

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
NATIONAL INSTITUTES OF HEALTH
NATIONAL LIBRARY OF MEDICINE
MINUTES OF THE BOARD OF REGENTS
May 9-10, 2017**

The 175th meeting of the Board of Regents was convened on May 9, 2017, at 9:00 a.m. in the Donald A.B. Lindberg Room, Building 38, National Library of Medicine (NLM), National Institutes of Health (NIH), in Bethesda, Maryland. The meeting was open to the public from 9:00 a.m. to 3:30 p.m., followed by a closed session for consideration of grant applications until 4:00 p.m. On May 10th, the meeting reopened from 9:00 a.m. until adjourning at 12:00 p.m.

MEMBERS PRESENT [Appendix A]:

Dr. Alessandro Acquisti, Heinz College, Carnegie Mellon University
Ms. Jane Blumenthal, University of Michigan
Dr. Robert Greenes, Arizona State University [Chair]
Dr. Eric Horvitz, Microsoft Research
Ms. Sandra Martin, Wayne State University
Dr. Daniel Masys, University of Washington
Dr. Gary Puckrein, National Minority Quality Forum
Dr. Esther Sternberg, University of Arizona
Dr. Jill Taylor, Wadsworth Center, New York State Department of Health

EX OFFICIO AND ALTERNATE MEMBERS PRESENT:

Col. Thomas Cantilina, United States Air Force
Dr. Wayman Cheatham, United States Navy Bureau of Medicine and Surgery
Dr. James Deshler, National Science Foundation
RADM Joan Hunter, Office of the Surgeon General, PHS
Mr. Stan Kosecki, National Agricultural Library
Dr. Mary Mazanec, Library of Congress
Col. Michael Nelson, United States Army
Dr. Dale Smith, Uniformed Services University of the Health Sciences

SPEAKERS AND INVITED GUESTS PRESENT:

Dr. Matthew Gillman, Office of the Director, NIH
Dr. Matthew Scotch, Arizona State University
Dr. Alfred Sorbello, Food and Drug Administration

MEMBERS OF THE PUBLIC PRESENT:

Mr. Glen Campbell, Friends of the National Library of Medicine
Dr. Lynne Holden, Montefiore Medical Center
Dr. Barbara Redman, New York University
Dr. Elliot Siegel, Consultant
Mr. Thomas West, Krasnow Institute

FEDERAL EMPLOYEES PRESENT:

Dr. Patricia Flatley Brennan, Director, NLM
Ms. Betsy Humphreys, Deputy Director, NLM
Dr. Milton Corn, Deputy Director for Research and Education, NLM
Mr. Terry Ahmed, Division of Library Operations, NLM
Ms. Stacey Arnesen, Division of Specialized Information Services, NLM
Ms. Dianne Babski, Division of Library Operations, NLM
Ms. Joyce Backus, Division of Library Operations, NLM
Dr. Dennis Benson, National Center for Biotechnology Information, NLM
Dr. Olivier Bodenreider, Lister Hill Center, NLM
Ms. Hua Florence Chang, Division of Specialized Information Services, NLM
Ms. Kathy Cravedi, Office of Communications and Public Liaison, NLM
Mr. Ivor D'Souza, Office of Computer and Communications Systems, NLM
Mr. Todd Danielson, Office of the Director, NLM
Dr. Kathel Dunn, Division of Library Operations, NLM
Dr. Valerie Florance, Division of Extramural Programs, NLM
Dr. Dina Demner-Fushman, Lister Hill Center, NLM
Ms. Rebecca Goodwin, Office of Health Information Program Development, NLM
Mr. Daniel Hartinger, Office of Acquisitions, NLM
Dr. Zoe Huang, Division of Extramural Programs, NLM
Dr. Michael Huerta, Office of Health Information Program Development, NLM
Ms. Christine Ireland, Division of Extramural Programs, NLM
Ms. Janice Kelly, Division of Specialized Information Services, NLM
Ms. Elizabeth Kittrie, Office of Health Information Program Development, NLM
Ms. Michelle Krever, Division of Extramural Programs, NLM
Ms. Lisa Lang, Division of Library Operations, NLM
Ms. Mary Ann Leonard, Office of the Director, NLM
Dr. Robert Logan, Office of Communications and Public Liaison, NLM
Dr. Zhiyong Lu, National Center for Biotechnology Information, NLM
Ms. Wei Ma, Office of Computers and Communication Systems, NLM
Dr. Clement McDonald, Lister Hill Center, NLM
Mr. Dwight Mowery, Division of Extramural Programs, NLM
Mr. David Nash, Office of the Director, NLM
Dr. Barbara Rapp, Office of Health Information Program Development, NLM
Dr. Jeffrey Reznick, Division of Library Operations, NLM
Ms. Ann Ripple, Lister Hill Center, NLM
Mr. Jerry Sheehan, Office of the Director, NLM
Dr. Hua-Chuan Sim, Division of Extramural Programs, NLM
Dr. George Thoma, Lister Hill Center, NLM
Ms. Victoria Townsend, Division of Library Operations, NLM
Dr. Wanda Whitney, Division of Library Operations, NLM
Dr. Fred Wood, Office of Health Information Program Development, NLM
Dr. Jane Ye, Division of Extramural Programs, NLM
Dr. Deborah Zarin, National Center for Biotechnology Information, NLM
Mr. Mark Ziomek, Division of Library Operations, NLM

I. OPENING REMARKS

NLM Board of Regents Chair Dr. Robert Greenes, welcomed members, alternates, and guests to the Board's 175th meeting. He introduced a new ex-officio member, Mary Mazanec, MD, JD, Director of the Library of Congress's Congressional Research Service. He also recognized NLM Board member Ms. Sandra Martin's recent appointment to the board of the Medical Library Association (MLA) and noted that Board of Regents member Ms. Jane Blumenthal was recently named an MLA Fellow. He then introduced RADM Joan Hunter, Assistant Surgeon General and Director, Personnel & Readiness, Office of the Surgeon General (OSG).

II. REPORT FROM THE OFFICE OF THE SURGEON GENERAL, PHS

RADM Joan Hunter, director of the US Public Health Service (PHS) Division of Commissioned Corps Personnel and Readiness, announced that the Surgeon General, a political appointee, recently resigned at the request of the new Administration. The Acting Surgeon General is RADM Sylvia Trent-Adams, PhD, RN, FAAN. The Administration is expected to nominate a new Surgeon General shortly.

RADM Hunter provided updates on the OSG transition and the Commissioned Corps, and described the Department's new goals and OSG priorities.

By June 20, the OSG must submit to the Office of Management and Budget a plan for personnel and priorities within the Department. HHS Secretary Tom Price has established working groups to examine the healthcare system. He wants the OSG to be engaged, be empowered to make recommendations, to optimize service, performance, stewardship, and sustainability.

RADM Hunter said that the priority of the USPHS Commissioned Corps is to serve underserved populations, such as prisoners and persons treated in Native American clinics. The Corps is actively involved in strengthening ties with HHS and non-HHS agencies, and re-establishing community health and service missions. They partner with Remote Area Medical, a group of volunteer medical personnel who travel nationwide to provide health care in underserved areas.

Board member Dr. Gary Puckrein asked RADM Hunter how an "underserved population" is defined. She said it was defined by multi-factorial components.

Ex-officio member Dr. Wayman Cheatham asked for an update on the placement of Public Health Service hospitals. RADM Hunter said that PHS hospitals no longer exist. They were abolished during the Reagan Administration in 1981. Board member Dr. Daniel Masys said he retired as a Commissioned Corps officer in 1994. He asked RADM Hunter if the OSG is looking at retired Commissioned Corps personnel to help. She said that the PHS Commissioned Officers Foundation is interested in doing so.

III. REPORT ON THE ENVIRONMENTAL INFLUENCES ON CHILD HEALTH OUTCOMES (ECHO) PROGRAM

Dr. Matthew Gillman, Director of the NIH Environmental Influences on Child Health Outcomes

(ECHO) Program described ECHO's mission: to enhance the health of children. Its overall scientific goal is to answer crucial questions about effects of a broad range of early environmental exposures on child health and development. ECHO operates, he said, under the notion that a good start to life can last a lifetime. ECHO believes that kids face challenges earlier in life that impact their future level of function and independence. To ensure a healthy start in life, ECHO seeks to understand the potential risks, like maternal obesity, gestational diabetes and unhealthy habits, and to understand to whom and when these potential risks apply in order to take action.

ECHO is currently in 44 states, DC, and Puerto Rico. There are 1280 key personnel and 110 PIs. Last December, 2016, ECHO made 62 grant awards. ECHO has seven components: a Coordinating Center; a Data Analysis Center; the Children's Health and Exposure Analysis Resource (CHEAR) Core; the Patient Reported Outcomes (PRO) Core; Cohorts Sites; the IDeA States Network; and a Genetics Core. Through both observation and intervention, ECHO seeks to address "so what" questions that have impact on programs, practice, and policy.

ECHO defines the environmental exposure period from conception to age five years. Staff is looking at health outcomes throughout childhood and adolescence with a focus on four high-impact pediatric conditions: upper and lower airway; obesity; pre-, peri-, and postnatal outcomes, and neurodevelopment.

The studies will share standardized core data elements managed by a central coordinating center and an associated data analysis center. The core elements to be addressed across all studies are: demographics, typical early health and development; genetic influences on early childhood health and development; environmental factors; and Patient (meaning parent and child) Reported Outcomes (PROs).

ECHO is developing a hybrid cloud environment for data capture, storage, and analysis. Different groups of people will have different levels of data access. There are security controls and data encryption, tracking of all user actions, and independent security audit.

ECHO is situated in the NIH Office of the Director. Dr. Gillman reports to the NIH Director. ECHO will soon hold the first meeting of its External Scientific Board.

Dr. Masys asked whether all individual-level data will go into the main coordination center. Dr. Gillman said that he expects that all cohorts will share individual level identifiable information on the data platform. Exact information will be determined by the data collection protocol.

Board member Dr. Esther Sternberg asked about Institutional Review Board (IRB) approval for this data sharing. Dr. Gillman replied that initially, during the pilot phase, they are asking cohorts to share aggregate data, then de-identified data, and then identified data. In the first case, there is general IRB approval needed; in the second, they imagine there is some variability; and in the third, they are using a central IRB. Dr. Sternberg said she is involved with a General Services Administration (GSA) project, and they have to go back to participants and ask approval for sharing the de-identifiable data with federal agencies.

Dr. Sternberg said that in her years of experience in interdisciplinary science, one of the big hurdles was getting junior and tenure track scientists to agree to get credit for being part of a massive team. She asked Dr. Gillman how he is dealing with that. He confirmed that it was a significant issue and they are trying to tackle it. First, they just ratified publication policies which talk about authorship and include team authorship. Second, they have an “opportunities and infrastructure” fund to support the junior investigators for their ability to lead analyses in ECHO cohorts.

Dr. Cheatham asked whether the Hawaii site reached Pacific Islander populations. Dr. Gillman said that the Hawaii site is mostly engaging Native Hawaiians, not other Pacific Islanders. Dr. Cheatham asked whether the application period has closed for applicants such as Guam. Dr. Gillman replied that all the funds have been disbursed: \$165 million in 2016.

Dr. Greenes asked Dr. Gillman if he had any ideas about how NLM concepts and approaches can inform ECHO’s activities. Dr. Gillman said that he has a slide that says, “If you do not know the answer to a question, just say it is Epigenetics.” He noted that he has been talking to NLM Director Dr. Patricia Flatley Brennan about big data, the longevity of the data, data sharing, and developing a platform. He said they don’t have a plan for long-term storage and curation of the data.

Dr. Brennan said that the ECHO project is particularly critical to the NIH right now. It is one of the few cohorts in which data has been collected at various inception points, and the agreements and rights under which the data was collected are in flux. So, there is an opportunity to address and solve some of these challenges. She said that the NLM is pleased to see common data elements, the idea around maintaining harmonization at the point closest to collection, and to look at distributed models of data sets. What is protected health information? What can be shared? What cannot be shared? She said that the data was paid for by the public and it is NIH’s responsibility to preserve and protect the rights of individuals while making the data accessible to the public.

Dr. Puckrein asked for clarification of how ECHO defines “the underserved.” Dr. Gillman said that the IDeA program defines the states that have underserved populations. Dr. Puckrein asked whether there is a website where one can see what is being collected. Dr. Gillman said that the work is not yet public but it will be in the near future. To find information on the IDeA program, the website is <https://www.nigms.nih.gov/Research/CRCB/IDeA/Pages/default.aspx>.

IV. FEBRUARY MINUTES AND FUTURE MEETINGS

The Regents approved without change the minutes from February 7-8, 2017 meeting. The September 2017 meeting will take place on September 12-13, 2017, the 2018 Winter meeting will take place February 13-14, 2018, and the Board approved holding the Spring meeting May 8-9, 2018.

V. REPORT FROM THE NLM DIRECTOR

NLM Director Dr. Patricia Brennan said that the Library will receive an increase of \$12 million

over FY 2016 funding for a total of \$407.5 in FY 2017. NLM has been able to strengthen its ClinicalTrials.gov operations, expand investments in data science, and address infrastructure needs. For FY 2018, the President’s proposed budget included an 18 percent cut to the HHS budget—and an 18 percent reduction in the NIH budget.

Dr. Brennan discussed key initiatives and new directions for NLM in 2017. In February, NIH Director Dr. Francis Collins indicated his support for the Opioid initiative and helping States better manage this challenge. NLM is doing a lot to help the country meet this challenge. NLM augmented RxNorm with codes for identifying Abuse-Deterrent (AD) drug products in electronic health records and claims data. Within the Value Set Authority Center (VSAC), NLM has 63 value sets related to “opioids,” that help institutions know how they are progressing with identifying patients at risk and how they are responding to them. NLM is collaborating with NIDA for the use of RxNorm, VSAC and the Common Data Elements repository to support work on drug abuse. This work had begun before Dr. Collins had asked for a campus-wide response.

Dr. Brennan also described work by NLM’s Dr. Olivier Bodenreider to conduct an observation study of opioid use from Medicare data calculating frequencies of prescriptions of abuse-deterrent opioids, all opioids, and all drugs using its Medicare dataset. The dataset contains information on 1 billion prescriptions from 2006-2014 for 4.8 million beneficiaries. The analysis of a 10 percent random cohort demonstrated a steady increase from 20 to 30 prescriptions of opioids for 1000 prescriptions between 2006 and 2012, and about 5 percent of abuse-deterrent opioids among all opioids prescribed. Oxycontin is the most prevalent. This information was provided to Dr. Collins and National Institute on Drug Abuse Director Dr. Nora Volkow as they were preparing to attend the summit on Drug Abuse and Drug Detection. Dr. Brennan said she was pleased to show how NLM can respond and learn from its internal resources. In addition, NLM identified 1200 trials in ClinicalTrials.gov studying abuse-deterrent opioid drugs. Of those, 210 were recruiting and 180 had posted results. Twenty-four list NIDA as a lead sponsor or collaborator. There were over 1300 trials studying both opioid-abuse deterrent and non-abuse deterrent drugs. Of those, 233 were recruiting and 198 have posted results. Twenty-nine list NIDA as a lead sponsor or collaborator. Lastly, NLM found 99 opioid clinical trials for substance abuse disorders. Nine are recruiting, 11 have posted results, and 50 list NIDA as a lead sponsor or collaborator.

Dr. Brennan said that the Specialized Information Services Division (SIS) has been expanding its online resources related to opioids. NLM has been able to be responsive to federal needs and public policy concerns that currently face the country.

Dr. Brennan thanked the Board for its support of the strategic planning process and gave an update. First, there are functional audits—internal explorations of the Library’s cross-cutting, key activities. So far, there have been three: the impact of MeSH terminologies on indexing and literature retrieval; outreach initiatives; and NLM investments in international communities. NLM support NIH’s interest in strengthening the research infrastructure in sub-Saharan Africa and has been investing in the African Journal Partnership Project.

A key element of the Strategic Plan is four panels of nationally recognized experts. Three of

May 9-10, 2017 – Board of Regents

these have already met; the other will be convened this week. Strategic planning co-chair Dr. Masys will say more in his report.

Dr. Brennan has visited six of the 14 active NLM training sites around the country and plans to tour three more in the next month. She found that NLM trainees are moving in and out of NLM's funding support. The NLM training program brings a level of both credibility and integration of medical informatics training onto the campuses. Several of these programs have expanded into the field of data science. The future is very promising, based on feedback from trainees and young faculty gathered via surveys, town hall meetings, and social media.

The Library continues to evaluate surveys received from NLM staff members, too. Dr. Brennan expects to present the final report from the strategic planning initiative at the fall Board meeting.

Dr. Brennan next provided updates on the NLM Divisions. For Extramural Programs (EP), she discussed two unique NLM grant programs. One is the NLM Administrative Supplement for Information Services, which brings a librarian/information specialist into research settings. NLM's EP has awarded 30 to date. The other program is Information Resource Grants, to reduce health disparities. Fifty-eight applications were reviewed by a NLM Special Emphasis panel. Awards will be made in FY 2017.

Dr. Brennan said that improvements to the ClinicalTrials.gov search capability, to make searching more intuitive, will debut in June 2017. In addition, effective this month, NIH-funded trial results must be reported one year from trial completion. ClinicalTrials.gov will make it possible for the public to see trial results.

The NLM Director noted that SIS has redesigned *AIDSinfo* and Tox Town. A TOXMAP app is now available and Tox Tutor has been refreshed. Disaster Information Specialization courses have been updated.

Dr. Brennan also highlighted progress in Library Operations outreach efforts. The National Network of Libraries of Medicine, which is now managed as a cooperative agreement by Extramural Programs, is moving into a new set of emphasis areas and priority programs for its second year. The Landstuhl Regional Medical Center will coordinate a tour of NLM's traveling exhibitions to US Military Bases in Germany from 2017 to 2021. And the History of Medicine Division hosted its inaugural Michael E. DeBakey Lecture with speakers Shelley McKellar, PhD, and George P. Noon, MD.

There have been other notable improvements in Library Operations resources. The Health Services Research Projects in Progress (HRSRProj) now has 33,000 records available for searching; an internal publisher knowledge base has been implemented and allows staff to efficiently track the publisher review process; and MedlinePlus now tops 1,000 health topics.

Dr. Brennan said that Ms. Vivian Auld has been named the US Representative to the General Assembly of SNOMED International. NLM Associate Director for Policy Jerry Sheehan is NLM's alternate. In addition, RxNorm has completed the Prescribable Name Project, user-friendly synonyms of drug names used as display names in e-prescribing systems. And the NLM

May 9-10, 2017 – Board of Regents

VSAC Electronic Clinical Quality Measure Value Sets for 2018 reporting to CMS are now in place.

Dr. Brennan said that NLM is committed to data science. The Library is awaiting guidance from its strategic planning committee to help crystallize what that means. Working closely with NIH, NLM has made a \$5-7 million commitment to advance knowledge of data science, and this relies in large part on the work of NLM extramural research programs. Dr. Brennan described NLM's new funding announcement, the Personal Health Libraries for Consumers and Patients, designed to support informatics and data science approaches to help individuals gather, manage, and use personal health data and information. NLM also has, through the BD2K project, one remaining program that was announced earlier this year, Enhancing the Efficiency and Effectiveness of Digital Curation for Biomedical Big Data. Its purpose is to support the development, improvement, and implementation of tools and approaches that increase the efficiency and effectiveness of digital curation processes. Thirty-four applications were received. Five were recommended for awards. NLM will manage these grants, engaging program officers from other NIH Institutes and Centers.

Dr. Brennan welcomed two new staff members to the Office of Health Information Programs Development and the NLM Data Science Coordinating Unit. Rebecca Goodwin, JD, is a data science specialist, and Elizabeth Kittrie, MHS, is a strategic advisor for data and open Science. The NLM Director welcomed 32 new National Network staff members who visited the NLM for staff orientation, and announced that Patricia Bosma, head of NLM's Collection Development and Acquisitions Section, will be retiring after 40 years of service at NLM.

Dr. Brennan said that founding director of NCBI Dr. David Lipman has decided to leave the NLM after 30 years of service. He will be the chief science officer at Impossible Foods, a California company that is applying molecular biology to the food industry.

Dr. Brennan asked Jerry Sheehan to provide an update on legislation of interest to NLM. Mr. Sheehan discussed the Scientific Integrity Act, which would require the head of each federal agency that funds or conducts scientific research to develop a scientific integrity policy to ensure the communication and open exchange of data and findings of agency research. Other legislative progress, he said, can be found at Tab C of the BOR book.

The Board book, Dr. Brennan continued, includes information about the decision to retire the NIHSeniorHealth.gov website and details on the upcoming June Friends of the NLM Conference on Consequential and Reproducible Clinical Research.

Dr. Brennan invited the Board to the celebration of the career of NLM Deputy Director Betsy Humphreys, which will take place in the Natcher Auditorium at 1:30 PM on June 19, 2017.

Dr. Masys asked whether the requirement for researchers to create data management plans is going to be problematic. NLM Associate Director for Program Development Dr. Mike Huerta said that he was working on a plan to give them guidance on how to provide it in a relatively simple way. The plans should be machine-readable, said Dr. Huerta. Dr. Masys pointed out that data management is not simple or self-evident, so the educational requirement needs to go along

with the detailed enumeration of the elements. Dr. Brennan asked Jerry Sheehan if there had been any discussion about scoring the data management plans. He said multiple working groups are reviewing the data sharing plan, but a decision has not yet been made. Dr. Brennan said that another facet of data sharing is informed consent. At this point, she called upon Dr. Deborah Zarin to comment. The ClinicalTrials.gov Director said that, at the end of June, ClinicalTrials.gov would be able to accept the voluntary submission of informed consent forms as a PDF. Dr. Zarin said that, separate from that, the Common Rule, which was recently reissued, requires the posting of an informed consent form for all studies that fall under its jurisdiction, to be housed in a federal database.

VI. NLM STRATEGIC PLAN UPDATE

Dr. Masys described the history, timeline, and structure of the strategic planning process. He said that three of the four working groups (Advancing Biomedical Discovery and Translational Science, Supporting the Public's Health, and the Building Collections Group) have completed their face to face discussions and draft reports are complete. The working group Advancing Data Science, Open Science, and Biomedical Informatics had meetings postponed due to weather.

He said several themes have emerged from the meetings, which include improving usability of NLM resources, increasing the visibility of NLM, and making the Library more relevant. The Regents also discussed issues surrounding many topics including commercialization of health information, implicit consent in research, health literacy, the difficulties of communicating complex health information, comparative searches, credibility of information, reaching out to search companies, search engines issuing results by popularity rather than context, and consumers assuming that information at the top of their searches is the best. Ms. Humphreys spoke about NLM's Cochrane Collaboration and about issues with ClinicalTrials.gov. Dr. Brennan mentioned that, in some communities, being from the government is not an asset. The Library is committed to making its resources available to everyone.

Dr. Greenes complimented Board members and strategic planning initiative co-chairs Dr. Masys and Dr. Jill Taylor and the rest of the team for their work on the strategic plan.

VII. PRESENTATION OF OUTGOING BOR CERTIFICATE, NLM DIRECTORS' AWARDS, AND FRANK B. ROGERS AWARD

On behalf of the Board of Regents, Dr. Robert Greenes expressed appreciation for Betsy Humphreys' service. He read from a special resolution from the Board: "On behalf of the NLM Board of Regents, the following resolution has been approved to commend, congratulate, and thank Betsy Humphreys, Deputy Director of the National Institutes of Health, National Library of Medicine for over 44 years of setting the standard for extraordinary leadership and public service."

Dr. Brennan then saluted Dr. Greenes for his work as chair of the Board of Regents. This would be the final meeting in his term as chair.

Dr. Brennan then presented awards to several staff members. Dr. Anthony Tse received the

May 9-10, 2017 – Board of Regents

Frank B. Rogers Award, which was established to recognize employees who have made significant contributions to the Library's fundamental operational programs and services. Dr. Tse had an essential role in supporting ClinicalTrials.gov operations by providing timely, accurate, and comprehensive analysis of key issues and disciplines that impact the program. Dr. Zarin accepted the award for Dr. Tse.

Next Dr. Brennan presented the NLM Director's Awards for the first time. Mr. Paul Kiehl, NLM deputy executive officer, was recognized for helping Dr. Brennan understand issues ranging from personnel to property. Ms. Mary Ann Leonard of the Office of Communications and Public Liaison was recognized for her outstanding work and guidance on digital and online resources. And Dr. Barbara Rapp of the Office of Health Information Programs Development was honored for her leadership and service, with special recognition for her role in the strategic planning process.

VIII. PHARMACOVIGILANCE AND DRUG SAFETY: COLLABORATION WITH THE FDA

Dr. Olivier Bodenreider of the Lister Hill National Center for Biomedical Communications gave an overview of four recent initiatives that Lister Hill has worked on with the Food and Drug Administration (FDA): 1) using PubMed for pharmacovigilance; 2) extracting drug-drug interactions from structured product labels; 3) creating a collection of structured product labels annotated for adverse events coded to MedDRA; and 4) extracting adverse events from MEDLINE indexing.

Dr. Alfred Sorbello from the FDA demonstrated the PEARL prototype, the web-based tool that the FDA constructed using information extracted from MEDLINE. (PEARL is an acronym for Prospective Detection of Emerging Drug-Adverse Event Safety Signals from Relevant Scientific Literature.) The tool would allow for systematically surveying across relevant literature and generating drug safety signals. Based on the magnitude of signals, they could be ranked and compared.

In addressing questions from board member Dr. Eric Horvitz, Dr. Sorbello said one challenge they've had is that, since PEARL uses only Medical Subject Headings (MeSH) index citations, the most recently deposited citations might not be immediately indexed with MeSH. He said they would like to systematically harness multiple types of complementary data streams.

Dr. Puckrein asked about the tool recognizing patient variability. Dr. Sorbello explained that they can exploit some metadata. For example, pie diagrams may look at male versus female or human versus animal and age groups as represented in MeSH. Dr. Bodenreider stressed that only the information available in the indexing can be visualized in PEARL.

Dr. Sternberg expressed enthusiasm for the project and asked about individuals reporting adverse events to the FDA. Dr. Sorbello said that this tool didn't do that, but there already is a database for spontaneously adverse events. They would like to get the point where they could integrate the information from both sources. She also asked about including food supplements and natural products, but they are not being focused on that at this point. Dr. Sternberg said that in her

May 9-10, 2017 – Board of Regents

opinion, that's important area that should be focused on.

Dr. Bodenreider followed up with more information about FAERS (the FDA Adverse Event Reporting System), a database that contains information on adverse event and medication error reports submitted to FDA and the importance of interoperability between the two sources. Dr. Cheatham stressed the importance of a correlation between the citation engine and the spontaneous reporting of adverse drug events.

Col. Michael Nelson of the US Army Office of the Surgeon General opened a conversation on drug interaction information on product labels. Dr. Masys stressed that this information needs to meet the needs of the end user.

IX. MERGING VIRAL GENETICS WITH CLIMATE AND POPULATION DATA FOR ZONOTIC SURVEILLANCE

Dr. Matthew Scotch, associate professor at Arizona State University, presented research on his hypothesis that a framework that properly merges viral genetic data with climate, population and travel data can predict the timing of initial peaks of seasonal epidemics caused by zoonotic viruses. He focused on concepts related to zoonotic diseases, public health surveillance, and phylogeography. He spoke about the reemergence of viruses due to factors like climate change, military events, over population and poverty and the importance of and issues surrounding surveillance. He addressed how nontraditional data sources may help address complex questions for public health agencies. They are developing and evaluating models for an online portal that health agencies could use.

Dr. Horvitz had questions about predicting the origin of a problem. Dr. Scotch spoke about predicting peaks and the hopes of making a real-time tool that could be used for seasonal flu and that could be used by health agencies. Dr. Taylor and Ms. Humphreys spoke about the importance of NLM and CDC working on this together.

There was a discussion about studying on a local level. Dr. Taylor spoke about the Zika virus, and how window screens and air conditioners can make a difference. Dr. Scotch agreed that more could be done on a local level.

Board member Dr. Alessandro Acquisti asked whether Dr. Scotch envisioned that by the end of the project they could say there is a model for certain viruses estimated by the metadata and about predicting more precisely than we can now about the spread of a virus. Dr. Scotch said they are going to try to predict forward using the parameters they get from the genetic models. He spoke of the differences between certain viruses and how a one size fits all definitely does not apply.

Responding to a question from Dr. Puckrein, Dr. Scotch said that getting vaccination rates by region, especially for flu, as a real-time thing was a great idea.

X. EXTRAMURAL PROGRAMS REPORT

Dr. Valerie Florance presented on two areas that included both the NLM-based training program entitled NLM Institutional Training Grants for Research Training in Biomedical Informatics and Data Science (T15) and the NIH proposal, Grant Support Index (GSI).

Dr. Florance announced that the competing grant award renewals were made for the period of July 1, 2017 to June 30, 2018. She provided historical perspective and chronological highlights over time providing the institutional names for awards issued in 1972 and 1978. Following these earliest of years, 1983 culminated into an emphasis in career training in informatics that included didactic instruction, involvement in Health Computer Science studies and advanced informatics science research.

Generally speaking, the 1970s was the era of Health Computer Science, the 1980s the time of Clinical Informatics, and the 1990s the period of Clinical & Bioinformatics with Dental Informatics in addition.

The 2000s saw the addition of training in Public Health Informatics and Bioimaging. The 2010s excluded Dental Informatics track support but added the Data Science and Environmental Exposure track.

In the program renewal for 2017, NLM received 34 applications and awarded 16 new and competing renewal grants with an overall success rate of 47 percent. The Full-Time Training Positions awarded are 157 in total. The four key areas of focus for these programs are: Health Care/Clinical Informatics (14 programs); Translational Bioinformatics (14 programs); Clinical Research Informatics (11 programs); Public Health Informatics (8 programs).

Data science themes were specified to include: Analytics, Precision Medicine, Data Visualization & Consumers, Integration of Large Scale Data Sets and Intelligent Curation Systems. More specific scientific emphasis within the new programs included at the State University of New York—Big Data Informatics; Indiana University—Public Health & Population Health; and the University of North Carolina—Advanced Training in Data Analytics. The Big Data to Knowledge (BD2K) support of training impacted 11 of 16 of these programs providing five active predoctoral trainees, one training supplement, one curriculum development supplement, and five active center awards. Data Science Course Content and Informatics & Data Science in the Responsible Conduct of Research was outlined in detail.

Looking forward, an overview was also provided on current Instructional Methods of training. Lastly, Dr. Florance and Dr. Brennan had done numerous program site visits to many of the awarded training institutions, with four more to take place soon, and the last three to be scheduled soon after. These are four-hour sessions that include three groups incorporating university faculty, student, and research administrators.

Dr. Florance provided an overview of the NIH Grant Support Index (GSI), as required for all NIH councils. The goal of the GSI assessment is to maximize use of NIH grant funds and define a research career path for principal investigators. NIH's current evaluation of scientific

investigators identifies three main areas: Early Career, Mid-Career and Late Career. Main concern is that NIH has skewed its resources, wherein 20 percent of the extramural research community receives 56 percent of the grant funding. This challenges the ability to build a strong research workforce. Bibliometric measures applied yield some insight into career strength. At some point, there is a diminishing return where additional funding to an investigator does not result in a stronger publication record.

There are many questions to be answered, to balance the NIH portfolio of investigator support. One approach is to continue to support the Early Scientific Investigator (ESI) plan that NIH already has in place. Additionally, actions could include supporting investigator-initiated research, bridging R01s with borderline scores to R56—Bridge Awards—and using the R35—Outstanding Investigator Grants—for emerging new investigators. NIH is prepared to track investigators' funding history through special Coded Grant Counts where a basic research grant, R01, constitutes seven points and wherein, 21 points are the maximum allowable under the proposed guidelines which is three R01 grants. If this GSI were to be applied across the NIH, it is anticipated that this would free up funding for up to 1,600 new grant awards.

Note: As of June 2017, NIH abandoned the GSI program.

XI. DATASCIENCE AT THE NLM

Dr. Brennan updated the Board on information she presented at their February meeting. The ability to create data science initiatives will require a large-scale effort across NLM, as the Library maintains its commitment to its core mission while expanding to address new opportunities and enriching its portfolio. She welcomes comments from all interested parties.

The last few months have been active ones, as NLM positions itself to carry out the charge of the 2015 Advisory Committee to the Director—that it become the epicenter for data and open science at NIH. NLM established the Data Science Coordinating Unit, a loosely structured, non-geographic organization that links data and open science activities across the Library and serves as a central contact when someone outside NIH asks where these activities are based.

Working with outside experts as well as NLM staff and members of the public, the Library is laying the groundwork for a five-year vision. This spirited process calls for delicate interactions and negotiations, as different individuals and offices at NIH divide up responsibilities.

NLM has developed a budget projection of research support services, which should address methodological development and advances in broad-based research training, effective in 2018.

There are new policy issues to consider, too, like protecting investigators that move into a research model where data is substantive and the actions of an individual researcher can be tracked down to the very files that are open. NLM must ensure its investigators can pursue ideas without unnecessary scrutiny and without being scooped—a very important process that has to be respected in our current knowledge-building model. To foster data sharing, NLM is evaluating tools that provide standard ways of representing the metadata related to data.

May 9-10, 2017 – Board of Regents

Just as the Journal Article Tag Suite system is used by PubMed to index literature, the DATS (Data Tag Suite) is proposed for a scalable way to index data sources in the NIH-funded Data Discovery Index prototype, DataMed. A two-day meeting at NIH explored how the efforts of the DATS align with things such as the FDA Center for Drug Evaluation and Research (CDER) effort.

As part of its data and open science efforts, NLM will be accepting PubMed Central data deposits and supportive articles by mid-fall. The Library is creating a simple metadata structure for submissions.

NLM is also taking inventory of its contributions in data science. The Lister Hill Center has data-intensive activities in such areas as machine learning, image processing, natural language processing, and advances in computation for extracting from clinical claims record systems. LHC's lead role in handling clinical related data will continue in the future.

As part of its functional audit, NLM is measuring the impact of MeSH (Medical Subject Headings) on identifying, cataloging, and retrieving the medical literature. So NLM has already made great strides towards creating big data as a substrate for discovery.

Dr. Brennan described the close working relationship between NLM and NIH. She meets often with the NIH Director and Deputy Director, and often consults with the NIH Scientific Data Council and the Scientific Data Policy Council. She is also coordinating NIH participation in the new Central Pre-print Service, an important initiative for centralized information sharing involving such funders as the Sloane Foundation and the Wellcome Trust. And she is engaged in partnerships with other federal agencies, particularly the NOAA and the NSF.

By August of 2018, activities currently supported by the NIH BD2K (Big Data to Knowledge) initiative will be reorganized, at the close of a five-year commitment by NIH to this program. There will be a synthesis of learning from the 12 BD2K Centers of Excellence, for example. Some of the Centers are investing more in methodology and some are investing more in data sharing models and Cloud platforms. In parallel, NIH will be conducting the Data Commons Pilot, a three-year, \$20 million initiative that will evaluate three high value data sets and how they can be moved into the Cloud and used as a platform for discovery. NIH is committed to opening a data storage structure which should be accessible in about 16 months.

There are related policy concerns. The various Data Commons constitute research places where individual investigators can store his or her work; remaining challenges include authentication, registry, and access control services, as well as cataloging, indexing, and data services.

What is the five-year vision for the NIH data science infrastructure? Dr. Brennan anticipates the creation of trans-NIH, Institute- and Center-specific public/private data commons, establishing a unified discovery strategy, data use policies analytics, and visualization frameworks. The goal is to enable scientific advances, accelerated and informed by data. NIH needs to develop a sustainable cost model, with responsibilities shared among the Institutes and Centers. This may be a \$200 million operation by the time all is up and running, but the rewards will be great.

Ms. Blumenthal asked for advice for persons in libraries and in the community who are dealing

with data science. What guidance can NLM offer? Dr. Brennan said this as an opportunity for library science to grow. Successful models are when a library assists in creating data management plans, creates a skill set among its staff to upload data to repositories, and grasps the difference between the repositories that currently exist, especially for data.

Dr. Horvitz expressed his enthusiasm for progress to date. The notion of NLM as the epicenter for data science may have seemed a radical one, given the original mission of NLM. However, data science is creating a huge wave through society, and this will happen with or without NLM. Dr. Sternberg said some may withhold their data from shared platforms, over fear of being scooped. Is there a way to give people credit for depositing a data set and then to look at how many people have accessed that data, how many other people have published findings based on that data, etc.? If so, the investigators who deposited the data should get that kind of credit, for overall use, rather than for how many papers did they themselves published.

Library Operations Director Joyce Backus concurred, saying that experts are already considering how such a formula could be integrated into the academic system.

Dr. Masys suggested a consultancy model, in which NLM could put on detail a tech wizard to work with NIH leaders, helping them learn the vocabulary in the context of their own Institutes' mission and future goals. Dr. Brennan said this sounded like the vision presented by Dr. Huerta—that NLM become a virtual Institute spanning all of NIH and providing such technical consulting. Such a service would match NLM's mission of providing research services.

Dr. Greenes remarked that Dr. Brennan had mentioned there are certain priority data sets that everybody agrees that, for the public good, will be in the Commons, then there are hierarchies of lesser or more private data sets. How does NIH draw the distinction? Dr. Brennan thought that weighty question would require several years of conversation. Funding plays a role, of course, but the key question is, what does NIH need in the way of data, and do we need to set up a review for data with the contributor? NIH neither can nor should store all the data in the world.

Dr. Puckrein said he sees a trend from digitization towards human knowledge. It would be helpful to view these shared data sets as infrastructure building; we have communities that have been displaced in the economy. This is an opportunity to get people involved.

Dr. Brennan mentioned that the Senate made sure that this year's appropriations bill includes a requirement of the NIH to build a data infrastructure plan. There is government attention to this issue, it is moving into the Congressional language.

XII. METRICS AND ANALYTICS: EXAMINING USE OF NLM SERVICES

Dr. Wanda Whitney from Reference and Web Services (RWS), in the Public Services Division of Library Operations, described her office as the front door for customer service for most NLM products, especially its flagship sites. Questions come in via every possible method and, in response, they provide information for anyone, anywhere. She and Dr. Zhiyong Lu from the National Center for Biotechnology Information will discuss how they use analytics to improve services and products, as well as user experience.

Dr. Whitney then presented a “before” and “after” story of the NLM customer relationship management system. Before the recent implementation of a new application, it was very difficult to use the existing customer relationship management tool. Not only did it present a steep learning curve, reference and other staff using the system had to look outside it for additional functionality to answer customers’ questions. In this disconnected schema, for example, staff had to look for answers in public FAQs and fact sheets on the NLM main website or search through stock supplies only available on the NLM intranet. Besides having to gather data from separate systems, staff used an external analytics application to run reports on request tickets and a separate web analytics tool to determine whether our customers were in fact using our FAQs or our staff were using stock replies to answer questions. The “before” process was complicated and tedious.

While RWS’s turnaround time to respond to queries is about 1.5 days, customers want information even faster than that. Also, customer service surveys showed that they would prefer to find answers to their questions themselves, if possible. The picture started to emerge of what we wanted and needed: an easy-to-use customer relationship management system with built-in standard reporting, use of NLM’s FAQ content, and improved usefulness of our content to customers, as well as a way of using data to determine when customers ran into trouble using NLM websites. Luckily now we do.

And here is the “after.” NLM recently implemented a new customer relationship management system that offers a public-facing portal of frequently asked questions that users can visit to find answers without having to submit service desk tickets. (Since the new system was implemented last year, the number of tickets has decreased by 30 percent; RWS attributes this change to customer use of the Parature knowledge base.) By analyzing the data associated with users interacting with the portal articles, NLM can now determine (or at least make an educated guess about) what information is useful or not to customers.

Dr. Whitney described the implementation of the NLM customer support portal, beginning with the creation of an internal knowledge base for staff to use to answer tickets, then the launch of a feature called Easy Answer; as customers type what they’re looking for in the subject line of the form, it shows them relevant FAQs, in hopes they can find the answer to their questions without submitting a ticket. This is the kind of customer self-service NLM has been eager to provide.

With the new data, NLM can review ticket reports and compare those to articles viewed, and reference personnel can track this relationship over time. Data shows the most popular FAQs, breaking them down by where the customers came from. Staff was pleasantly surprised that people were coming from external sites, not just NLM’s, which suggests that they are sharing these FAQs and putting links to them on their own websites.

Dr. Whitney mentioned the top 10 FAQs from the new portal, two of which were surprising. Where are my test results? Can I update my medical record on your website? Could some of these users be lost on the website, thinking they were in the portal for their Electronic Health Record (EHR). MedlinePlus Connect links EHRs to information on MedlinePlus. After an analysis of consumer health service request tickets, RWS determined that about 20 percent of people were in fact lost patrons from EHRs, entering the NLM customer service system from

May 9-10, 2017 – Board of Regents

MedlinePlus. She described several steps taken to mitigate the problem, like updating FAQ language to inform people up front that the MedlinePlus site isn't the correct source to answer specific patient questions.

More work lies ahead, but Reference and Web Services has streamlined its internal collection of question and answers, removing redundancies and rarely used information, and opened opportunities to provide more and better content for our users to discover on their own. The reference team will continue to coordinate the addition of content to the knowledge base and participate fully in the knowledge management process; the point is not only to have the number of tickets drop but to have better understanding of customers and their needs, which will mean ongoing analysis and refinement of FAQs. This knowledge base and resulting customer service analytics provide a broader set of tools with which to approach these challenges and opportunities.

NCBI scientist Dr. Zhiyong Lu discussed how his group, which does data mining and natural language processing, uses analytics to improve the PubMed user experience.

On an average day, PubMed has about a million users doing 3 million queries resulting in 9 million page views. Now featuring citations to more than 27 million articles, PubMed is a resource that serves the international community. PubMed debuted as an experimental system in 1996 and became official in 1997. A redesign of the user interface 10 years ago resulted in a doubling of PubMed usage.

Dr. Lu next described his group's workflow. They look for what PubMed provides and assess the information needs of its users. If they see a gap, they have an opportunity for improvement—for perhaps developing an implemented solution or a simple change in interface or computation approaches. Once they've identified their approach, a vigorous vetting process. First a group of internal users tests the features. Assuming all goes well, the group will test with 10,000 real users. They divide them into two groups, A and B, based on the number of user clicks. Dr. Lu described research he did earlier in his NCBI career, to identify the most searched topics on PubMed. Not surprisingly, gene disease conditions are at the top of the list. One use scenario is that, if you find a paper that is relevant to you, you can click on the author name and locate more information. The problem, however, is that you might get 7,000 queries of people with the same name, but not necessarily yielding relevant information. You might sort these results by publication dates, because papers that came out many decades apart probably aren't by the same author. This can all be done manually, but in 2012 the group devised an algorithm that could winnow those author results down to something much more relevant.

This process of analyzing user behavior and refining PubMed searches has the broader goal of delivering the most relevant results in the fastest possible time to drive accelerated discovery and better health. Later this year, Dr. Lu and his group will be launching PubMed Labs, an experimental system that will run parallel with PubMed. It has new features and a redesigned user interface. Since it is experimental, it will also provide more opportunities for analytics.

Ms. Martin thanked Dr. Whitney for showing the impressive new system. Does it have a machine learning feature, to develop those FAQs? Yes, she replied. She and her colleagues can

May 9-10, 2017 – Board of Regents

do things on the back end in terms of knowledge base to boost the ratings.

Dr. Sternberg asked Dr. Whitney for clarification. Are the online chatrooms for visitors open 24/7? No, they offer the chat feature several hours in the morning and the afternoon, but the FAQ feature is 24/7.

XIII. REPORT FROM THE NOMINATING COMMITTEE FOR NEXT BOR CHAIR

Nominating committee chair Col. Michael Nelson recommended Dr. Esther Sternberg for incoming Board of Regents Chair. The nomination was unanimously approved.

XIV. PROGRESS IN DIGITIZING HISTORICAL COLLECTIONS

History of Medicine Division (HMD) Chief Dr. Jeffrey Reznick described the growing holdings of NLM, with over 28 million items and a variety of digital-related resources. Electronically and by interlibrary loan and other methods, it is shared with millions of people around the world.

The Library's rich historical collections span 10 centuries and appear in a wide range of formats NLM is gradually digitizing these remarkable items, making them widely accessible today and preserving them for tomorrow, through a variety of initiatives informed by public feedback, strategic partnerships, and several key Library programs and resources. These actions will help ensure that present and future generations can examine and reexamine these items, explore and reexplore the data they hold, make new discoveries about the human condition, and perhaps even work to improve that human condition.

This digitization work aligns with the NIH Open Science initiative, as we both open access to and preserve the science of the past and the science of today and tomorrow. NLM undertakes this work as part of its broader mandate to collect, preserve, and provide access to medical cultural heritage as it is broadly applied to biomedicine. Dr. Reznick described two major streams in the digitization of historical collections: NLM Digital Collections and PubMed Central.

Digital Collections is the Library's online repository. It currently features over 90,000 items, which are freely available worldwide and in the public domain, except for a few copyrighted items for which HMD has sought and received permission to include in this resource. The collection also includes *Hidden Treasure*, the well-received book featuring hidden gems from the HMD collections, produced by Blast Books for NLM's 175th anniversary in 2011.

Digital Collections now features a new book about NLM in the "Images of America," series. Accompanied by numerous images, this history is also freely available. NLM staff across various units are working now to model born-digital materials like PDFs and websites. Staff are also working to model Digital Collections to monitor hundreds of thousands of pages of digitized handwritten manuscripts. Some of these, like the Library's recipe books, are already available in Digital Collections but to come is the existing content from the Profiles in Science site including over 30,000 digitized items.

HMD has made considerable progress but they have a long way to go, said Dr. Reznick. To date,

they have digitized hundreds of thousands of manuscripts—roughly the equivalent of 53 football fields. Why haven't they digitized more? Human and financial resources are required, and also HMD has very high standards for its digitization work. Also, the importance and complexity of this work requires that staff of various backgrounds and talents select material, scan its metadata, analyze it, and ingest it into NLM's public-facing interfaces. There is always room for technical improvement and HMD is striving to achieve it. The unfolding NLM strategic plan and the pillars of the NIH ACD report for the future of the Library suggest that the time is right to continue this work and to prioritize it in thoughtful ways, in alignment with what NLM patrons are looking for, because the HMD collections are as diverse as the people who consult them.

PubMed Central (PMC) offers an ever-increasing number of digitized historical medical journals, reaching back in time for more than two centuries. This free online resource makes these digitized assets widely accessible for research and education and learning. PMC involves biomedical and life sciences journal literature and digital collections. In cooperation with the Wellcome Trust, NLM has been working to expand public access to historical journal literature in PMC. This collaboration has enabled a generation of researchers today and generations to follow to have ready access to a deep and detailed record of the human experience in medicine via the back files of medical journals.

Digital Collections and PMC are not static; they are growing retroactively and actively. So even as NLM faces the challenge of digitizing its current collection, there is still a long way to go.

Ex-officio member Mr. Stan Kosecki from the National Agricultural Library praised this NLM initiative, noting that one can often find content from one's colleagues' institutions in very interesting places. He was recently at the National Building Museum and came upon several images from the NLM collections in an exhibition on the history of St. Elizabeth's Hospital in Washington, DC. The 21st century is engulfed in ever-expanding social media, and it produces a variety of different content, some relevant to the NLM's domains, and perhaps some of it should be preserved for posterity as well. This may prove a difficult challenge for the future, for archivists and librarians.

XV. REFLECTIONS ON NLM'S PAST, PRESENT, AND FUTURE

Deputy Director Betsy Humphreys gave a valedictory address recalling her career off 44+ years at NLM. Her main reflection is that she has been incredibly privileged to work at the Library. Citing a favorite quote, she said, "If you don't work on important problems, it is unlikely that you will do important work." At NLM, you get to address important problems and learn from a wide range of people.

She arrived as a temporary employee in January of 1973 and, in hindsight, can see that NLM's fundamental strengths were already in place: a great mission, organization and delivery of information, intramural and extramural research and education and training, an outstanding multi-disciplinary staff, a tradition for innovation, an enthusiastic (and usually judicious) embrace of information technology, and engaged users and advisors. In 1973, the increase of document requests throughout the country was, to paraphrase John Shaw Billings, "a pattern and a looming problem of tomorrow." NLM's current strategic planning process is working to

discern the same thing: to see patterns and identify emerging problems, while also keeping up with the basic demands of the present day.

A week after her arrival at NLM, Ms. Humphreys continued, she was assigned to the work of automating basic library operations. She was among the first to do direct online editing of bibliographic data and to make heavy use of commercial database software for data cleanup, analysis, and reporting. Much of her first decade was focused on the initial automation of serials data and processes, and on designing a sustainable approach to collecting standardized data from libraries across the country. They did this to support future automated document requests and delivery. She served on the MEDLARS III Task Force under former NLM Associate Director for Library Operations, Joseph Leiter.

Wonderful people readily agree to help NLM and I sincerely hope this never changes because it has always been a great strength of the Library. For Ms. Humphreys, the most significant part of her early days was the UMLS (Unified Medical Language System) project. Then-NLM Director, and the person she credited as being her most important mentor, Dr. Donald Lindberg, arranged a “listening tour” with information technology experts across the nation, to discuss what research and development should be involved in UMLS and other NLM projects, and why the Library was uniquely positioned to undertake and advance the field of biomedical informatics. He was particularly interested in problems that were not well matched to university-based research funded by grants, and this perpetually relevant question is still being addressed by every strategic planning panel and by all of you who think about where NLM should go in the future.

When Dr. Lindberg arrived in 1984, he had developed the answer to what NLM might be uniquely qualified to do, and that was make it possible for computers to understand biomedical meaning. NLM is still working on this challenge today, although great strides have been made.

That mission immediately led to the UMLS project. Ms. Humphreys became the executive secretary of the UMLS team and later the project officer on contracts with medical informatics luminaries across the country, including Bob Greenes. This was a very heady time. Many of the stellar people involved in those early days are now in the American College of Medical Informatics and even the National Academy of Medicine.

In the early years, NLM was building something that the intended audience didn’t really understand, that required technology that they did not have, and that was aimed at problems that most of them had yet to encounter. Fortunately, cheaper, more powerful computers and the spread of the Internet came along, and a killer app for the World Wide Web, and we beat the system. Sometimes NLM has to promote and produce the early use of innovation in order to get the level of use that proves whether the resources are worth sustaining or not.

The Web gave NLM access to new user groups, including the public health workforce and the general public and, at the end of this period, you could say that everyone was a potential NLM user. In 1998, Ms. Humphreys gave a presentation entitled, “Under Construction: Medical and Health Information on the Web.” At the time, there were people who actually believed that NLM might have sufficient power to rid the world of bad health information. So, after delivering this bad news, she went on to outline a strategy for discerning reliable online information. In sum, the

May 9-10, 2017 – Board of Regents

1973 fundamentals that she mentioned before are still important to NLM in 2017. NLM is still the path to authoritative information on health and medicine, delivered to the user by methods that have dramatically improved over the decades.

In 2005, Ms. Humphreys read a quote by software developer and one of the co-authors of XML, Tim Bray. He said, “XML is by and large pretty easy, whereas semantic interoperability is insanely difficult.” And she thought to myself, “No wonder what I’ve been working on is really hard!” It is a hard problem and we’re still on the quest that Don Lindberg set out for the Library, to help computers understand meaning. Every little step along the way is delivering a lot of better service to a lot of people so Ms. Humphreys encouraged the Board and NLM staff not to give up.

There is a truism that it is better to have influence than to have control. NLM has had a lot of influence over many things that it absolutely did not have total control over and, under the leadership of Dr. Brennan, Ms. Humphreys expressed confidence that this will continue. It is the issue of being willing to engage, having good ideas, and being persistent and, in her opinion, the National Library of Medicine has a great, exciting future.

XVI. ADJOURNMENT

Chair Dr. Robert Greenes thanked Betsy Humphreys for her many years of excellent service and noted that it had been an enormous privilege to be on the Board and to be closely involved with the Library in several capacities for many years. With that, the meeting was adjourned.

Dr. Greenes adjourned the Board of Regents meeting at 12:00 p.m. on May 10, 2017.

ACTIONS TAKEN BY THE BOARD OF REGENTS:

- Approval of the February 7-8, 2017 Board Minutes
- Approval of the May 8-9, 2018 Future Meeting Dates
- Nomination and Approval of New Board Chair Dr. Sternberg

Appendix A - Roster - Board of Regents

I certify that, to the best of my knowledge, the foregoing minutes and attachment are accurate and complete.

Patricia Flatley Brennan, RN, PhD
Director, National Library of Medicine

Robert A. Greenes, MD, PhD
Chair, NLM Board of Regents