

## **JPBM Meeting**

Minutes of Meeting

October 27, 2014

**Organizational Attendees:** Robert Bryant, James Crowley, Robert Devaney, Barbara Faires, Irene Fonseca, David Levermore, Don McClure, Michael Pearson, Stephen Pierson, Miriam Quintal, Carla Savage, Nathaniel Schenker (chair), David Vogan, Ron Wasserstein

**Guests:** Harrison Dreves (NAS Communications Specialist), John Lafferty (CATS member), Michelle Schwalbe (CATS Director), Joan Ferrini-Mundy (Assistant Director, EHR), Hank Warchall (Deputy Division Director, DMS), Michelle Dunn (Senior Advisor for Data Science Training, Diversity, and Outreach)

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The meeting began at 9:03am.

Nat Schenker, ASA President and chair of JPBM, welcomed the members, who then introduced themselves.

Minutes from the April 28, 2014 JPBM Meeting held were approved (Crowley, Vogan).

### **NAS/BMSA/CATS *Frontiers in Massive Data Analysis* and *Training Students to Extract Value from Big Data***

David Levermore introduced both this portion of the agenda and our guests from the National Academy of Sciences. He said the societies can do more using NAS reports as we work to promote our professions on the Hill. These reports have great credibility, Levermore noted, and said the reports being brought to our attention today have significant value.

Michelle Schwalbe presented the “Frontiers” report. Schwalbe noted it is difficult to get a comprehensive understanding about how a report impacts a community. Both of these reports have been highly successful in terms of downloads. “Frontiers” is the single most downloaded math/science report, and is also the 39<sup>th</sup> most viewed report of all time, with about 12,000 downloads.

The report was built on about two decades of NRC leadership in massive data analysis. Schwalbe reviewed the structure of the report and highlighted the diversity of the committee in terms of areas of practice. The charge of the study was to assess the current state of data analysis for mining of massive sets and streams of data, identify gaps in current practice and theory and propose a research agenda to fill those gaps. She reviewed the findings of the study, noting the importance of blending ideas from computer science and statistics.

There will not be a turnkey solution to the problems identified in the report, at least not soon, Schwalbe said.

Lafferty provided an overview of the “Training Students” report. A committee organized a workshop, held last April, to look at what should be taught, to whom and how. The workshop had sessions that

looked at: case studies and experiences on the need for training; principles for working with Big Data; courses, curricula and interdisciplinary programs; shared resources (including computational resources); and workshop lessons (summarized at the conclusion of the workshop).

The discussions focused on learning outcomes and needed skills and Lafferty reviewed these. He noted they were very cross-disciplinary, that there is broad applicability for these skills and that people need good grounding in the scientific application domain. There is a need for small data fluency before big data proficiency can be attained.

Another area of focus was the data analysis pipeline (steps moving from a general question to actionable insights). There was much discussion about visualization. It is important, but difficult to train for, Lafferty said.

There was discussion about whether Big Data (or Data Science) should be a new discipline or seen as a complementary skillset for other disciplines. The roles of intense courses (MOOCs, “boot camps,” etc.) were discussed, as was whether this subject should be introduced at the undergraduate or graduate level.

Fonseca noted that many people are not aware of these reports, asking how we can get the word out more effectively. Lafferty suggested the professional societies could advertise them. McClure noted that the means of communication would vary based on the intended audience. He said it is difficult for the societies to influence curriculum changes and that new approaches are needed to get the word to individual departments.

Pearson noted that we need to figure out how to integrate the ideas in these reports into the educational efforts of our own societies and professions.

Vogan asked about NSA’s commission of the report. Levermore said the NSA paid for it and set up the charter for it. He said the NSA has funded many NAS reports, including those in BMSA or CATS. NSA has historically asked for broad, general advice about issues, not focused on things corresponding to their core mission. Vogan said he was concerned that the direction for the report came from NSA. Fonseca noted that the questions addressed in the charge are issues that should have been raised by the mathematical community.

Pierson commended Schwalbe and Lafferty for these reports, noting that they met a big demand in the statistics community. He asked whether there might be some other ideas in the report pipeline regarding massive data. Schwalbe said there was nothing at this time, but that they were interested if specific suggestions (including funding sources) are made.

Schenker noted that both reports emphasized understanding of fundamentals. Principles of scientific study design are often omitted. Many Big Data collections are observational in nature and error measurement is difficult if design is not properly understood. Scientific studies should be reproducible and have theories to underpin them, and this often gets overlooked. Lafferty noted that these matters came up in the workshop. CATS will be doing a workshop on reproducibility in February 26-27, 2015.

Levermore noted there was much passion at the workshop about the “ownership” of data science by existing disciplines. Lafferty said it was clear during the workshop that what is at play cuts across many

disciplines in the mathematical and statistical sciences. Calling it “data science” or something else new helps avoid discipline barriers and opens involvement to all.

Schenker thanked the presenters for their efforts and for making time for JPBM today.

### **NSF/EHR - Joan Ferrini-Mundy, Assistant Director, EHR**

Pearson introduced Joan Ferrini-Mundy. He noted the importance of EHR to the mathematics and statistics community and highlighted how Ferrini-Mundy has been instrumental in emphasizing evidence-based approaches in the division.

Ferrini-Mundy presented “Perspectives from NSF on Education in the Mathematical Sciences.” She said that now is the time for focus on the first two years of mathematics. The nature and practice of science is becoming computationally intensive and data-driven across most fields. New technologies and new understandings about learning and teaching allow new possibilities for instruction, she said.

There are many opportunities in STEM education, including such things as the transition from secondary school to undergraduate education, implementation of active learning oriented instruction, engagement from underrepresented groups, learning support by technology and mathematics through authentic STEM research experiences.

Ferrini-Mundy pointed to four investments in UG education by the division: research and development to improve math learning environments, direct support to students and faculty to improve success, research experiences for students and preparation for the STEM workforce.

Lack of preparation in mathematics is rampant and worse still within some traditionally underrepresented minority and ethnic groups. This restricts access to the pipeline into the mathematical sciences. Students entering college needing remedial work succeed at a much lower level than those ready for calculus.

College attainment is a focus of the Obama administration, Ferrini-Mundy noted. A five-year strategic plan for STEM education has been created. The plan looks at such things as implementation of evidence-based instructional practices and innovations, improving STEM education at 2-year colleges and dealing with low success rates.

She noted the low proposal pressure from the mathematics community. Only 11% of proposals contained a focus on mathematics. She encouraged more strong proposals from the mathematics community. Among areas being funded, she pointed us to two “Cyber-learning and future learning technologies” (joint with CISE) and “Cybercorps: Scholarships for Service.”

The agency faces challenges relative to the merit review process and the efforts by some in Congress to look at individual, specific proposals.

Levmore asked about the proposal pressure issue, suggesting the EHR be invited to speak to the individual societies the way DMS does. Ferrini-Mundy agreed, and noted that EHR works very closely with DMS.

Pierson asked about how to get people's attention about the opportunities for funding in EHR. Better public explanations of the interesting results that come from EHR-funded research would be useful, Ferrini-Mundy said.

Vogan noted that DMS puts pressure on people to publish results and asked about dissemination from EHR research. Ferrini-Mundy said the same expectations as those for DMS are used in EHR. Partnerships that get innovative ideas to market (for example, into textbooks) are also part of dissemination.

Fonseca asked about the "broader impact" criteria. This is a major source of discussion at NSF and in the field, Ferrini-Mundy said. In the new broader impacts statement there is an increased focus on accountability, asking whether the ideas worked (and how we know if they did).

Bryant noted the large NSF investment in calculus reform. He asked whether any longitudinal studies have been conducted. Ferrini-Mundy said that none were planned or funded. There was relatively little design for measurement of long-term impact in many reform efforts. She said that NSF is working to build this type of measurement into new proposals. Vogan stressed the importance of getting the good ideas that are discovered by research into practice. The question, Ferrini-Mundy said, is what the right role for NSF should be. There are those who think we already have the information on education that is needed, and that money should be spent on getting these ideas out into the field, she said, but there is definitely not agreement on this premise. In response to a question by Vogan, she noted that EHR still funds textbook and course material development.

Ferrini-Mundy mentioned a series of "ideas labs" that have developed educational ideas and agenda in some other scientific areas. EHR is interested in partnering to do this kind of discipline-specific research.

Pierson asked about whether the emergence of "data science" is on the agenda of EHR. Ferrini-Mundy said they are seeing proposals in this area in many programs, and it is in general a big topic of discussion NSF-wide.

Schenker expressed thanks to Ferrini-Mundy for her support of education and for taking time with JPBM today.

### **Washington overview - policy/government relations reps**

Quintal said there were hopes this year that the appropriations would be completed in regular order, but these were dashed this summer in a procedural dispute. There is a lot of agreement on funding for NSF, and this may be helpful in including such funding in an omnibus bill. If any appropriations get done, Commerce/Justice/Science seems ready to get addressed.

However, there is no chance of authorization of the "COMPETES Act," which is good for the research community. Republicans on the committee want to divide out NSF funding by division, specifically so they can cut SBE funding. Democrats are strongly opposed and no compromise is being considered.

Representative Frank Wolf, a huge NSF champion, is retiring. Ditto with Senator Rockefeller.

In general, attacks on community evaluation of basic research are a major problem. Quintal noted a specific grant proposal on social network research that was drawing considerable Republican attention.

Regarding FY2016, sequestration is coming back, but the cuts look to be much smaller. The “cut exercises” are looking at 2%. Next year’s Congress is likely to be more deadlocked, particularly if the Republicans take the Senate.

Pierson said the scientific community has been united in support of SBE and has opposed the various maneuvers to defund it. There was vigorous discussion among JPBM members about how to respond to these attacks while fully recognizing the rights of Congressional oversight. Quintal noted that Republicans are champions of basic research, so they agree with many of the principles the scientific community articulates, but approach the issue of how to apply them differently.

### **NSF/DMS Update (Hank Warchall, Deputy Division Director, DMS)**

Warchall indicated he would highlight the research institutes, the MSPRF program, the second year of the innovation incubator activity and the enriched doctoral training program. Warchall pointed out as a matter of perspective that 75% of the DMS budget is invested directly through the disciplinary programs. The programs he’s discussing today, therefore, represent a smaller portion of the DMS investment.

There are nine research institute and there is also a small investment in four foreign institutes that involve many US participants. Five institutes have renewal proposals that are currently under review. Site visits are currently being completed. Institutes represent 13% of the DMS budget. Recommendations for awards will come out in the spring.

Committees of Visitors have pointed to some improvements needed in the Mathematical Sciences Postdoctoral Research Fellowships (MSPRF). NSF is implementing changes. In FY2015, panel size has been changed, instructions have been improved and applicants will get better feedback. In FY 2016, modifications to the application structure will be made, and even more feedback will be given to applicants.

The Mathematical Sciences Innovation Incubator (MSII) encourages mathematical scientists to take advantage of funding available in other areas of NSF, including those areas of annual science priorities from the National Science Board. There are an “embarrassment of opportunities” for DMS to invest in other NSF solicitations. This opportunity for investment is advantageous in some respects, but cuts into the availability of funding for other things. MSII tries to bring this under the DMS umbrella in this way: If a mathematical scientist submits a proposal in a national high-priority research area (identified by OSTP) elsewhere in the agency (and meets some other criteria as well), DMS will get involved in the review process and stands ready to provide part of the funding. In FY2014, about \$3.8 million of DMS’s investment in 22 awards were made through this program. Warchall said that MSII proposals do not add to the proposal pressure of DMS and that “this is a good thing.”

Among the ideas for the future of this program is an annual explanation by a distinguished professional, to be spread through the societies to clarify what the OSTP Priorities Memo directs.

Warchall also highlighted the Enriched Doctoral Training in the Mathematical Sciences (EDT) program, which supports efforts to prepare PhD students to recognize and find solutions to mathematical challenges

arising in other fields and in areas outside today's academic setting. It aims to prepare PhD students for a broader range of mathematical opportunities and career paths than has been traditional in US mathematics doctoral training. The inaugural competition will take place in FY 2015. Proposals are due November 12.

Warchall also noted the National Materials Genome Initiative (MGI). To emphasize opportunities in this program, DMS is funding a mini-symposium at the SIAM Conference on Computational Science and Engineering in March 2015. In addition, he pointed out an NRC report on optics and photonics, noting there are good opportunities for mathematics in research in these areas. This is an expanding area.

Crowley asked about NSF involvement in the Brain Initiative. Warchall said NSF had invested only \$10 million in the BRAIN Initiative in FY 2014. He noted these were not new funds, but monies that were repurposed. NSF continues to support research in brain neuroscience. DMS supports some of this work through both the mathematics and statistics programs.

Quintal emphasized the importance of communicating the DMS is supportive of Obama administration priorities, especially through the MSII program. Levermore noted that the societies can help spread the word. Warchall said the program will be brought to the attention of the MPS advisory committee at its upcoming meeting.

Schenker thanked Warchall for his support of the communities and for once again briefing the JPBM.

#### **NIH ADDS Michelle Dunn (Senior Advisor for Data Science Training, Diversity, and Outreach)**

Pierson introduced Dunn, noting that she is a distinguished leader in the statistics community.

Dunn said the NIH is interested in attracting more proposals from the mathematical sciences community. She wants to know what the NIH can do to engage the quantitative community in biomedical research.

The NIH is deeply interested in data science/big data, Dunn said. Her office, that of the Associate Director of Data Science, is built around a program called Big Data to Knowledge (BD2K). It is a cross agency initiative and it is a major change. There are four programmatic areas: facilitating broad use of biomedical data; developing and disseminating analysis methods and software for biomedical big data; enhancing training for biomedical big data; and establishing centers of excellence for biomedical big data. The program has been two years in development, and is underway. Seven years of funding has been committed to BD2K.

The mission of the Office of the ADDS is "to foster an ecosystem that enables biomedical research to be conducted as a digital enterprise that enhances health, lengthens life, and reduces illness and disability." The ecosystem consists broadly of issues related to policy, infrastructure and community. Policy issues include data sharing (to have data sharing plans on all research awards, in an enforceable form) and data citation (to legitimize data as a form of scholarship). Community issues include training, workshop and think tank developments (Dunn noted that the math societies can increase representation by providing direct support to send additional people to these workshops on top of those that the NIH can invite within its budget caps) and dissemination. Infrastructure issues include the creation of some sort of "commons," a conceptual framework for finding, sharing and providing attribution to digital research objects, not tied to ("agnostic from") any computing platform.

Schenker thanked Dunn for her leadership and for meeting with JPBM today.

### **Business meeting**

- Math Awareness Month (2015) update

Crowley provided the update. The theme for 2015 is “Math Drives Careers.” Theme profiles and essays will be developed. Links to society materials on careers will be established.

- Suggestion regarding including NAM in the JCW membership

Pearson discussed a suggestion to add the National Association of Mathematicians (NAM) to the list of organizations represented on the Joint Committee for Women in the Mathematical Sciences (JCW). There were questions about procedure for doing this, as well as concerns about precedent and what other organizations might also be interested in being invited to participate. Noting that the NAM had not asked for membership, a better approach would be to encourage societies to be thinking about minority representation as they make appointments. Pearson will communicate this to the committee.

- Promoting diversity and advancement of under-represented groups of students

McClure shared with the JPBM a proposal, submitted by two AMS members, to create an Office of Education and Diversity in the American Mathematical Society. The proposal is for the AMS to provide an institutional home for the National Alliance for Doctoral Studies in the Mathematical Sciences. It has been discussed by two policy committees, and although it is at an early stage, the concept is gathering momentum. There will be interest in coordinating efforts with the other JPBM societies should this proposal come to fruition.

Vogan noted that the Alliance has demonstrated it can and is doing the things it aims to do. It is a tested concept. The proposal provides mechanisms for sustainability, not just depending on a few committed individuals.

McClure said that next steps involve thinking through how to operationalize this within AMS, including budget and staffing.

- Welcoming Environment Policy (JCW)

Crowley asked whether any of the societies had taken action regarding the “Welcoming Environment Policy” proposed by the JCW.

McClure said AMS is converging on a policy, and will probably be adopted in January at the next Council meeting. Wasserstein said the ASA has adopted a “meetings conduct policy” that is more general than the policy proposed by JCW, and that this new policy is now in force (effective September 2014). Faires said that a labor attorney cautioned against adding to the MAA’s current code of ethics, but the MAA will change the name of the code to reflect the concept of a “welcoming environment.”

- Government travel restrictions

Crowley said that people working in US government labs (DOE, DOD, NIST) are having trouble getting funding and permission to travel to research conferences. He said SIAM has formed a group to consider ways to address this issue. The ASA has members who have similar problems.

- Issue with JPBM communications awardee

Wasserstein noted that Simon Singh, one of the individuals selected to receive the 2015 JPBM communication award, has asked to defer his receiving the award until 2016. McClure suggested that we re-label the award as a 2016 award and give it to him next year. He noted that, under our new award structure, this approach would not restrict next year's committee in any way. Singh also offered to give a presentation in 2016, but this is not possible within the JMM structure. A book signing could be arranged, however. Members of the selection committee agreed with this approach, and the rest of JPBM concurred. Wasserstein will follow up with Singh.

- Further discussion; sharing among societies

Pearson drew JPBM attention to the NSF funded Common Vision for Undergraduate Mathematics Education 2025 being coordinated by the MAA. Each society is represented in the organizing committee.

Pearson said the MAA has implemented a monthly dues payment method (as opposed to taking just an annual payment). They will report on the results at a future JPBM.

Fonseca asked the societies to help spread the news of a job fair at the SIAM CSE meeting in March 2014.

The meeting adjourned at 4:04 pm.