DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTES OF HEALTH

NATIONAL ADVISORY COUNCIL FOR BIOMEDICAL IMAGING AND BIOENGINEERING

Summary of Meeting[1]
September 12, 2017

The National Advisory Council for Biomedical Imaging and Bioengineering (NACBIB) was convened for its 45th meeting on September 12, 2017, at the Bolger Center in Potomac, Maryland. Dr. Roderic I. Pettigrew, Director of the National Institute of Biomedical Imaging and Bioengineering (NIBIB), presided as Council chairperson. In accordance with Public Law 92-463, the meeting was open to the public from 9:00 a.m. to 12:50 p.m. for review and discussion of program development, needs, and policy. The meeting was closed to the public from 2:00 p.m. to 2:50 p.m. for the consideration of grant applications.

Council members present:
Dr. Richard Buxton, University of California, San Diego, La Jolla, CA
Dr. Carol Espy-Wilson, University of Maryland, College Park, MD
Dr. David Grainger, University of Utah, Salt Lake City, UT
Dr. Raphael Lee, University of Chicago, Chicago, IL
Dr. John H. Linehan, Northwestern University, Evanston, IL
Dr. Charles Mistretta, University of Wisconsin, Madison, Madison, WI
Dr. A. Gregory Sorensen, Imris Deerfield Imaging USA, Minnetonka, MN
Dr. Daniel Sullivan, Duke University Medical Center, Durham, NC

Council members attending by telephone:
Dr. Kristi Anseth, University of Colorado, Boulder, Boulder, CO
Dr. Karen Hirschi, Yale University, New Haven, CT
Dr. Carolyn Meltzer, Emory University Hospital, Atlanta, GA

Ex officio member present:
Dr. Vincent Ho, Uniformed Services University of the Health Sciences, Bethesda, MD

Ex officio members absent:
Dr. Francis Collins, National Institutes of Health, Bethesda, MD
Dr. Anne Plant, National Institute of Standards and Technology, Gaithersburg, MD
Dr. Thomas Price, National Institutes of Health, Bethesda, MD
Dr. Sohi Rastegar, National Science Foundation, Arlington, VA

Chairperson:
Dr. Roderic I. Pettigrew

Executive Secretary:
Dr. David T. George

[1] For the record, it is noted that members absent themselves from the meeting when the Council is discussing applications (a) from their respective institutions or (b) in which a conflict of interest may occur. This procedure only applies to applications that are discussed individually, not to "en bloc" actions.

Also present:

NIBIB staff present for portions of the meeting:

Ms. Roberta Albert
Dr. Tatjana Atanasijevic
Dr. Richard Baird
Dr. Michael Cheetham
Ms. Shirley Coney-Johnson
Ms. Emily Conlan
Ms. Christine Cooper
Ms. Zoe Ann Copeland
Mr. Anthony Dorion
Ms. Jacklyn Ebiasah
Ms. Kate Egan
Mr. Jason Ford
Ms. Pam Glikman
Dr. John Hayes
Dr. Jill Heemskerk
Dr. Dennis Hlasta
Ms. Mary Hogan
Dr. John Holden
Ms. Alisha Hopkins
Dr. Rosemarie Hunziker
Dr. Thomas Johnson
Dr. Krishna Kandarpa
Dr. Chris Kelley
Dr. Randy King
Dr. Steven Krosnick
Ms. Tiffani Bailey Lash
Dr. Richard Leapman
Dr. Guoying Liu
Dr. Shadi Mamaghani
Dr. Rishi Mathura
Mr. Mark Murdock
Dr. Vinay Pai
Dr. Grace Peng
Mr. Brandon Pleasants
Dr. Edward Ramos
Dr. David Rampulla
Ms. Vicki Rein
Dr. Antonio Sastre
Ms. Saltanat Satabayeva
Dr. Seila Selimovic
Dr. Behrouz Shabestari
Mr. Shaun Sims
Ms. Ashley Storm
Dr. Manana Sukhareva
Ms. Holly Taylor
Dr. Shumin Wang
Dr. Andrew Weitz
Dr. Michael Wolfson
Ms. Li-Yin Xi
Dr. Huaying Zhao
Dr. Ruixia Zhou
Dr. Steven Zullo

Non-NIBIB National Institutes of Health (NIH) employees:

Dr. Rajeev Agarwal, Office of Research on Women's Health, NIH
Ms. Gretchen Buckler, Office of Research on Women's Health, NIH

Members of the public present for portions of the meeting:

Mr. Martin Berrios, Bolger Center, Potomac, MD
Ms. Casey Cappelletti, Academy of Radiology Research, Washington, DC
Ms. Renee Cruea, Academy of Radiology Research, Washington, DC
Mr. Dan Eckstein, NOVA Research Company, Silver Spring, MD
Ms. Martha Nolan, Academy of Radiology Research, Washington, DC
Ms. Ariana Olshan, McAllister & Quinn, Washington, DC
Ms. Kathy Sedgwick, NOVA Research Company, Silver Spring, MD
Ms. Breanna Todd, Academy of Radiology Research, Washington, DC
Dr. Bruce Tromberg, University of California, Irvine, Irvine, CA
Ms. Ye Wan, Academy of Radiology Research, Washington, DC
Mr. David Zinn, Academy of Radiology Research, Washington, DC

I. Call to Order: Dr. David T. George

Dr. David T. George called to order the 45th meeting of the National Advisory Council for Biomedical Imaging and Bioengineering. He reminded attendees that the morning session of the meeting was open to the public and welcomed attendees.

II. Director's Remarks: Dr. Roderic I. Pettigrew

A. NIBIB Awards, Transitions, and New Staff

Dr. Peter Schuck, an investigator in NIBIB's Laboratory of Cellular Imaging and Macromolecular Biophysics, received the 2017 James J. Christensen Memorial Award for his outstanding innovative contributions to the development and use of calorimetric instrumentation.

Dr. Pettigrew said farewell to recently departed NIBIB staff members: Ms. Keisha Whitaker-Duncan, Dr. Antonio Sastre, and Mr. Matthew Quade. He welcomed new staff to NIBIB: Dr. Tatjana Atanasijevic, Scientific Program Analyst; Ms. Jacklyn Ebiasah, Scientific Program Analyst; Ms. Artavia Mitchell, Program Assistant; and Dr. Shadi Mamaghani, Scientific Program Manager, Division of Discovery Science and Technology.

B. NIH/NIBIB Budget

A Continuing Resolution (CR) will fund the federal government at the current level through December 8, 2017. The CR includes a specific callout for support of the 21st Century Cures Act, which funds major initiatives such as Brain Research through Advancing Innovative Neurotechnologies (BRAIN), Precision Medicine, Alzheimer's disease, and the Cancer Moonshot.

C. NIH Activities

Next Generation Researchers Initiative: NIH will launch this initiative to address challenges faced by researchers who are trying to embark upon or sustain independent research careers. The intent is to prioritize support for early-stage investigators and early-established investigators and improve retention of these investigators as they transition to established careers.

New NIH Clinical Trials Requirements: In August, NIH announced new clinical trials requirements for grants and contracts, in line with the NIH clinical trials definition. The requirements are designed to enhance study efficiency, transparency, accountability, and reporting. Future clinical trial research grant applications must be submitted to a Funding Opportunity Announcement (FOA) specific to clinical trials.

NIH-Gates Foundation Global Health Workshop: This fourth-annual workshop focused on infectious disease, vaccine development, and HIV prevention and therapy as well as immunotherapy, which is closely tied to NIBIB's interest in immunoengineering. Dr. Pettigrew moderated a point-of-care diagnostics session that featured development of smartphone-based home diagnostics for influenza and other infectious diseases.

D. NIBIB Activities

Synthetic Biology for Engineering FOA: This initiative will support tools, technologies, and interdisciplinary collaborations for redesign of biological systems tailored for biomedical solutions.

Point-of-Care Technologies Network Centers FOA: This initiative aims to support development and application of point-of-care (POC) technologies that merge scientific and technological capabilities with clinical need. Five other Institutes and Centers (ICs) have joined NIBIB in supporting this effort—the Fogarty International Center, the National Center for Complementary and Integrative Health, the National Heart, Lung, and Blood Institute, the National Institute on Aging, and the Office of Behavioral and Social Sciences Research.

NIBIB Exploratory/Developmental Research Grant Program FOA: This R21 program aims to support research that leads to breakthroughs in development of innovative technologies, methodologies, and models. This program provides early stage funding to make inroads into completely new areas of research.

News and Science Highlights

Microneedle Patch for Influenza Vaccination: NIBIB Quantum Grantee Dr. Mark Prausnitz has reported successful conduct of a phase I clinical trial of a microneedle patch that enables painless self-administration of flu vaccine. After application to the wrist, the microneedles dissolve within 5 minutes, delivering vaccine through the skin. The vaccine is a temperature-stable solid that could be delivered by mail.

Design by Biomedical Undergraduate Teams (DEBUT) Challenge: The 2017 DEBUT challenge engaged 224 students from 22 universities in 16 states. First-place winners from the University of Maryland, College Park, investigated an approach for early diagnosis of Alzheimer's disease that uses machine learning. Second-place winners from Arizona State University built a tool to track functional brain areas for use in awake neurosurgery. The third-place winners from The Johns Hopkins University developed a device that dramatically simplifies the placement of corneal grafts.

International Robotics Competition: In the FIRST Global Robotics Competition, NIBIB staff mentored Team Venezuela in a 3-day "coopetition" where teams built robots to model the separation of pure water from contaminants.

E. Science Highlights

New Insights in Genome Architecture: Dr. Ed Ramos presented a science highlight from NIBIB-funded researchers who have used an electron microscopy tomography (EMT) technique called ChromEMT to reveal the ultrastructural and three-dimensional (3D) organization of individual chromosomes *in situ*. The observed flexible and disordered 5- to 24-nm-diameter granular chain model challenges long-standing textbook representations of the chromosome structure. The ability to visualize the fine structure of chromatin and its global organization offers opportunities for new areas of research such as the discovery of novel drug targets to better combat disease.

Early Pancreatic Cancer Cyst Dysplasia Assessment: Dr. Behrouz Shabestari presented a science highlight from NIBIB-supported investigators who have developed an optical biopsy tool for early detection of cancerous pancreatic cysts during endoscopy. The new device uses light scattering spectroscopy (LSS) technique that provides structural and functional information about living tissues to inform early diagnosis and potential treatments. LSS identifies malignant potential of pancreatic cystic lesions with high accuracy during regular endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) biopsy procedures. The technique is rapid and inexpensive and integrates well into existing diagnostic approaches. Used routinely, the technique could reduce unnecessary pancreatic surgery for benign cysts and significantly improve malignancy detection in early treatable stages.

Printable Pressure Sensors: Dr. Seila Selimovic presented a science highlight from NIBIB-funded investigators who have developed 3D printed, compressible pressure sensors that could dramatically improve robotic surgical instruments or prostheses. An engineered portable 3D printer uses off-the-shelf polymer ink that cures at room temperature and can be printed directly on tissue, e.g. skin. The sensors measure externally applied pressure, and could be combined with a haptic system to provide feedback to the user. A sensor was worn for three consecutive days with no degradation of data. The investigators now are working to add wireless signal transmission capability to the sensors.

III. BRAIN Update: Dr. Bruce Rosen, NIBIB Representative to the BRAIN Multi-Council Working Group

Dr. Rosen reported on progress with the BRAIN initiative. The BRAIN 2025 report prioritized technological development and validation for the first phase of the initiative, with growing emphasis on problem-driven neuroscience after FY2020. The goal is to see neural circuits in action and understand how the brain works, plans, and executes. This understanding will lead to new approaches to diagnosis and treatment of elusive brain disorders. Toward these goals, the BRAIN Initiative has already made major scientific advancements in

brain imaging technology and neural connectivity mapping.

Dr. Rosen summarized active BRAIN funding opportunities. New initiatives of particular interest to the NIBIB research community focus on characterizing brain circuits, developing innovative imaging technologies for use in human studies and work on theories, models, and methods of data analysis.

Other initiatives include technology development to study cells and circuits, and research center networks to build a comprehensive atlas of mouse, non-human primate, and human brain cells. New Requests for Applications (RFAs) in FY2018 will include tools for non-neuronal brain cells and to facilitate high-throughput microconnectivity analysis.

Ongoing initiatives on training and dissemination support the career advancement of researchers looking to build skills in a cross-disciplinary science and to promote diversity. Plans for FY2018-19 include resource grants for technology integration and dissemination, and faculty recruitment in quantitative neuroscience.

With the BRAIN initiative's strong focus on and continued need for new technology development, Dr. Rosen emphasized the importance of NIBIB's participation in the BRAIN initiative.

IV. Strategic Planning Process: Dr. Jill Heemskerk

Dr. Heemskerk outlined progress on the NIBIB strategic planning process and the opportunity for the NACBIB Strategic Planning Working Group to provide input into development of the plan. The Working Group is co-chaired by Drs. Carolyn Meltzer and John Linehan. Members include current Council members and Drs. Bruce Rosen and Bruce Tromberg. The group has met twice to provide input to NIBIB's proposed high-level strategic objectives. Work on the strategic plan will continue with a progress update at the January Council meeting.

V. Fourth Annual Lopez Lecture: Precision Measurement in Medicine: Dr. Stephen Quake

Dr. Quake presented an overview of his work in precision measurement with a focus on innovations in microfluidics and assays that eliminate or reduce the need for invasive procedures. Microfluidics takes advantage of the unusual physics at small length scales, allowing for unique capabilities not otherwise possible.

Dr. Quake outlined how advances in microfluidics led to development of a protein crystallization technology capable of analyzing pharmaceutically important structures. Commercial applications of microfluidics include high-density valves, droplet emulsions, and microfabricated well plates. A combination of microfluidics, polymerase chain reaction (PCR) and multiple displacement amplification (MDA), high-throughput sequencing technologies, and single-cell manipulation technologies enables study of single-cell genomics in virtually any organism. Applications have included exploration of distinct cell types in the developing lung and analysis of lung cancer.

Dr. Quake expects cell-free DNA will be particularly useful in monitoring cancer survivors for recurrence and for assessing transplanted organ rejection without a tissue biopsy. Dr. Quake noted the importance of building a strong foundation in an academic setting—proof-of-principle studies and publication—and working with technology transfer offices to build confidence of potential investors.

VI. Adjournment

The open session of the NACBIB meeting was adjourned at 12:50 p.m.

VII. Closed Session

Review of Council Procedures and Regulations: Dr. David T. George

The grant application review portion of the meeting was closed to the public in accordance with provisions set forth in Section 552b(c)(4) and 552b(c)(6), Title 5, U.S. Code, and 10(d) of the Federal Advisory Committee Act, as amended (5 U.S.C. appendix 2). The closed session was adjourned at 2:50 p.m.

Certification:

We certify that, to the best of our knowledge, the foregoing minutes are accurate and complete.[2]

David George

David T. George, Ph.D.
Executive Secretary
National Advisory Council for Biomedical Imaging and Bioengineering
Acting Associate Director for Research Administration
National Institute of Biomedical Imaging and Bioengineering

Jill Heemskerk, Ph.D.
Chairperson,
National Advisory Council for Biomedical Imaging and Bioengineering
Acting Director,
National Institute of Biomedical Imaging and Bioengineering

[2] These minutes will be approved formally by the Council at the next meeting on January 18, 2018, and corrections or notations will be stated in the minutes of that meeting.