DEPARTMENT OF HEALTH AND HUMAN SERVICES
NATIONAL INSTITUTES OF HEALTH
NATIONAL LIBRARY OF MEDICINE

MINUTES OF THE BOARD OF REGENTS
May 8-9, 2012

The 160th meeting of the Board of Regents was convened on May 8, 2012, at 9:00 a.m. in the Board 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 4:10 p.m., followed by a closed session for consideration of grant applications until 4:30 p.m. On May 9, the meeting was reopened to the public from 9:00 a.m. until adjournment at 12:00 p.m.

MEMBERS PRESENT [Appendix A]:
Ms. Virginia Tanji [Chair], University of Hawaii at Manoa
Dr. Ronald Evens, Washington University School of Medicine
Dr. Henry Lewis, Florida Memorial University
Dr. Trudy MacKay, North Carolina State University
Dr. Joyce Mitchell, University of Utah
Dr. Ralph Roskies, University of Pittsburgh
Ms. Mary Ryan, University of Arkansas for Medical Sciences Library
Dr. F. Douglas Scutchfield, University of Kentucky College of Medicine

EX OFFICIO AND ALTERNATE MEMBERS PRESENT:
Dr. Regina Benjamin, Office of the Surgeon General, PHS
Col. Nori Buising, United States Army
Dr. Joseph Francis, Veterans Health Administration
Dr. Simon Liu, National Agricultural Library
Ms. Kathryn Mendenhall, Library of Congress
Dr. Charles Rice, Uniformed Services University of the Health Sciences
MGEN Kim Siniscalchi, United States Air Force

CONSULTANTS TO THE BOR PRESENT:
Dr. Marion Ball, Johns Hopkins School of Nursing
Dr. Holly Buchanan, University of New Mexico
Dr. H. Kenneth Walker, Emory University School of Medicine

SPEAKERS AND INVITED GUESTS PRESENT:
Dr. William Gahl, National Human Genome Research Institute, NIH
Dr. Jay Hoofnagle, National Institute of Diabetes and Digestive and Kidney Diseases, NIH
Dr. Joanne Marshall, University of North Carolina
Dr. Jason Moore, Dartmouth Medical School
Ms. Julie Sollenberger, University of Rochester

MEMBERS OF THE PUBLIC PRESENT:
Dr. Ted Mala, Southcentral Foundation
Ms. Mary Lindberg
Dr. Elliot Siegel, Consultant
Mr. Thomas West, The Krasnow Institute for Advanced Study

FEDERAL EMPLOYEES PRESENT:
Dr. Donald A.B. Lindberg, Director, NLM
Ms. Betsy Humphreys, Deputy Director, NLM
Dr. Milton Corn, Deputy Director for Research and Education, NLM
Dr. Michael Ackerman, Lister Hill Center, NLM
Ms. Anne Altemus, Lister Hill Center, NLM
Ms. Stacey Arnesen, Division of Specialized Information Services, NLM
Ms. Joyce Backus, Division of Library Operations, NLM
Ms. Gina Bethea, National Institute of Diabetes and Digestive and Kidney Diseases, NIH
Dr. Olivier Bodenreider, Lister Hill Center, NLM
Dr. Steve Bryant, National Center for Biotechnology Information, NLM
Ms. Florance Chang, Division of Specialized Information Services, NLM
Ms. Kathy Cravedi, Office of Communications and Public Liaison, NLM
Ms. Francesca Crawford, Division of Extramural Programs, NLM
Mr. Todd Danielson, Office of the Director, NLM
Ms. Kisha Davis, White House Liaison, USDA
Mr. Ivor D'Souza, Office of Computing and Communications Systems, NLM
Ms. Josseline de Saint Just, Division of Extramural Programs, NLM
Dr. Kathel Dunn, Division of Library Operations, NLM
Ms. Gale Dutcher, Division of Specialized Information Services, NLM
Dr. Valerie Florance, Division of Extramural Programs, NLM
Dr. Dina Demner-Fushman, Lister Hill Center, NLM
Mr. Kevin Gates, Office of Computing and Communications Systems, NLM
Mr. David Gillikin, Lister Hill Center, NLM
Dr. Zoe Huang, Division of Extramural Programs, NLM
Dr. Michael Huerta, Office of Health Information Programs Development, NLM
Ms. Christine Ireland, Division of Extramural Programs, NLM
Ms. Janice Kelly, Division of Specialized Information Services, NLM
Dr. James Knoben, Division of Specialized Information Services, NLM
Dr. Preeti Kochar, Lister Hill Center, NLM
Mr. Sheldon Kotzin, Division of Library Operations, NLM
Ms. Lisa Lang, Lister Hill Center, NLM
Dr. David Lipman, National Center for Biotechnology Information, NLM
Dr. Robert Logan, Office of Communications & Public Liaison, NLM
Ms. Wei Ma, Lister Hill Center, NLM
Dr. Clement McDonald, Lister Hill Center, NLM
Mr. Dwight Mowery, Division of Extramural Programs, NLM
Dr. Aaron Navarro, Lister Hill Center, NLM
Dr. Steven Phillips, Division of Specialized Information Services, NLM
Dr. Barbara Rapp, Office of Health Information Programs Development, NLM
Dr. Jeffrey Reznick, Division of Library Operations, NLM
Dr. Angela Ruffin, Division of Library Operations, NLM
Mr. Wesley Russell, Office of Computing and Communications Systems, 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

2

Dr. Alan Vanbiervliet, Division of Extramural Programs, NLM
Ms. Kristina Womack, Division of Library Operations, NLM
Dr. Fred Wood, Office of Health Information Programs Development, NLM
Ms. Yani Yancey, Office of Communications and Public Liaison, NLM
Dr. Jane Ye, Division of Extramural Programs, NLM
Dr. Deborah Zarin, Lister Hill Center, NLM

I. OPENING REMARKS

Ms. Virginia Tanji, NLM Board of Regents Chair, welcomed the Regents, alternates and guests to the 160th meeting of the Board. She then introduced guest speaker Dr. William Gahl, the clinical director of NIH's National Human Genome Research Institute (NHGRI) and the Undiagnosed Diseases Program's (UDP) lead investigator. The UDP includes an elite team of doctors and researchers that search for clues to solve medical mysteries that have eluded a diagnosis.

II. NIH UNDIAGNOSED DISEASES PROGRAM

Dr. Gahl said that the UDP attempts to obtain a diagnosis for patients who have long been unable to achieve that goal. The program aims to advance medical knowledge about new diseases and provide insights into normal cell biology, biochemistry and physiology.

A trans-NIH initiative, the UDP was organized by NHGRI, the NIH Office of Rare Diseases Research (ORDR) and the NIH Clinical Center. It was established in May 2008 to help patients reach a diagnosis and to achieve discovery of new disorders and new pathways that impact the entire medical profession. Many medical specialists from other NIH research centers and Institutes contribute expertise needed to conduct the program. Physicians from endocrinology, immunology, oncology, dermatology, dentistry, cardiology, and genetics, participate in UDP.

A long-standing medical condition that eludes diagnosis by a referring physician can be considered undiagnosed and may be of interest to the UDP. Patients submit a referring letter from a physician, their medical records, including charts with images, biopsy slides and videos. Of all cases that are referred to the UDP, a very limited number will be invited to participate in the program. In general, it takes 8-12 weeks for the UDP's medical team to evaluate an application. The waiting list for admission is 2-6 months.

UDP participants may receive consultation regarding their treatment from 1-5 consultants when they arrive at NIH for evaluation, but treatment is usually not provided as a component of the program. Implementing treatment recommendations that NIH clinicians may offer remains the responsibility of the patient and their referring physician. Open meetings are scheduled monthly, in which the NIH clinicians and consultants present special cases including radiology and pathology data.

3

Board consultant Dr. Kenneth Walker remarked that Dr. Gahl's work is inspirational. He noted, as had Dr. Gahl, that a patient who can't be diagnosed is so frustrating and challenging to a physician. Dr. Walker said that he had a patient recently who was in the hospital for the fifth time with intractable vomiting. We put hot water bottles on his stomach and he stopped the vomiting. His resident searched PubMed for "vomiting" and "hot water bottles" and found 10 such cases involving people who use cannabis.

Board member Dr. Ronald Evens noted that he was on the Clinical Center Advisory Board when the UDP started and that the public support for the program was amazing.

Dr. Lindberg observed that Dr. Gahl is inventing a new way to practice medicine and that academic medical centers will want to be practicing medicine this way. Dr. Gahl agreed and noted that he would propose that NIH Common Fund money be used to establish six UDP Centers at medical centers nationwide.

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

Surgeon General Regina Benjamin noted that everything her Office is working on is prevention-related. The most recent Surgeon General's report is about preventing tobacco use among youth and young adults. The 800-page report details how 1,200 people die every day from cigarette smoking, and each one is replaced by two young smokers. She is urging the country to focus on young adults. 90% of all smokers start before the age of 18 and 99% start before the age of 26. About $27 million a day is spent marketing to young people. In response, her Office has produced public service announcements featuring young people talking about not smoking.

Dr. Benjamin said the OSG is also working with the HHS Office of the National Coordinator of Health IT to use social media in their prevention efforts. She discussed "Journey to Joy," a program the OSG is supporting to help people find joy in healthy living. The OSG also launched a program in Detroit to educate people about health risks of diabetes called, "Fighting the D in the D," which stands for Fighting Diabetes in Detroit.

Some years ago, the OSG teamed up with NIH to develop an online Family Health Portrait. Family history is important to health, yet only one-third of Americans record their family's health history. This OSG initiative provides the online tool for families to do so. The OSG also teamed up with Facebook in a suicide prevention initiative. It enables users to click on a link and be taken to a live chat with a suicide prevention specialist. Dr. Benjamin discussed other innovative social media tools that her office is using, including twitter, to get prevention messages out.

Board member Dr. Henry Lewis asked the Surgeon General about FDA's efforts to regulate nicotine. She reported that an FDA report with findings about menthol should be out in the early fall. Both Dr. Lewis and the Surgeon General agreed that African Americans smoke menthol cigarettes at a disproportionately higher rate than other populations. Dr. Lindberg asked how the

4

NLM could help. She said getting the word out about smoking and its consequences would help.

IV. FEBRUARY 2012 MINUTES AND FUTURE MEETINGS

The Regents approved without change the minutes from the February 2012 meeting. It was agreed that the fall meeting will be September 11-12, 2012, the winter meeting will be February 5-6, 2013, and the spring meeting will be May 21-22, 2013.

V. REPORT FROM THE NLM DIRECTOR

NLM Director Dr. Lindberg reported NLM has been obligating funds received through the FY 2012 appropriation bill signed into law by the President on December 23, 2011. It included funding for NIH and it established the National Center for Advancing Translational Sciences (NCATS). NLM received $345.7 million. Also, $27.6 million will be transferred to NLM to support NCBI activities. No information is available on the FY 2013 appropriations.

With respect to personnel, Dr. Lindberg noted that Phil Osborne, Director of NLM Acquisitions, accepted a position as the Director of the National Oceanic and Atmospheric Administration's National Capital Acquisition Division. While at the NLM, Osborne expanded the acquisition office to cover the contracting needs of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

Dr. Lindberg called upon Dr. Clem McDonald to introduce new personnel at the Lister Hill Center. He introduced Heather Dobbins, PhD, who has been appointed to a Staff Scientist position with the Cognitive Science Branch where she will oversee the submission and quality review process for ClinicalTrials.gov. He also introduced Elizabeth Workman, who joined NLM Cognitive Science Branch in March 2012 as a fellow.

Dr. Lindberg updated the Board about legislative and regulatory issues. He reported that legislation was introduced by Reps. Doyle, Yoder and Clay, and Senators Wyden, Cornyn, and Hutchison, to require federal departments and agencies with annual extramural research budgets of $100 million or more to establish public access policies that make peer-reviewed papers resulting from agency-funded research freely available online within 6 months of publication.

Dr. Lindberg described the new Genetic Testing Registry introduced by NIH Director Francis Collins, M.D. on February 29, 2012. The Registry is a public database of test information submitted voluntarily by genetic test providers and includes the test's purpose, validity, evidence of the test's usefulness and laboratory contacts. The Registry, developed with the NCBI, is a portal to medical genetics information: http://www.ncbi.nlm.nih.gov/gtr/.

As part of an international consortium, Dr. Lindberg described how the NCBI worked together with Amazon and others to make data from the 1000 Genomes Project (www.1000genomes.org) available on the Amazon Web Services (AWS) computing cloud. The 1000 Genomes Project's

sequence data set is the world's largest set of data on human genetic variation and is freely available for downloading from NCBI and the European Bioinformatics Institute (EBI) in the UK, but those without a robust local computing capacity may find it easier to use in the cloud. In the first week after cloud availability, 3,000 researchers accessed the data.

Dr. Lindberg commended the NLM CFC team for the great job it did during 2011 when NLM was the lead IC for the NIH Combined Federal Campaign (CFC). Nearly half of all NIH employees made a gift to the CFC. NLM received an award from the CFC for the Directors' Challenge "Picture of Giving" contest. The NIH community voted for their favorites. Nearly 10,000 votes were cast by NIH staff.

Dr. Lindberg noted that HMD's Archives and Modern Manuscripts Program, in conjunction with library scholar Dr. Cheryl Dee, has produced *In His Own Words: Martin Cummings and the NLM,* an online edition of selected speeches and articles by the Library's director from 1964 to 1983.

Dr. Lindberg invited the Board to visit a new special display in the HMD reading room, *"And there's the humor of it":* Shakespeare and the four humors. It features Shakespeare's understanding of human personality through the use of the four bodily humors — blood, bile, melancholy, and phlegm. This effort was a collaboration with the Folger Shakespeare Library. Dr. Lindberg noted that collaboration between HMD and Mount Vernon will result in a traveling exhibition and companion Web site entitled *"Every Necessary Care and Attention": George Washington and Medicine.* This banner exhibition will launch in the fall of 2012 and will travel to public, university and medical libraries, and cultural institutions across the country.

Dr. Lindberg announced that DHHS Secretary Kathleen Sebelius named NLM's Patient Tracking and Locating System a "Secretary's Pick" in the latest HHS*innovates* awards announced on March 30, 2012. The system was developed and tested during disaster drills by NLM and the three nearby hospitals that form the public-private Bethesda Hospitals' Emergency Preparedness Partnership (BHEPP). The system helps hospitals handle the surge of patients during a disaster. It is a portable, electronic system that provides real-time information on the number of incoming patients, the severity of their injuries, and their location within the hospital so key personnel can make strategic decisions about patient care as they move between hospitals.

Dr. Lindberg reported that in January, 2012, NLM released an extensive selection of digitized documents of American surgeon Henry Swan II (1913-1996) on NLM's Profiles in Science Web site (http://profiles.nlm.nih.gov). Swan pioneered the use of hypothermia in heart surgery.

Providing an update about the *Native Voices* exhibition, Dr. Lindberg encouraged Board members to explore a new application developed by the NLM for the iPad. It is freely downloadable through the Apple Store and features video clips related to the ongoing exhibition. Ms. Tanji and Dr. Mala had tried it prior to the meeting.

Dr. Lindberg concluded his remarks by providing a progress report on NLM's activities to work with the IBM Watson program. NLM will be signing an agreement soon to begin a joint project geared to providing answers to questions from patients, families and the public.

Ex-officio member Dr. Joseph Francis responded to Dr. Lindberg by updating the Board on the VA's use of the Watson database for the electronic health record. He noted that the VA was more interested in the prognostic and prediction assistance that Watson might provide.

VI. IMPACT OF LIBRARY AND INFORMATION SERVICES ON PATIENT CARE: RESULTS OF A NATIONAL SURVEY OF HEALTH CARE PROVIDERS

Prior to introducing this topic, Board Chair Virginia Tanji called upon Dr. Robert Windom to report briefly on the meeting of the Board's Working Group on Disaster Information Management Research Center (DIMRC) held the previous day. Dr. Windom noted that NLM should continue to play a key role in the country's efforts to disseminate disaster information.

Ms. Tanji then introduced Ms. Julie Sollenberger, University of Rochester, and Dr. Joanne Marshall, University of North Carolina, to present a report on a study of the impact of library and information services on patient care.

Ms. Sollenberger explained the background of the study and the methodology involved in the data collection for the survey which was a joint project of the NN/LM's Middle Atlantic Region (NN/LM/MAR) and researchers at UNC-Chapel Hill. The study sought to assess the impact of the health sciences library, information services, and the librarian on patient care. The study replicated many aspects of the earlier 1992 "Rochester study." The impetus for this study was a decision by New York State to not require hospitals to have a library because there was no evidence that a library contributed to improved patient care. At that time, physicians were seen as in the best position to judge the quality and the impact of library and information services. So, the study looked at the perceptions of physicians only. The results of that study indicated that, in the eyes of physicians, library services were valued and that the information provided by the librarian was seen as making a positive difference in patient care. In 2007, at the meeting of the Regional Advisory Committee of the Mid-Atlantic Region, a discussion of potential projects that could make a difference for libraries in the region took place. A planning group, consisting of a both library practitioners and researchers, was formed to explore the possibility of replicating the landmark Rochester study. The planning group took into account changes in the health care and information technology environments since the original Rochester study. Initially, participation in the study was offered to libraries affiliated with the NN/LM/MAR. In the end, the study was opened to other areas in the US and Canada.

The study's research design was based on active collaboration between researchers and the community that would benefit from the research. Each site was provided with a detailed instruction manual describing the steps for the study, and study and marketing materials. Librarians were also asked to obtain participation from high level champions within their

institutions. The study attempted to get a cross section of types and sizes of hospitals. There were two levels of recruitment: library participants were recruited and then those librarians assisted by sending survey invitations and reminders to physicians, residents and nurses within their hospital or their affiliated hospital within the health system. Over 172,000 invitations were sent. In addition to the survey, UNC conducted phone interviews. Data collection methods included: 1) two initial focus groups of librarians who had interviewed hospital administrators about the perceived value of the library and information services; 2) a Web survey of physicians, residents and nurses at 56 sites serving 118 hospitals; and 3) 24 additional telephone interviews of health professionals designed to further explore the value of the library and the librarian. The Web survey was piloted at seven sites prior to the full launch. Survey respondents were asked to recall a recent "critical incident" in which a search was conducted for a patient care purpose. Respondents provided search details related to 16,122 information searches (5,379 from physicians, 2,123 from residents and 6,788 from nurses). The figures do not add up to 16,122, Ms. Sollenberger said, because 1,158 respondents reported "Other" for their position and 674 did not report a position at all. The estimated response rate was 10%, which is about average for a Web-based survey. Each participating library received a PowerPoint presentation with results for their own site, their own dataset and the combined study results for benchmarking purposes.

Dr. Joanne Marshall presented the results. Three quarters of the health professionals responded that they had definitely or probably handled some aspect of a patient care situation differently as a result of the information provided by the library and information services. Among the changes in patient care reported were: advice given to the patient (48%); choice of drugs (33%); choice of other treatment (31%); choice of tests (23%); and diagnosis (25%). Ninety-five percent of the respondents said that the information resulted in a better informed clinical decision. In some cases, many hours were saved as a result of using this information. We did find that the librarians are doing the more complex searching. Adverse events avoided as a result of the information included: patient misunderstanding (23%); additional tests (19%); misdiagnosis (13%); adverse drug reactions (13%); medical errors (12%); and patient mortality (6%). These findings have major significance for patient safety. People were asked if they would be interested in participating in a follow up interview and over 1,000 people said they would - a very interesting result. Some data was collected that wasn't possible in the original "Rochester study" because of the limitations of the survey method and collecting via paper surveys. We were able to ask people what specific information resources they used and then ask them a series of questions about their use of that particular resource. These data are going to be useful in strategic planning for people who make information resources available such as NLM. The top five information resources by these groups were: online journals, PubMed/MEDLINE, UpToDate Inc., online books and Micro Medix.

The study was funded in part by NLM via the NN/LM Middle Atlantic Region. Additional support came from Hospital Library Section, and the NY/NJ, Philadelphia, Upstate New York and Ontario Chapters of the MLA; the New York State Reference and Research Library Resources Councils; UNC; and the Donald Lindberg Research Fellowship from MLA.

One Board member asked to what extent the libraries are helping the professionals address evidence based practice. Dr. Marshall said the study did not ask specifically about evidence-based practice but that libraries are all about providing the best evidence for practice.

VII. PRESENTATION TO OUTGOING BOR CHAIR, FRANK B. ROGERS AWARD AND NLM DIRECTOR'S AWARD

Dr. Lindberg thanked the departing Ms. Ginny Tanji for her excellent chairmanship of the Board. He then presented the NLM Director's Award to Dr. Mike Sappol for his exceptional work in the production of a book which celebrates the NLM's 175th anniversary, *Hidden Treasure: The National Library of Medicine.*

The Frank B. Rogers Award went to Dr. Marilu Hoeppner of the National Center for Biotechnology Information. She was honored for her work as the staff scientist who headed up NLM's electronic bookshelf.

The Board also unanimously agreed on a resolution saluting the exemplary service of Sheldon Kotzin during his long and fruitful career at the National Library of Medicine.

VIII. DRUGS AND LIVER TOXICITY – LIVERTOX DATABASE

NLM Associate Director for Specialized Information Services (SIS) Dr. Steven Phillips began the presentation on LiverTox, which he termed a unique resource. The impact of liver disease and drug-induced liver failure is staggering, not only in terms of pain and suffering, but also in its economic toll. A liver transplant alone costs roughly $200,000, and this does not include drugs and other expenses. Drug-induced liver disease (DILD) is the main cause of liver failure in the US, exceeding all other causes combined. It's also the most common reason for failure of new drugs in clinical trials. LiverTox unites medical and scientific specialists to create a central repository of clinical information in support of research on the prevention and control of drug-induced liver injury. Dr. Phillips introduced Dr. Jay Hoofnagle, director of the Liver Disease Research Branch (LDRB) of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). LiverTox is a joint effort between NIDDK and NLM, with assistance from the National Cancer Institute.

The overarching goal of LiverTox is to create is an international information repository for DILD, providing on a single site information on the diagnosis, cause, frequency, patterns and management of liver injury attributed to prescription and nonprescription medications, herbals and dietary supplements.

Other objectives are to provide a common base of reliable clinical information; to help standardize diagnostic criteria, causality assessment, and reporting quality; to enhance recognition and understanding of the disease and its management; and to stimulate coordinated

research on the etiology and mechanisms of drug induced liver injury. Researchers have known about the harmful consequences of DILD for 50 years and haven't made a dent in it, primarily because there has been no central location to find this kind of information.

Until recently, the only way to control DILD has been to take the drug off the market and to stimulate research on its pathogenesis. DILD used to be one of the leading causes of medications being taken off the market. The reason it isn't any more is because the FDA has developed an early warning system and can spot problems sooner.

DILD can resemble any form of acute or chronic liver disease, such as acute viral hepatitis, biliary obstruction, chronic hepatitis, and fatty liver disease, so it's a diagnosis of exclusion. There is no test that proves to patients that "This is due to the drug you're taking." A thousand people can take a medication with no problem, and then patient 1,001, or 1,000,001, contracts jaundice. DILD is very rare for any one drug. That's a key challenge: physicians may see a case every 2-3 years, but it rarely involves the same drug, so it's hard for them to recognize symptoms.

The creators of LiverTox have categorized the patterns of injury, dividing them into 12 clinical phenotypes, or 12 different liver diseases caused by at least 500 different drugs and numerous herbals. The literature on the subject is vast, in hundreds of journals written in dozens of languages.

To address the problem, LiverTox collaborators created a network of eight academic medical centers in the United States to enroll consecutive cases into a central database with rigorous evaluation, and also to collect serum, liver tissue, and DNA for mechanistic studies. They are now doing genetics and immunology studies on all of this, but getting the clinical material was the first step. Toward that end, the medical center partners have now enrolled over 1,000 patients.

Dr. Hoofnagle then demonstrated the LiverTox Web site. After entering a drug name, a user can explore four components: a clinical diagnostic overview about DILD; drug reports, which is the biggest section; a case registry; and information resources. These include several instruments developed to study causality. There are various ways to do severity grading from the World Health Organization (WHO), NCI, the AIDS Clinical Trials group, and one that's unique to LiverTox, developed for use in the Drug-Induced Liver Injury Network.

Dr. Hoofnagle also showed the hepatic histology, with images provided by NCI, accompanied by a brief description of each. It was a major task to find the references for all parts of the LiverTox site, he noted, and he credited NLM with being instrumental in helping to develop the long reference lists, which the creators of LiverTox annotate.

10

LiverTox includes links to other information about the drug, including its structure, and the complete labeling in DailyMed, which has been invaluable resource in this effort.
The case report registry is being run by NIDDK and is experimental. It allows users to submit a clinical case to LiverTox, the FDA or Medwatch, the FDA site for drug adverse events. This living registry does not have any personal identifiers.

LiverTox had its beta release in April. Staff is currently editing the contents and making sure everything's working properly. There are 500 drug records on the site, with another 50 awaiting posting. The site also features 12,000 references. The goal is to get all 800 of the different compounds that are approved for use in the US posted. LiverTox will have its formal release in September 2012.

Board member Dr. Henry Lewis expressed excitement about this new resource and its potential, and asked whether NIH's National Center for Alternative and Complementary Medicine (NCCAM) was also a collaborator, since herbal medicines and supplements seem an integral component.

Dr. Hoofnagle responded that several well-known alternative medicines are included in LiverTox, such as saw palmetto. However, most of the agents NCCAM deals with do not cause drug-induced liver injury. The herbal compounds that do cause injury are usually Chinese medicines sold for weight loss and muscle building. Another goal of LiverTox is to have the FDA test mysterious substances like these, which patients bring in, to determine what's in them and what effect they may have on the liver. He added that they're actually going to post on the site a list of drugs that *don't* cause liver damage. It's very difficult to know that a drug doesn't cause such damage, because there is no literature.

Dr. Lewis pointed out that many drugs are used in combination, so you potentially have more than one liver disease-causing drug. Physicians need to know that when putting patients on a regimen. Dr. Hoofnagle agreed. These days, patients are on multiple drugs and start them all at the same time, so it's hard to tell which one is actually causing a problem. He expressed hope, though, that LiverTox would prove helpful in determining which one is most likely to be the cause. Dr. Lewis urged Drs. Hoofnagle and Phillips to start looking at renal toxicity or cardiotoxicity soon, as this would be an ideal model to build upon.

Ex-officio member Dr. Joseph Francis asked how LiverTox was structured and staffed for sustainability over time, particularly imagining a health IT enabled environment where you might be able to access this information directly from querying patients' health records. How would the site look in a health IT-enabled environment, particularly assuming that in stage III clinical trials there will be some type of capability for reporting adverse events?
That's what they're hoping for, said Dr. Hoofnagle — that researchers can ask how many cases are in the database, what's the average age, sex distribution and so on, which would allow them

to look at the patterns of injury and the cases, too. Were you asking whether users can import information from an electronic medical record into this type of database, he asked?

No, Dr. Francis replied. He wondered how the site would be sustained over time. It sounds like this is a combination of sweat equity and project funding, yet you're presumably going to see a growth of reporting, and a growth of toxicity, because of all the new drugs on the market.

Dr. Lindberg commented that this effort is neither sweat equity nor project funding but, rather, NIH at its best. Dr. Hoofnagle is a professional who has spent his career at NIH and has earned the commitment of an Institute that says, "Do it."

Dr. Francis asked whether the project had dedicated staff because this is going to be a growing concern. NLM Deputy Director Betsy Humphreys said that electronic health records could not replace the need for high-level subject experts to curate the LiverTox site, but they should be able to facilitate the generation of useful case reports so that the case registry part of the site could be expanded more rapidly.

Board member Dr. Douglas Scutchfield said that, before coming to this meeting, he reviewed his 20 hospital patients. Twelve of them had significant abnormalities of the liver. He acknowledged the difficulty of analyzing the liver tests and asked Dr. Hoofnagle whether he'd consider adding a clinical decision support element to the site. It's very difficult, even for experts, admitted Dr. Hoofnagle. One of the problems with the literature is that it's always the classic case where the patient is not taking any other medication and they don't have any other liver disease when, in truth, what you see is often very confusing.

Board member Mary Ryan mentioned a presentation at a previous board meeting, from a Vanderbilt researcher who was analyzing a big data warehouse of patient information drawing connections between the drugs that people were taking and liver disease. If there were some way of capturing data from all of the places where they're analyzing hundreds of thousands of patient records to make connections between drug adverse effects and somehow get that information in here, too, that might be part of the way to gather a lot of the data. Dr. Hoofnagle said that a lot of drugs will cause an abnormality of the liver enzymes in a good percentage of people, like 4-5%, but that's not really serious drug-induced liver disease. Idiosyncratic liver disease is very rare, so it's not going to be found when you're testing thousands of people. This is the challenge that the FDA faces all the time. A new drug comes along that is tested in 2,000 people, but if an injury occurs in only 1 out of every 10,000 people, they won't see it. That's what gives them nightmares. So, they have to use signals of milder disease that may indicate with more patients more serious problems could emerge. It still happens that drugs get on the market with this 1 in 10,000 risk of liver toxicity. Take Lipitor, which is used by millions of people, so one in a million doesn't sound like a lot, but when you have 30 million Americans on a statin, you'll start seeing evidence of liver damage. In truth, statins are very safe, it's just that they're so ubiquitously used.

Board consultant Dr. Ted Mala reported that Alaska Natives have used herbs for millennia. Still, after all of that time, a challenge is trying to figure out the interaction between allopathic medicine and what people are using. At Dr. Mala's facility, they see at least 2,000 patients a day and a number of them are taking their traditional medicines and mixing them with Western ones. There's a lot of work to do for figuring out the safety.

Dr. Hoofnagle agreed that drug-drug interactions make that effort very complex. They clearly occur and can trigger problems. He hoped LiverTox would be an important and useful tool in that effort to identify such interactions.

IX. NLM AND THE NEXT GENERATION INTERNET PROTOCOL

Ivor D'Souza, director of the Office of Computer and Communications Systems (OCCS) began a presentation on Next Generation Internet Protocol, now known as Internet Protocol version 6 or IPv6. In what constitutes a revolutionary change, the Internet is moving from the fundamental protocol, called IPv4, to the new version, IPv6. How will it impact NLM and the Internet as a whole?

Mr. D'Souza gave a history of the Internet, which began as a partnership of the US Department of Defense, universities and the corporate research community, with the goal of designing open, standard protocols and building multi-vendor networks. The first experimental version, the ARPANET, appeared in 1969, and NLM was the very first civilian agency in the US government to join, in 1984. The first prototype of a set of protocols was the TCP (Transmission Control Protocols)/IP suite, designed in 1973. Versions 1-3 were meant primarily for researchers. By 1979, IP, the new official name, had evolved into version 4 (IPv4), the fundamental building block of the Internet. IPv5 was an ephemeral version, meant to fix some quality issues within v4, but it never made it to the Internet. IPv6, then, is the new gold standard, meant to make up for any shortcomings of v4 and also greatly expand the number of available IP addresses.

Why is that important? Every device on the Internet needs its own IP address. Unfortunately, IPv4 offers only 4. 3 billion addresses. More than half of those belong to US-owned organizations. Understandably, countries like China, with rapidly growing economies, are clamoring for more IP addresses.

Compounding the problem, manufacturers are looking to put Internet connectivity in all kinds of equipment, mobile devices, household appliances, automobiles, gaming devices, etc. IPv4 addresses are projected to be depleted by 2014.

How many addresses does IPv6 offer: 340 undecillion or 3.4×10^{38}. Putting that figure in context, if the earth were made up entirely of one cubic millimeters of grains of sand, then you could give a unique IPv6 address to each grain and to an additional 300 million planets the size of the earth.

13

Who cares about the implementation of IPv6? In 2010, Vivek Kundra, who was then Federal Chief Information Officer, mandated that the government upgrade all public-facing services by September 30, 2012. Private industry is on board, too. On IPv6 day, June 8, 2011, designed to test functionality across the Internet, all of the top service providers, including Amazon, Google and Yahoo, elected to test the IPv6 infrastructure for reachability by their users. NLM successfully tested IPv6 delivery of public-facing applications, such as the main NLM Web site and MedlinePlus.

On June 6, 2012, NLM will take part in the World IPv6 Launch. Many top providers on the Internet plan to implement IPv6 permanently on that date. NLM has been working hard behind the scenes since 2006, when IPv6 was ratified as a standard, published and pronounced ready for use on the Internet. OCCS did its own investigation, making sure staff clearly understood the protocol and sending them to training as needed. Beginning in 2008, OCCS began meticulously assessing its in-house technology, subsequently upgrading hardware and software to position NLM to adopt IPv6.

OCCS's most important activity, Mr. D'Souza noted, was the creation of an IPv6 enclave — an isolated network which served as a laboratory, allowing frequent testing and providing a real-world experience of the new IP version before it was actually put in production.

By the end of 2008, NLM was positioned to deploy IPv6. OCCS now has a major set of systems that are pending to go live, two to four weeks from now, Mr. D'Souza reported, so the list of NLM assets migrating to IPv6 will keep growing.

With only two months' worth of data to analyze, 0.35% of NLM"s total traffic is IPv6. (HHS will soon make a domain name service change on their end, which will make more people aware of NLM as an IPv6 service provider and probably drive that statistic up.)

The current NLM figure in on par with Google's worldwide Internet statistics: 0.58% of its traffic is currently IPv6. However, it's only a matter of time before the new version catches fire, particularly, especially with the well-publicized World IPv6 Launch taking place June 6, 2012.

NLM will continue with the implementation. The Library has 136 systems that are externally-facing. (Many entire federal Departments don't have that many.) NLM is also planning to work with its sister organization, the Center for Information Technology (CIT) at NIH, to implement IPv6 at their joint off-site data center. That should happen in a couple of months.

Board Member Dr. Ralph Roskies asked what would happen if two Internet users are communicating each other close to midnight on June 5th, and then the switch to IPv6 occurs. What would happen to their messages? There is no switchover in this case, Mr. D'Souza replied. NLM will continue to support IP versions 4 and 6 in a "dual-stacked" configuration until IPv4 is phased out altogether. Users won't see any change.

Dr. Roskies then inquired about other IPv6 capabilities, besides more address space. There are many, said Mr. D'Souza, but with them come new challenges. Improved security is built into the capability of IPv6. Without any add-ons, you can now digitally sign, or encrypt information. That's significant. Mobility is very important in IPv6, too. You can be moving from Verizon's network to T-Mobile's network to your office network, to your home, and your device will get its own local address, and this enables mobility.

Ex-officio member Dr. Simon Liu expressed congratulations, noting that many other organizations are far behind. What lessons has OCCS learned? Mr. D'Souza said that starting early is the key, and doing lots of advance testing. Being an early adopter is not enough; you've still got to do due diligence.

Board consultant Dr. Holly Buchanan said she thought the switch to IPv6 sounded like Y2K all over again. Will there literally be a massive changeover on June 6th, or is it between 2012 and 2014? World IPv6 Launch day is not a drop-dead day for switching, Mr. D'Souza told her. Rather, the Internet industry is using it as a focal point to spur their customers to move to IPv6. It's in their economic interest to close down IPv4, because then they won't need to support two systems.

Board member Dr. Ronald Evens asked about the underlying mathematics of going from 4 billion to undecillion IP addresses. How is that accomplished? Mr. D'Souza pointed out that, in IPv4, the IP address structure is made up of 32 bits. IPv6 is made up of 128 bits — many more bits to play with. That's the math that makes the vast new pool of IP addresses available.

X. MACHINE LEARNING APPROACHES TO THE GENETIC ANALYSIS OF COMPLEX TRAITS

Dr. Jason Moore, professor of genetics and community and family medicine at the Geisel School of Medicine at Dartmouth College, addressed the Board. He is a bioinformaticist, interested in the genetics of common human diseases, such as cancer, and cardiovascular and psychiatric diseases. He's interested in this fundamental question: Will genes improve our ability to predict who's at risk for these diseases?

The sequencing of the human genome has made it possible to identify millions of rare and common variants across the genome that can be used to carry out genome-wide association studies (GWAS). Scientists have had available to them for about 7 years the technology to measure a million or more genetic variants throughout the entire human genome, and then to identify those that are associated with risk of common disease.

He showed a slide from the National Human Genome Research Institute (NHGRI) genome-wide association catalog Web site, summarizing all of the various genetic associations that have been identified using this technology and large population-based studies. There are more than 1,500

published associations at genome-wide statistical significance levels — more than 200 human traits in different diseases.

This technology has largely been successful. However, it turns out that most single nucleotide polymorphisms (SNPs) discovered via GWAS have very small effects on disease susceptibility and thus may not be suitable for improving health care through genetic testing.

To illustrate the point, Dr. Moore presented his personal genetic testing results for type II diabetes, from the 23andme service, which provides direct genetic testing to the public for a million or more genetic variants for about $99. The company reports that the average male of European ethnicity has about a 24% lifetime risk of developing diabetes and, based on his results, he has a 22% chance.

The big question in genetics right now is how useful is this information? What does it mean that I have a 22% chance versus a 24% chance? Does that mean I don't need to worry about diabetes or my lifestyle factors? This is pretty typical for a lot of common diseases, that the effect size of the individual genetic predictors is pretty small and not enough to get excited about. With these large-scale genetic studies, we have explained a very small proportion of the variability in disease susceptibility that we know is due to genetics based on heritability estimates.

We've been overpromising genetics to the public dating back to the early 1990s and the Human Genome Project. I think there's a real concern in the genetics community that if we're not careful, Congress is going to get wind of this and turn off the funding spigot for genetics. It's just a matter of time before the patient advocacy groups get tired of being promised cures for their diseases based on genetics.

In Dr. Moore's view, most of the remaining genetic variance is tied up in more complex and more interesting genetic effects. Epistasis is something he studies; it literally means "one gene standing upon another gene," and it's the idea that genes are working together to influence biology and disease susceptibility. Obviously, genes don't act in isolation. They work in environmental contexts. Autism and schizophrenia, for example, are probably diseases of massive heterogeneity. Each family with autism probably has a different constellation of genetic risk factors which greatly complicates autism even though it has enormous heritability.

Dr. Moore stressed the need for more of a multivariate bioinformatics approach to get at these more interesting effects. A data-mining, machine-learning approach can take into account many factors simultaneously and model the non-linear interactions between those factors. In his view, this is where a lot of the missing heritability is. Genetics researchers need different methods than we've used for the univariate parametric biostatistical approaches.

16

It's a pretty simple idea, but obviously there's a lot of computation required, to explore all of the combinations and to pick the best model. He and his colleagues worry about things like overfitting and statistical significance.

In 2005, Dr. Moore and colleagues released an open source software package for multifunctional dimensionality reduction (MDR). It's user-friendly, open source and will run on Windows, Mac and Linux. It can do validation and cross permutation testing, and provides statistics, and publication-quality graphical output. The software has been very popular, downloaded 35,000 times since 2005. There are over 350 published studies using MDR for a wide range of different diseases. What's exciting is that there is a whole community of methodologists who are developing extensions and modifications to their approach, Dr. Moore noted. The fact that it was open source made the methodology available for people to take it. Others have rereleased the software with their own extensions and modifications, which is a positive thing.

Dr. Moore described collaboration with two cancer epidemiologists at Dartmouth. They did a study of 491 bladder cancer cases and 791 controls, all from New Hampshire. In this study they were looking at DNA repair enzyme genes as candidates for influencing bladder cancer. They theorized that polymorphisms, the genetic variants of these genes, might have something to do with that. They also looked at smoking, age, and gender as covariates.

Using theMRD software, we looked at all possible two-way, three-way, four-way, five-way combinations of factors, and came up with the best model. It consisted of two genetic variants in *xeroderma pigmentosa*, a DNA repair enzyme gene, and pack years of smoking. Smoking is a known, published, documented risk factor for bladder cancer. Then the question is: what is the genetic effect? Are the genetic variants acting synergistically with pack years? Overall, this model correctly predicted bladder cancer 66% of the time, with an odds ratio of 3 that was highly significant on two different types of permutation tests. In short, these two polymorphisms have a very strong synergistic interaction such that if you looked at them individually, you wouldn't see anything. You only see an effect when you put them together.

In closing, Dr. Moore mentioned systems genetics. His earlier example looked at 2-4 genetic variants at a time, using machine learning to model the nonlinear interactions between those factors. Now, they're starting to think more globally. He believes that hundreds if not thousands of genes play a direct role in diabetes, along with all of the many environmental factors.

We need to move away from one gene to thinking about networks of interacting genes, he posited. It's really all of those things working together. His team has published a series of papers on using interaction information, which is an entropy-based approach. This approach of using entropy to document synergy interaction goes back to the 1950s and has been rediscovered about every 2-3 years. The basic idea is, does putting combinations of SNPs together predict case control status better than individually?

Another project of Dr. Moore's team was funded by NLM American Recovery and Reinvestment Act (ARRA) money, a supplement funded to an RO1 grant at the NLM, to build a bioinformatics visualization lab at Dartmouth. Dr. Moore thinks visualization is the future of bioinformatics. With the ARRA money, they were able to purchase an immersive 3D visualization wall where you can stand in front of the wall and be immersed in your data. This new area of visual analytics which arose in the past decade, combines visualization with machine-learning, data mining, and other data analysis, and human-computer interaction using touch-based computing, like the Microsoft surface computer, the Apple iPad. It will be revolutionary to put all of these pieces together for understanding high dimensional complex data.

Two RO1 grants from the National Library of Medicine that have played a central role in the work that Dr. Moore presented. The ARRA money was very useful for supporting students and some of the hardware we were able to purchase.

The NIH and the taxpayers have put a lot of money into measuring genes and the human genome and genetic variation. In many ways, technology has driven the field. That's going to come to an end soon and we're going to be left with mountains of data sitting in the cloud. Then it's going to be up to bioinformatics, biomedical informatics, and biostatistics, epidemiologists, biologists, genomicists, etc. to make sense out of all of that information. We can only throw money at this problem for so long. We're going to really have to sit down and do some thinking.

Board member Dr. Trudy MacKay said she agreed that this was the wave of the future. You're exploring in a largely two-way interaction space, but we know with these networks you have not enough people in the universe to explore all of the possible genotype interaction space. And even if you could, how does that manage to make prediction from that knowledge possible? What are your thoughts about taking these network architectures and actually translating those into predictions?

Dr. Moore agreed that the networks are constructed from two-way interactions. But these networks are but a shadow of the etiological complexity that they know is there. Two-way interactions can point you to a subset of important three-way interactions, and so on.

Asked by Dr. MacKay how they turn this research into something useful, Dr. Moore said the first step is that we need to convince human geneticists that they need to do this kind of work. More than 99% of the literature is filled with one-at-a-time univariate approaches that ignore the complexity. We have to fill the literature with papers that look at the data in this way. Once we have the community thinking about the matter this way, then the research community can start to assess how it might use this information to predict disease.

Dr. MacKay pointed out, and Dr. Moore agreed, that, in the model organism community, our first studies is mapping factors affecting things in model organisms showed that epistasis was as

large if not larger than the main effects of genetic variation. Unfortunately, human geneticists have decided to completely ignore it, as if humans are simpler than yeast, said Dr. Moore.

Dr. Francis remarked that medicine is a very linear science, He did graduate work in ecology and learned that you treat mosquito infestations with DDT, and we've not gotten beyond that point. Are you doing in your research teams something that is explicitly interdisciplinary to bring in perspectives from network systems, ecosystems, etc.?

Yes, Dr. Moore replied. They've collaborated with multi-disciplinary teams including an ecologist, a geographer, epidemiologists, statisticians, and bioinformaticists, among other professionals, producing a paper that said here's how we should be putting all of these layers of information together. They're very interested in these kinds of team-based approaches and think that's the future. NIH is all about team science now and I think that's a good direction to be focusing on.

Dr. Lindberg asked whether the technology exists, if the gene is bending back and the enhancer is coming back to where it wants to be, is to show that in 3D. How would you do that?

Yes, said Dr. Moore, they're starting to be able to visualize such phenomena. Chromatin has a 3-dimensional structure in the cell. There are people that are trying to image what the DNA looks like in the nucleus of the cell in its 3-dimensional state. There have been a couple of high profile papers that have come out in the last few years trying to infer that 3-dimensional structure. The layers of complexity between the mapping of the DNA to a disease are part of it. How does this all fold up and what are all of the biomolecular interactions going on in the nucleus that drive the biology? The kinds of genetic studies he's just been talking about completely ignore all of that complexity.

XI. EXTRAMURAL PROGRAMS REPORT

Extramural Programs (EP) Director Dr. Valerie Florance referred members to the Board book description of a policy change that NIH wants to implement in fiscal year 2013. Under the provision, which is included in the President's budget, each Institute should have its governing body (for NLM, the Board of Regents) give extra consideration before making an award to a principal investigator (PI) who already has more than $1.5 million total in NIH grants. It is suggested that evidence of innovation and impact of the new work should be considered before additional funds are granted.

Members were given an example of the type of information they would receive. NIH has analyzed all grants pending in the current Council round to see who would have to go through this process. There were no NLM grantees who met the requirements. She described the process, noting that the EP Subcommittee would review any such grantees and report back to the full Board. At the fall meeting, she will likely ask for a change to operating procedures to accommodate this new review.

Dr. Lindberg said that the impetus for this came from the Office of Management and Budget. He observed that $1.5 million is not a large amount, there are many NIH grantees already beyond that threshold. Many feel that this procedure runs counter to the NIH mission of fostering the best science.

Dr. Florance next discussed one of NLM's largest extramural programs, the Informatics Research Training Programs, which just completed another 5-year cycle. Over the last 5 years, NLM has supported18 programs at the cost of about $77 million. Informatics research training consumes roughly 25-30% of the total EP budget, while the average amount NIH spends on research training is less than 5%. Funding supports stipends, tuition, health insurance, and travel funds, training-related expenses, and a small amount of overhead — only 8% is provided for training grants.

In the 18 programs, there are 171 pre-doctoral and 72 post-doctoral slots. There are also 13 or 14 short term diversity enhancement slots, 3-month slots used to expose people to the field by having them work on an informatics research projects with NLM-funded training faculty. Ethnic and racial minorities, women, people from disadvantaged backgrounds, and the disabled are specifically invited into that program.

Regarding career choices, based on data in the most recent renewal applications, about 70% of NLM's pre-doc trainees go into academics, and 29% into industry, government or health care. Among the post-docs, about 79% go into academics, and 22% into industry, government or health care. This differs from 5 years ago, when closer to 50% went into academics. The informatics job market is strong, and NLM strongly encourages the training programs to focus on training for research careers. Dr. Florance also noted that in the past five years, over 600 publications acknowledged NLM training grants.

Dr. Walker asked whether there was any continuing relationship between NLM and the graduates. Dr. Florance responded that at this time, there are only informal contacts, no consistent tracking is done. However, EP staff are considering methods to track their careers and stay in touch without violating any federal rules about surveys and privacy. Dr. Francis suggested that social media might be a good tool for this. OMB doesn't have quite the same strictures on information-gathering in that realm. Professional societies could also be of help. Dr. Clem McDonald asked whether a pre-doc someone who is going to get a PhD, even though they have an MD? No, Dr. Florance responded, if they have an MD, they're a post-doc.

NLM has made 14 new five-year awards that begin July 1, 2012. Two new programs, University of California, San Diego, and Ohio State University, are coming aboard, and 6 existing programs are not receiving new awards.

NLM Deputy Director for Research and education Dr. Milton Corn asked how many actually graduated in 2011. Based on data from 2008, 2009 and 2010, Dr. Florance guessed that 25-30

NLM-supported pre-docs graduate each year with a PhD each year. She estimated that 10-20 post-docs who leave every year. Dr. Corn commented that it doesn't sound like enough people, given market demand for informatics expertise.

Dr. Roskies asked whether, with a training grant, a person would be funded for the full 6 or 7 years it takes to get a degree. Five years of support is the average, Dr. Florance replied. Some use fewer years, some take more.

In response to information provided about curriculum supplement awards made in FY 2010 to NLM training programs, Dr. Francis asked whether NLM-funded curricula are made broadly available. Dr. Florance responded that, while there is no official policy requiring sharing of curriculum materials, those who received the curriculum awards were asked to create resources that could be shared with one another.

XII. NATURAL LANGUAGE PROCESSING AND INFORMATION RETRIEVAL CHALLENGES

Olivier Bodenreider, PhD, Chief of the Cognitive Science Branch, Lister Hill National Center for Biomedical Communications (LHNCBC), briefed the board on what NLM has learned by participating in natural language processing and information retrieval challenges. People throughout LHNCBC as well as the National Center for Biotechnology Information (NCBI) have worked together to participate in these challenges over the past decade. Natural language processing (NLP) and information retrieval (IR) challenges focus on specific research problems with the goal of evaluating the best solutions and developing standards for evaluation. Examples include extracting medication information from patient records (NLP) or retrieving radiological images (IR).

Dr. Bodenreider summarized the various challenges in which NLM has participated. They include: the Text REtrieval Conference (TREC) which was sponsored by the National Institute of Standards and Technology (NIST) and included genomic and medical record tracks; the Cross Language Evaluation Forum (CLEF), which has an image retrieval track; and Informatics for Integrating Biology and the Bedside (i2B2) NLP challenge to extract information on specific, practical topics such as smoking and obesity from a clinical data warehouse; and the Collaborative Annotation of Large Biomedical Corpus (CALCB).

The challenges give NLM an opportunity to evaluate a number of its tools and to use a broader set of clinical records. NLM tools evaluated include: MetaMap (which is a tool run on an arbitrary piece of text to extract concepts from the UMLS); the Medical Text Indexer (which plays the role of an indexer in some journals and is now a part of NLM's indexing workflow; Essie (the search engine that fuels ClinicalTrials.gov); and Openi (an open access biomedical image search engine).

Dr. Bodenreider said NLM has participated in more than a dozen tracks in a variety of challenges

over the past decade and frequently was among the top performers--and in some cases was the top performer. He listed several "lessons learned" from the challenges include identifying good word or sentence boundaries; text/captions are useful in addition to images. He said the challenges are good training opportunities for summer interns and visiting fellows and provide an opportunity for NLM to report on its work—15 publications came out of the challenges.

In questions following the presentation, Dr. Joyce Mitchell asked if NLM's systems for extracting information from clinical documents are ready for prime time. Dr. Bodenreider said Openi is ready. His colleague Dr. Dina Demner-Fushman added that a beta version is available and gets about 500 unique users a day. Much of the rest of the discussion focused on lively exchanges concerning electronic medical records.

XIII. REPORT FROM THE NOMINATING COMMITTEE FOR BOR CHAIR

Ms. Kathryn Mendenhall, chair of the Board of Regents nominating committee, spoke on behalf of other members Dr. Simon Liu and Dr. Charles Rice, and nominated Dr. Joyce Mitchell to be the next chair of the Board of Regents.

The nomination was put to a vote and unanimously approved.

XIV. REPORT FROM THE SUBCOMMITTEE ON OUTREACH AND PUBLIC INFORMATION

Ms. Virginia Tanji, Board Chair and chair of the Subcommittee on Outreach and Public Information, reported on the subcommittee meeting. Sarena Burgess, a librarian with the MedlinePlus team, provided an update on MedlinePlus and GovDelivery, a service that allows people to easily subscribe to receive information about updates from your system. In the case of MedlinePlus, people interested in information on arthritis or diabetes, for example, can subscribe to that part of it and any updates will be emailed to them. There's been a big increase in sign-ups and use on both the English and Spanish side. Because this is licensed for all of NLM, the subcommittee talked about using this for DIMRC's information resources

Dr. Michael Huerta, head of NLM's Office of Health Information Programs Development, updated the subcommittee on efforts regarding health literacy promotion and careers in informatics at the Universities at Shady Grove. Dr. Steve Phillips, head of the Division of Specialized Information Services, updated the subcommittee on the Environmental Health Information Outreach partnership. It now involves 22 institutions across 15 states. Dr. Fred Wood updated the board on the Native Voices exhibition and the variety of groups visiting it. Dr. Ted Mala commented on reaction to the exhibition saying people are always surprised about how many interviews are done and how many tribes were represented.

XV. HEALTH DATA STANDARDS UPDATE

NLM Deputy Director Betsy Humphreys provided an update on health data standards, focusing on NLM's role in the national effort to achieve "meaningful use" of electronic health records (EHRs). NLM is the central coordinating body for clinical terminology standards within the Department of Health and Human Services and works closely with the HHS Office of the National Coordinator for Health Information Technology (ONC) to facilitate the development of certified electronic health record (EHR) products and their implementation and "meaningful use" by hospitals and health professionals. The Library develops or provides significant support for the maintenance of the three major clinical terminologies (RxNORM, SNOWMED CT, LOINC) currently required for certification of EHRs. NLM's work in this area, Humphreys noted, is called for in the Board's current long range plan for NLM.

She said NLM had made health data standards a priority and expanded its funding and activity in the area even before the meaningful use agenda was set forward in 2009. In 2008, the Board of Regents established a working group that determined NLM's current activities were useful and were not adequately funded. The Working Group's 2009 report recommended four priorities for NLM to pursue. Given the funding available, NLM focused on the work it thought would have the most immediate benefit to the country. So, the most effort is going to enhancing user support and providing additional tools and services to help vendors and users incorporate standards where they will have a positive impact on the achievement of meaningful use of electronic health records.

Ms. Humphreys said there are three key players in meaningful use. The Centers for Medicare and Medicaid Services (CMS) is establishing rules for who is eligible, how they'll get paid, and criteria for judging meaningful use. ONC is responsible for publishing the rules for certification of EHRs. The National Institute of Standards and Technology (NIST) is establishing test procedures to be used in the certification of EHRs. Certified electronic health record products must be used in order to achieve meaningful use. And certain health data standards must be used to meet some criteria.

Ms. Humphreys briefed the board on the work NLM has been doing. With regard to enhanced user support, NLM has created a consolidated customer service contact point; provided more and better documentation and educational resources on the Web; hosted more Webinars; and had a greater presence at HIMSS and other meetings and events that attract developers. NLM has plans to do even more. With regard to providing additional tools and services, NLM has been enhancing its browsers and APIs (Application Program Interfaces). NLM also has been creating vocabulary subsets and making additions to controlled vocabularies to help people achieve meaningful use and useful clinical applications. NLM also is working on mappings to facilitate the transition from SNOMED CT to ICD-10-CM and ICD-9-CM to SNOMED CT. Ms. Humphreys also showed off a "cool tool" called I-Magic that NLM developed. With the tool, users create a problem list using SNOMED CT, then press a button and get the ICD-10 code.

In the discussion following the presentation, Dr. Ronald Evens commented that the electronic health records industry is fragmented, and he applauded NLM for the work it does regarding standards. Dr. Joseph Francis stressed the importance of having a neutral party like NLM, that's not making any money from EHRs, serving as an honest broker in the discussions around meaningful use.

XVI. REPORT ON COUNCIL OF COUNCILS

Dr. Joyce Mitchell, who represents the NLM on the NIH Council of Councils, briefed the Board about the group. The Council, which is congressionally mandated, is one of four advisory committees for the NIH Director. The Council reports through the Division of Program Coordination, Planning and Strategic Initiatives (DPCPSI) and oversees the common fund, which facilitates trans-NIH research, and other parts of the Office of the Director. Council members represent every NIH Institute and Center and serve a three-year term. The council provides concept clearance for the Office of Research Infrastructure Programs, second-level grant review; and advises the NIH Director on strategic directions.

One huge thing that will impact NIH and NLM is that the Common Fund grants are supposed to transfer to the Institutes after their initial funding, so they'll get funded for five years, they might get renewed once and then they transfer to support from individual institutes, such as NLM. This is because they want to preserve the common fund for new NIH Director initiatives.
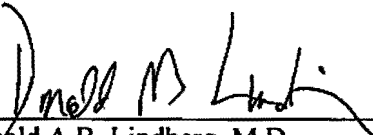
XVII. ADJOURNMENT

The Board of Regents meeting was adjourned at 12:00 p.m. on May 9, 2012.
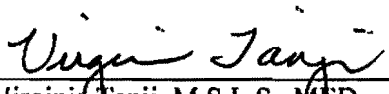
ACTIONS TAKEN BY THE BOARD OF REGENTS:
➢ Approval of the February 7-8, 2012 Board Minutes
➢ Approval of the May 21-22, 2013 Future Meeting Dates
➢ Approval of next Board of Regents Chair

Appendix A - Roster - Board of Regents

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

Donald A.B. Lindberg, M.D.
Director, National Library of Medicine

Virginia Tanji, M.S.L.S., MED
Chair, NLM Board of Regents