

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

**MINUTES OF THE ONE HUNDRED THIRTY-SEVENTH MEETING OF THE
NATIONAL ADVISORY ENVIRONMENTAL HEALTH SCIENCES COUNCIL**

September 11, 2012

The National Advisory Environmental Health Sciences Council convened its one hundred thirty-seventh regular meeting on September 11, 2012 in the Rail Building, Rodbell Auditorium, National Institute of Environmental Health Sciences, Research Triangle Park, NC. Dr. Gwen Collman presided as Chair until Dr. Linda Birnbaum's arrival at the meeting, at which time she took over as Chair.

The meeting was open to the public on September 11, 2012 from 8:30 a.m. to 2:00 p.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 22, 2012 from 2:00 a.m. to 5:00 p.m. for consideration of grant applications. Notice of the meeting was published in the *Federal Register*.

Council Members Present

Kim Boekelheide, PhD
Julia Brody, PhD
Thomas Gasiewicz, PhD
Andrea Hricko, MPH
Howard Hu, MD, MPH, SeD (by telephone)
James Johnson, PhD (*ex-officio*)
Randall Kramer, PhD
Mary M. Lee, MD
Grace LeMasters, PhD
R. Stephen Lloyd, PhD
Yvonne Maddox, PhD (*ex-officio*) (by telephone)
Thomas McKone, PhD
Sem Phan, MD, PhD
Edward Postlethwait, PhD
Palmer Taylor, PhD
Viola Waghiyi
Deborah Winn, PhD (*ex-officio*)
Elizabeth Yeampierre, JD

NIEHS Staff

Kathy Ahlmark
Janice Allen, PhD
Beth Anderson
Robin Arnette, PhD
Joellen Austin
John Balbus, MD
David Balshaw, PhD
Martha Barnes
Linda Bass, PhD
Sharon Beard
Linda Birnbaum, PhD
John Bucher, PhD
Matthew Burr
Danielle Carlin, PhD
Trisha Castranio
Nisha Cavanaugh, PhD
Lisa Chadwick, PhD
Sandra Chambers
Jennifer Collins
Tammy Collins, PhD
Gwen Collman, PhD
Helena Davis
Caroline Dilworth, PhD
Mike DeVito, PhD
Christina Drew, PhD
Dorothy Duke
Benny Encarnacion
Katherine Fine
Symma Finn, PhD
Christine Flowers
John (Jef) French, PhD
Rachel Fisher
Mary Gant
Kimberly Gray, PhD
Astrid Haugen
Michael Humble, PhD
Caroline Johnson
Laurie Johnson
Ed Kang
Annette Kirshner, PhD
Gabriela Knudsen, PhD
Cindy Lawler, PhD
Chris Long

Robin Mackar
J. Patrick Mastin, PhD
Kim McAllister, PhD
Steven McCaw
Rose Anne McGee
Liz McNair
Fred Miller, MD, PhD
Sri Nadadur, PhD
Liam O'Fallon
Michelle Owens
Jerry Phelps Kristi
Pettibone Nicole
Popovich Scott
Redman Ericka
Reid, PhD Leslie
Reinlib, PhD Lisa
Rogers Elizabeth
Ruben John
Schelp
Thad Schug, PhD
Wynona Sessoms
Daniel Shaughnessy, PhD
William A. Suk, PhD, MPH
Kimberly Thigpen Tart, JD
Tameka Thomas
Claudia Thompson, PhD
Sally Tilotta, PhD
Frederick Tyson, PhD
Nigel Walker, PhD
Betty Wilkins
Leroy Worth, PhD
Darryl Zeldin, MD

Members of the Public Present

Ernie Hood, Bridport Services
Pia MacDonald, SSS
Charles Novak, SSS
Michael Phillips, RTIInternational
Pamela Schwingl, PhD, SSS
Robert Tanguay, Oregon State University
Bill Wade, SAIC
Robert Yates, SSS

I. Call To Order and Opening Remarks

Dr. Gwen Collman, Director of the NIEHS Division of Extramural Research and Training (DERT), welcomed attendees and called the meeting to order. She mentioned that Council members Dr. Marie-Francoise Chesselet, Dr. Vivian Cheung, and Dr. Lisa Conti were absent from the meeting. She also noted that *ex-officio* members Dr. Steven Dearwent and Dr. Jennifer Orme-Zavaleta were not present. She welcomed *ex-officio* member Dr. James Johnson from the EPA, who was sitting in for Dr. Orme-Zavaleta. She said that Council members Dr. Yvonne Maddux and Dr. Howard Hu would be attending by telephone. She then asked all present in the room to introduce themselves, which they did.

II. Review of Confidentiality and Conflict of Interest

Dr. Collman reviewed the Conflict of Interest and Confidentiality procedures, which had been provided earlier to Council members in written form, and went over various other administrative matters.

III. Consideration of May 2012 Meeting Minutes

Approval of the May 2012 minutes was moved and seconded, and Council voted unanimously to approve the minutes. Dr. Collman noted the dates of the upcoming Council meetings for members to put on their calendars.

IV. Report of the Director, DERT

DERT Director Dr. Gwen Collman updated Council on DERT developments, beginning with staff activities.

She briefed Council on DERT staff activities during the spring/summer 2012 period, which she noted had been very busy, with seemingly a meeting every week. Program meetings included a CNS Grantee meeting in May, a Gene and Environment Trainees meeting, a ONES Awardees Forum, a Breast Cancer and the Environment Program Integration meeting and a DHHS Environmental Justice Task Force meeting in July, a in August a Nanotechnology Program Grantee meeting and a SAMSHA/NIEHS Gulf Study meeting, which focused on community resilience and mental health issues in the Gulf region. SAMSHA is partnering with both the intramural and extramural components of the NIEHS Gulf Oil Spill program to develop a research agenda related to behavioral health, with another meeting scheduled for later in 2012.

Dr. Collman said that there have been an ongoing set of discussions on implementation planning related to the new 2012-2017 NIEHS Strategic Plan. The activity took up a great deal of DERT's time and attention and energy over the last months. DERT has created Strategic Goal Implementation Teams that have been actively brainstorming ideas on the specific goals contained in the plan and potential activities over the next five years to carry out the plan and achieve those goals. She said that the large number of ideas are in the process of being prioritized, and will soon be matched with budgetary realities.

She updated Council on NIEHS extramural involvement with the FDA-NIH Tobacco Program. She described several funding announcements NIH has issued over the past several months, building on existing 2012 grant programs, with applications having been received and reviewed and decisions having been made. She noted that NIEHS mission areas coincide with roughly 5-6 of the approximately 58 research areas covered by the program. NIEHS received three applications for the R01 competitive revision activity; none were recommended for funding by FDA. No applications were received for administrative supplements to program project grants or center grants, or for U01 competitive revisions. Nine unsolicited applications were submitted; one project was funded. Going forward, NIEHS is participating in several more funding opportunities, including P50, R21, R03 and R01 mechanisms. The institute is continuing to engage FDA in dialogue regarding its mandate and needs and how NIEHS can align with them. Also, NIEHS is leading the Trans-NIH/FDA training program committee, with several institutes participating. The group is currently exploring options for career development awards and individual fellowships.

Dr. Collman said that at this meeting the time had come to implement the new policy called Special Council Review, on which she had briefed Council at its last meeting. The policy involves council review of applications from investigators with more than \$1 million in direct costs of research support. She noted that the threshold had changed since her previous briefing, when it had been \$1.5 million in *total* costs. She went over the types of grants that would receive Special Council Review, which are competing Research Project Grants, with certain exceptions:

- P01s (unless all PIIPDs exceed threshold)
- Other multi-component RPGs (unless all PI/PDs exceed threshold)
- Multi-PIIPD applications (unless all PIIPDs exceed threshold)
- Applications submitted for RFAs

She added that only applications that NIEHS is interested in funding would be brought forward for Special Council Review. She described the characteristics that would contribute to the \$1 million threshold. She reminded the Council members about the guidelines they should follow in their consideration of the Special Review applications,

which she had detailed previously. She went over the materials provided to them for the review, including the summary statement, relevant information from other currently funded grants (including grant number, title, project end date, direct/total costs, and other attributes), and the project's potential contribution to NIEHS' strategic goals. There is also scientific information about other funded grants and recommendations or further appropriate information from the Program Officer.

During the Council meeting's closed session, there were to be three applications subject to Special Council Review. Dr. Collman explained that with a motion for approval, Council would be asked "to recommend consideration of funding for applications that afford a unique opportunity to advance research which is both highly promising and distinct from the other funded projects from the PD/PI."

V. Report of the Director, NIEHS

NIEHS/NTP Director Dr. Linda Birnbaum updated Council on Institute developments.

She related that the NIEHS 2012-2017 Strategic Plan was released on August 1, and that there had been much good feedback on it. She noted that its formulation had been a very inclusive process, with the involvement of several Council members and many other stakeholders. She noted that everyone at NIEHS is currently working hard on implementation planning, delineating "exactly what we're going to do, and how we're going to spend our money to do it over the next five years." She said that the divisions have all developed their own implementation plans, which are now being merged into an institute-wide plan, along with cross-divisional efforts, encompassing her "one NIEHS" concept. She said that the implementation plans should be in place and operational by the next Council meeting in February, 2013. She also mentioned that NICEATM-ICCVAM had in July released a draft of its Five-Year Plan for 2013-2017, which is expected to be finalized within the next two months.

Dr. Birnbaum described a new challenge initiative in partnership with EPA called *My Air, My Health*. It is a competition to create the best personal sensor, measuring air pollution exposure and individual physiological responses, in the form of wearable monitors. There will be four initial awards for \$15,000 followed by selection of one winner, who will receive \$100,000. It is the first such challenge to stimulate innovation undertaken by EPA and HHS.

Dr. Birnbaum introduced Dr. Tammy Collins, the new director of the NIEHS Office of Fellows' Career Development.

She updated the NIEHS budget situation, beginning with FY2010-2013 appropriations. The high point in recent years was in FY2010, at nearly \$690 million (1). She noted that in FY2011 and so far in FY2012, a series of Continuing Resolutions (CR) has been

funding the Federal government, with NIEHS funding declining slightly in the full-year 2011 CR, but rising slightly under the FY2012 CR. Superfund has dropped slightly from its peak in FY2010. The training pass-through from the Department of Energy has been maintained its level of \$10 million for the past three years. The FY2013 President's Budget shows very slight budget decreases for NIH and NIEHS. Another six-month CR is expected in the near future, and planning is taking place for spending under that measure.

She reported on the considerable recent legislative activity related to NIEHS. The Senate Labor HHS allocation reported a \$100 million increase for NIH and a \$2 million increase for NIEHS, which is essentially flat when inflation is taken into account. Highlighted research priorities included women's health issues such as endometriosis, fibroids and breast cancer, expansion of Tox21 tools and methods, and \$165 million for continuation of the National Children's Study, which is a decrease from current funding. The House Labor HHS bill includes a \$725,000 cut for NIEHS, with \$175 million for the National Children's Study. She noted, however, that "none of these bills are actually going to happen." Of concern nonetheless was the inclusion of a prohibition on NIEHS using any funds for the Report on Carcinogens (RoC) until 30 days after completion of the National Academy of Sciences peer review study of the process, which is expected to take up to two years to complete. What had been called for in the FY2012 budget bill was for the Office of the Assistant Secretary of Health to review the listing of styrene and formaldehyde in the RoC, not a review of the process itself. The Office has put the contract with the Academy in place to review the listings. It is hoped that the language calling for the prohibition, which would essentially shut down the RoC process for a period of time, will not survive the legislative process.

She also reported that the House Interior/Environment bill reported but did not vote on cuts of \$4 million in funding from NIEHS Superfund. There was some language calling for the people trained under the Worker Education and Training Program (WETP) to pay for the cost of the training, despite the fact that many of the workers are unemployed. Also, the House Energy and Water bill passed with no mention of the NIEHS/DOE Worker Training Program. The Senate report directed DOE to fund the program, but did not attach an amount.

Ultimately, she said, there will be no budget in the near future-certainly not before the election, and perhaps it may take much longer. She talked about the potential for budget sequestration in January 2013. If that was to occur, HHS would be cut by approximately 7.8% (2), which would also apply to NIH, with no discretion in the cuts among divisions, or among institutes. Within each institute, however, there would be flexibility on how the cuts would be achieved. The hope, she said, is that after the election, action will be taken to prevent the automatic cuts from occurring, as they "would be devastating to many, many programs in our country."

She reported that Congressman Joe Barton (R-TX) has been concerned about Title 42, which is a hiring mechanism used by the Federal government, particularly HHS. He has introduced a bill to limit the total number of Title 42 employees to 5%, limit it to HHS, and impose a salary cap to 150% of Level 1 of the Senior Executive Service (SES). The bill also requires an annual report to Congress on Title 42 numbers, and provides for a salary cap exemption for up to 50 people by the Secretary of HHS.

There have been newly mandated restrictions on conference and travel support, although training for scientific purposes is exempt from the cuts, and the restrictions do not apply to grantee meetings. Overall travel and materials costs are to be cut by 20% compared to an FY2010 baseline. For conferences, more than 50 employees cannot attend an international conference unless the Secretary deems it necessary. Conference costs now include travel. Any meeting costs in excess of \$25,000 must be approved by NIH Director Dr. Collins. Costs over \$100,000 must be approved by the Deputy Secretary of Health, and costs over \$500,000 must be approved by Secretary Sibelius.

Dr. Birnbaum shared recent scientific advances from research conducted or supported by NIEHS. First, she summarized a paper whose senior author was Dr. Fred Miller, who is Acting NIEHS Clinical Director. The paper addressed the prevalence and sociodemographic correlates of antinuclear antibodies in the United State, shedding new light on the dramatic increase in autoimmune health conditions in recent years by mining the NHANES database. Another paper, on *Criteria for environmentally associated autoimmune diseases*, discussed results emerging from a recent workshop on autoimmunity and the environment. A paper published by researchers from the DNTP and the NIEHS Clinical Unit addressed induction of apoptosis and autophagy in human peripheral blood monocytes from exposure to cerium dioxide nanoparticles, reflecting the institute's research interest in nanomaterials. Other papers she described included works addressing common disease-associated variation in regulatory DNA, gestational exposure to bisphenol A and transgenerational changes in behavior and gene expression, the pervasive effects of polymerase II pausing on stimulus-responsive gene networks, and a study testing an aflatoxin B1 gene signature in rat archival tissues that pointed to the potential of using archival tissues to answer specific questions.

Turning to other news and highlights from the institute, she addressed activities related to science data and translation. Dr. Kris Thayer and her team in the NTP Office of Hazard Assessment and Translation (OHAT) have been developing methodology to facilitate Systematic Reviews. The Chemical Effects in Biological Systems (CEBS) database has been improved and expanded. NIEHS is working with NCI and NIOSH to maintain a Nanomaterials Registry. Also, an NIEHS researcher recently contributed to the on-line *Journal of Visualized Experiments* (JoVE), which has become an important venue for the use of videos associated with papers.

In highlights related to global environmental health and sustainable development, Dr. Birnbaum mentioned that NIEHS had participated in a series of workshops related to the Roundtable that the institute co-sponsors with the Institute of Medicine (the Roundtable on Environmental Health Sciences, Research, and Medicine), which worked on Rio+20 sustainability indicators. The group held webinars both before and after the Rio meeting to acquaint the community with the opportunities presented by that forum. She said that Dr. John Balbus is leading an effort to re-establish NIEHS as a WHO Collaborating Centre, which will support a variety of related activities, including support for participation in international meetings on children's health, low-dose response and endocrine-disrupting chemicals, and international chemical management. She also alluded to the clean cookstoves program, citing the Clean Cookstoves Support Act of 2012, and the UN's recognition of 2012 as the Year of the Clean Cookstove. NIH is the largest contributor to the federal profile of research related to indoor air and cookstoves, and NIEHS is the largest contributor to that effort within NIH. She described grantee Dr. Kirk Smith's research in the area. In a publication this year, he was the first to show that improved cookstoves can reduce indoor air pollution and protect health. She added that a call for administrative supplements related to cookstove research had gone out from NIH and NIEHS and four other ICs.

In environmental health ethics developments, Dr. Birnbaum recognized the efforts of the head of the NIEHS Office of Ethics, Bruce Androphy, J.D. She noted that his office sponsors an Annual Ethics Day and publishes a newsletter, *Ethics Insights*, twice per year. She also mentioned the recent publication of a book by resident NIEHS bioethicist Dr. David Resnick, *Environmental Health Ethics*.

She described several recent meetings and events. In May, NIEHS hosted a major workshop on *Emerging Issues in Large-Scale Genetic Studies*. In June, a small workshop on Parkinson's premotor symptoms was co-organized by DERT program administrator Dr. Cindy Lawler and DIR research Dr. Honglei Chen. In June, NIEHS also sponsored an NAS Emerging Science Workshop devoted to *Systems Biology and Informed Risk Assessment*. June also saw a second annual NIEHS-EPA co-sponsored Climate Change Workshop for high school students. In July, a meeting of the Genes, Environment and Health Initiatives grantees was held at RTP, which included graduate students, postdoctoral trainees, and training directors from the three universities involved (University of Cincinnati, University of Arizona, and Harvard University). Also in July, NIEHS sponsored a well-attended Environmental Justice Stakeholders meeting, another NAS workshop on individual susceptibility issues, and the fourth bi-annual meeting of the NIEHS Nanotechnology Health Implications Research Consortium. Later in the summer, the Superfund Research Program (SRP) sponsored two meetings; one was a dialogue between the SRP and the Agency for Toxic Substances and Disease Registry (ATSDR) on connecting research and practice, the other was an SRP

stakeholder meeting on response, recovery and resilience to oil spills and environmental disasters. Over the summer there was also a meeting with SAMSHA and the NIEHS Gulf Oil Spill response group to discuss the \$3.3 million grant being given by SAMSHA to NIEHS for research on the psychosocial and behavioral impacts of the disaster. She also alerted Council members to several other significant meetings coming up in September, October, and November of this year and January, 2013.

Dr. Birnbaum recognized honors recently received by NIEHS personnel or grantees. NTP visiting fellow Dr. Xiaohua Gao received a Young Investigator Award from the Society of Toxicologic Pathology for her work on the effects of cadmium on several cellular signaling processes. Yasmin Crespo-Mejias, an undergraduate from the University of Puerto Rico, who was a summer intern in the Laboratory of Developmental and Reproductive Toxicology, won an NIH Undergraduate Scholarship award, which provided her \$20,000 toward her tuition and providing her a year of research involvement at NIH.

Related to other awards and recognitions, Dr. Birnbaum noted the return of former NIEHS/NTP Director Dr. Kenneth Olden to the RTP area. In July, he was named director of the EPA's National Center for Environmental Assessment and the Human Health Risk Assessment Program. She also reported that David Ciplet, a graduate student in the Brown University Superfund Research Program (SRP), has received a Switzer Environmental Fellowship Program award for students whose studies are directed at improving environmental quality.

Concluding her presentation, Dr. Birnbaum entertained questions from Council.

Dr. Kramer asked her to elaborate on the WHO Collaborating Centre, and whether it is based in Geneva or is a virtual collaborating center. She said that it would be based at NIEHS, but is conducted collaboratively. She noted that there used to be such a center at NIEHS for many, many years.

Dr. Lloyd asked for more information on the potential prohibition on NIEHS using funds for the RoC, in terms of what that would mean in practical terms. She said it would mean that the \$2 million per year normally spent on preparation and review of the report "would have to come to a dead stop." It is unclear, she said, what the full implication would be until it was enacted. She noted that all are hopeful that it will not go forward, and that various friends of the institute have actively expressed their concern. Dr. Lloyd asked how far the restrictions would go, even beyond the RoC, to peer review publications, for example. Dr. Birnbaum replied that it would be specific to the RoC itself.

Dr. Lee asked Dr. Birnbaum for more information on the budget cuts to the National Children's Study. She said that when there is a budget in place, the answer to that would be known. She noted that work is proceeding on the study.

Dr. Birnbaum presented certificates of appreciation to retiring Council members Dr. LeMasters, Dr. Lloyd, Dr. Phan, and Dr. Taylor.

VI. Concept Discussion: Occupational Safety and Hazardous Substances Training Programs in Emerging Technologies

Program administrator Dr. Danielle Carlin presented the Superfund Research Program (SRP) R25 Concept Clearance to Council.

She reviewed the grants for which the SRP is best known, including P42, R01 and R43/R41 grants. She noted that the SRP enabling legislation (Superfund Amendments and Reauthorization Act [SARA] of 1986) encourages training, including programs such as short courses and continuing education for state and local personnel, as well as graduate or advanced training in the field. Under that mandate, SRP offers a number of training opportunities and activities, which Dr. Carlin described.

As background for the concept, she noted that training, along with development of advanced technologies, have been recognized to be important elements in both of the most recent SRP and NIEHS Strategic Plans. This emphasis led to the February 2012 issuance of an RFI to gather information about the importance of training for professionals and graduate students in the area of emerging technologies, which includes hazards waste processes, green chemistry, sustainable remediation, exposure science, etc. The "overwhelming response" was that there is a need for training in those areas. Thus, the concept affords a new opportunity to develop continuing education and academic curricula on occupational and safety management practices in the area of emerging technologies. The programs may include web-based training modules, short courses, continuing education, and full academic courses. They would be targeted to graduate students, industrial hygienists, and other professionals involved in training of personnel involved in the clean-up and enforcement of hazardous waste sites. The goal would be to help such personnel gain valuable skills, knowledge and experience to prepare them for work and research in new industries. The program would expand and complement existing education and training programs in occupational and safety training and industrial hygiene.

The Concept Clearance involves use of the NIH R25 funding mechanism- Research Education Program Grants. SRP would allocate \$750,000 annually to support up to four programs for up to three years. Dr. Carlin added that one goal of the initiative

would be to establish consortia of 3-5 institutions to achieve greater representation of various disciplines, and to leverage expertise and funding.

The timeline would be to release the RFA in November, 2012, with applications due in early 2013. Then scientific review would occur, followed by Council review in May, 2013. The awards would be issued in June, 2013. After the first three-year period, the programs would be evaluated and a new RFA would be released.

First Council reviewer, Dr. Hu, said that it was his impression that the concept had a different orientation than that called for in the R25 description, which he said is aimed at developing researchers in particular. He asked Dr. Carlin if there was a specific orientation in mind. He said that his own bias is that "we are in desperate need of folks who can do research in this area." Dr. Carlin replied that the staff mainly had in mind the training of professionals, but that the training would ultimately apply to the research to be conducted by the graduate students and post-docs. She said it would be likely that the institutions applying for the funding would be aware of their research in the field and would be applying that knowledge to the training opportunities.

Dr. Hu asked if, for example, the funds could be used to support a Ph.D. student doing work in exposure science. Dr. Carlin said that they could, and cited the example of a web-based training seminar as appropriate training for such a student.

Dr. Hu said that he liked the examples given for emerging products and technologies. He pointed out that the training cores within Superfund P42 Centers are one of the only types of mechanisms within NIH that allow the training of international students, which has resulted in the training of "some absolutely outstanding international scholars." He wondered if anyone at NIEHS had ever tracked the outcomes of those scholars. Dr. Carlin said that NIEHS had developed a database called CareerTrac to follow all alumni and track their career outcomes.

Dr. Hu described a phenomenon he had been seeing, where occupational health and safety professionals are increasingly being called upon to become sustainability officers in their companies. He said that constitutes an opportunity and a challenge, because there are no established, clear competencies for sustainability science. He suggested that NIEHS could help lead the conversation about what is sustainability science and its interface with environmental health science. Dr. Birnbaum noted that sustainability and green chemistry are already areas of interest for NIEHS, with a variety of initiatives in progress.

The Second Council reviewer, Ms. Yeampierre, said that she was excited about the concept, as it would afford opportunities for training within industrial waterfront communities where there is potential for a storm surge, and allow emerging technologies training of personnel in the local communities, such as first responders

dealing with a storm surge situation. Dr. Carlin noted that SRP's collaboration with the Worker Education Training Program would help contribute to the type of learning opportunities envisioned by Ms. Yeampierre. Ms. Yeampierre said that accessing such training would be important for the small industries who are not unionized and do not have ready access to training programs.

Dr. Hricko said she was confused about how this program would fit in with the NIOSH University Education and Research Centers (ERCs), particularly in light of ongoing efforts to eliminate the ERCs. Dr. Carlin said SRP has been trying to think ahead and offer training that could at least partially replace some of the services provided by the SRCs. The R25 program would be driven by the SRP and NIEHS strategic plans, and would aim for a niche, to contribute to any gaps created by the demise of the ERCs.

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

VII. Harnessing the Power of Zebrafish to Advance Environmental Health Sciences

NIEHS grantee Dr. Robert Tanguay, a professor of molecular toxicology at Oregon State University, described his group's research using a classical model, the zebrafish, in innovative new ways. The team has developed several new technologies to allow the application of high-throughput screening techniques to the zebrafish, and the model's utility in environmental health sciences research is poised to increase dramatically.

He said that the enormous challenges facing NIEHS are to identify how environmentally relevant exposures are causally related to adverse health outcomes, and to unravel specific mechanisms of toxicity. Traditional rodent models are simply too slow and expensive to evaluate the universe of potential exposures. With ARRA funding from NIEHS, Tanguay and his group invented robotics to automate the production, exposure and assessment of three million zebrafish embryos per year. He explained that embryonic development is the ideal stage to identify chemical hazards, because it requires the full repertoire of molecular signaling, thus increasing the likelihood of identifying adverse gene-chemical interactions. The whole-animal toxicity platform provides essential phenotypic anchoring to identify hazardous exposures, while facilitating the discovery of the targets and pathways responsible for the toxicity. The platform can be used to identify phenotypic responses following complex exposures, including complex mixtures collected with passive sampling technology from Superfund sites and from the Gulf oil spill.

VIII. GWAS and Benzene-Induced Hematotoxicity in the Mouse

Dr. John "Jef" French, leader of the Intramural Host Susceptibility Group within the Biomolecular Screening Branch, briefed Council on the results of recent benzene exposure experiments with two types of mouse models – a fixed-genotype, highly inbred, 18-strain panel (the "NTP" panel) and a highly genetically diverse model called the J:DO Diversity Outbred Mouse (DO), where outbreeding was used to revert a laboratory mouse strain into a wild-type animal, creating a new population-based model.

As Dr. French noted, individual response to exposure-related disease may be based upon differences in exposure and/or genetic-epigenetic variations. Acute exposures to benzene, a component of tobacco smoke and a ubiquitous environmental carcinogen, may result in hematotoxicity and genotoxicity, while chronic exposure may result in cancer of the lymphohematopoietic systems of humans and rodents. To link environmental exposure to benzene and susceptibility or resistance to toxicity, French's group performed a genome-wide association study (GWAS) using the DO mice, which were created from the Collaborative Cross (CC), a population of advanced intercross recombinant inbred lines (AIRILs). Each DO mouse is genetically different from every other DO mouse from generation to generation, and represents a significant degree of genetic diversity in the mouse genome that is equal or greater than that of human populations. To test for genome-wide association in DO mice based upon individual responses to benzene-induced toxicity, the researchers exposed the mice to 0 (air control), 1, 10, or 100 ppm benzene by inhalation in two independent experiments. The results describe a link between environmental exposure and susceptibility-resistance to benzene-induced hematotoxicity and genotoxicity through quantitative-trait analysis. The CC AIRILs, from which the DO mice have been created, are a critical tool for validating candidate genes identified in the QTLs using molecular biology and reverse genetics approaches. Also, determination of a variable range of response and the genetic basis can aid in improving the extrapolation of results from rodent models to human hazard identification and risk assessment. Dr. French noted that the observations would be placed into the context of Goals 1 and 2 of the new NIEHS Strategic Plan 2012-2017.

IX. Consideration of Grant Applications

This portion of the meeting was closed to the public 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).

X. Adjournment

- I. The meeting was officially adjourned at 5:00 pm on September 11, 2012.

CERTIFICATION:

Linda S. Birnbaum

Linda S. Birnbaum, PhD, DABT, ATS
Chairperson
National Advisory Environmental
Health Sciences Council

Gwen W. Collman

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

Attachment:
Council Roster

Notes added after Council:

- (1) This \$690 million figure refers only to the Health and Labor Committee budget and does not include the Superfund budget.
- (2) Since Council, this figure has been updated to 8.2%.