gov/covid-19/radx-tech-program/radx-tech-phase2-awards

Intramural Update - Trans-NIH National COVID19 Serosurvey



Biomedical Imaging and Bioengineering



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 States Systemic equity in education

oo 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 and antidated amon in my Black

educated Black I eventually doctorate in cl sity; the fifth gree; and the f a tenure-track is discouraging my journey ren dents interested ogy, engineerin of diversity am schools. This e and feeds a vici

"It's time to abandon the myth that students and faculty of color can't be found."



Gilda Barabino, Ph.D

to active a sense or 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 offents

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

care

effic

July 27, 2020

When my brother told with COVID-19, I was scar iumped to visions of his c ma, which he described chain around his chest. ID-19 patients at so many and all of the patients wh alive. As we now know, A brother are several times VID-19 than someone who



"...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 that worse for everyone."

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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



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