

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
NATIONAL INSTITUTES OF HEALTH
NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES**

**MINUTES OF THE ONE HUNDRED FIFTY-EIGHTH MEETING OF THE
NATIONAL ADVISORY ENVIRONMENTAL HEALTH SCIENCES COUNCIL**

September 10-11, 2019

The National Advisory Environmental Health Sciences Council convened the open session of its one hundred fifty-eighth regular meeting in the Durham Convention Center, Durham, NC. The meeting was open to the public on September 10, 2019 from 9:15 a.m. to 5:00 p.m. and September 11, 2019 from 8:30 a.m. to 11:23 a.m. In accordance with the provisions set forth in Section 552b(c)(4) and 552b(c)(6), Title 5, U.S. Code and Section 10(d) of the Federal Advisory Committee Act, as amended (5 U.S.C. Appendix 2), the meeting was closed to the public on September 10, 2019 from 8:30 a.m. to 9:00 a.m. for consideration of grant applications. Notice of the meeting was published in the *Federal Register*. Dr. Linda Birnbaum presided as Chair.

Participating Council Members

William Cibulas, Jr., PhD (*ex officio*) (by webcast)
José Cordero, MD, MPH
Irasema Coronado, PhD
Gary Ellison, PhD (*ex officio*)
Suzanne Fitzpatrick, PhD (*ex officio*) (by webcast)
Lynn Goldman, MD, MPH
Shuk-Mei Ho, PhD
Terrance Kavanagh, PhD (by webcast)
Katrina Korfmacher, PhD
Maureen Lichtveld, MD
José Manautou, PhD
Edith Parker, DrPH
Marla Perez-Lugo, PhD
Brad Racette, MD
Susan Schantz, PhD (by webcast)
Andy Shih, PhD
Michael Slimak, PhD (*ex officio*)
Patrick Sung, DPhil
Robert Tanguay, PhD
Robert Wright, MD, MPH

NIEHS Staff

Kathy Ahlmark
Janice Allen, PhD
John Balbus, MD, MPH
David Balshaw, PhD
Martha Barnes
Linda Bass, PhD
Mamta Behl, PhD
Brian Berridge, DVM, PhD
Linda Birnbaum, PhD
Abee Boyles, PhD
Jed Bullock
Danielle Carlin, PhD
Trisha Castranio
Tocara Chamberlain
Jennifer Collins
Gwen Collman, PhD
Christie Drew, PhD
Chris Duncan, PhD
Anika Dzierlenga
Lisa Edwards
Benny Encarnacion
Symma Finn, PhD (by webcast)
Amanda Garton
Kimberly Gray, PhD
Jenny Greer
Arshya Gurbani
Janet Hall, MD, MS
Astrid Haugen
Michelle Heacock, PhD
Heather Henry, PhD
Jon Hollander, PhD
Chip Hughes, MPH
Mike Humble, PhD
Bonnie Joubert, PhD
Helena Kennedy
Richard Kwok, PhD
Alfonso Latoni, PhD
Cindy Lawler, PhD
Chris Long
Sarah Luginbuhl
J. Patrick Mastin, PhD
Kim McAllister
Steven McCaw
Liz McNair
Christopher McPherson, PhD
Carolina Medina

Aubrey Miller, MD, MPH
Rosemary Moody
Sri Nadadur, PhD
Sheila Newton, PhD
Liam O'Fallon
Kristi Pettibone, PhD
Nicole Popovich
Tina Powell
Alicia Ramsaran
Lingamanaidu Ravichandran, PhD
Les Reinlib, PhD
Carol Schreffler, PhD
John Schelp
Thad Schug, PhD
Dan Shaughnessy, PhD
Varsha Shukla, PhD
Robert Sills, DVM, PhD
Bill Suk, PhD, MPH
Kimberly Thigpen Tart, JD, MPH
Laura Thomas, PhD
Claudia Thompson, PhD
Brittany Trottier
Steven Tuyishime, PhD
Fred Tyson, PhD
Chris Weis, PhD
Leroy Worth, PhD
Rick Woychik, PhD
Demia Wright, MPH
Dahea You

Members of the Public Present

Maureen Avakian, MDB Inc.
Megan Avakian, MDB Inc.
Michael Baker, MDB Inc.
Ernie Hood, Bridport Services, LLC
Michael Hatcher, DrPH, ATSDR
Steve Romero, UAW Health & Safety
Niani Zhang, PhD, NCSU

I. Call To Order and Opening Remarks

NIEHS and NTP Director Linda Birnbaum, Ph.D., welcomed attendees and called the meeting to order. She asked the attendees in the room to introduce themselves. Division of Extramural Research and Training (DERT) Director, Gwen Collman, Ph.D., went over some of the logistics for the meeting.

I. Consideration of June 2019 Meeting Minutes

Approval of the February 2019 meeting minutes was moved and seconded, and Council voted to approve the minutes, with all in favor. Dr. Collman noted the dates of the upcoming Council meetings for members to put on their calendars. She thanked retiring Council members Drs. Coronado, Manautou, and Lichtveld for their service.

II. Report of the Director, NIEHS

Dr. Birnbaum briefed Council on Institute developments since the June 2019 Council meeting.

She updated the group on budget and appropriations matters. She noted that there have been increases in the NIH and NIEHS budgets since 2016, with the Senate recently marking a \$3 billion increase for NIH for the upcoming fiscal year. She indicated that the proposed \$2 billion increase marked by the House was more likely to pass, which would still represent a substantial increase for NIEHS.

Dr. Birnbaum described the FY 2020 budget deal, which the President signed into law on August 2, 2019. It is a two-year budget deal that raised overall spending by \$320 billion and lifted the debt ceiling through mid-2021. It also marked the end of sequestration. She noted that a continuing resolution is expected at the end of the current fiscal year.

Dr. Birnbaum discussed several recent Congressional actions involving or potentially involving NIEHS. A measure designating \$6.25 million of the NIEHS budget for research on Harmful Algal Blooms was adopted by the House in June. Interest in the issue of plastic waste and human health has been expressed by members of Congress. Recent Congressional activities have also included NTP's use of animals and a telebriefing on cell phone radiofrequency radiation.

Dr. Birnbaum updated the council on the progress of renovations to the Rodbell Auditorium (which necessitated the holding of this meeting at the Durham Convention Center).

Turning to science advances, she briefly summarized several recent publications by NIEHS/NTP personnel or grantees. She began with two One NIEHS papers, one on preeclampsia, the other on technical improvements to an understanding of biological responses to liver injury chemicals. She cited three DIR studies: the first on artificial light at night exposure, the second on a gene controlling fidelity of transcription initiation, and the third on cardiomyocyte receptors. She described a paper from DNTP on toxicokinetics of PFBS, PFHxS, and PFOS. Finally, she recognized five DERT publications: on e-cigarette flavoring chemicals, on mitochondrial stress response in neural stem cells exposed to electronic cigarettes, on changes in air quality and asthma in California children, on continuing medical education as a translational science opportunity for health communication researchers, and on prostate cancer in World Trade Center survivors.

Next, Dr. Birnbaum discussed some of the most significant developments at NIEHS/NTP during her nearly 11 years as Director. She concentrated on several areas:

- Strategic planning and science management
- Areas of science
- Emerging issues and disaster research
- Translation and dissemination
- Early-stage investigators and training
- Community engagement
- Employee engagement
- Management and facilities
- Leadership appointments

She provided a timeline of upcoming events for the Council. She summarized several recent awards and recognitions given to NIEHS personnel and grantees.

Dr. Birnbaum updated the Council on developments at Environmental Health Perspectives, including recruitment of a new editor-in-chief. She summarized existing Children's Environmental Health research programs, as well as plans for the renovation of the Rodbell Auditorium, where Council meetings are held. She recounted several relevant past events and looked ahead to upcoming events through September. She summarized several recent awards and recognition given to NIEHS personnel and grantees, including the most recent Outstanding New Environmental Scientist (ONES) awardees.

Dr. Birnbaum announced that she would retire from her position as Director of NIEHS and NTP on October 3rd. and described several associated events. She will continue working in her lab for two years and plans to continue to be engaged with the environmental health research community. She described the recruitment process for a new IC director, which typically takes more than 12 months. She announced that Dr. Rick Woychik will serve as Acting NIEHS/NTP Director, Dr. Gwen Collman will serve as Acting Deputy Director and Associate Director of DERT and Dr. Pat Mastin will serve as Acting Director of DERT.

Following Dr. Birnbaum's presentation, Dr. Collman introduced an opportunity for Council members to share their thoughts about her, given that this would be her last Council meeting as chair. The tribute session was chaired by Dr. Susan Schantz. Council members spoke affectionately and respectfully about their feelings for Dr. Birnbaum.

Dr. Lynn Goldman reminisced about Dr. Birnbaum's important scientific contributions related to dioxins and other persistent organic pollutants and praised her leadership of the institute and the field. She recognized Dr. Birnbaum as a role model for:

- Science as a continuous exploration and source of joy

- Leadership within science
- Scientific integrity
- Public health, her priority
- Clear and forthright communications
- Courage
- Moral clarity

Other Council members lauded Dr. Birnbaum's wide variety of achievements in environmental health sciences. Dr. Maureen Lichtveld focused on Dr. Birnbaum's pioneering promotion of community engagement, as did Dr. Katrina Korfmacher. Drs. Jose Manautou, Jose Cordero, and Shuk Mei Ho also contributed their memories to the tribute. The Council members and all present gave Dr. Birnbaum a lengthy standing ovation. She thanked her colleagues for their recognition.

IV. Concept: Continuation of the Environmental Health Sciences Core Center Program

Dr. Claudia Thompson, Program Director of the Environmental Health Sciences Core Center (EHSCC) Program, briefed the Council on the proposal to continue support for the program.

The EHSCCs guide and support environmental health research at an institution or region. Their goals are to:

- Provide intellectual leadership and foster innovation
- Translate research into public health outcomes
- Support new ideas and collaborations
- Provide career development for future leaders
- Engage communities in multi-directional communication

There are currently 22 funded core centers across the U.S. Dr. Thompson described the evolution and achievements of the program in translational research, community engagement, multi-institutional collaborations and networks, and career development. She discussed the impact of the 2013 change to a sliding scale in funding, including a trend to more and larger pilot projects.

Dr. Thompson proposed that the EHSCC program should continue, using the NIH P30 grant mechanism. She noted that consideration would be given to the continuation of the sliding scale and other structural changes, including the Integrated Health Sciences Facility Core.

Dr. Edith Parker was the first Council discussant. She said the EHSCC program had had a profound impact on advancing environmental health sciences, as well as the areas of community engagement and translation. She noted the importance of the continual process of evaluation of changes to the program undertaken by NIEHS. She discussed some of the drawbacks of the sliding scale and felt that instead of going back

to fixed amounts, the sliding scale should be tweaked, potentially using the tiered system. She liked the emphasis on translation and said that more flexibility would be useful. She said that overall, she was pleased that the program would be continuing.

Dr. Ho was the second Council discussant. She approved of the emphasis on seed money for pilot projects. She added that it would be critically important to invest in people such as junior faculty transitioning to independent status. Regarding the sliding scale, she suggested that new applicants have a slightly lower bar, looking at both people and the number of grants, modeled on the NCI approach.

Dr. Wright said that the sliding scale is good, but that the focus on dollars is an overemphasis that creates problems.

Dr. Tanguay said he strongly supports the program, particularly the aspect that encourages technology development. He felt that EHS researchers who identify other sources of funding should be rewarded, and investigators should be encouraged to find other resources, rather than discouraged.

Dr. Kavanagh also very much supported the concept. He suggested that there should be a match by institutions for pilot programs.

Dr. Goldman said the program had been of critical importance to the field. Regarding the sliding scale, she felt that institutions are already highly incentivized to get NIH funding, and that tweaking of how much funding is in the center grant would not change that one way or the other. She said she could see other bases for the sliding scale. She felt that matching funding by the institution was a reasonable request, as that is done with funding by other NIH institutes. She supported the idea of a tiered approach. She added that the centers should be made to feel that they are constantly under pressure to stay at the top of their game.

Dr. Collman noted that in the past there have been lower thresholds for new centers.

Dr. Korfmacher asked about the rationale for the sliding scale, and what would be the opportunities for ancillary center activities. Dr. Thompson described some of those opportunities. Dr. Korfmacher expressed concern about the status of the CECs under the new program concept. She said it would always be important to emphasize the four audiences for engagement. She noted that some institutions would be more able to meet potential matching funds requirements than others and that it would be important to take that into account.

Dr. Collman called for and received a motion and second to approve the concept. The Council voted unanimously in favor of the motion.

V. NIEHS Worker Training Program: Opioids in the Workplace Training Initiative

Chip Hughes, Director of the Worker Training Program (WTP), briefly described the WTP workplace training initiative related to opioids. He provided historical background regarding the NIEHS track record as a national resource in disaster preparedness and response, including several responses by the NIH Disaster Research Responder (DR2) Project. He outlined the Opioids and the Workplace: Prevention and Response publication, which was released on July 2019 in response to the crisis of opioid use and abuse in the workplace. He described the NIEHS WTP Opioids Workplace Training Materials Project, which is a partnership between NIEHS, the NIH Office of Disease Prevention and the NIH Office of Behavioral and Social Sciences Research.

He summarized the current state of opioid-related deaths in the United States—130 Americans every day, according to the CDC. He discussed a March 2018 workshop on the Prevention of Occupational Exposure to Fentanyl and Other Opioids. He provided background information about the connection between workplace injuries and opioid addictions and deaths. He described a May 2019 WTP workshop, held in Pittsburgh, addressing Interventions to Address Workplace Stress and Addiction.

Mr. Hughes introduced Steve Romero, a health and safety representative with the United Auto Workers in Michigan.

Mr. Romero recounted the tragic death from opioid misuse of his beloved brother Jeffrey, who died in 2018 at the age of 48. The tragedy hit the Romero family hard and profoundly affected his thinking about opioid abuse. “It’s time to treat those affected by this epidemic in the same way we treat other epidemics the world is facing—with compassion, education, treatment accessibility, and financial resources,” he said. Today, Romero works with the WTP team on interventions designed to prevent and treat workplace opioid problems in UAW-affiliated factories.

Dr. Gary Ellison, liaison to the Council from the NCI, expressed the feelings shared by many who were present for Romero’s talk. “Thank you for sharing your story,” he said. “I hope you find it empowering to turn such a tragic loss into something positive where you can help others.”

Mr. Romero provided information about the NIEHS/WTP Opioid and the Workplace: Prevention and Response Training in the UAW Facilities program, which is developing and distributing tools to help stem the tide of workplace opioid abuse.

Dr. Manautou asked Mr. Romero for his thoughts on the costs of prevention efforts. Mr. Romero said that the prevention of workplace injuries would be one key element. He noted that one downside of the situation is when an employee would fail a drug test, and the company and union would lose an otherwise valuable worker. Mr. Hughes said that only about 10-15% of all people who suffer from opioid use disorder receive any treatment. Mr. Romero said that the removal of stigma would be a key factor in ameliorating the problem.

Dr. Lichtveld said that prevention of injury is just as important as the treatment of abuse. Mr. Romero said that in his experience, in the Big Three automakers, there is a constant process by the union and the companies to improve workplace conditions and to prevent injuries. He noted that the jobs are inherently rough on the body, particularly at the smaller companies.

Dr. Ho said she was concerned about third shift workers. Mr. Romero said he was a third shift worker for 20 years, and that her concerns are valid.

Dr. Lichtveld asked how the WTP/UAW program is truly engaging the workers. Mr. Romero noted that he was relatively new to the effort and had seen that virtually all the workers knew someone affected by the epidemic. He said it was important to present the facts. He noted that his group had built a rapport with the workers in the plants.

Dr. Woychik asked whether Mr. Romero was seeing, on the ground, increasing awareness of the alternative strategies for pain management, both on the part of the workers who suffer pain and the physicians. Mr. Romero replied that in his very limited capacity, he was seeing that physicians are “in a scary stage.” He said that due to their compassion, as doctors and nurses become aware of alternatives, they will start to use them.

Dr. Goldman hoped that NIEHS could have a role in getting the word out to the people who practice medicine with workers that there are alternatives to opioids for pain management. She compared the situation to AIDS when patients stood up to the stigma and demanded better treatment. She felt that the medical community needs to hear similar voices today, to help remove the stigma of opioid addiction. She said it is an extremely important public policy issue.

VI. Concept Clearance: Functionally Inferred Gene-Environment (G x E) Discovery & Validation

Dr. Kim McAllister briefed the council on the concept of functionally inferred gene-environment (G x E) discovery and validation. The goal of the program is to generate proof-of-principle studies for using recent advances in functional genomics tools and technologies, *in vitro* approaches, and biological knowledge for G x E discovery and/or validation.

She listed several challenges with identifying new G x E findings in human epidemiology or validating existing ones:

- Underpowered studies
- Difficulty in harmonizing environmental risk factors across a consortium
- The complexity of measuring environmental exposures
- Genetic and phenotypic heterogeneity
- Limited range of genetic and environmental variation
- Patterns of linkage disequilibrium and genetic modifiers can reduce power

- Most genetic variants in non-coding regions

She noted that functionally informed G x E analyses might advance the field to meet those challenges. She showed that functional validation is lagging very far behind technological advances in the field and that functional analysis is needed to aid mechanistic understanding of both G and G x E findings related to disease in this post-GWAS era. She described the recent technological advances in the field such as CRISPR and provided examples of how they could be used to enhance validation or discovery G x E. She delineated potential considerations for a possible initiative:

- Very limited ES applications with scattered study section assignments, and a need for more interdisciplinary expertise for review
- Entice non-ES grantees to begin thinking about incorporating these strategies for environmental health science and toxicology applications
- The desire for strong preliminary data emphasizing current evidence for an existing G x E hit or possible association of gene pathways/exposures with disease outcomes for discovery-based proposals
- Multiple independent validations (in different species, strains, animals, or cellular systems) and/or multiple cellular/molecular readouts to ensure robust identification or validation of G x E findings

There is currently a need to stimulate this field as a preliminary portfolio analysis suggests an underutilization of the advanced functional genomics technologies and tools to explore G x E at NIEHS. Several other NIH institutes have expressed an interest in joining the solicitation, including NHLBI, NCI, and NHGRI, which would show a trans-NIH effort.

Dr. Ho was the first Council reviewer. She endorsed the emphasis on validation in the proposal, which she strongly supported. She felt that it is important that the discovery platform be adequately powered, and that anything that is underpowered should not be funded. She said that with the CRISPR technology being available, it is a good time to also push for long-range sequencing. She said that new opportunities to use human tissues should be encouraged. She recommended a focus on sex differences and said that many opportunities will include artificial intelligence methods.

Dr. Tanguay was the second Council reviewer. He noted that the RFA is quite broad, with several potential methods of entry. He said that much of the technology proof of concept already exists. He wondered if it might be effective to target specific disease outcomes or exposures in the potential FOA. Dr. McAllister replied that there had been a discussion that the concept may be too broad. There was also a discussion about what the appropriate funding mechanism would be.

Dr. Woychik said that he is representing NIEHS on a new trans-NIH international effort being spearheaded by the Broad Institute, called the International Common Disease Alliance. It is an international effort to take GWAS to a different level, he noted and has some potential overlap with the concepts that might be incorporated into this FOA.

Dr. Ho said that international collaborations have a much higher environmental impact than some others, citing air pollution as an example.

Dr. Wright wondered how the element of exposure timing might be handled in the validation models. Dr. McAllister agreed that it should be included.

Dr. Ellison said that there is a group of program officers at NCI who are very interested in the topic and encouraged Dr. McAllister to continue discussions with them.

Dr. Collman asked for and received a motion and second to approve the concept. The council voted unanimously in favor of approval.

VII. RESolution of InflammaTion in EnvirOnmentally Related Disease (RESTORE) Concept

Dr. Sri Nadadur presented the RESTORE concept to the Council. He illustrated the association between chronic inflammation and a variety of disease states including cancer, obesity, and diabetes.

Acute inflammation is a protective response to an injury or infection. If the response to infection or injury is suboptimal or hyperresponsive, the resolution process may be prolonged, leading to chronic inflammation, which is a severe and progressive process where aging plays a major role. Resolution of inflammation has become increasingly recognized as a dynamic and complex process. Resolution is an active process where inciting stimuli are removed. It is a tightly regulated process that promotes tissue repair and regeneration. It will be highly beneficial to integrate this emerging area of science into environmental health research.

Dr. Nadadur noted that while there is good information on biological response to acute exposures to many toxic chemicals, most exposures to environmental pollutants are chronic. Understanding pollutant-related perturbations in the resolution of inflammation will aid in developing biological plausibility for environmentally related morbidity, and ultimately potential intervention strategies.

Dr. Nadadur described the trans-NIH Inflammation Resolution Biology Workshop held at NIEHS in March, 2019. The workshop yielded two proposed approaches:

- A Notice of Special Interest (NOSI) with multiple IC participation
- A tailored FOA to promote mechanistic research on environmental impacts on inflammation resolution and associated disease morbidity

The short term goals would be to characterize inflammation resolution pathways in pulmonary and cardiovascular systems via chronic exposure studies. Long term goals

would be to characterize inflammation resolution pathways in diabetes, neuronal effects, reproductive and developmental effects, and obesity, via chronic exposure animal models.

The program will address the need to develop a focused research program aimed at air pollution-induced cardiopulmonary, neuronal inflammation, as well as chronic inflammation conditions such as diabetes and obesity.

Dr. Kavanagh was the first Council reviewer. He said he was impressed by the concept and felt that it was an important advance, with an opportunity for NIEHS to engage with other NIH institutes in coordinated fashion. He suggested that might be useful to access other research in airborne toxicants as well as secondhand tobacco smoke. He said he was very much in support of what he called an important program for NIEHS.

Dr. Manautou was the second Council reviewer. He said it is an important field that represents a space where NIEHS should be present. He agreed that a focused approach would be a good way to start. He said that the workshop provided a good foundation and helped to identify needs in the field. He said there are still multiple unknowns about some key players in inflammatory responses and their resolution as it relates to human cells. He wondered if resolution of inflammation always involves repair and tissue regeneration, and said that is a question that deserves more attention. He questioned whether it may be too soon to be talking about nutritional and pharmacological intervention, since there is still room to identify valid therapeutic targets. He said he was open to the idea of further discussion about whether it is the right time to include nutritional and pharmacological intervention within the scope of the program.

Dr. Birnbaum noted that it is difficult to do chronic exposure studies involving particulate matter. NTP has conducted such studies, and she suggested there may be opportunities to mine that data.

Dr. Cordero asked Dr. Nadadur about inclusion of reproductive outcomes. Dr. Nadadur replied that *in utero* exposures would be included.

Dr. Racette said he understood the rationale for the program's short-term and long-term goals, but he was concerned that the cardiopulmonary studies may not yield what is needed regarding the adverse effects. He worried that those studies may delay needed research in other disease states. Dr. Collman asked him if he felt that the evidence base for pursuing full R01s for CNS and neuro outcomes is already there, or would require development using different tools, perhaps with a targeted R21-type effort. Dr. Racette said he thought it was "right on the edge."

Dr. Tanguay said that he liked the fact that the program would tackle processes relevant to many diseases, and the idea that for many toxicant exposures, the mode of action for recovery may be similar in many systems.

Dr. Collman asked for and received a motion and second to approve the concept. The Council voted unanimously in favor.

VIII. Pediatric and Reproductive Environmental Health Fellowships: Strengthening the Pipeline Concept

Liam O'Fallon briefed the Council on a new program for NIEHS to collaborate with the Agency for Toxic Substances and Disease Registry (ATSDR) and the EPA, as part of the Pediatric Environmental Health Specialty Unit (PEHSU) program. There is a need for a fellowship program to train pediatric and other healthcare professionals in the assessment and management of children whose health problems are related to the environment, and to provide those professionals with the necessary public health and clinical expertise to be successful academicians and physician-scientists. In that context, the Pediatric and Reproductive Environmental Health Fellowship (PREHF) program is proposed. It will build off the robust children's environmental health research and community engagement base, enhance the growing connections with PEHSUs, and provide a reliable source of support for pediatric and reproductive environmental health fellows.

The training opportunity is aimed at pediatricians, family medicine doctors, obstetricians/gynecologists, and nurses, and will expand the pipeline of healthcare professionals who are researchers, resources, and leaders in pediatric and reproductive environmental health (PREH).

Mr. O'Fallon provided background information about the PEHSU network. It is an interconnected system of specialists located throughout North America who responds to questions from public health professionals, clinicians, policymakers, and the public about the impacts of environmental factors on the health of children and reproductive-age adults. PEHSUs does not conduct research.

The proposal encompasses an institutional award that requires a partnership with a currently funded PEHSU. If an applicant institution is not already part of a funded PEHSU, it must submit its proposal in collaboration with a funded PEHSU. Expected outcomes include:

- Increased interaction among the NIEHS research community and PEHSUs
- Fellows gain and apply PREH research skills and knowledge
- Fellows gain and apply communication skills and knowledge
- Strengthen environmental health literacy of healthcare professionals –
 - Fellows, directly
 - Practitioners, indirectly
- The expanded pipeline of healthcare professionals with EH knowledge and skills
- Increased PREH in medical education, long term

The K12 mechanism is proposed for the program. Grants would be awarded in the spring of 2021.

Dr. Michael Hatcher, Chief of the Environmental Medicine Branch of the ATSDR, presented more detailed information about the PEHSU program.

Dr. Wright was the first Council reviewer. He said that if the endgame of the initiative is to work to get environmental health into medical education then it would be a good opportunity to engage residency directors or other officials in the pediatric medical education field. He noted that it is not difficult to motivate people to apply for NIH grants, and such awards can help residency directors get promoted. He thought that residency directors who may know a resident who is interested in environmental health could steer them into the program, constituting a pipeline for the field. He said he likes the K12 mechanism, as it would enhance recruitment to be able to hire as faculty.

Dr. Cordero was the second Council reviewer. He likened the program to previous efforts to train geneticists in the early years of his career. He said that he thought that environmental health has lagged in expanding capacity in the field and that there is a great need. He sees the program as a very important step to move in the right direction. He felt that the idea of developing environmental health literacy is extremely important. He added that it would be a critical step in aiding translation.

Dr. Racette said he had some concerns. He said that for NIEHS to be taking on the program, it should be about research. He felt that it should concentrate on the physician-scientists, as clinicians would find it difficult to be advocates for environmental literacy. He said he would strongly encourage making clinical training limited in focus. He said that NIEHS may want to think about an R25 mechanism. He said he would like to see the concept replicated in adult diseases.

Dr. Lichtveld asked if there was any attention to risk factors, such as socioeconomic status, and recommended that practitioners come from the area that he or she would serve. Mr. O'Fallon said those were both good points. Dr. Hatcher mentioned that much of the work the PEHSUs do is in environmental justice communities.

Dr. Manautou asked if there had been consideration of including pharmacists and said he would encourage that.

Dr. Lichtveld described her experiences in working to put together a network after the Gulf Oil spill. She said that the educational component had been important, as well as the connection of specialists with primary care physicians. She felt that some of the education must happen on the front line.

Dr. Collman asked for and received a motion and second to approve the concept. The Council voted unanimously in favor of the concept.

Dr. Goldman commented that she would encourage the PEHSUs to be more inclusive of other professionals. She also encouraged the team to find the appropriate language for the professional level sought – for example, “post-grad year four,” which is specific to clinicians, and not nurses.

IX. Report of the Director, DERT

Dr. Collman updated the Council on recent developments in the division.

She welcomed new DERT staff member Arshya Gurbani and bid farewell to departing staff member Symma Finn.

She presented an overview of the NIEHS T32 program goals and objectives, and introduced T32 program evaluation plans.

The NIH T32 program goals are to prepare qualified predoctoral and postdoctoral trainees for careers that have a significant impact on the health-related research needs of the nation. The program’s objectives are to develop and enhance individual research training opportunities that provide:

- Foundation for research design, methods, and analytic techniques needed for proposed area
- Enhancement of trainees’ ability to conceptualize/think through research problems with increasing independence
- Experience conducting research using state-of-the-art methods, presenting and publishing findings
- Opportunity to interact with scientists at appropriate scientific meetings and workshops
- Enhancement of trainees’ understanding of the health-related sciences and the relationship of their research training to health and disease

The NIEHS T32 program supports approximately 365 to 480 trainees per year. Overall funding has fallen slightly between 2008 and 2018.

Dr. Collman presented data on T32 trainees and their career paths. She delineated the timeline for T32 evaluation planning. Phase 1 will be evaluation design, from September – December 2019. Phase 2 will be evaluation implementation, from January – December 2020.

Dr. Collman presented a detailed discussion of the NIEHS Research Project Grant (RPG) paylines, including history and goals, and raising the possibility of a change to an 8% payline. The NIEHS payline has been steady at 10% since 2014. It has averaged close to the 25% solicited/75% unsolicited RPG breakdown during that time. The mean

for unsolicited raise to pay applications (RTPs) has been 17.4%. She described what would have been the impact in 2019 if an 8% payline was used: there would have been 17 fewer grants in the payline, and about \$6 million would have moved from payline to raise to pay – 13% of budget. This would have allowed NIEHS to be more intentional in its grantmaking. Projected into 2020, there would be 26% solicited, 50% unsolicited, and 24% raise to pay.

Dr. Collman said she was eager to solicit opinions about the change from the Council, and opened a discussion session.

Dr. Birnbaum clarified that grants within the payline are not automatically funded.

Dr. Goldman expressed concern that lowering the payline could cause a shift in some of the applications as they would go to other institutes. Otherwise, she said, the proposal made sense to her in principle. Dr. Collman said that intentionality of assignment was related to established referral guidelines, with investigators having the opportunity to request assignment to different institutes, but usually with discussion, and investigators with a long history with NIEHS would find it more difficult to shift. Dr. Goldman agreed. Dr. Collman observed that people do shop around to find the best home for their work, and potential to be funded is certainly among their criteria.

Dr. Sung noted that it was a very sensitive issue. He said the 10% payline is “awful.” He felt that raise to pay was thoughtful, but decreasing the payline would result in less transparency. Dr. Collman noted that there are different paylines for different mechanisms. Dr. Sung made note of Dr. Birnbaum’s comment that not all grants within the payline actually get paid. Dr. Collman said that there are some situations where a particular grant may be deferred or passed over. Dr. Sung said that should be made clear on the institute website, which could make it unnecessary to lower the payline. Dr. Mastin asked Dr. Sung if he was suggesting a more liberal policy for skipping applications in the payline. Dr. Birnbaum noted that it is very rare that a payline grant is not ultimately funded. Dr. Sung said it should be made less rare. Dr. Birnbaum said that would be much more work and more confusing to applicants.

Dr. Ho said that having a steady payline is actually “a very comforting thing,” and is important to sustaining the community, giving people a comfort zone that the payline is at 10%. Dr. Collman that historically the institute has spent the majority of its money through the unsolicited payline, using discretion for a smaller percentage of the dollars.

Dr. Sung asked Dr. Collman if an RTP would pay for a full 5 years in the case of an R01 at full cost, or whether discretion would be used to reduce the budget during a number of years. Dr. Collman said that discretion is used for any grants, and sometimes that conversation is part of the RTP, depending on the score and science of the application.

Dr. Sung noted that there is some room to maneuver. Dr. Collman agreed, and said it helps with outyear commitments.

Dr. Korfmacher said that the NIEHS commitment to transparency makes for less elasticity for investigators to shop among other institutes. She made the point that the proposed change would fit with the presentations heard at the last Council meeting regarding a shift from RFAs to Notices of Special Interest (NOSIs). Dr. Collman noted that NOSIs had taken the place of Program Announcements, which did not have special study sections.

Dr. Racette said he was not worried about fairness. He felt that the payline was too low at 10%, and was not enthusiastic about the 8th percentile proposal. He said he thought that NIEHS should be funding at the 15th percentile, but dropping to the 8th percentile would be unfair.

Dr. Wright asked if there had been an analysis of the impact on early stage investigators. Dr. Collman said that the institute pays great attention to ESIs, and talks about every one in detail as grants are considered, including whether specific proposals are “ready for prime time.” Dr. Wright asked if greater discretion would lead to changes in what is funded, in an effort to help understanding of what would actually happen. Dr. Collman said that it would be impossible to predict what would happen in any round of grant-making. She said that perhaps a simulation could be conducted, but that could be biased based on past practices.

Dr. Goldman said that the NIEHS budget should be “so fat” that there could be a 15% payline. She said she was concerned with a relatively large fraction of external resources going into either solicited or unsolicited raise to pay, it is very important to communicate the data about the quality of the work. She felt that many of the meritorious raise to pay proposals would have been funded under a 15% payline. In terms of NIEHS’s relative positioning with the other institutes and the view of the scientific community at large, she said it is extremely important to communicate that the quality of the science being funded is quite high. Dr. Collman said that it has been her impression that over the years since there has been a payline, the reputation of the science and its quality has evolved differently than it might have previously.

Dr. Manautou said he was concerned about the fate of new investigators should the payline be changed. He said it was very important to have a cohort of new investigators who will call NIEHS their home institution. He was concerned that without knowing the nuances of the change, investigators would simply migrate to another institute. Thus, efforts to communicate the implications of the potential changes would be critical, to make clear the chances of being funded by NIEHS, given good science. Dr. Collman said that while they are ESIs, NIH and NIEHS have worked to communicate that grants

over the 10th percentile would be considered. Some ICs have created a payline for the second grant for ESIs, to ease them into their payline, and she noted that that may be another strategy to cushion the changes. She added that there has been much effort to communicate, and that NIEHS is “not about hiding our decisions.”

Dr. Birnbaum commented on the fairness issue. She said that the institute is locked in at the 10th percentile. She said there is little or no difference between an 8th, 9th, 10th, 11th, or 12th percentile. She noted that “in some ways it would be so much nicer if we had plenty of money, and we could just say ‘superb!’, ‘excellent!’, ‘really good’ and use those as categories as opposed to saying ‘5th percentile,’ 9th percentile,’ 11th percentile.” She said that some of the conversation is based on frustration at looking at grants that the institute thinks are really great but cannot be funded due to percentile. She noted that every year there is the issue of the amount of money devoted to non-competings—when there are many non-competings, there is less money available for raise to pay. She discussed the NIH support for ESIs, hoping they will be funded to the 25th percentile. She said NIEHS does that as long as it believes that the grants are scientifically meritorious.

Dr. Collman, noting that Dr. Birnbaum needed to depart the meeting at that point, asked her for any last comments. Dr. Birnbaum said that she would not say goodbye. She found the tribute from the first day of the meeting to have been moving, and said it was an honor and a privilege working with the Council over the years. She said, “I feel like I’m just saying au revoir, because I will still be active and will come to Council sometimes and sit in the back row.” She thanked the Council for being part of NIEHS.

Dr. Goldman said it would be really important to look at the issue in the broader context of education in environmental health. She said that those in the field had concerns about the ability to attract students to the field, particularly at the “feeder level.”

Dr. Coronado asked how many women and minorities are currently in the field, citing the fact that there is data from 20 states, but wondering about the rest of the states. Dr. Collman said that could be looked at, and that data would be gathered.

Dr. Lichtveld suggested asking why and how questions instead of yes or no questions in evaluations. She endorsed an enterprise approach in evaluations. She asked Dr. Collman how she would explain the process to an applicant new in the field. Dr. Collman replied that during presentations to potential applicants in a variety of contexts, the effort is made to describe the process and the thinking behind it in detail.

Dr. Sung said that due to its payline, he does not advise his junior faculty to go to the NCI, and now with the proposed payline change, he may advise them to avoid NIEHS as well. Dr. Collman said she appreciated Dr. Sung’s honest and candor, and that it

helps NIEHS to better understand how people in the field take the information and make real life decisions as a result.

(Dr. Ellison said that early stage investigators should not avoid NCI, as it funds ESIs up to the 14th percentile. Dr. Ho agreed that a significant amount of NCI money goes to ESIs.)

Dr. Collman thanked the Council members for their comments.

X. Introducing the Human Health Exposure Analysis Resource (HHEAR)

Dr. David Balshaw briefed the Council on the HHEAR program, which builds upon the success of the Children's Health Exposure Analysis Resource (CHEAR).

Whereas CHEAR offered exposure analysis resources to researchers studying health outcomes in children, HHEAR will offer these resources to research studying adults as well. The expanded program will provide a larger community of researchers access to centralized, high-quality exposure assessment services. This will allow researchers to better understand the influence of environment on health throughout the life-course and eventually support more comprehensive assessment of the developmental origins of health and disease.

HHEAR is made up of three main components:

- Network of Exposure Analysis Laboratories, including:
 - Targeted Analysis of Biological Samples
 - Untargeted Analysis of Biological Samples
 - Environmental Sample Analysis
- Data Repository, Analysis and Science Center
- Coordinating Center

HHEAR is a trans-NIH partnership among NIEHS, NCI, NHLBI, the Superfund Research Program, and ECHO (Environmental Influences on Child Health Outcomes). Funding began in September, 2019, and is scheduled to run through June, 2024.

Dr. Lichtveld thanked Dr. Balshaw for his efforts related to CHEAR and HHEAR, calling it "a gift and a new resource for us to take the science of environmental health to the next level."

Dr. Cordero asked how the program will work in terms of people considering applying for a grant, versus those who already have grants. Dr. Balshaw said that was a subject of discussion, and an important consideration going forward.

XI. Office of Communications and Public Liaison Report

Ms. Christine Bruske Flowers, Director of the Office of Communications and Public Liaison (OCPL), briefed the Council on recent OCPL activities and achievements. She listed the many communications support and services provided by the office. She provided details about the number of news stories and media requests from 2015 through 2018.

Ms. Flowers noted that in her more than ten years as NIEHS/NTP Director, Dr. Birnbaum had given 357 media interviews, was quoted in more than 3,000 news stories, and gave 31 on-camera interviews for television specials and film documentaries.

Ms. Flowers provided more detailed information about the 2018 media relations, and listed some of the notable recent press releases issued by her office. She described the successes and growth of the NIEHS monthly newsletter, *Environmental Factor*, as well as other NIEHS newsletters.

She delineated the considerable traffic and activities related to the NIEHS websites, including new sites recently unveiled. She described a Facebook ad campaign designed to help increase NIEHS human study recruitment, which has successfully expanded as a result. She also listed activity levels on other social media platforms such as LinkedIn, Twitter, Reddit, and YouTube.

She listed and thanked the members of the NIEHS Communications Team for their efforts.

Dr. Cordero asked if the materials were being translated into any other languages. Ms. Flowers replied that they are translated into Spanish, French, and Chinese, and that they would also be available on the NIEHS website in those languages.

XII. Integrated Testing Strategies for Developmental Neurotoxicity (DNT) Testing

Dr. Mamta Behl, a DNTP neurotoxicologist, reported to the Council on a program to re-envision the NTP strategy for DNT evaluation.

She provided background information about the rise in neurodevelopmental disorders in the U.S. and their profound effects on public health and the economy. She described the need for a new framework for assessing DNTs. The NTP recently created a new DNT Health Effects Innovation (DNT-HEI) program to help establish the new framework to evaluate environmental chemicals with neurodevelopmental potential.

The DNT-HEI mission is to:

- Have global public health impact by identifying environmental chemicals that have the greatest potential to affect susceptible populations such as the developing embryo/fetus, infants, and children.

- Provide a forum for collaborations among scientists at NIEHS, NIH, EPA, and the FDA's National Center for Toxicological Research as well as engagement with external stakeholders including clinicians and children's health advocacy groups.
- Train the next generation of scientists on aspects of neurodevelopmental disorders related to environmental exposures and on the latest technology.

Dr. Behl noted that NTP is in a unique position to move the field of DNT evaluation forward. She discussed the history of DNT screening and what the NTP has accomplished thus far. She described the creation of a DNT screening battery. The data integration and visualization tool created as part of that effort is called DNT-DIVER (Developmental NeuroToxicity Data Integration and Visualization Enabling Resource). It is the first integrative analysis and visualization resource to compare chemical effects across assays covering critical nodes of neurodevelopment.

Dr. Behl provided usage statistics for DNT-DIVER since its introduction in January 2019 through June 2019. She listed the next steps for DNT screening:

- Implement screening at the NTP on a routine basis
- Have DNT-DIVER serve as a resource to host global DNT efforts
- Expand DNT-DIVER to include additional features such as chemicals, assays, human exposure and translation
- Incorporate 3-D models, genetic diversity, barriers, metabolism
- Include epigenetics in the resource

She discussed potential improvements to *in vivo* DNT testing and the next steps in exposure assessment and clinical translation. The program's ultimate hopes are to:

- Implement novel tools to advance technology to better identify chemicals that may be associated with neurodevelopmental disorders.
- Interface and contextualize scientific advances with public health issues.
- Provide data for timely public health protection to prevent neurodevelopmental disorders.

Dr. Coronado asked Dr. Behl if there was information available to provide to educators, teachers, and child care development workers to make them aware of the recent research in the field. Dr. Behl said there are plans to do so, in concert with the Office of Communications and Public Liaison.

Dr. Wright asked Dr. Behl whether there are plans to work with CHEAR or ECHO. Dr. Behl replied that this was a great opportunity for the program to discuss potential collaborative work across divisions.

Dr. Ho asked if there are plans to look at any other windows of development such as puberty, or gender and sex. Dr. Behl said that it was under discussion, but for now, neurodevelopment was chosen to be able to map out a strategy. Dr. Ho asked whether there could be a collaboration with other federal agencies. Dr. Behl said that was planned.

Dr. Shih asked about the relevance of complementary animal models being used, such as zebrafish and planaria, concerning capturing social deficits that may manifest in children, and how results might translate to higher organisms. Dr. Behl described studies illuminating shoaling behavior in zebrafish as one example of evaluating social behavior. She noted that the initial goal is to flag environmental compounds with unknown developmental neurotoxic potential as the first tier of screening, with the intent to follow those studies up with more specific studies of suspect compounds.

XIII. Adjournment

Dr. Collman thanked the Council members for their contributions, and the staff members who had contributed to a very successful meeting. Dr. Mastin added his thanks to the AV and IT staff for their extra work at the remote venue. Dr. Woychik thanked the Council and for the members' input on the tribute to Dr. Birnbaum. He adjourned the meeting at 11:23 am, September 11, 2019.

CERTIFICATION:

/s/

Richard Woychik, PhD
Chairperson
National Advisory Environmental
Health Sciences Council

/s/

Gwen W. Collman, PhD
Executive Secretary
National Advisory Environmental
Health Sciences Council

Attachment:
Council Roster