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
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

• 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

- 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

• 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.

Dr. Kathryn R. Nightingale
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
Shawn Chen, Ph.D.


designed 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
Scientific Program Analyst
Division of Discovery Science and Technology

Saltanat Satabayeva, MSc, PMP
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

1) Grant Supplement Programs
2) Common Fund Initiatives
3) Special COVID contracting (RADx)
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)

<table>
<thead>
<tr>
<th>Applicant(s)</th>
<th>NOSI Number</th>
<th>Contact</th>
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<tr>
<td>Current Grantees</td>
<td>NOT-EB-20-008</td>
<td>Program Director on existing award</td>
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<td>(most mechanisms)</td>
<td></td>
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<tr>
<td>SBIR/STTR (R41, R42, R43, R44)</td>
<td>NOT-EB-20-006</td>
<td><a href="mailto:NIBIB-SBIR@mail.nih.gov">NIBIB-SBIR@mail.nih.gov</a></td>
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<tr>
<td>RPGs (R01, R21, R03)</td>
<td>NOT-EB-20-007</td>
<td><a href="mailto:COVID19NIBIB@mail.nih.gov">COVID19NIBIB@mail.nih.gov</a></td>
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For more information:

NOSI Budget Distribution

- 21 Awards
- $8,420,883
More expected

POC 32%

Digital Health 12%
Therapeutic Agent 8%
Telemedicine 2%

COVID Diagnosis - Radiology 12%
COVID Diagnosis - Wearable Sensors 5%
Sensor, Imaging and Platform Development 29%
Harnessing Data Science for Health Discovery and Innovation in Africa

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

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

DS-I Africa

Tiffani Lash, PhD

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)

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<table>
<thead>
<tr>
<th>Date</th>
<th>Upcoming Session Topics</th>
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<tr>
<td>Sept 23</td>
<td>Leveraging Data Science Approaches to Address Environmental Health Challenges in Africa</td>
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<tr>
<td>Sept 30</td>
<td>Biomedical Informatics and Data Sciences in Africa</td>
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<td>Oct 7</td>
<td>Innovative Approaches to Improve Maternal and Child Health</td>
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<td>Oct 13</td>
<td>Infectious Diseases</td>
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<td>Oct 14</td>
<td>COVID-19</td>
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<tr>
<td>Oct 21</td>
<td>Innovations in Health Metrics Sciences: Measuring, Mapping, and Monitoring Morbidity and Mortality at the Regional, National, and Local Levels in Africa</td>
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RFA-RM-20-015, 016, 017, 018

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

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

*Includes biological and behavioral studies

**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

Grace Peng, Ph.D.
NIH Technology Accelerator Challenge (NTAC)

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

6 winners announced Sept 10, 2020!

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

BMGF POC team: Dan Wattendorf, Andrew Trister, Arunan Skandarajah, Jessica Lee
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.
3rd Prize: $100,000 (4-way tie)

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

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

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

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

Honorable Mention: James Y. Suen, CytoAstra, LLC; University of Arkansas for Medical Sciences, Yale. Cytophone
Design by Biomedical Undergraduate Teams Challenge

2019

52 applications from 32 universities in 18 states
Total of 250 students engaged

2020

86 applications from 46 universities in 20 states
Total of 410 students engaged

$100,000 Awards

Zeynep Erim Ph.D.
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*

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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The Onchoscope: A Diagnostic Tool Using Nailfold Capillaroscopy
HIV/AIDS Prize- $15,000
**CytoScope** *(Johns Hopkins University)*
The Future of HIV Monitoring: CD4 estimator

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.

Venture Well Winners

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

1) Imaging and AI
2) Digital Health Platforms
3) Diagnostic Test Technologies
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
Rapid Acceleration of Diagnostics (RADx)

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

$1.5B to NIH; $500 Million to NIBIB

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

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

Applications Started:
~3000

Projects in each Phase:
707
125
33
16

END OF SUMMER/FALL 2020

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

DEPLOY MILLIONS of tests per week

Rolling submission open April 29

5-6 Months
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](https://www.poctrn.org)

**Project Tech:**
1) Review
2) Funding
3) Expertise
4) Testing

**Validation Core**

**Clinical Studies Core**

**Scale up Core**
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
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

Projections (RADx pipeline + Current Mfg) ~6.5 million/day
Intramural Update - Trans-NIH National COVID19 Serosurvey

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

REMOTE SAMPLING
Mucosal Swab
Blood

ASSAY AUTOMATION

DATABASE DEVELOPMENT

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

ANTIBODY DETECTION

• 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

Kaitlyn Sadtler, PhD
NIBIB Intramural PI
Diversity, Equity and Inclusion: NIBIB Community

Science

Systemic equity in education

T
o 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 uplift 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 books I had. In Black education, systemic racism still exists, and it is up to our institutions to address this systemic inequity.

The lack of access to advanced degrees for Black Americans is a reality that can be overcome. I eventually obtained my doctorate in chemistry, the fifth in my family; and the fact that a tenure-track is discouraging my young scientists is another example of diversity and inclusion.

Gilda Barabino, Ph.D

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 that COVID-19, I was scared. I jumped to visions of his chil-

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 that COVID-19, I was scared. I jumped to visions of his child, who is 3 years old, and all of the patients who are alive. As we now know, a brother is several times more likely to have COVID-19, and someone who is more likely to die.

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.

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.
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