

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTES OF HEALTH
NATIONAL CANCER INSTITUTE
15th VIRTUAL NATIONAL CANCER ADVISORY BOARD**

**Summary of Meeting
September 1, 2021**

**Virtual Meeting
National Cancer Institute
National Institutes of Health
Bethesda, Maryland**

**NATIONAL CANCER ADVISORY BOARD
BETHESDA, MARYLAND
Summary of Meeting
1 September 2021**

The National Cancer Advisory Board (NCAB) convened for its 15th virtual regular meeting on 1 September 2021. The meeting was open to the public on Wednesday, 1 September 2021, from 1:05 p.m. to 4:23 p.m., and closed to the public from 4:32 p.m. to 5:45 p.m. The NCAB Acting Chair, Dr. Scott W. Hiebert, Hortense B. Ingram Chair in Cancer Research, Professor of Biochemistry, Department of Biochemistry, Vanderbilt University School of Medicine, presided during both the open and closed sessions.

NCAB Members

Dr. Scott W. Hiebert (Acting Chair)
Dr. Peter C. Adamson
Dr. Francis Ali-Osman
Dr. Anna D. Barker
Dr. Deborah Watkins Bruner
Dr. Yuan Chang (absent)
Dr. Howard J. Fingert
Mr. Lawrence O. Gostin (absent)
Dr. Andrea A. Hayes-Jordan
Dr. Nikan Khatibi
Dr. Timothy J. Ley
Dr. Electra D. Paskett
Dr. Nancy J. Raab-Traub
Dr. Margaret R. Spitz
Dr. Susan Thomas Vadaparampil
Dr. Max S. Wicha

President's Cancer Panel

Dr. John P. Williams (Chair) (absent)
Mr. Robert A. Ingram (absent)
Dr. Edith P. Mitchell

Alternate Ex Officio NCAB Members

Dr. Michael A. Babich, CPSC (absent)
Dr. Joseph R. Graber, DOE (absent)
Dr. Michael Kelley, VA
Dr. Gwen W. Collman, NIEHS
Dr. Richard Pazdur, FDA (absent)

Dr. Craig D. Shriver, DoD
Dr. Kerry Souza, NIOSH (absent)
Dr. Lawrence A. Tabak, NIH (absent)
Dr. Aaron Tustin, OSHA

Members, Scientific Program Leaders, National Cancer Institute, NIH

Dr. Norman E. Sharpless, Director, National Cancer Institute
Dr. L. Michelle Bennett, Director, Center for Research Strategy
Dr. Oliver Bogler, Director, Center for Cancer Training
Dr. Philip E. Castle, Director, Division of Cancer Prevention
Dr. Stephen J. Chanock, Director, Division of Cancer Epidemiology and Genetics
Dr. Henry P. Ciolino, Director, Office of Cancer Centers
Dr. Robert Croyle, Director, Division of Cancer Control and Population Sciences
Dr. William Dahut, Scientific Director for Clinical Research, Center for Cancer Research
Dr. James H. Doroshow, Deputy Director for Clinical and Translational Research
Dr. Dan Gallahan, Director, Division of Cancer Biology
Mr. Peter Garrett, Director, Office of Communications and Public Liaison
Dr. Satish Gopal, Director, Center for Global Health
Dr. Paulette S. Gray, Director, Division of Extramural Activities
Dr. Ed Harlow, Special Advisor to the NCI Director
Dr. Toby T. Hecht, Deputy Director, Division of Cancer Treatment and Diagnosis
Dr. Tony Kerlavage, Director, Center for Biomedical Informatics and Information Technology
Dr. Kristin Komschlies McConville, Acting Director, Office of Scientific Operations, NCI at Frederick
Dr. Douglas R. Lowy, Principal Deputy Director, National Cancer Institute
Dr. Glenn Merlino, Scientific Director for Basic Research, Center for Cancer Research
Dr. Tom Misteli, Director, Center for Cancer Research
Dr. Margaret Mooney, Associate Director, Cancer Therapy Evaluation Program
Dr. Henry Rodriguez, Director, Office of Cancer Clinical Proteomics Research
Mr. Jeff Shilling, Chief Information Officer and Chief of Infrastructure and Information Technology Services Branch, Center for Bioinformatics and Information Technology
Ms. Donna Siegle, Executive Officer and Deputy Director for Management, Office of the Director
Dr. Dinah Singer, Deputy Director, Science Strategy and Development
Dr. Sanya Springfield, Director, Center to Reduce Cancer Health Disparities
Dr. Louis M. Staudt, Director, Center for Cancer Genomics
Mr. Michael Weingarten, Director, Small Business Innovation Research and Small Business Technology Transfer Programs
Dr. Robert Yarchoan, Director, Office of HIV and AIDS Malignancy
Dr. Maureen Johnson, Executive Secretary, Office of the Director

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WEDNESDAY, 1 SEPTEMBER 2021

I. CALL TO ORDER AND OPENING REMARKS—DR. SCOTT W. HIEBERT

Dr. Scott W. Hiebert called to order the 15th virtual National Cancer Advisory Board (NCAB) meeting. He welcomed members of the Board, *ex officio* members, President’s Cancer Panel members, liaison representatives, staff, and guests. Members of the public were welcomed and invited to submit to Dr. Paulette S. Gray, Director, Division of Extramural Activities (DEA), National Cancer Institute (NCI), in writing and within 10 days, any comments regarding items discussed during the meeting. Dr. Hiebert reviewed the confidentiality and conflict-of-interest practices required of Board members in their deliberations.

Motion. A motion to accept the minutes of the 14–15 June 2021 Joint Meeting of the Board of Scientific Advisors (BSA) and the NCAB was approved unanimously.

II. FUTURE BOARD MEETING DATES—DR. SCOTT W. HIEBERT

Dr. Hiebert called Board members’ attention to the future meeting dates listed on the agenda.

III. NCI DIRECTOR’S REPORT—DR. NORMAN E. SHARPLESS

Dr. Norman E. Sharpless, Director, NCI, welcomed NCAB members and attendees to the 15th virtual meeting and provided an update on several NCI activities, the NCI budget, and cancer research progress.

National Cancer Act of 1971 (NCA) 50th Anniversary. Dr. Sharpless reminded the NCAB members that the NCI is continuing to commemorate the 50th anniversary of the NCA of 1971 and has been joined by other groups across the cancer community, including the NCI-Designated Cancer Centers (Cancer Centers), to reflect on five decades of progress. Social media outlets have been used to highlight and feature stories, some of which Dr. Sharpless noted later in his presentation. Dr. Sharpless commented that the NCA 50th anniversary is not just about the NCI; it is about everyone who has an investment in cancer research, from academia to industry to nonprofits and advocacy to philanthropy. Organizations have aligned with the NCI on the theme “Nothing Will Stop Us” to end the effects of cancer. To date, nine stories encompassing broad cancer-related topics have been featured on the [NCA 50th anniversary webpage](#), and the current topic focuses on the cancer research workforce. Members of the cancer research community are encouraged to share why they work in cancer research on social media using the hashtag, “#ThisIsWhy.”

Dr. Sharpless noted that the NCI’s efforts to commemorate the NCA—two of which he highlighted—have been well received. HealthCast, a podcast run by GovernmentCIO Media, has produced a miniseries focused on the 50th anniversary, with four episodes completed. In January 2021, *The Cancer Letter*—founded 2 years after the NCA—launched the collaborative [Cancer History Project](#), which is a publicly available historical cancer research online resource. A live event also was hosted on 17 June 2021 in collaboration with *The Washington Post*. Similar events are planned for late December 2021. The NCI’s remaining activities will focus on its vision for the next 50 years of cancer research. In addition, Dr. Sharpless noted that the NCA ensured high-level access of the NCI to Congress and the White House, appointed advisory committees (e.g., NCAB, the President’s Cancer Panel), and enabled the NCI Bypass Budget (i.e., Professional Judgment Budget) process, which he next discussed.

Annual Plan and Budget Proposal for Fiscal Year 2023. Dr. Sharpless announced that the NCI released its *Annual Plan and Budget Proposal for Fiscal Year 2023* in August 2021. This year, the NCI Professional Judgment Budget for fiscal year (FY) 2023 proposes \$7.8 billion (B) to increase R01

paylines to the 13th percentile, allowing a greater number of meritorious applications to be funded, including those for new and junior scientists. The NCI previously proposed a “5 in ’25” plan to increase funding for the Research Project Grant (RPG) pool to reach a 15th percentile payline for R01 grants for established investigators by FY 2025. Robust and sustained investments are needed to achieve that level of commitment to investigator-initiated research, and it requires strong support from Congress. Steady rates of increase to the NCI budget have enabled raising paylines from the 8th percentile to the 11th percentile in FY 2020. Dr. Sharpless remarked that achieving the payline goals will be a gradual process, given the high out-year costs of the RPG pool and the significant growth in R01 applications the NCI has experienced in recent years. This proposed budget would allow the NCI to keep pace with the continued need to invest in programs and priorities outside of the RPG pool, including the Cancer Centers, the NCI National Clinical Trials Network (NCTN), and the Specialized Programs of Research Excellence (SPOREs).

In the context of the NCI Professional Judgment Budget proposal, Dr. Sharpless highlighted statistics on the national cost of cancer care in the United States. He reflected on the comments of philanthropist Mary Woodard Lasker, who played a critical role in passing the NCA. The costs of cancer care in 2020 (\$208.9 B) and the modeled economic impact of lost productivity due to cancer mortality (\$147.6 B), are estimated to be in the hundreds of billions of dollars. Even then, this model reported by Bradley *et al.*, in 2008, does not illustrate the financial toxicity associated with cancer placed on the individual patient. This numerical analysis also does not account for the tragedy and devastation of cancer familiar to all. Because the cost of cancer in societal and financial terms is immense, the NCI is proposing an appropriation for FY 2023 of \$7.8 B.

Dr. Sharpless underscored that the federal investment in cancer research is an effective use of federal dollars that is leading to (1) better understanding of cancer; (2) new ways to prevent, diagnose, and treat cancer; (3) better ways to disseminate cancer care to vulnerable populations; and (4) a reduction in cancer health disparities. Progress is evident by decreased mortality rates, increased survival rates, and the many U.S. Food and Drug Administration (FDA) approvals for cancer therapeutics, all of which emphasize that cancer research funding works for its intended purpose. The *Annual Plan* highlights four scientific priorities and emerging opportunities: (1) clinical trials, (2) computer-based drug design, (3) precision prevention, and (4) tumor dynamics. Copies of the full report and the executive summary can be accessed from the NCI website.

NCI Budget and Appropriations. Dr. Sharpless reported that the FY 2022 President’s budget released in May 2021 proposed \$6.73 B for the NCI, a 2.73 percent increase over the FY 2021 enacted budget. The President’s budget also includes a \$9 B overall increase for the National Institutes of Health (NIH), of which \$2.5 B is for the NIH and \$6.5 B is designated to establish the Advanced Research Projects Agency for Health (ARPA-H). Dr. Sharpless noted that Ms. M.K. Holohan, Director, Office of Government and Congressional Relations (OGCR), NCI, will provide further details on the NCI budget later in the meeting.

Cancer MoonshotSM. Dr. Sharpless pointed out that the Cancer MoonshotSM has provided unprecedented opportunities to the cancer research community. The NCI anticipates that in its 7 years, this initiative will have started several new networks, established an infrastructure to conduct cancer research, and shared resources broadly. Of the established networks, two consortia are focused on pediatric oncology research: The Fusion Oncoproteins in Childhood Cancers (FusOnC2) Consortium and The Pediatric Immunotherapy Discovery and Development Network (PI-DDN). The NCI is planning projects for beyond the end of the 7-year funding period in FY 2023 and is exploring ways to transition those efforts into existing programs. Congress has expressed interest and is envisioning a Cancer MoonshotSM 2.0.

On 9 September 2021, 5 years after the NCAB Blue Ribbon Panel (BRP) delivered its report to the NCAB and the NCI, Dr. Sharpless and the NCI will host a virtual Blue Ribbon Panel Report Anniversary Seminar. He will be joined by the BRP co-chairs, Drs. Tyler Jacks, Elizabeth M. Jaffee, and Dinah S. Singer, as well as BRP member Dr. María Elena Martínez, to discuss Cancer MoonshotSM progress. Registration is open and details can be accessed from the [Cancer Moonshot Seminar Series](#) webpage.

Cancer Research Updates. Dr. Sharpless provided updates on three research initiatives. The Dual Anti-CTLA-4 and Anti-PD-1 blockade in Rare Tumors (DART) trial successfully has used a basket clinical trial approach to a Phase II trial with a common infrastructure that is useful in several settings. Results of this study led by the Southwest Oncology Group (SWOG) Cancer Research Network and sponsored by the Division of Cancer Treatment and Diagnosis (DCTD) reported in the 1 July 2021 issue of the *Journal for Immunotherapy of Cancer* that using ipilimumab and nivolumab to treat angiosarcoma were promising. Tumors in four patients partially or completely responded to treatment, and two other patients had long-term, but stable disease for more than 6 months. These data align with the results of the “Count Me In” initiative’s angiosarcoma project led by the Broad Institute of Massachusetts Institute of Technology and Harvard University and are a significant advancement for patients with this rare cancer. DART also will be investigating other rare subtypes of cancers of the ovary, small intestine, lung, sinuses, pancreas, and breast. This use of a basket trial model is similar to the NCI-Molecular Analysis for Therapy Choice (NCI-MATCH) rare tumors studies that have shown compelling efficacy in certain rare-disease populations. Although small-scale unrandomized Phase II trials can present regulatory challenges, cancer patients have benefitted from the FDA Oncology Center of Excellence’s vision to approve drugs based on this trial design using expedited reviews and an accelerated process.

The NCI Pediatric Oncology Branch (POB) investigators, in collaboration with researchers from Washington University in St. Louis, reported findings in the 31 August 2021 issue of *PLOS Medicine* of using liquid biopsy in neurofibromatosis type 1 (NF1) to distinguish between benign, plexiform neurofibroma (PN) tumors and malignant peripheral nerve sheath tumors (MPNSTs). NF1 tumors almost always are diagnosed in childhood, and approximately 15 percent transform into lethal MPNSTs. MPNST is a challenging clinical syndrome requiring biopsies as well as serial imaging and remains a clinical issue. In this study, the researchers developed a blood test that could reduce the need for full-body scan imaging or biopsies for diagnosing these patients. This test could offer a sensitive and inexpensive approach to cancer monitoring in patients with NF1 tumors. Dr. Sharpless highlighted that POB investigator Dr. Brigitte Widemann previously had reported her research using selumetinib to treat patients with NF1 tumors. He also noted that further details on this study will be presented later in the meeting.

The Division of Cancer Control and Population Sciences (DCCPS) researchers used Surveillance, Epidemiology, and End Results (SEER) Program and National Center for Health Statistics data to investigate cancer survival outcomes for adolescents and young adults (AYA). The study, reported in the 21 July 2021 issue of *Cancer*, examined the incidence, mortality, and survival for the nine cancer types with the highest mortality rates in AYA ages 15 to 39 years from 1975 to 2016. The results revealed an 85 percent 5-year relative survival rate for AYA patients with cancer, with significant improvements in 5-year survival rates for brain and other nervous system tumors, colon and rectal cancer, lung and bronchus cancer, acute myeloid leukemia, and non-Hodgkin lymphoma. The data showed little to no improvement in survival for female breast cancer, cervical cancer, ovarian cancer, and some sarcomas. Through this research, the field has a better perspective on AYA cancer patients that will help inform future research efforts.

Dr. Sharpless informed the NCAB members that the Childhood Cancer Data Initiative (CCDI) funded the establishment of a new AYA Patient-Reported Outcomes Task Force organized by the Children’s Oncology Group (COG). A key goal is to develop methods to standardize the collection of

patient-reported outcomes from AYA participating in clinical trials conducted through the NCI Community Oncology Research Program (NCORP) or the NCTN. This task force, composed of representatives from across the NCTN network, aims to foster collaboration across multiple clinical trial groups and expand AYA research.

NCI COVID-19 Research. Dr. Sharpless reported updates on NCI COVID-19 research projects. He remarked that the NCI serology research and its accomplishments have shaped the national pandemic response collaborations with the National Institute of Allergy and Infectious Diseases (NIAID) and other federal partners—including the FDA, Centers for Disease Control and Prevention (CDC), Biomedical Advanced Research and Development Authority, and National Institute of Standards and Technology—have been key to these efforts.

Regarding clinical and translational serology, the Frederick National Laboratory for Cancer Research (FNLCR) collaborated with the FDA to evaluate commercially available serology devices for SARS-CoV-2 (the coronavirus that causes COVID-19) detection. To date, 130 evaluations have been completed, and assessments have been provided to the FDA for regulatory decision-making. In December 2020, the FNLCR developed a U.S. serology standard, a tool useful in serologies across the country, and this reference has been shipped to 31 investigators. Dr. Sharpless pointed out that the \$306 M supplemental appropriation to the NCI for serology research is separate from the NCI's regular appropriations and does not shift the NCI's priority from cancer.

In December 2020, the NCI and FNLCR partnered with the U.S. Department of Health and Human Services (HHS), CDC, and NIAID to launch the online COVID-19 Seroprevalence Studies Hub ([COVID-19 SeroHub](#)). An online dashboard designed to assist researchers and policymakers in monitoring SARS-CoV-2 seroprevalence and U.S.-based studies, COVID-19 SeroHub has received more than 1.1 million visits (9,000 daily), primarily from users in the United States, Canada, France, and the United Kingdom (U.K.).

The NCI–HealthVerity, Inc. study—a real-world analysis of SEER prevalence and the relationship between antibody positivity and the future risk of infection—reported findings in the 24 February 2021 issue of the *Journal of American Medical Association Internal Medicine*. The data showed a tenfold reduction in the risk of symptomatic COVID reinfection in people with antibodies against SARS-CoV-2. These findings are part of the first evidence suggesting that antibody status can be a predictor of prior infection.

The NCI partnered with the National Institute of Biomedical Imaging and Bioengineering to fund eight projects aimed at developing innovative digital health tools to address the COVID-19 pandemic. These include remote health monitoring tools for patients at risk of COVID-19, analytic platforms for differentiating between COVID-19 and non-COVID-19 respiratory diseases, and a platform to integrate workplace contact tracing with verifiable health status reporting. The NCI anticipates these new technologies also will relate to cancer research and that the results will apply to future pandemics. In addition, the NCI partnered with Google and Apple to implement a platform for aggregate performance data from the Google and Apple Exposure Notification System widely used internationally. Last, the NCI is sponsoring several clinical trials on cancer and COVID-19, including the NCI COVID-19 in Cancer Patients Study (NCCAPS).

In terms of foundational serology, the NCI and NIAID launched the Serological Sciences Network for COVID-19 (SeroNet), a nationwide collaboration of 25 institutions to increase serological testing and understand the immune response to SARS-CoV-2 infection and vaccination. SeroNet has been operational since October 2020 and has been productive, with data reported in 90 publications. Dr. Sharpless described four recent notable SeroNet publications focusing on the effect of SARS-CoV-2 variants on T-cell reactivity in infected or vaccinated individuals (Tarke *et al.*, 2021); infection and

vaccine-induced neutralizing-antibody responses to the SARS-CoV-2 variants (Edara, *et al.*, 2021); longitudinal analysis demonstrating durable and broad immune memory after SARS-CoV-2 infection (Cohen *et al.*, 2021); and COVID-19 breakthrough infections in vaccinated health care workers (Bergwerk *et al.*, 2021). The NCI blog—*Cancer Currents: An NCI Cancer Research Blog*—recently featured a post on SeroNet in which the program directors discussed the insights gained from the Network. These efforts demonstrate NCI’s history and expertise in virology and vaccinology and highlight the capabilities of the FNLCR.

Dr. Sharpless announced that the NCI will soon formalize a new collaboration with the Health Resources and Services Administration and FDA on the Cancer Diagnostic Devices (CD2) Interagency Task Force, focusing on accelerating diagnostic devices for near-patient testing use. The CD2 Task Force will organize scientific and programmatic coordination, discuss areas of regulatory challenges of bringing these devices to market and ways to overcome them, and emphasize challenges specific to rural and medically underserved communities. The virtual memorandum of understanding signing ceremony is scheduled for 17 September 2021.

Update on Global Cancer Research. Dr. Sharpless reminded NCAB members that the NCA directed the NCI to engage to address cancer internationally, encompassing research and training. The NCI established the Center for Global Health (CGH) in 2011, which led to the development and promotion of resources that advance global cancer research and collaboration, particularly in low- and middle-income countries (LMICs). The CGH is celebrating its 10th Anniversary in 2021, and Dr. Sharpless and CGH Director Dr. Satish Gopal published a commentary—“Cancer as a Global Health Priority”—in the 6 August 2021 issue of *The Journal of the American Medical Association*, calling attention to the burden of cancer in LMICs. Dr. Sharpless noted that the CGH’s three main strategic priorities are increasing the portfolio of NCI extramural funding involving LMIC collaborators, targeting areas for extramural funding based on key scientific gaps in global cancer control, and promoting equity in global cancer research. In terms of the CGH’s impact, in FY 2020, 13 percent of the NCI’s extramural awards (\$900 M) included international components, an increase from 9 percent in FY 2010. Of the 1,079 extramural awards that engage non-U.S. countries, 342 (32 percent) focused on LMICs.

In June 2021, President Joseph Biden and Prime Minister Boris Johnson agreed to convene the first U.S.–U.K. Bilateral Cancer Summit. The NCI staff has been working with colleagues in the United Kingdom and other stakeholders in both governments to organize this summit. A planning meeting is scheduled for November 2021, and the summit is projected to be held in spring 2022.

NCI Training Programs. Dr. Sharpless explained that the majority of NCI training activities are outside the RPG pool funding, but some are supported by RPG pool R01 grants. The NCI will be updating its training programs to increase flexibility, stimulate greater inclusion and innovation, and encourage careers in cancer science. The Center for Cancer Training Director Dr. Oliver Bogler posted information about the future of NCI training programs on the NCI blog—*NCI Bottom Line: A Blog About Grants and More*. Dr. Bogler will provide a detailed update at a future NCAB meeting.

Leadership Appointments. Dr. Sharpless announced that Dr. Robert T. Croyle, Director, DCCPS, who has had a celebrated career in federal service, will be retiring in early 2022. Dr. Katrina Goddard has been selected as the new DCCPS Director, pending NIH approvals.

Questions and Answers

Dr. Timothy J. Ley, Professor of Medicine and Genetics, Division of Oncology, Department of Medicine, Washington University School of Medicine in St. Louis, suggested authoring an opinion piece in *The Washington Post* commemorating the 50th Anniversary of the NCA that would highlight the five decades of progress in cancer research versus the national cost of cancer care. Dr. Sharpless noted the

ongoing discussions with the NCI Office of Communications and Public Liaison (OCPL) on how best to communicate the NCA 50th anniversary message and will consider this option.

Dr. Anna D. Barker, Chief Strategy Officer, Ellison Institute for Transformative Medicine, University of Southern California, asked about the approach taken by the NCI Division of Cancer Prevention (DCP) to address different assays for early detection and prevention of cancer. Dr. Sharpless remarked on DCP's new approaches to early detection, prevention, and screening that rely on modern molecular attributes of cancer research and involve the development of blood-based screening assays that can detect cancer at an early stage, potentially in asymptomatic individuals. Several assays are at various stages of development, some of which are promising and have compelling preliminary data. The DCP also has been evaluating a modern design to address the complexity of conducting cancer screening trials that succinctly studies the population at risk, is cost effective, and keeps pace with technology. Dr. Francis S. Collins, Director, NIH, and Dr. Eric Lander, Director, White House Office of Science and Technology Policy, President's Science Advisor, have asked about highlighting this topic for ARPA-H.

Dr. Max S. Wicha, Madeline and Sidney Forbes Professor of Oncology, Director, Forbes Institute for Cancer Discovery, and Founding Director Emeritus, University of Michigan Rogel Cancer Center, Professor, Internal Medicine, Division of Hematology and Oncology, University of Michigan, commented that understanding the relationship of the mutations responsible for carcinogenesis to the fundamental basic science of the new tests being developed in DCP might be an undertaking for the ARPA-H initiative. Dr. Sharpless emphasized that NCI funds meritorious science associated with cancer prevention technologies without assistance from other entities (e.g., ARPA-H) and noted this would be an option only if their capabilities exceed those of the NCI. He continued that conducting large, complicated clinical trials rapidly and at scale is something the NCI can do, but the NCI will need to plan appropriately for budgeting and accruing.

IV. LEGISLATIVE REPORT—MS. M.K. HOLOHAN

Ms. Holohan reported on legislative activity, the FY 2022 budget and appropriations, and the congressional calendar. On 10 August 2021, the Senate passed a \$1 trillion bipartisan infrastructure bill that focuses on building roads, bridges, railways, and broadband capabilities. On 11 August 2021, the Senate passed a FY 2022 \$3.5 trillion budget resolution to enable the reconciliation process. The House passed the \$3.5 trillion budget plan and aims to vote on the infrastructure plan in mid-September. Currently in a reconciliation package, the infrastructure plan includes provisions for universal pre-Kindergarten, childcare tax credits, and strengthening the U.S. medical supply chain. Raising the debt limit was not linked to the budget resolution and will be voted on separately. It could possibly be added to the spending bills or a stop-gap continuing resolution (CR). More than one vote to extend the debt limit could occur during the FY 2022 appropriations process. Ms. Holohan explained that use of budget reconciliation for budget resolutions allows a quick legislation process that cannot be filibustered.

The President's FY 2022 budget request includes \$52 B for the NIH (\$9 B increase), which includes \$6.5 B for ARPA-H and \$6.73 B for the NCI (\$174 million [M] increase). The House Appropriations Subcommittee on Labor, Health and Human Services, Education, and Related Agencies (Labor-HHS) passed its bill out of committee in June 2021 and included \$49 B for the NIH (\$3.5 B increase) and \$6.99 B for the NCI (\$430 M increase), with \$3 B designated for ARPA-H. The Senate Appropriations Subcommittee on Labor-HHS has not released its bill. The House passed a minibus appropriations package containing seven bills, including the Labor-HHS bill.

Ms. Holohan reviewed the upcoming legislation of interest likely to be linked to the reconciliation package. The U.S. Innovation and Competition Act passed the Senate in June 2021, and the House passed two slightly different versions. The Creating Opportunities Now for Necessary and Effective Care Technologies for Health Act was introduced. A draft version of Cures 2.0, the vehicle

likely to authorize ARPA-H, was released in June 2021. The committees are drafting various sections for the reconciliation package and are expected to make their reports by mid-September.

Regarding the congressional calendar, both chambers will be in session for 9 days at the end of September. The vote on suspending the debt limit must proceed before credit of the United States becomes an issue and could be attached to a CR to fund the government past 30 September 2021 if a budget agreement is not reached.

V. OVERVIEW: ALLOCATION OF NCI APPROPRIATED DOLLARS FOR RESEARCH— DR. DOUGLAS R. LOWY

Dr. Douglas R. Lowy, Principal Deputy Director, NCI, provided an update on distributing the appropriated NCI budget, focusing on the overall trends from FY 2014 to FY 2020, the trend in FY 2020, and the estimated NCI budget increase in the RPG pool needed to achieve the “5 in ’25” goal. He expressed appreciation to the NCI Office of Budget and Finance, Office of Scientific Operations, Center for Research Strategy, and OCPL for their support in generating this report. The RPG pool is the largest investment of NCI funding, at 43 percent of the total budget. Specifically, 75 percent of the NCI budget in regular appropriations funds extramural research, and the balance supports intramural research, of which a third is dedicated to research management.

From FY 2014 to FY 2020, the NCI regular appropriations steadily increased, with more than 50 percent of the \$1.3 B increase supporting the RPG pool, translating to a funding growth from 41 percent to 43 percent. Of the 43 percent of RPG pool funding, 57 percent supports traditional R01 grants, an additional 3 percent funds R01 request for applications (RFAs), and the remainder supports other mechanisms, such as Program Project (P01), R21, R35, and the U mechanisms (e.g., U01). A small percentage (0.015 percent) supports the Director’s Awards (DP) and R15 mechanisms. Other research grants outside of the RPG pool—including K awards, resource grants (U24 and R24), education grants (R25), and the Clinical Cooperative Groups (U10 and UG1)—comprise 9 percent of the budget. The Cancer Centers and SPOREs make up 10 percent (\$570 M) and support planning and administrative supplement grants and the Specialized Centers (U54s).

In addition, the NCI spends 5 to 12 percent of its intramural budget to support the FNLCR, of which 48 percent is in direct support to the NCI Extramural Research Program and 52 percent is marked for indirect support for large-scale projects (e.g., Rat sarcoma virus [RAS] Initiative), laboratories, and core facilities. Examples of direct support include the NCI Experimental Therapeutics (NEXT), Patient-Derived Models Repository (PDMR), Genomic Data Commons (GDC), SeroNet Coordinating Center, and SeroNet Capacity Building Centers. Aside from the RPG pool educational efforts, the NCI invests approximately \$280 M in training and developing a strong cancer research workforce consisting of Early Stage Investigators (ESIs), National Research Service Awardees, intramural fellows, cancer education (R25), and research careers (K awards).

Regarding the FY 2020 sources of funds and major budget increases, the NCI received \$437 M in general congressional increases and \$75 M that was mandated for the Childhood Cancer Survivorship, Treatment, Access, and Research (STAR) Act and the CCDI. The NCI increased the RPG pool budget by \$243 M; invested \$183 M in Pediatric MATCH, NCI-Comprehensive Oncology Network Evaluating Rare CNS Tumors (CONNECT), and Cancer Centers; and spent \$76 M on mandatory costs.

Dr. Lowy reminded NCAB members that the number of competing (Type 2) NCI R01 applications the NCI receives remains higher than the rise in the NCI budget and these increases are higher than those received by other NIH Institutes and Centers. Reaching the “5 in ’25” payline goal will require substantial increases to the RPG pool between FY 2021 and FY 2025. Specifically, the RPG pool

budget needs to be \$1.4 B higher in FY 2025 than FY 2021 and the NCI's total budget would need an increase of \$2.8 B during this period.

Questions and Answers

NCAB Acting Chair Dr. Hiebert asked whether the House markup budget would be sufficient to make progress toward the “5 in '25” goal. Dr. Lowy explained that the NCI has been increasing the number of awards and investments in new RPG pool awards in the first year of funding and continued increases support the out-year costs.

In response to a question from Dr. Ley about identifying members of Congress who would champion and advocate achieving the “5 in '25” goal as current members retire, Ms. Holohan noted that, in general, Congress has expressed interest in understanding the NCI payline issues and discussions about the success rates for applications have broadened among the appropriators. Dr. Lowy added that Congress has included language in its funding awards about specific milestones for the RPG pool.

Dr. Francis Ali-Osman, Margaret Harris and David Silverman Distinguished Professor of Neuro-Oncology, Professor Emeritus in Neurosurgery, Duke University Medical Center, commented on the challenge to sustain the influx of ESIs into cancer research if paylines are not increased. Dr. Lowy called attention to the Method to Extend Research in Time (MERIT) Awards (R37) mechanism, which extends funding for ESIs who are R01 recipients for an additional 2 years and which the NCI implemented to address retaining this group in the field.

Dr. Susan Thomas Vadaparampil, Associate Center Director, Community Outreach, Engagement, and Equity, Moffitt Cancer Center, expressed concern about making comparisons with paylines of specific NIH Institutes and Centers, particularly those that use different funding cutoff points.

Dr. Deborah Watkins Bruner, Senior Vice President for Research, Robert W. Woodruff Professor in Nursing, Emory University, requested that the presentation slides on how NCI regular appropriations are allocated to research be shared with the NCAB members.

VI. THE SHERLOCK-LUNG STUDY—DR. MARIA TERESA LANDI

Dr. Maria Teresa Landi, Senior Investigator, Integrative Tumor Epidemiology Branch, Senior Genomic Advisor, Division of Cancer Epidemiology and Genetics, NCI, provided an overview of results from the Sherlock-Lung study, which aims to perform genomic and evolutionary classification of lung cancers in never smokers (LCINS) to infer processes leading to LCINS tumor formation. The study also aims to mine electronic health records (EHRs) to uncover such risk factors as associations with other medical conditions or long-term use of certain medications. The Sherlock-Lung study design involves collecting samples and data from LCINS patients from either a high-exposure population (e.g., known exposure to radon, coal, pollution, secondhand tobacco smoke, or asbestos) or a general population with no known exposures. Whole-genome sequencing (WGS) will be performed on up to 2,000 tumor and blood samples, with one half of the samples and normal lung tissue also undergoing RNA sequencing (RNAseq) and methylation. Dr. Landi also reported on an EHR nested case-control study in the Clinical Practice Research Datalink (CPRD) GOLD data set, a data set collected from clinics in the United Kingdom and validation in the CPRD Aurum data set.

Dr. Landi detailed early results from the first 232 general population cases assessed by WGS for the study. These cases consisted of 189 lung adenocarcinomas, 36 carcinoids, and 7 other mixed tumor types; 97 percent of the patients were of European descent. An initial observation was that LCINS tumors had a much lower mutational burden and longer telomere length than other cancers. LCINS tumors were classified into three subtypes based on increasing copy number variations (CNVs): *piano* tumors

exhibited the fewest CNVs, *mezzo forte* tumors exhibited intermediate CNVs, and *forte* tumors exhibited the most CNVs. This characterization was useful, because many other genomic characteristics differed across the three subtypes. Tumor mutation burden, copy number alterations, and structural variants decreased from *forte* to *mezzo forte* to *piano* subtypes; telomere length and subclonal mutation ratios increased in the same direction.

Each tumor subtype is being subjected to computational analyses of mutational signatures, in which analytical algorithms associate distinct mutation patterns with either endogenous or exogenous biological patterns. For example, Dr. Landi described how *piano* adenocarcinomas had a lower reactive oxygen species signature, which was absent in carcinoids. Most mutations were determined to originate from endogenous, rather than exogenous, exposures. Surprisingly, although 62 samples had some known exposure to secondhand smoke, the algorithm did not identify a tobacco smoke signature. This could be because the associated mutations were below the detection threshold, which is estimated to be 15 percent of the sample mutational burden in 62 tumors.

Another observation was that certain tumors exhibited a long lag between the appearance of the tumor progenitor cells and the time of diagnosis. This has important clinical implications, because tumors with a long latency period have an extended window for early detection, whereas tumors with a short latency period could be identified by biopsy followed by targeted treatment.

Tumors grouped into the *piano* subtype had the longest latency period, indicative of a slower growth rate. Another genomic characteristic of the *piano* subtype—the longer telomeres—would result from the fewer cell divisions associated with slow growth. Notably, *piano* tumors were enriched in mutations in the Kirsten rat sarcoma virus (*KRAS*) gene. The *KRAS* gene is involved in the proliferation of bronchioalveolar cells that give rise to lung adenocarcinoma. Additionally, mutations in genes involved in stem cell regulation—such as ubiquitin-like modifier activating enzyme 1 (*UBA1*), rearranged during transfection (*RET*), NK2 homeobox 1 (*NKX2-1*), AT-rich interaction domain 1A (*ARID1A*)—were found in only *piano* tumors. These results led to the hypothesis that some tumors in the *piano* subtype are driven by adult stem cells that exit the quiescent state.

To test this hypothesis, expression of stem cell markers was evaluated in RNAseq data from the Sherlock-Lung study and The Cancer Genome Atlas (TCGA) study. Expression levels of a series of genes—such as SRY-box transcription factor 2 (*SOX2*), SRY-box transcription factor 9 (*SOX9*), and high mobility group AT-hook 2 (*HMGAT2*)—were measured, and tumor samples were assigned a developmental score. Notably, *piano* subtype tumors had a higher degree of “stemness” than tumors from other subtypes. Dr. Landi announced that she is conducting a series of pilot investigations using single-nucleus RNAseq and single-molecule DNA sequencing to verify the cell of origin and evolutionary trajectory of *piano* tumors.

Dr. Landi continued with results from a case-control study in the CPRD GOLD database, which includes patient information for more than 650 clinical practices in the United Kingdom. From a total of 77,099 lung cancer cases diagnosed between 1 January 1988, and 31 December 2019, a total of 1,581 cases fell within the study criteria (i.e., had no prior cancers, were never smokers and did not smoke after diagnosis, were aged 30 to 89 at diagnosis, had been with the clinic for at least 1 year before diagnosis, and had at least five matched control cases.) These 1,581 cases and their 14,318 controls were used as a discovery data set in conjunction with 2,840 cases and 30,427 controls from the CPRD Aurum study population in England, which were used for validation. This study found that chronic and inflammatory gastrointestinal conditions were strongly associated with LCINS. Dr. Landi is working to confirm this association in a U.S. data set. These findings can help design screening strategies for LCINS diagnosis and provide a mechanistic explanation for some key genomic features identified in LCINS tumors. Dr. Landi currently is analyzing more than 1,200 Sherlock-Lung whole-genome sequencing data files and

also combining data from the Environment and Genetics in Lung Cancer Etiology (commonly known as EAGLE) study to perform analyses between groups based on ethnicity, tobacco smoke exposure, and sex.

The second objective of the Sherlock-Lung study is to develop an integrated molecular, histological, and radiological classification of LCINS to provide finer tumor classifications. Dr. Landi outlined progress in this area, noting that 2,430 histology and 284 radiology images have already been scanned and added to an analysis that also will include somatic copy number alteration (CNA) subtypes, driver genes, smoking status, ethnicity, sex, and other factors. A deep-learning approach will integrate this information with RNAseq and methylation information to correlate gross and molecular tumor phenotypes with risk factors and survival outcomes. Thus, radiographic imaging or biopsy results will be useful in predicting tumor features for clinical decision-making in the future.

Questions and Answers

Dr. Margaret R. Spitz, Professor, Department of Medicine, Dan L. Duncan Cancer Center, Baylor College of Medicine, commented that this concept exemplifies integrative molecular epidemiology, incorporating genomic technology to explain the mechanistic underpinnings of observed risks and outcomes.

Dr. Wicha asked whether the researchers plan to create and study human tumor xenografts for each tumor subtype. He also asked whether *piano* tumors have a hierarchical organization based on single-cell RNAseq analysis and whether they maintain that organization in the developed tumor. Dr. Landi noted that she has just begun a collaboration to test the *piano* tumor stem cell hypothesis in both mouse and organoid models. She added that the Sherlock-Lung study collected frozen tumor samples, which are not ideal for performing single-cell RNAseq analysis. Her group will be piloting a single-nucleus RNAseq analysis, with the awareness that the group is missing information regarding cytosolic RNA.

VII. INTEGRATING GENOMICS INTO THE PEDIATRIC ONCOLOGY CLINIC— DR. JACK F. SHERN

Dr. Jack F. Shern, Lasker Clinical Research Scholar, POB, NCI, presented on how genomics is being integrated into the pediatric oncology clinic. He highlighted previous clinical success, noting that genomics already has been useful in understanding and treating pediatric acute leukemias, neuroblastomas, and some rare tumors, such as infantile fibroid sarcomas. Other rare tumors lag in this area, including soft-tissue sarcomas, which comprise about 7 percent of all pediatric cancer cases. Most soft-tissue sarcomas are rhabdomyosarcomas (RMSs), which themselves encompass a large heterogeneity of tumor types. Although RMS is the most common soft-tissue sarcoma of childhood, therapies remain aggressive and nontargeted and are based on clinical and pathologic features, rather than on molecular markers. Current risk stratification for RMS—into low-risk, intermediate-risk, and high-risk categories—is imprecise. Discovery of the forkhead box O1 (FOXO1) fusion protein as an RMS status indicator has improved diagnosis and classification, but further efforts are required to better understand and treat RMS.

Dr. Shern described the results of one study investigating genomic risk stratification of RMS. An international collaboration to study RMS led to the collection of 641 primary tumor samples from patients enrolled in COG trials and U.K. patients enrolled in malignant mesenchymal tumor and RMS 2005 trials. A custom-capture sequence panel targeting 39 genes previously implicated in RMS was used to profile the samples. A notable association in the data included frequent mutations in the *RAS* gene found in patients younger than 1 year of age. Also notable, mutations in three of the genes—myogenic differentiation 1 (*MYOD1*); cyclin dependent kinase 4 (*CDK4*); or MYCN proto-oncogene, BHLH transcription factor (*MYCN*)—were detected predominantly in older teenage patients. Anatomical location

of the primary tumor also was relevant, because tumors that arose in the female urogenital tract had an increased number of Dicer 1, ribonuclease III (*DICER1*) mutations. Multiple genetic markers also held prognostic significance. An L122R point mutation in the *MYOD1* gene present in 3 percent of all FOXO1 fusion–negative (FOXO1–) cases was associated with a distinct spindle histology and very poor prognostic outcomes. It also was associated with co-mutations in the phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha (*PIK3CA*) and cyclin-dependent kinase inhibitor 2A (*CDKN2A*) genes. Current risk stratification had overlooked these cases, which were categorized as low or intermediate risk.

Mutations in the tumor suppressor protein p53 (*TP53*) gene also were genomic markers of aggressive disease. *TP53* mutations occur in 13 percent of FOXO1– cases and were frequently associated with a second oncogenic mutation. Tumors harboring *TP53* mutations were associated with worse outcomes regardless of their risk category. Dr. Shern expressed an interest in substratification of FOXO1 fusion–positive (FOXO1+) patients and noted that *TP53* mutations also correlated with *CDK4* or *MYCN* focal amplifications and worse outcomes in FOXO1+ cases. Dr. Shern proposed the establishment of a new “ultra-high-risk” category consisting of FOXO1– patients with *MYOD* mutations and FOXO1+ cases with *TP53* mutations.

Dr. Shern elaborated on current international efforts to implement genomic risk stratification of RMS. The COG has initiated two national trials: a high-risk trial (ARST2031) to prospectively test the prognostic value of *TP53*, *MYOD1*, *CDK4*, and *MYCN* mutations and a low-risk trial (ARST2032) investigating the potential for removing high-risk patients with *MYOD1* or *TP53* mutations from the low-risk group. With these cases removed, the low-risk survival group may reach 100 percent survival. The COG also is actively performing genomic characterization of the intermediate-risk study (ARST1431). The Childhood Cancer Data Initiative is developing a protocol for molecular characterization of tumors. Germline and tumor exome sequencing, methylation arrays, and RNA-based fusion panel results are to be verified by Clinical Laboratory Improvement Amendments (CLIA) and returned within 2 weeks to the treating team. Detailed correlative clinical data also will be collected under the umbrella of the COG’s Project:EveryChild.

Dr. Shern described results from a second study of MPNSTs, tumors that are generally rare but common in NF1 patients. These tumors are resistant to treatment and must be diagnosed early to be treated surgically. Half of patients with germline mutations in the *NF1* gene will develop large, benign PN tumors. Occasionally, PNs develop an intermediate, premalignant lesion called an atypical neurofibroma, likely as a result of a “second hit” mutation in the *CDKN2A* gene. The accumulation of additional mutations, including significant genome aneuploidy, causes the full transition MPNSTs. Early detection of MPNSTs is difficult because they evolve within bulky neurofibromas. Serial MRI and PET scans are currently in use in clinics for this purpose, but diagnostic accuracy is a challenge. MPNSTs often are not detected until new pains are felt within a PN, and by this time it is frequently too late for effective treatment.

Dr. Shern outlined a study conducted to identify a diagnostic cell-free DNA (cfDNA) assay to detect MPNSTs. DNA libraries were prepared using plasma from 16 healthy volunteers, 23 PN patients, and 14 MPNST patients and underwent ultra-low-pass WGS. Copy number analysis was performed on cfDNA with a shorter fragmentation profile—which was found to be more prevalent in MPNST patients—to estimate the fraction of plasma cfDNA originating from the tumor (tumor fraction). These results were correlated with serial imaging and other clinical outcomes. Dr. Shern described how tumor fraction in plasma cfDNA could distinguish pretreatment MPNST from PN with 86 percent accuracy. This correlation also could be observed when patients were responding to therapy (i.e., tumor fraction decreased following successful treatment). Other distinctive MPNST genomic characteristics, such as a chromosome 8 copy number alteration found in virtually all MPNST tumors, also were found. Importantly, increases in cfDNA tumor fraction were found to precede radiographic metastatic

progression. Tumor diameter could appear to be stable by imaging, whereas cfDNA tumor fraction rose with distant metastatic progression. In one case, metastatic recurrence was detected by surveillance imaging 240 days after resection; rising cfDNA tumor fraction was detectable in this patient 90 days prior to detection.

Dr. Shern concluded by stating that cfDNA will be a powerful tool in the pediatric oncology clinic. These assays will facilitate early cancer detection (especially useful in cancer predisposition syndromes), minimize residual disease after treatment, and provide a deeper understanding of responses to such therapies as tumor clonal evolution.

Questions and Answers

Dr. Ley asked whether the *TP53* mutations observed in the RMS study were mono- or bi-allelic. He also commented on the format of the RMS study, noting that WGS studies would be preferable to exome studies, which might be out of date. Dr. Shern responded that the *TP53* mutations were bi-allelic, with some possible dominant negative mutations. He agreed with Dr. Ley about the study methodology, asserting that broader forms of data collection will be important moving forward, and noted that the reason the study was performed in this manner was to return CLIA-certified results to treating physicians.

Dr. Peter C. Adamson, Global Head, Oncology Development and Pediatric Innovation, Sanofi, commented that the potential impact of cfDNA will extend well beyond the field of soft-tissue sarcomas, with the potential to reduce exposure to imaging radiation in pediatric patients. He noted that the COG is continuing to expand its collection of cfDNA, which will be critical for analyzing cancer subtypes. Dr. Shern agreed and added that the ease of collecting cfDNA sequentially over time will provide multidimensional insights into the development of these tumors.

Dr. Barker asked how soon these results can be applied within the clinic. Dr. Shern cautioned that he would like to see results from a larger study, but if the results are confirmed, entry into the clinic should occur soon.

Dr. Andrea A. Hayes-Jordan, Byah Thompson Doxey Distinguished Professor of Surgery, Division Chief, Pediatric Surgery, Surgeon-in-Chief, University of North Carolina Children's Hospital, expressed appreciation for Dr. Shern's efforts, noting that industry is finally paying attention to these cancers. Dr. Hayes-Jordan asked what tools will be used when approaching low- and intermediate-risk RMS patients who unpredictably relapse. Dr. Shern noted that unanswered questions still exist and mentioned a study that he is performing in concert with the COG that will identify genomic and evolutionary patterns in primary and relapse samples.

VIII. ONGOING AND NEW BUSINESS—DR. SCOTT W. HIEBERT

Dr. Hiebert invited the Subcommittee Chairs to present their respective reports.

NCAB *ad hoc* Subcommittee on Global Cancer Research. Dr. Ali-Osman, Chair of the NCAB *ad hoc* Subcommittee on Global Cancer Research, presented the report of the 31 August 2021 meeting. NCI Director Dr. Sharpless and NCI Principal Deputy Director Dr. Lowy attended the meeting. The Subcommittee heard presentations from CGH leadership focusing on the accomplishments since the last update. CGH Director Dr. Gopal introduced the *Center for Global Health Strategic Plan 2021–2025*, which was developed after soliciting input from multiple internal and external stakeholders. Dr. Patti E. Gravitt, Deputy Director, CGH, described implementation science to reduce inequities in global cancer control, highlighting the initiatives developed at the CGH. Dr. Ali-Osman summarized the four main goals of the Strategic Plan: first, research to support innovative, impactful studies and key scientific issues

in global cancer control; second, research training that would enable equitable, impactful global scientific cancer research; third, dissemination and integration of scientific knowledge and research advances into global cancer policy and practice; and fourth, partnerships that represent NCI globally to engage and promote key partners in global cancer research and control. The detailed Strategic Plan can be accessed from the NCI website. Dr. Ali-Osman conveyed the Subcommittee’s enthusiasm about the initiatives to expand implementation science at the CGH and with new approaches.

Motion. A motion to accept the report of the 31 August 2021 NCAB *ad hoc* Global Cancer Research Subcommittee meeting was approved unanimously.

NCAB Planning and Budget Subcommittee. Dr. Barker, Chair of the NCAB Planning and Budget Subcommittee, presented the report of the 31 August 2021 meeting. NCI Director Dr. Sharpless and NCI Principal Deputy Director Dr. Lowy attended the meeting. The Subcommittee discussed the NCI budgets and *Annual Plan*. Dr. Barker remarked on a common theme of the Planning and Budget Subcommittee meetings: the need for a continuous increase in funding to support raising the NCI R01 paylines. The Subcommittee was provided a detailed report of the *Annual Plan for Fiscal Year 2023* by Dr. Diane Palmieri, Deputy Director, Center for Research Strategy, and Dr. Laura Brockway-Lunardi, Health Science Analyst, Center for Research Strategy. The Subcommittee also heard an update on the FY 2021 budget—including current developments and trends—by Mr. Patrick McGarey, Associate Director for Finance and Legislation, and Subcommittee Executive Secretary. The Subcommittee discussed suggestions for future consideration in two potential areas: (1) trends and ratios of program announcements (PAs) and PAs with special receipt, referral, and/or review (PARs) and PAR spending within NCI’s RPG pool; and (2) cost modeling related to NCI’s “5 in ’25” payline goal. Dr. Barker noted that the Subcommittee will focus on these topics at its next meeting.

Motion. A motion to accept the report of the 31 August 2021 NCAB Planning and Budget Subcommittee meeting was approved unanimously.

Future Agenda Items. The NCAB members were asked to forward any suggestions for potential future agenda items to Drs. Hiebert and Gray.

Dr. Electra D. Paskett, Marion N. Rowley Professor of Cancer Research, Director, Division of Cancer Prevention and Control, Department of Internal Medicine, College of Medicine, The Ohio State University, suggested presentations representing the wide range of cancer research from basic to clinical to population science—including implementation science and biobehavioral research—at future NCAB meetings.

Members noted several other potential agenda items: advances and accomplishments of population science in cancer research, a report of implementation clinical trials in cancer care, and highlights of successes in non-cancer projects (e.g., lessons learned from implementation science in human papillomavirus vaccination programs).

Other Items. Dr. Hiebert explained that that Board will need to accept the letter that was distributed prior to this meeting addressing the continued low NCI paylines.

Motion: A motion to accept the NCAB letter addressing low NCI paylines was approved unanimously.

IX. ADJOURNMENT OF OPEN SESSION—DR. SCOTT W. HIEBERT

Dr. Hiebert adjourned the open session. Only Board members and designated NCI staff remained for the closed session.

X. CLOSED SESSION—DR. SCOTT W. HIEBERT

This portion of the meeting was closed to the public in accordance with the provisions set forth in Sections 552b(c)(4), 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). ”

There was a review of grants and a discussion of personnel and proprietary issues. Members absented themselves from the meeting during discussions for which there was potential conflict of interest, real or apparent.

The Board was informed that a comprehensive listing of all grant applications to be included in the **en bloc** vote was in the Special Actions package. Those grant applications, as well as those announced during the closed session, could be considered for funding by the Institute.

The NCAB **en bloc** motion to concur with IRG recommendations was approved unanimously. During the closed session, a total of 2,490 NCI applications were reviewed requesting direct cost support of \$962,854,580.

XI. ADJOURNMENT— DR. SCOTT W. HIEBERT

Dr. Hiebert thanked all the Board members, as well as the visitors and observers, for attending.

There being no further business, the 15th virtual meeting of the NCAB was adjourned at 5:45 p.m. on Wednesday, 1 September 2021.

Date

Scott W. Hiebert, Ph.D., Acting Chair, NCAB

Date

Paulette S. Gray, Ph.D., Executive Secretary