UNIVERSITY OF CALIFORNIA **ACADEMIC SENATE**

COORDINATING COMMITTEE ON GRADUATE AFFAIRS

Notice of Meeting
Wednesday, June 5, 2013
10:00 a.m. – 3:30 p.m.
UCOP, 1111 Franklin Street, Oakland, CA -- Room 5320
Primary Dial-In: 1-866-740-1260 Passcode: 9879483

AGENDA

Action	Item		Enclosures
Information **10:00-11:00**	**I.**	**Chair's Report/Announcements/Updates –** *Chair Ruth Mulnard* • May 7 Academic Planning Council Meeting • May 17 UCOP Budget call • May 22 Academic Council Meeting • May 24 PDST Task Forces	
Action **11:00-11:15**	**II.**	**Consent Calendar** • Approval of the Draft Minutes from the January 2, April 3, and May 1, 2013 Meetings • Approval of the Agenda ***ACTION REQUESTED: Approve the draft minutes and agenda.***	**1** **(pp. 1-6)** **2** **(pp.7-11)** **3** **(pp. 12-17)**
	III.	**Proposed Graduate Degrees and Programs** *All program proposals and current reviews are posted on the CCGA SharePoint site; please contact the committee analyst if you would like proposal materials or documents e-mailed to you.*	
Discussion **11:15-11:30**		**Proposal for a Program of Graduate Studies in the Interdisciplinary Humanities for the M.A. and Ph.D. Degrees at UC Merced** – *Lead Reviewer Bruce Schumm (UCSC)*	**4** **(SP)**
Discussion **11:30- 11:45**		**Proposal for a Graduate Program leading to the Master of Information and Data Science (MIDS) at UC Berkeley**– *Lead Reviewer Divy Agrawal (UCSB)*	**5** **(SP)** **6** **(pp. 18-35)**
Action **11:45-12:00**		**Proposal for a Graduate Program in Informatics Leading to the Ph.D. Degree at UC Irvine** ***ACTION REQUESTED: Select a lead reviewer.***	**7** **(SP)**
Action **12:00- 12:15**		**Proposal for a Graduate Program leading to M.S. and Ph.D. Degrees in Applied Mathematics at UC Merced** ***ACTION REQUESTED: Select a lead reviewer.***	**8** **(SP)**

Working Lunch/ Information 12:15-1:15	**IV.**	**Consultation with Academic Senate Leadership** *Robert Powell, Academic Council Chair* *William Jacob, Academic Council Vice Chair*	
Information 1:15- 2:00	**V.**	**Announcements from the President's Office** – *Pamela Jennings, Graduate Studies Director, Office of Research and Graduate Studies* *Hilary Baxter, Interim Director, Academic Planning, Programs and Coordination*	**9 (p. 36)** **10 (pp. 37-45)** **11 (pp. 46-65)** **12 (pp. 66-69)**
Discussion 2:00-3:00	**VI.**	**Updates/Inquiries from the Divisional Senates** – *Chair Mulnard and Members* • Rationale for Permitting Professional PhD Programs to Apply for PDST Funds – *Michael Vanderwood (UCR)* • *In Absentia* Policy and Practices –*Joseph Nagy (UCLA)* • Doc2A Policy – *Jutta Heckhausen (UCI)* • Administration of Interdisciplinary Programs that Cross School Lines – *Jutta Heckhausen (UCI)* • UCLA Global EMBA Program–*Joseph Nagy (UCLA)* • UCSB Master of Fine Arts Program–*Divy Agrawal (UCSB)* • Renewal of UC Merced's Interim Individual Graduate Program (IIGP) for AY 2013-2014 – *Valerie Leppert (UCM)*	**13 (p. 70)**
Discussion 3:00-3:15	**VII.**	**Executive Session**	
Discussion 3:15-3:30	**VIII.**	**New Business**	

Agenda Enclosures:

1. Draft Minutes from the January 2, 2013 CCGA Meeting (pp. 1-6).
2. Draft Minutes from the April 3, 2013 CCGA Meeting (pp. 7-11).
3. Draft Minutes from the May 1, 2013 CCGA Meeting (pp. 12-17).
4. Proposal for a Program of Graduate Studies in the Interdisciplinary Humanities for the M.A. and Ph.D. Degrees at UC Merced – (See "UCM: Interdisciplinary_Humanities_UCMerced_Proposal.pdf on SharePoint Graduate Degree Program Proposals Under Review).
5. Proposal for a Graduate Program leading to the Master of Information and Data Science (MIDS) at UC Berkeley (See "UCB: MIDS proposal w- GC cover letter.pdf on SharePoint Graduate Degree Program Proposals Under Review).
6. Letters of Review for a Graduate Program leading to the Master of Information and Data Science (MIDS) at UC Berkeley (pp. 18-35)
7. Proposal for a Graduate Program in Informatics Leading to the Ph.D. Degree at UC Irvine – (See "UCI: UCI PhD Informatics.pdf on SharePoint Graduate Degree Program Proposals Under Review).
8. Proposal for a Graduate Program leading to M.S. and Ph.D. Degrees in Applied Mathematics at UC Merced – (See "UCM: PDF 1- Applied_Mathematics_UCMerced_Proposal.pdf on SharePoint Graduate Degree Program Proposals Under Review).
9. Responses from Pamela Jennings regarding CCGA requests from the May 1 meeting (p. 36).
10. Q213 Award Update report (pp. 37-45).
11. AAAS Brief: Federal R&D and Sequestration in the First Five Years (pp. 46-65).
12. ACE: The Likely Impact of Sequestration on Higher Education (pp. 66-69).
13. Request to Renew the Interim Individual Graduate Program (IIGP) (p. 70)

Important Meeting Information

Location: The May 1 meeting will convene in Room 5320 at the UC Office of the President in downtown Oakland. UCOP is located at 1111 Franklin Street, between 11th and 12th Streets. Upon arrival, please check in at the security desk where you will be issued a visitor badge. Online directions and a map are available at: http://www.ucop.edu/services/directions-franklin.html.

If you are arriving by way of the Oakland airport, you may taxi or BART to the UCOP building. For BART, purchase an AirBART shuttle ticket from the ticket machines located at terminal exits. The shuttle will take you to the Coliseum BART station. From there take a Richmond-bound train and exit at the 12th Street/Oakland City Center Station.

Parking: Parking is available at 989 Franklin Street for $8/day if you park before 10 AM. Visitor parking is also available at UCOP on the 12th Street side of the building for $11/day if you enter the parking structure before 9:00a.m. Daily parking is also available at a number of lots in the building vicinity.

Travel Regs: Detailed travel information (booking travel and receiving reimbursements) is available online at:

http://www.universityofcalifornia.edu/senate/resources/

Please submit completed and signed travel voucher with original receipts within 21 days after the meeting to:

Business Resource Center - Team Blue
University of California Office of the President
1111 Franklin Street 9th floor
Oakland, CA 94607-5200

Account/Fund Number: M-430384-69085-03

UNIVERSITY OF CALIFORNIA **ACADEMIC SENATE**

COORDINATING COMMITTEE ON GRADUATE AFFAIRS
DRAFT MEETING MINUTES – JANUARY 2, 2013

Present: Present: Ruth Mulnard (Chair), Donald Mastronarde (Vice Chair), Jutta Heckhausen (UCI), Ari Kelman (UCD), Valerie Leppert (UCM), Joseph Nagy (UCLA), Kwai Ng (UCSD), Martin Olsson (UCB), Bruce Schumm (UCSC), Youngho Seo (UCSF), Michael Vanderwood (UCR), Matthew Gorlick (Student Representative-UCLA), Robert Powell (Council Chair), William Jacob (Council Vice Chair), Eric Zarate (Committee Analyst), Consultant Hilary Baxter. Guest Tyrus Miller.

I. Chair's Reports/Announcements/Updates

December 12 Academic Council Meeting
Vice Chair Mastronarde informed the committee that the highlights of the last Academic Council meeting were the discussion on rebenching and the exchange of ideas with Regent Keiffer, who had been invited to attend that meeting.

December 10 PDST Task Force Meeting
Chair Mulnard observed that Provost Dorr has the PDST Task Force on a rapid trajectory, meeting more often than originally planned, and in-person. Discussion has focused largely on the differences between policy and guidelines, and how PDST programs relate to SSPs. Chair Mulnard stated that each campus has its own policy on returning fees to the professional schools from which they are generated. The Task Force debated whether there should be more consistency in the process and if it should perhaps be overseen by the Office of the President.

December 14 Budget Call
Vice Chair Mastronarde reported that the Office of the President is having very exacting discussions with the governor and the Department of Finance. The overarching message is that UC should lower its fiscal expectations. More detail will be available after the governor releases his budget on January 10. Vice Chair Mastronarde stated that the governor is very concerned about tuition and compensation issues; he prevented tuition increases at the last Regents' meeting and has indicated that he would not like to see across-the-board salary increases. The Governor challenged the long-range vision embedded in OP's budget request as based on unsustainable budgetary assumptions.

Vice Chair Mastronarde remarked that there has been some consternation regarding a report put out by the Legislative Analyst's Office on UC faculty recruiting and retention, which was based on data from a few years ago and finds that UC's salaries and benefits are competitive and faculty recruitment and retention are not problems. Academic Council Chair Powell suggested that it would be best not to call attention to the report in that it would only boost its profile and perceived credibility.

In closing, Vice Chair Mastronarde commented that at the last Academic Council meeting a serious concern was raised concerning composite benefits rates that are being adopted in the new UCPath payroll system. While new categories have been created, there are still problems with the latest scenarios. The next meeting will provide more information and detail.

COGD Conference Call Report
Professor Kelman observed that the COGD call was extremely brief and was centered around the rollout of UCPath. Considerable frustration was voiced, with campuses expressing concern as to whether their procedures would be compatible with the rollout timeframe and if the process might result in a disruption in payment of UC salaries.

Professor Kelman explained that UC Day in Sacramento might be rescheduled because the UC Governmental Relations office felt that discussions around budgeting were going to be radically changed due to the Democratic super majority in the legislature.

December 19 Academic Council Conference Call
Chair Mulnard explained that the conference call was very brief and focused on the rebenching memorandum that Academic Council Chair Powell had drafted to go to Provost Dorr. Ultimately, it was decided that the topic would be discussed again after the first of the year. Chair Mulnard explained that when the memorandum is refined, she will send it to the committee.

Upcoming Meeting Schedule
Chair Mulnard remarked that the committee has five more meetings scheduled, all of which are meant to be in-person, convened meetings. Also, an ANR task force committee is being reactivated and Vice Chair Mastronarde has agreed to commit to two years of membership on this task force; he will provide the committee an update after next week. Chair Mulnard observed that committees are increasingly choosing to meet in person rather than by conference call.

II. Consent Calendar

A. Approval of the Agenda
ACTION: ***Members approved the agenda.***

B. Approval of the Meeting Minutes of December 5, 2012
Chair Mulnard noted that the minutes were not yet completed, and that Analyst Zarate would send them out in the next few days via email.

III. Proposed Graduate Degrees and Programs for Review

A. Proposal for a Program of Graduate Studies in Pursuit of the Degree of Master of Technology at UC Santa Barbara
Professor Heckhausen agreed to lead the review of the proposal. Analyst Zarate will send her the materials.

B. Proposal for a Graduate Program leading to the M.S. degree in Pharmaceutical Chemistry at UC Davis
Professor Seo stated that this is an extension of the program's bachelor's degree into a master's, and that it does not require any new courses. The proposal included letters of support from pharmaceutical industry contacts in the Bay Area. Professor Seo remarked that he contacted five reviewers: two internal to UC and three external. The two UC reviewers have agreed to respond to the proposal by the end of January, and Professor Seo plans to report at the February meeting of CCGA.

C. Proposal for a Graduate Program leading to the M.S. degree in Games and Playable Media at UC Santa Cruz
Professor Olsson stated that he had commitments for two external and two internal reviews but has yet to receive them. Chair Mulnard informed him that she could suggest faculty from Irvine if the internal reviews did not materialize.

D. Proposal for a Graduate Program leading to the Ph.D. in Art History at UC Riverside
Professor Nagy informed the committee that he secured internal and external reviews. The letters included in the review have caused professor Nagy to consider contacting the department at UC Riverside to ask for responses to the points they raise. Both letters are somewhat hesitant about supporting the proposal; Professor Nagy posted them to the CCGA website for others to

review. The letters expressed concern about the number of potential jobs for art historians and whether another art history PhD program is warranted.

E. Program for an M.S. in Healthcare Administration and Interprofessional Leadership at UC San Francisco

Professor Schumm remarked that he had received some very strong letters, and was awaiting one more from Courtney Lyder, dean at the UCLA School of Nursing. Professor Schumm emailed UCSF over a month ago regarding some issues raised in the letters and also SSP costs, the financial aspects of the program, and the disestablishment of the existing master's degree program that this program is intended to replace. That email has not yet been answered; however Professor Schumm is confident that the program will be approved; all three reviews were quite positive.

F. Proposal for a Self-supporting Master of Finance Program at UC Riverside

Vice Chair Mastronarde stated that he compiled a list of queries after the last CCGA meeting and sent them to the proposers who responded rapidly and in detail. He expressed satisfaction with their reply, but is still awaiting external reviews. The internal reviews are on SharePoint along with the responses from the proposers.

Professor Schumm and Chair Mulnard commented on the mention of needed FTEs and suggested that the proposers commit to providing adequate faculty for the program.

A member of the committee asked if the proposals could be loaded on SharePoint. Chair Mulnard stated that she has asked Analyst Zarate to put all of last year's completed proposals into a separate folder and set up a new folder for this year. As a committee, CCGA is not supposed to rely just on the lead reviewer; all committee members are supposed to look at the proposals and give input.

IV. Announcements from the President's Office, Academic Affairs

Interim Director Hillary Baxter raised some points regarding PDST. She noted that Regents' Policy 3103 deals with professional degree supplemental tuition. Provost Dorr said that an initial revision of 3103 would be sent out for review. Discussion also centered around the elements that constitute a professional degree. An increasing number of programs are being categorized as professional degrees due partly to the need for supplementary resources, and partly to the increasing specialization – particularly at the master's level – of a host of disciplines that have applied areas of study that didn't exist previously.

Ms. Baxter informed the committee that Ralph Wolff, the president of WASC, will be retiring as of June. She noted that WASC has undergone many changes in staffing and that these may affect its ability to keep pace with the accreditation revisions it plans to approve in February.

Ms. Baxter mentioned an item that will be on the Regents' agenda in March: Academic Efficiencies. The Regents feel that they are familiar with a considerable number of administrative efficiencies put forth by the University, but that they have not heard many reports about any academic efficiencies that have been achieved or that are planned. The item arose in part as a response to the governor's and the Board's interest in faculty workload; Governor Brown asked if it be possible for faculty to teach one more class each. The Provost does not want to make this an item on faculty workload, and Vice Provost Carlson is going to work with the Senate in the review, revision, and preparation of the item. Ms. Baxter welcomed any suggestions from the committee on the item and stated that there would be more to report next month.

V. Consultation with the Academic Senate Leadership

Academic Council Chair Powell remarked that there would not be a faculty pay increase by January 31 unless it is voted on by the legislature very quickly. Furthermore, it is extremely unlikely there will be one starting April 1. There is a small chance that there will be an increase on June 1 of 1.5 percent.

Chair Powell said that he was fairly certain that there would be a salary increase for the 2013-14 year. The crucial element at this time is whether to rebuild the salary scales; he stressed that it is very important that individual campus committees take time to discuss the issue.

The University is developing a long-range enrollment plan for the campuses. The draft template was sent to the campus administrations, and they have expressed concern that it has too much detail. Chair Powell urged the committee members to make sure that their campus Senates were engaged and involved in the process; input on the campus level will be key.

Academic Council Vice Chair Jacob informed the committee that the composite benefits situation continues to move slowly. The main sticking point is the issue of summer salaries. OP is negotiating with the federal government, which is unaccustomed to this type of arrangement. The Senate should know the outcome by the end of January.

Chair Powell remarked that one more meeting in Sacramento is scheduled with BOARS; he expressed concern that staffing shortages would prevent him from scheduling the three meetings in Sacramento that he wanted. During the upcoming meeting, he intends to put forward a compelling case for academic PhD programs and the University's outstanding professional degree programs

VI. Program Reviews

A. Irvine: Request to Change the Name and Degree Title of the Pharmacology and Toxicology Graduate Program to the Pharmacological Sciences Graduate Program

Professor Heckhausen noted that this request was for a simple name change; the previous term is too specific to represent the breadth of the program, and is also no longer accurate. The committee discussed the issue and voted on the request via iLinc.

ACTION: ***This request was approved.***

B. Merced: Request to Change Name of a Graduate Group

Professor Leppert stated that she had submitted a proposal for a program name change for UC Merced, but it was not on the agenda. Chair Mulnard asked Analyst Zarate to forward the proposal to the committee during the meeting so that members could review it and action could be taken. The materials were forwarded.

Professor Leppert stated that this request was related to an emphasis program under the IIGP, and in the past, CCGA has simply wanted to be notified of the change. When it opened, UC Merced had an umbrella program that was approved by CCGA. The Individualized Interim Graduate Program has several emphases under it which are operating as if they are graduate programs.

ACTION: ***This request was approved.***

VII. Systemwide Senate Review Items

A. Proposed Open Access Policy

Vice Chair Mastronarde stated that the policy materials give an excellent explanation and reflect a thorough process of consultation. He stated that he was in favor of the policy, but asked if impact graduate students might adversely.

Professor Schumm explained that graduate students and post-doctoral students could be sole authors or leading authors; some graduate students do not need to write a thesis because they are lead authors.

A committee member remarked that the policy constitutes an agreement between the Academic Senate and the California Digital Library and applies to members of the Senate but not post-doctoral students if they are sole authors. The committee voiced the opinion that the Library should be asked if the policy should be applied to post-doctoral students.

B. Final Review of Proposed Revised APM 015 – Faculty Code of Conduct

Approximately two years ago, the Academic Council adopted a resolution proposed by the Committee on Academic Freedom to recommend revising the language of sections 010 and 015 of the APM to protect faculty when they participate in governance; the administration proposed a change in APM 016 to subject violations of University policy to administrative sanctions. The proposed amendment to 016 has been dropped; the amendment to 010 was deemed non-controversial. This final proposal concerns only 015. Professor Heckhausen remarked that she did not think the proposal was relevant to graduate education. Chair Mulnard agreed that the committee would pass on the issue.

VIII. Discussion and Input from CCGA on SSP Policy Revisions

Chair Mulnard informed the committee that she had relayed to Academic Senate Chair Powell the committee's concerns regarding Provost Dorr's seemingly conflicted views regarding SSPs and the continued decrease of state support. The Provost had stated at the December meeting of CCGA that since the state cannot provide the support it has in the past, any program that can justify and successfully operate a SSP should do so either through conversion or through the addition of new programs. Chair Mulnard stated that Provost Dorr invited the committee to provide as much input on the SSP policy revision as possible.

The committee discussed various aspects of the proposed policy revisions, including the distinction between SSPs and professional degree programs with supplemental tuition and the amount of return-to-aid. Chair Mulnard asked members to closely review the comments that Vice Chair Mastronarde had compiled. She stated that she would like the committee members to circulate the Vice Chair's document and add additional concerns; she would then submit it to Provost Dorr for further consideration by the Academic Planning Council.

IX. CCGA Discussion on Academic Efficiency

Professor Kelman asked Interim Director Baxter if her office had noticed the *Wall Street Journal* article about the slow but steady increase in the size of administration at public universities, including the University of Minnesota, over the past 20 years. She responded that she had seen the article, but would like to re-read it and possibly talk with someone from the University of Minnesota to learn its response to the article. Professor Kelman stated that he curious to know if the teaching load at UC has gone up or down. His experience at Davis is that faculty have the same basic teaching load but are teaching many more students than they did a few years ago.

Ms. Baxter stated that the University has data related to student credit hours in its accountability report, which compares 2004-05 through 2009-10. She said that she would send the committee a link to accountability report. She observed that it is difficult to communicate information about academic efficiencies to the Board in a way that is viscerally compelling. The Board needs to be made to understand that a good deal of teaching – particularly with graduate students – is not captured in traditional metrics. Also overlooked are the two other components of faculty time: research and service. The Provost is going to present these broad fundamental points to the Regents and use the data to show the workload increases that have already taken place. Ms. Baxter explained that the written item will probably go into a fair amount of detail that won't be covered in the presentation itself.

Professor Leppert observed that WASC's new accreditation requirements are increasing workload on faculty as well. She offered that the National Advisory Committee on Institutional Quality and Integrity (NACIQI) website has posted several letters from the president of Princeton and other university leaders

quantifying the impact in terms of workload; that information might be helpful in terms of getting an estimate of the UC workload increase resulting from the WASC accreditation changes.

Professor Schumm noted that a lot of the highest quality teaching that he does is directly connected to research; if he is required to spend more time teaching lower or upper division didactic classes, the quality of his overall contribution to UC and the State of California will be reduced.

Chair Mulnard told Ms. Baxter that the committee would be happy to provide comment on any materials she might have ready by the end of January. Ms. Baxter responded that she would try to have something for their review by that time.

X. New Business

There was no New Business.

XI. Executive Session

No minutes were taken for this portion of the meeting.

The meeting adjourned at 4:00 p.m.

Attest: Ruth Mulnard, CCGA Chair

Prepared by Fredye Harms, Committee Analyst

UNIVERSITY OF CALIFORNIA **ACADEMIC SENATE**

COORDINATING COMMITTEE ON GRADUATE AFFAIRS
DRAFT MEETING MINUTES – APRIL 3, 2013

Present: Ruth Mulnard (Chair), Donald Mastronarde (Vice Chair), Divyakant Agrawal (UCSB), Jutta Heckhausen (UCI), Ari Kelman (UCD), Valerie Leppert (UCM), Joseph Nagy (UCLA), Kwai Ng (UCSD), Martin Olsson (UCB), Bruce Schumm (UCSC), Youngho Seo (UCSF), Michael Vanderwood (UCR), Matthew Gorlick (Student Representative-UCLA), Charles Saenz (Student Representative-UCSD), Robert Powell (Council Chair), William Jacob (Council Vice Chair), Eric Zarate (Committee Analyst), Consultant Pamela Jennings. Guests Todd Giedt and Tyrus Miller.

I. Chair's Report/Announcement/Updates

- March 11 UCORP/CCGA Meeting in Sacramento with LAOs
  Vice Chair Mastronarde explained that CCGA joined with other UC advocates in Sacramento to meet with a number of leadership representatives including governor's office staff, representatives from the Senate, and the governor's education adviser. Most of the meeting was devoted to the enthusiastic presentation of what research means at UC. Conversely, most of the subsequent discussion focused on undergraduate education; approximately 10 minutes were devoted to graduate education. State representatives suggested that the University plan to make similar presentations annually to ensure that new members are informed about UC's issues. Professor Mastronarde informed the committee that UC will have a more extensive meeting in Sacramento next year and that graduate issues will be better addressed at that time.

  Chair Mulnard added that the Academic Council had shared the four handouts that UCORP made for the Sacramento meeting: UC Research Challenges, UC Research Highlights, UC Research Impacts, and Research as a Central Mission at the University of California. She distributed copies to the committee and stated that they would be uploaded to SharePoint. She noted that they were good summary documents that could be used in many instances.

- March 22 UCOP Budget Call Meeting
  Vice Chair Mastronarde stated that the Senate Budget Subcommittee hearing generally went well, however concerns about performance standards were voiced. The Department of Finance is working with an unspecified party on the standards; the primary concern is that the standards will be CSU-based and not appropriate for UC.

  A trailer in one of the budget bills asks for all of the segments of higher education to provide the cost-per-campus for undergraduate and graduate research. Such an undertaking would place a huge administrative burden on the University.

  Professor Mastronarde explained that the governor does not want any earmarks in the University's budget except for his earmark for online education. The Subcommittee is not amenable to that proposal as it has had earmarks in the UC budget previously. The Subcommittee voted against the governor's proposal for a unit cap.

  According to projections, the revenue coming into the state is approximately $5B more than what was anticipated in January.

  There is tremendous concern regarding SB 520 (Steinberg) which would allow third-party courses to be accepted for UC credit. The Academic Senate is vehemently opposed to this bill and is hoping that changes will be made to it. SB 547 (Block) poses a different request about

online education: it states that the three segments of higher education should cooperate in creating online courses at all three institutions. The details of this bill are yet to be seen.

The group conferred about performance expectations and the difficulty with tracking students in California. It is especially hard to track students in K-12, the community colleges, and CSU, all of which have students who come and go fairly frequently. The future of this issue is unclear at this time.
Lastly, the group discussed UCPath. The executive vice chancellors are not comfortable with the benefit rates that are currently in the proposal and want changes to be made. They are concerned that there could be a danger of more benefit costs being applied to the general fund and fewer on the auxiliary fund. The Academic Senate is arguing that the process needs to start over again – that the model developed by the consultant was flawed from the beginning and does not seem to be "fixable." However, there may not be time to start over.

- March 27 Academic Council Meeting
  A strategic decision was made to pull main item about academic efficiency and faculty workload from the Regents' March agenda.

  The Senate has taken robust action against SB 520 (Steinberg). Heretofore, Senate President pro Tem Steinberg has been a friend to UC; it was very alarming when he put forward this bill. SB 547 language is very vague and includes elements regarding statutorily enacted course approval.

  The remuneration study that the Senate was pressing to have redone has now been approved and will move forward. This study will closely examine faculty and staff salaries and benefit comparisons with UC competitors.

  SB 259, regarding the unionization of graduate students, is up again; UC is likely to oppose it. The bill did pass last year and then was vetoed by the governor. UC thinks it is in a better position this year to oppose it and establish a stronger position with the students, because the University has approved a systemwide childcare plan for graduate students, which was one of the main issues of the bill.

  Provost Dorr spoke about the $10M online initiative carved out of our budget by the governor; the Provost is moving forward with it and assuming the University will have that money on an ongoing basis. Two workshops will take place on April 13 -- one in southern California and one in northern California -- to discuss online education. The groups will communicate by teleconference in the afternoon. An RFP for the online initiative that will be funded by a portion of the $10M will be coming out shortly. It is believed that a large chunk of the $10M will be for IT infrastructure across the campuses.

  The presidential search is on track and has a strong advisory group with representatives from each campus. Similarly, the nomination for the next Academic Council vice chair has been determined. Professor Mary Gilly from the Irvine campus won the nomination. That nomination will be moving forward to the UC Assembly.

- March 28 Academic Planning Council iLinc Meeting
  Provost Dorr understands that the the PDST revision and the SSP policy are intimately related, and would like the groups working on them to cross-reference each other to ensure there are no inconsistencies.

  On the whole, things are moving in a positive direction. Everyone now agrees that conversions

should be a very infrequent and uncommon occurrence. That said, no one is yet willing to address the issue of how many new SSPs UC should have and their rapid proliferation as of late. The PDST Task Force is continuing to move through the policy. The Task Force is a large group and is student dominated. Student Representative Matthew Gorlick will report back to the committee at the next meeting.

II. Consent Calendar

***ACTION:* Members approved the agenda; the draft minutes were not available.**

III. Proposed Graduate Degrees and Programs for review

A. Proposal for a Graduate Program Leading to the M.A. and Ph.D. Degrees in Political Science at UC Merced

Professor Ng said that he is in the process of getting a fourth reviewer, and hopes to be ready soon.

B. Proposal for a Program of Graduate Studies in the Interdisciplinary Humanities for the M.A. and Ph.D. Degrees at UC Merced

Professor Shumm indicated that he also is missing a last reviewer. He is going to ask for reviews by the middle of May.

C. Proposal to Establish a Graduate Program Leading to the Ph.D. in Public Health at UC Irvine

Reviewers have been secured, and are proceeding in an efficient manner.

D. Proposal for a Graduate Program Leading to the Master of Information and Data Science (MIDS) at UC Berkeley

Professor Mastronarde has most reviewers in place for this proposal, and discussed some concerns he had with the committee.

E. A Proposal for a Graduate Program Leading to the M.S. Degree in Games and Playable Media at UC Santa Cruz

***ACTION:* Members approved the proposal for a Graduate Program leading to the M.S. Degree in Games and Playable Media at UC Santa Cruz.**

IV. Announcements from the President's Office, Academic Affairs

Graduate Studies Director Pamela Jennings noted that her office is working with the communications department to highlight the GSR benefit. There is some difference from campus to campus as to how it is being implemented. Davis and UCSF are offering it to all graduate students, but most campuses feel that they cannot do that at this time. Some campuses are going to implement it as soon as this fall.

The graduate deans and the graduate students have continued their advocacy efforts in Sacramento. They have received clearance to request a meeting with the governor, and are hoping to set up a direct meeting between him and graduate students in the near future.

V. Updates/Inquiries from the Divisional Senates

A. UC Irvine: Name Change Request for Graduate Program in Environmental Technology

***ACTION:* Members approved the Name Change Request for Graduate Program in Environmental Technology at UC Irvine.**

B. UCLA: Recent Campus Enforcement of the *In Absentia* Policy at UCLA

Professor Nagy informed the committee regarding UCLA's *in absentia* practices and asked how other campuses handle the situation. Since 2009, the Office of the President's policy is that leaves of absence for graduate students can no longer to be granted for academic reasons. Nevertheless, UCLA continued the preexisting policy of leaves of absence if a good argument was made by the student. UCLA's new dean of the graduate division is now enforcing the UCOP policy with the support of the Graduate Council. In response, the GSA passed a resolution and presented it to the dean asking for academic leave to remain. The *in absentia* policy, which remains in place, is valid only for activities outside of California. The committee discussed the campuses' various practices and the possibility of considering a time (as opposed to geographical) limit on the *in absentia* policy. Also discussed was the concern of insurance liability for graduate students in relation to the policy. It was agreed that the graduate deans should discuss the situation and determine how it should be resolved.

C. UC Merced: Name Change Request for Mechanical Engineering and Applied Mechanics IIGP Emphasis to Mechanical Engineering IIGP Emphasis

***ACTION:* Members approved the Name Change Request for Mechanical Engineering and Applied Mechanics IIGP Emphasis to Mechanical Engineering IIGP Emphasis at UC Merced.**

D. UC Merced: Name Change Request for Physics and Chemistry IIGP Emphasis to Physics IIGP Emphasis

***ACTION:* Members approved the Name Change Request for Physics and Chemistry IIGP Emphasis to Physics IIGP Emphasis at UC Merced.**

E. UCSB "Simple" Name Change Request for the M.S. and Ph.D. in Geological Sciences and Proposed Discontinuation of the M.S. in Geophysics

***ACTION:* Members approved the "Simple" Name Change Request for the M.S. and Ph.D. in Geological Sciences and Proposed Discontinuation of the M.S. in Geophysics at UC Santa Barbara.**

VI. Consultation with the Academic Senate Leadership

Academic Senate leadership met with Senate President pro Tem Steinberg about the bill he has put forward (SB 520) regarding online courses between UC, CSU, and the community colleges. Senator Steinberg was not pleased with UC's opposition to the bill, which will be heard by the Senate Education Committee on April 24. SB 547 (Block) proposes that each of the three entities create their own online courses for their students. UC is not vocally opposing this bill.

UC is waiting on the May revise of the governor's budget. If the University is not allowed to restructure its debt, it will have difficulty surviving the tuition freeze put in place by the governor. In addition, several new tuition freeze bills are being proposed that the University plans to oppose. The connection between tuition and access remains a difficult argument to convey to the state.

Regent Chair Sherri Lansing has voiced dubious concern regarding faculty workload. The Provost met with her to explain the difference between the number of courses and student credit hours.

A huge enrollment management effort is being put forth systemwide. Its two major foci are the Master Plan and funding streams. Non-resident enrollment also plays a part. The Senate has been concerned about enrollment management for quite some time.

Executive Vice President Brostrom has expressed enthusiasm for restructuring the UCOP tax.

VII. Draft PDST Policy Revision

Chair Mulnard explained that the copy of the PDST policy seen by the committee is currently being modified by the PDST Task Force. Both the PDST and SSP groups are trying to be clear about separating policy from implementation guidelines. Current policy holds that there is always a return to aid. The issue of financial aid is being examined closely by UCOP for both PDSTs and SSPs. Some SSPs are developed for very discrete programs that will be 100 percent employer-supported; not all will necessarily have return to aid. The committee discussed the issue of SSPs and accessibility/financial aid at length. Also discussed were the annual reviews by the Regents, professional versus non-professional degrees, and the possibility of WASC implications.

Chair Mulnard stated that the revision viewed by the committee did not reflect the two-hour iLinc meeting held to discuss it. She shared with the committee the general outcomes of that meeting. A strong area of agreement was that the rationale for a SSP cannot be purely financial. Also, newly-approved SSPs should be reviewed just as any other proposal would be.

Much of the discussion surrounded conversions. It was determined that new programs and conversions will be required to have a letter of support from the campus stating where the burden of that program will fall if it should fail as an SSP. State funds cannot be used to finalize the program if it closes. In addition, conversions that have a change in their academic program will need to undergo review like a new proposal.

Chair Mulnard stated that the work on the PDSTs and SSPs is moving forward fairly quickly and will be reviewed by the campuses and by the Academic Senate committees.

VIII. Draft SSP Policy Revision

This topic was discussed in conjunction with Item VII.

IX. New Business

There was no New Business.

X. Executive Session

There was no Executive Session.

The meeting adjourned at 4:00 p.m.

Attest: Ruth Mulnard, CCGA Chair
Prepared by: Fredye Harms, Committee Analyst

UNIVERSITY OF CALIFORNIA **ACADEMIC SENATE**

COORDINATING COMMITTEE ON GRADUATE AFFAIRS
DRAFT MEETING MINUTES – MAY 1, 2013

Present: Ruth Mulnard (Chair), Donald Mastronarde (Vice Chair), Divyakant Agrawal (UCSB), Jutta Heckhausen (UCI), Ari Kelman (UCD), Valerie Leppert (UCM), Joseph Nagy (UCLA), Kwai Ng (UCSD), Martin Olsson (UCB), Youngho Seo (UCSF), Michael Vanderwood (UCR), Matthew Gorlick (Student Representative-UCLA), Charles Saenz (Student Representative-UCSD), Robert Powell (Council Chair), William Jacob (Council Vice Chair), and Fredye Harms (Analyst). Consultants Hilary Baxter, Steven Beckwith, and Pamela Jennings. Guests Todd Giedt and Tyrus Miller.

I. Chair's Report/Announcement/Updates

- April 3 PDST Task Force Meeting

  Student Representative Matt Gorlick reported that the PDST Task Force is developing separate guidelines and policy for the PDSTs. At this time, it appears that most of the specific logistics will be housed in the guidelines. One of the primary areas of discussion has been ensuring that total professional degree fee charges do not exceed those in comparable institutions. Peer institutions have to be used for all elements of comparison (academic quality, etc.) not just fee charges; at least a third of those comparators will be public institutions whenever possible. Financial aid and affordability components of the policy still pose many questions, the most pressing of which concerns whether to include a specific percentage of return-to-aid in the policy. The current version states that 33 percent of PDST fees must go to return-to-aid. Some members of the Task Force do not want to be restricted to a specific number.

  Progress in diversity of enrollment is a strong focus of the policy, but the Task Force is finding it difficult to specify what qualifies as an effort to increase diversity. The Provost reserves the right to return the PDST proposal if progress has not made in the area of diversity after three years; if no progress is made after six years, then the program could be required to dedicate specific funds toward diversity efforts.

  The Task Force is recommending that multiyear plans be shared at the Regents level as well as information related to revenue, affordability, financial aid, and diversity. The Task Force is still finalizing the timeline for the policy and guidelines, but intends to have everything submitted to UCOP by August 15 in order to be on the Regents' November agenda. It is unclear when the policy and guidelines will go to the campuses for review.

  Professor Vanderwood raised a question regarding doctoral programs that require accreditation and licensure, and if they have been addressed in any of the Task Force discussions. Mr. Gorlick indicated they had not. The committee discussed the issue.

  ACTION: ***Chair Mulnard encouraged Professor Vanderwood to write a memo to Provost Dorr and to the PDST Task Force in order to bring this issue to their attention.***

- April 10 UC Assembly Meeting

  The UC Assembly meeting was held via teleconference and included annual reports from all of the Senate committees. An amendment to Senate Bylaw 110 was put forward to allow for the appointment of a parliamentarian *pro tem* in instances when the parliamentarian would not be available.

Chair Mulnard was on the Assembly agenda regarding the new degree title of Masters of Technology Management for UCSB; the item was unanimously approved and has gone forward for presidential approval.

The last item on the Assembly agenda was the nomination from the Academic Council of Mary Gilly for Vice Chair of the Senate for the 2013-2014 term; Professor Gilly won the unanimous vote of the Assembly.

An all day meeting of the Assembly will be held on June 12.

- April 24 Academic Council Meeting

The Academic Council meeting was held in Sacramento to give the Council members an opportunity to speak in opposition to SB 520 (Steinberg) at a hearing before the Senate Education Committee. If the bill should pass the Assembly, the University will be taking an even more robust and concerted stand against it. CCGA members discussed many issues raised by SB 520 including the legislative mandate to work with private vendors, intellectual property issues, and maintaining UC quality.

Composite benefits were discussed at the Council meeting and continue to be deadlocked on the issue of summer salaries. The chancellors were given the option of charging either zero percent summer salary or the full benefit rate; neither option appealed to them.

Executive Vice President Brostrom has proposed that UC's contribution to UCRP be increased to 14 percent, simultaneous with the employee contribution raised to eight percent, effective July 1, 2014. The UC Faculty Welfare Committee is opposed to this proposition unless all faculty get a three percent salary increase this year. The Council supported this suggestion and has written a memo to the Provost in this regard.

The campus salary equity plans were reviewed by three Council committees and were determined to be of little generalizable value. Most of the plans were surprisingly brief and not sufficiently detailed. There will be further work on these plans.

An all-day meeting was held on April 13 to discuss the UC online education initiative. Northern participants met at OP, and southern participants met at UC Irvine. The meetings were productive and resulted in a webinar that the entire University community can view. This weekend, a small group of division chairs, EVCs, and selected key personnel will develop the RFP for the online initiative.

ACTION: ***Chair Mulnard will send committee members a link to the webinar.***

- April 26 UCOP Budget Call Meeting

Vice Chair Mastronarde stated that the budget call primarily concerned the Assembly Education Committee budget hearing which had just taken place. The multi-year plan for UC's budget was discussed as well as performance outcome measures. The governor had said there would be outcome measures attached to the increased funding for UC, CSU, and the community colleges. The University pressed for appropriate evaluative measures, however the Department of Finance did not respond. Ultimately, the Department of Finance came out with a broad approach requiring that each segment increase its graduation rate by 10 percent. Professor Mastronarde illustrated the extreme disparity in this seemingly uniform approach: UC currently has a graduation rate of 60 percent, compared to CSU's 15 percent. The Education Committee chair did seem to recognize the problematic nature of this generalized expectation and said that the legislature would work to create an alternative measure.

The Assembly does not want to allow the University to restructure the financing of its debt, which poses a significant obstacle to the University's current fiscal plan. UC hopes to reinstate the debt restructuring in its negotiations with the governor. If it remains off the table, the University will propose revenue bond approval from the legislature. The Assembly did approve $4.2M in furniture and equipment for a building at UC Merced which was finished but empty. The legislature is considering the insertion of language regarding enrollment targets into the UC budget; the governor vetoed that effort last year.

II. Consent Calendar

A. Approval of the Draft Minutes from the March 6, 2013 Meeting and the April 3, 2013 Meeting.

ACTION: Members had corrections to the March 6 minutes; the April 3 minutes were not available.

B. Approval of the Agenda

ACTION: Members approved the agenda.

III. Proposed Graduate Degrees and Programs for Review

A. Proposal for a Graduate Program Leading to the M.A. and Ph.D. Degrees in Political Science at UC Merced

ACTION: Members approved the proposal for a Graduate Program leading to the M.A. and Ph.D. Degrees in Political Science at UC Merced. (9-1-0)

B. Proposal for a Program of Graduate Studies in the Interdisciplinary Humanities for the M.A. and Ph.D. Degrees at UC Merced

Chair Mulnard remarked that Professor Schumm has commitments from four reviewers, but reviews have not yet arrived. He hopes to take action on this proposal at the June meeting; the committee could also consider action beyond that date via email.

C. Proposal for a Graduate Program Leading to the Master of Information and Data Science (MIDS) at UC Berkeley

Professor Agrawal stated that he has three reviews – two external and one from UC – and is awaiting two more reviews, one of which will be from a UC campus. All three current reviewers agree that Berkeley has submitted a very innovative proposal, but have expressed concern that it may involve interaction with other departments, namely Engineering/Computer Science (ECS). The committee agreed it would be advisable for the proposers to secure a letter of support from the ECS chair. Professor Agrawal stated that he would prefer to postpone the full discussion of the proposal until he had the two outstanding reviews, particularly the review from UC. However, he was feeling pressured by the proposers, who were hoping to start the program by fall 2013. Chair Mulnard advised that Professor Agrawal not feel compelled to complete the review process to accommodate the proposers' aspirations.

Committee members were shocked and dismayed at the proposal's supposition that the private partner in the program be given 70 percent of the self-supporting program fees. Many observed that similar concerns had been raised with previous proposals and that SSP budgets have not been adequately reviewed. Chair Mulnard expressed frustration; the original CCGA guideline - which required that every SSP be reviewed by UCPB – has been completely and repeatedly disregarded. The committee discussed the ramifications of such information about excessive charges from private vendors being made public. Assistant Director Hilary Baxter observed that the issue should be brought to the attention of the Provost and others; she said she would "red flag" the topic.

D. Proposal to establish a Graduate Program leading to the Ph.D. in Public Health at UC Irvine

***ACTION:* Members approved the proposal for a Graduate Program leading to the Ph.D. in Public Health at UC Irvine. (8-2-0)**

IV. Consultation with the Academic Senate Leadership

Senate Chair Robert Powell thanked everyone on the Academic Council who was able to come and speak in opposition to SB 520 (Steinberg). He stated that the Assembly has said it will not support the measure and that the governor has said he won't sign it; however, positions often change during the budget finalization process.

Senate Vice Chair William Jacob said that he had spoken with Senator Block regarding SB 547 and indicated that the University would support the measure if it were amended to state that each segment of higher education would create its own courses. Senator Block seemed amenable to the suggestion.

Chair Powell provided an update on the online education initiative and the webinar that grew out of the April 13 meeting. The group hopes to have the RFP out by June 1. The University is feeling pressure to show movement on the proposal, and would like pilot courses over the summer and in September. The legislature is particularly focused on "lower division bottleneck" courses, and the University is investigating ways to offer classes across the system (from more than one campus) via an online delivery system. Cross-campus collaboration has already begun in some areas.

The search for a new UC President is moving apace, as is the search for a new Riverside Chancellor.

Vice Chair Jacob discussed the governor's seven proposed accountability measures, which focus almost exclusively on undergraduate education. The first and most problematic is the insistence that the University increase its graduation rate (currently at 61 percent) by ten percent over the next four years. Susan Bonilla, chair of the Budget Subcommittee on Education and Finance agrees with the University that the requirement is ridiculous. The final outcome is yet to be determined.

The composite benefit issue has not yet been resolved, and it is unclear where it rests at this time, much to the frustration of the Council. Chair Powell stated that the Provost is very open to the idea of adding a fourth year to non-resident tuition (NRT) relief. He encouraged the committee members to urge their graduate councils to push on this issue. At this point, the state does not care about time-to-degree for graduate students; it is not considered in the accountability model. The rebenching document does not speak to it, and rebenching is the foundation for the budget.

Chair Mulnard raised the issue of SSP proposals that involve outside vendors with contracts for excessive fees. CCGA does not have the expertise to evaluate the financial ramifications of these contracts; UCPB should be reviewing the proposals. Senate Chair Powell voiced concern about SSPs, outside providers, and intellectual property rights. The committee discussed the many complications and difficulties with SSPs at length. It was agreed that both issues (vendor fees and intellectual property rights) need to be brought to the attention of the administration and the Senate.

***ACTION:* Senate Chair Powell, Committee Chair Mulnard, Assistant Director Baxter, and Associate Director Todd Giedt will write a letter to the Provost outlining their concerns.**

V. Announcements from the President's Office

Vice President Steven Beckwith stated that his office has been tracking the effects of the federal sequester on graduate students. Many federal agencies seem to be preserving existing grants but are not giving new grants. Some campuses have heard that their grants will not be renewed. Overall, the

University is anticipating a seven to ten percent drop in federal funding for graduate students. Mr. Beckwith's office has a report detailing the cuts to various federal grant programs and will forward that to the committee.

Graduate Director Pamela Jennings shared the results of the first systemwide placement survey, which was emailed to the committee during the meeting. The University does not have much systemwide data on graduate education and is pleased to now have this survey as a foundation for future work and evaluation. Berkeley and UCLA have done placement surveys for years, so the amount of data for those campuses is quite dense. The other campuses assembled their data in a somewhat ad hoc fashion; it is not uniform across the system. The ability to do a more systematized and in-depth study is currently hampered by a lack of funds.

Assistant Director Baxter referred to the materials that had been sent to the committee regarding trends in the planning pipeline. This information was previously collected annually and has recently moved to biannual collection. She asked if the information was helpful to CCGA and the campus committees or if it was superfluous. Ms. Baxter stressed that she would like to provide any information that might be helpful to the campuses, but was not sure if this particular report was of significant value. Committee members voiced various perspectives on the application of the report at the campus level. The final consensus was that the report is helpful in forcing campuses to articulate their upcoming plans and demonstrate forethought in developing a particular degree program. However, it was noted that not everyone was familiar with the presumed function of the report and that some guidelines and direction would be helpful.

Ms. Baxter addressed the topic of academic performance indicators (formerly academic efficiencies) at UC. Item E1 "Academic Performance Indicators at the University of California" will be heard at the May Regents' meeting. Ms. Baxter suggested that the committee members read the item and listen to (or view) the upcoming meeting. The issue of adding additional classes to the faculty workload and the governor's performance indicators will be discussed. She said that she would send a link for the Regents' audio/video to the committee.

A committee member had asked about WASC policy regarding degree level approval. Ms. Baxter explained that when institutions are accredited, they need to have programs at each degree level at which they want to offer degrees for a certain number of years before they can have general approval. UC Merced does not have that standing, and must undergo WASC's substantive change process any time it wants to add anything other than a bachelor's degree program. Questions were raised about SSPs in relation to WASC. Ms. Baxter explained that a program's funding mechanism is not a "trip wire" for WASC. If 50 percent of the coursework is online, then it must be reviewed by WASC.

VI. Updates/Inquiries from the Divisional Senates

Professor Nagy reported that UCLA has dispelled with graduate student leave of absence for academic reasons. The graduate dean is working with some of the programs to develop ways to adapt to the new methods and determine how students can take time off. Changes to the in-state/out-of-state requirements for the *in absentia* policy have been suggested. UCSC Vice Provost Tyrus Miller stated that the University deans are largely in favor of such a change. The development of substantive criteria for granting *in absentia* – instead of geographical location – is a possible option.

Professor Heckhausen said that UC Irvine has discovered an increase in its Doc2A student numbers across a variety of programs. Irvine's graduate advisers explained that the change has risen from two different sources. International students are trying to advance as quickly as possible to avoid paying nonresident tuition rates. This accelerated progress puts considerable stress on students and they do not always finish in the three years allowed after candidacy, thus becoming Doc2A students. Separately, dissertation completion rates vary among disciplines; some can be done in two years and others can

easily run longer due to hurdles or additional tasks the student undertakes. Professor Heckhausen said that there is also perception that students will have a difficult time in the market, so they don't submit their dissertations even though they are finished. The campus has been discussing the possibility of having qualifying exams to catch students who are having problems and who perhaps should go only for a master's degree.

Professor Heckhausen then asked why there is a "once size fits all" three-year rule after candidacy for all graduate students; normative time to degree is variable, and perhaps this should be as well. She suggested that CCGA discuss the matter and forward it to the Senate leadership. UCSC Vice Provost Miller stated that he did not have a problem using the normative time to degree but would not want to reward campuses for "carrying" students. The two discussed the issue with some input from other committee members.

***ACTION:** Chair Mulnard said that the committee would look at the issue of Doc2A students in terms of rebenching.*

VII. New Business

Professor Heckhausen stated that UC Irvine has interdisciplinary programs that cross school lines, and a question has been raised as to how to house them administratively. She asked if other campuses shared this issue and how they handled it. Committee members discussed the approaches taken by their campuses and their level of success. Chair Mulnard said that it would be helpful to have the input of Professor Kelman on this topic – Professor Heckhausen will contact him to understand his experience at UCDavis with graduate groups.

***ACTION:** Professor Heckhausen will discuss the issue with Professor Kelman, who will report back to the committee at the next meeting.*

Professor Vanderwood explained that UC Riverside is in the midst of starting a medical school. He asked if other campuses had their medical schools take their courses through the normal graduate council approval process and program review. Chair Mulnard said that course approvals, if they are for anything other than the medical school (i.e., graduate programs that live in the medical school that are not about the medical students) go through the regular channels for course and program approval. She remembered that Professor Shumm (who was not present) had commented that when he was chair of CCGA he got the policy changed because it had the Senate outside of the oversight of law schools, medical schools, etc. He said he had it changed so that CCGA was reinserted into that process. Todd offered to share that policy (105.2) with the committee.

***ACTION:** Mr. Giedt will forward policy 105.2b to the committee.*

Chair Mulnard reminded the committee that the next meeting (June 5) is the last in-person meeting. However, the committee remains on duty until the end of August. She remarked that President Yudof may take some action before he leaves that might cause CCGA to meet via iLinc.

The meeting adjourned at 3:20 p.m.

Attest: Ruth Mulnard, CCGA Chair
Prepared by: Fredye Harms, Committee Analyst

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April 30, 2013

Re: Review of the proposed MIDS program.

Dear Prof. Agrawal,

I have reviewed the proposal for the Master of Information and Data Science (MIDS) degree from the School of Information at the University of California at Berkeley. The proposal has been competently prepared and to the best of my evaluation, it has the chance to be a successful program that would serve the students well if some of my concerns raised below can be addressed.

As a student, I was enrolled in the Stanford SITN program while working at Oracle Corporation and completed the coursework required for my Ph.D. degree as an online student before pursuing my research work as a full-time student. As a professor at Penn State, I have taught two graduate courses in Data and Knowledge Management, one graduate course in Data Mining, and one undergraduate course in Networks and Telecommunications in the last 2-3 years. Our program has seen increasing enrolments. Our online program has been rated #1 in 2011 and as one of the top programs in information sciences and technology consistently. My experiences both as a student and an instructor influence my views expressed below.

I am impressed by the arrangement with 2U that seems to have been set up, by the general curriculum outlines in the proposal, by the commitment of the Dean and the faculty behind the program, and by the commitment to keep the class size small (~20). These are all factors that lay the foundation for it it a very successful program. While I have no doubt that the program will quickly establish itself as a top online program and have real impact on students and set them up for success, I do have some serious concerns that I raise below.

1. Faculty: The proposal lists 10 faculty members in the School of Information who, presumably, will be primarily responsible for teaching the courses. A look at their research and the coursework shows some dissonance between their expertise and the syllabi of the courses. Each of these faculty members is an eminent scholar in his or her own field. They have done substantial work in law, sociology, public policy, cognitive psychology, business administration, library sciences, media arts, and political science (page 31-34)[1]. The courses being taught are in storing and retrieving of data, exploring and analyzing data, machine learning, and data visualization. Typically, graduate courses in Research I universities are taught by faculty members whose core

[1] Interestingly, Prof. Hearst, who is an eminent faculty member of the school, is not listed as an associated faculty but is listed to teach the machine learning course.

research area and publication are in the subject related to the course. Per my reading, very few of the professors involved with the course with the exception of Prof. Larson has handled a project with big data in the past --- at least the proposal does not provide any such evidence.

Ideally, a top program would have faculty members whose core research are in the areas of the courses they teach and who can then bring into their courses experiences and anecdotes from their cutting-edge research. I firmly believe that the most important characteristic of a top program is the quality of the faculty members teaching a course. This issue is even more vital for a graduate program and one that involves topics that are at the cutting edge such as data science and big data. I would strongly encourage the school to involve faculty members whose core research areas are in data sciences and big data to teach the course. Perhaps the school has a plan to hire faculty in these areas --- the issue of adding faculty members who can teach courses in the program was discussed in the proposal --- but I did not get a good feel of what that plan is. Alternatively, faculty members from other departments --- and Berkeley has some excellent faculty members who have had research projects involving "big data" --- such as CS, EE, astronomy, physics, statistics, etc. could be consulted to teach part or whole of some courses or co-teach courses with iSchool faculty members. Co-teaching could be useful because it would show the students how an information scientist interacts with a domain scientist, etc. From my perspective, experts in the storage and management of data, extraction and retrieval of information, and mining and analysis of the data and information, especially those whose works address scalability e.g., in the database, information retrieval, and distributed systems community could help make the courses more top-notch.

2. Program: Nine courses is perhaps the minimum required for a "masters" program. The overall course requirement seems a bit light. Also, as a remote student working full-time, all my time was used up by two graduate courses in CS/EE at Stanford. I do not think I would have learned as well were I to take three courses after working full-time. I have the following recommendations:
    a. Allow students the flexibility to alter the pace of the program. For example, if a student wants to take two courses a semester and take 4-5 semesters to complete, such students will be better educated and should be encouraged.
    b. I would recommend that the number of courses be increased to 12. Then, the program could include courses that will be pivotal for big data. For example, a course in distributed system and cloud computing, and another course in social media and web information systems as that being currently offered as an elective could be made required. Maybe a course in privacy and security could be made core. These topics are important for a data scientist and are not currently in the core. That would mean that some students will have significant holes in their education and would later be hampered by that.
3. Courses: The plan for courses is good. The courses are very relevant and topical. I have the following comments in this area:
    (a) The first part of the proposal talks about data science being a new field that requires students to acquire a "mix of disciplinary skills that include, but, go beyond, CS, statistics, and art". However, a significant number of courses are in traditional computing and information science areas such as the courses on data storage/retrieval, data analysis, machine learning, and data visualization. Should the course descriptions reflect this excellent vision? For example, the course on data storage could have a topic on legal issues

involved in data sharing, privacy and security issues involved in data storage on the cloud, etc.

(b) The course descriptions of the courses on data storage/retrieval, data analysis, machine learning, and data visualization read like conventional courses in these fields. These content mentioned in these courses have been taught in such courses in the last ten years. There are unique challenges to handling big data especially with respect to scalability. None of the course descriptions have topics that are specially relevant to handling big data and the challenges it poses. For example, the data analysis course contains conventional statistical methods but does not contain much about new computational methods that would be needed to analyze large datasets.

4. Course Delivery: I wonder why the lectures are just taped and made available online. At our college, the courses are webcast live when the lectures are being made and students can call in or chat to ask questions.
5. Student Diversity: While diversity is a boon, diversity in students' academic preparation makes it hard for a graduate course to succeed. If we assume the least common preparation and have students from various fields with little background in programming or statistics, the course has to be at a very basic level. I have faced this directly in the courses I have taught in the graduate level because our students come from diverse backgrounds. Our courses are taken over two years; so we can work with our students to help them improve. In this case, it seems that the requirement of one programming course and one statistics course is not enough. Especially for working students, these courses may have been taken 5-7 years before they enroll in the program and they have forgotten the concepts by now. I would suggest giving the students a skills examination at the beginning and requiring students who do not have the background to take remedial courses. Alternatively, increase the pre-requisites to make sure that there is enough academic (or as a substitute industry) experience such that the students can do their projects in the data storage, data analysis, machine learning and data visualization classes. We have seen students with the adequate background often drag a class back, become free-loaders in group projects, and struggle in individual projects. Such an experience is not good for the student and for the program. Thought needs to be given to this matter.
6. Evaluation: The evaluation plan is good. The only comment I will make is that the student evaluation that is obtained on a weekly basis be analyzed properly. Student evaluation is very important. The different types of comments should be carefully addressed differently. For example, a comment about not being able to access materials or understand the materials is very important to address early. However, complaints about the material itself should be taken with a grain of salt; not ignored, but considered carefully. In my personal experience, a lot of students who are working complain on the amount of work they have to do. A rigorous program should have a rigorous curriculum. If the focus becomes on making the students happy and customer satisfaction, professors who set the bar high may have more dissatisfied students. In order to maintain the quality of the program, such professors should be protected. I am sure these issues also arise in non-online programs at Berkeley and faculty administrators are fully aware of the issues but since in this case, student feedback is obtained on a weekly basis, I wanted to make sure that there are mechanisms to enable the faculty members teaching the course some degree of freedom and leeway.

7. Cost: The cost is high. $14,000 out of $20,000 goes to 2tor while $500 per student goes to the instructor and $100 per student goes to the lead instructor. The following issues come to the mind:
   (a) The proposal mentions that there is no competition in this space. However, a ratio of $14,000 to $500 for technology to the instruction seems to be extremely lopsided. Even if we assume that the market can bear this cost of tuition, and perhaps it can, the instructor who does most of the intellectual work that is different from course to course the distribution of remuneration is not fair and the instructor is essentially being exploited with the profits going not primarily to the university but primarily to the technology company. In essence, the university is acting as a enabler to the technology company, given that 70% of the funds are going to the technology company. I wonder if this is the best deal that the university could get from the company. The number does seem too high.

       Penn State handles things in house using a combination of Skype and Adobe Connect. We also webcast our classes live from technology-enabled classrooms and allow students to call in or send questions via chat that our instructors read aloud and answer. I am positive that we do it at a fraction of the cost. It is quite possible that our students' online experience is perhaps not as great as one that can be enabled using 2tor but the real question is whether our students learning is less than that of those using 2tor and which model provides the best the value for money.
   (b) I do not know the market and what it can bear. However, the proposal mentions getting students from India and China. I wonder whether students from these countries can afford these costs. Then, the issue becomes whether the enterprise is one of revenue generation or whether the school wants to get the best students in the program even if they cannot pay full price. It seems like students' ability to pay is more important than their academic merits. There is some mention of merit-based scholarships almost as a throw-away sentence. There is no information about how many and no indication of how it will be financed. If it is being financed by a fraction of the $6000 per student per semester that comes to the university, then the chances are that such academic aid will be rare. If it is otherwise, the proposal should contain a description of how many scholarships and at what level are being envisaged, for starters.
   (c) How long is the contractual obligation with 2tor and how exclusive is it? Now there is no competition, but, assuming there is a market, the technology is not rocket science, and there is bound to be competitors who will offer similar functionality at reduced costs. Can Berkeley shift to such companies easily? Were other competitors evaluated? What was the process for selecting 2tor?
8. Academic Integrity: The issues of academic integrity --- a special challenge for online courses --- has to be thought of a bit more carefully. Does the student have to meet face to face with the instructor every week? If not, then the instructor does not really know who is doing the homework or project. On the other hand, I have found that administering a proctored exam is extremely hard especially when people are at drastically different timezones (India/China and the U.S.). It is near impossible to administer the test at one particular time to people across the globe. And, if we give the tests at different times, there is a chance that the questions will be leaked. I have resorted to using projects. However, I would like to see the issue of academic integrity addressed a bit more at some point a bit more formally.

I have no concerns about the facilities, the budget, and the administrative structure. I also have no doubts that the issues I have raised can all be addressed well if there is a commitment to have a world-class program and should that be done, this program will be a great success.

Should you have any further questions or would like me to elaborate on any of the issues I have raised, please do not hesitate to contact me.

Thanking You,
Sincerely,
Prasenjit Mitra, Ph.D.

UNIVERSITY OF CALIFORNIA, SAN DIEGO

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April 6, 2013

Divyakant Agrawal
Professor of Computer Science
University of California, Santa Barbara

Dear Divy:

In response to your request on behalf of the systemwide Academic Senate Coordinating Committee on Graduate Affairs (CCGA), this is a letter of evaluation of the proposal for a new Master of Information and Data Science (MIDS) degree at the Berkeley campus. I appreciate that the tone of this letter is negative, and I am sorry about that. Nevertheless, I think it is important to stand up for high standards, and it is the role of the Academic Senate to do so. All the concerns below are constructive in the sense that it is clear what needs to be done to address them.

A note about my background: I have been a full-time ladder-rank faculty member in the University of California system for over 20 years. My research is in machine learning, analytics, and data science. For the last five years I have taught a course in data mining to around 50 graduate students per year. Each year the course attracts about a dozen professionals from nearby companies who are already working as data scientists. The course has been televised to a different University of California campus, so I have some personal experience with distance education.

Also, until recently, for many years, I was the director of an M.S. program that currently has around 150 full-time students, many of whom receive job offers as data scientists at companies such as Google and Amazon, with starting salaries well over $100,000.

The following headings in italics correspond directly to the questions posed in your request for this evaluation. Notes like (page 16) refer to pages in the proposal dated October 15, 2012. Notes like (WASC page 20) refers to Appendix I, the WASC accreditation document.

Quality and academic rigor of the program.

Unfortunately, the level of the proposed program is likely to be low. The MIDS program will have 40 weeks of instruction: two regular Berkeley 15 week semesters

and one 10 week summer semester (WASC page 20). It is part-time. In contrast, the regular School of Information professional M.S. program, called MIMS, takes two years and is full-time (page 29).

MIDS students will have little interaction with ladder-rank Berkeley faculty. The program is all online except for four initial orientation days (page 16). Lecturers and adjuncts will teach most sections. Some of these lecturers may be located in other time zones (pages 21 and 39), meaning that they themselves will not interact in person with ladder-rank faculty. Ladder-rank faculty will not develop course content directly. Instead, they will "co-produce" with staff from the company 2U (page 8) In steady state, ten sections of each core course will be offered per year (200 students with 20 per section). Research-oriented faculty will not agree to teach so many sections, so teaching will be done by instructors who are not active researchers.

Effectiveness of using online methods (as proposed) for content delivery for advanced graduate degree.

The online methods proposed by the 2U company are reasonable. The inclusion of face-to-face synchronous communication is positive, as is the involvement of professional instructional designers in preparing lecture modules. However, these elements are common in other course delivery systems, including those being developed by Coursera, Udacity, EdX, Google, and others.

Unfortunately, this will not be an "advanced" graduate degree. The only specific prerequisites required from students will be one undergraduate programming course and one undergraduate statistics course. No course in the program is a prerequisite for any other. Therefore, the courses cannot reach an upper-division undergraduate level of depth and rigor.[1]

The proposal says that students "will gain hands-on practice working with unstructured or semi-structured 'data in the wild,' from acquisition and cleaning through the communication of findings." This hands-on experience has to involve programming in languages such as Python, R, Java, C++, etc. It cannot be achieved using only software for non-programmers. The proposal does not explain how students

[1]The dilemma that undergraduate programs can be more advanced than graduate programs is not new. In the 1990s the British government decided that too few students were trained in information technology (IT). Many universities were incentivized to create master's degree programs in IT. However, these programs accepted applicants with undergraduate degrees in many areas of study. Therefore, in one year, they could only bring students up to a level that was lower than that of a bachelor's degree in computer science.

will be taught hands-on programming skills. In computer science undergraduate programs, these skills are taught using labs and significant numbers of undergraduate tutors and graduate teaching assistants.

Adequacy of the number and expertise of faculty to administer the program.

The existing ladder-rank faculty are enough in number and expertise to administer the program, given that it is designed so that most actual teaching is done by lecturers to be hired in the future.

The proposal does not contain an explicit table of how many sections are expected to be taught by ladder-rank faculty, how many by full-time lecturers, and how many by part-time instructors. Such a breakdown should be provided. The employment conditions of these people should be described briefly, and their anticipated qualifications. Given the strong demand and high salaries for senior data scientists in Silicon Valley, will Berkeley be able to attract high-caliber graduate faculty, at $10,000 per section? In general, experts from industry are willing to teach single courses, but not to teach multiple repeated sections, quarter after quarter.

Adequacy of the facilities and budgets.

Students will pay $60,000 for the program. Of this amount, $42,000 will go to the for-profit company named 2U (page 41: $14,000 per semester per student). This amount seems outrageous. The marginal cost of providing computer services and support to 2U will be less than $1000 per student per semester. Berkeley should negotiate a new contract with 2U where fixed and marginal costs are paid for separately, and where payments are reasonably related to costs.

There are some inconsistencies in the budget projections. Page 11 says steady state will be 180 students by 2018. WASC page 40 says "The minimum number of students per year necessary to make the program financially viable is 200." And according to the budget in Appendix P, the program will generate a surplus as soon as it has 80 students.

The proposal says in several places that each section will be limited to 20 students. The sample brochure for applicants, however, says "a maximum of 10 (15?) (sic) students to each faculty member." The brochure is coy about the fact that these faculty will rarely be ladder-rank.

Applicant pool and placement prospects for the graduates.

It is plausible that the program will have a large applicant pool, and that the gradu-

ates will find jobs. However, they will not find top-paying jobs, unless their hands-on technical skills are already strong before they join the program.

As mentioned, programming skills are critical in data science, and will not be taught much. Consider the statement from a Microsoft representative, Raghu Ramakrishnan, on page 26:

> Programs like Berkeley's proposed graduate degree program will go a long way towards meeting this need by training the types of technical staff we seek, with a strong grounding in Statistics and Machine Learning, and the systems skills to work with Big Data environments such as Azure and Hadoop.

Unfortunately, no one-year part-time program can provide this "strong grounding."

Adequacy of the administrative structure.

The organization chart proposed at Berkeley looks fine. However, more oversight of the for-profit vendor 2U is needed. Amplifying the comments above, according to the budget in Appendix P, in steady state students will pay $10.8M in tuition per year. Of this, 66% will go to 2U, 1% (sic) on course development, and 9% to pay instructors. The 66% is for "technology, marketing, and production."

The financial arrangement with the company 2U is unfair to Berkeley. The biggest asset of the program will be the Berkeley brand. However, the company will reap most of the profit from the arrangement. Many decades ago, the CEO of the Quaker Oats company supposedly said

> If this business were split up, I would give you the land and bricks and mortar, and I would take the brands and trademarks, and I would fare better than you.

The same is true of the MIDS program.

Other comments.

The results of the market research are questionable. According to pages 22 and 23, 19.7% (that is, 96.6% of 20.4%) of all people in the US between 21 and 54 with a bachelor's degree and household income at least $50,000 "are likely to apply to a graduate program within the next three years." This high percentage is not believable. Perhaps questions were asked in ways designed to elicit the desired

responses.

The proposed degree program is risky for the Berkeley brand, in several ways.

1. It may be perceived as diluted in quality. The perception about quality will be reinforced by the fact that on-campus full-time MIMS students will be banned from enrolling in sections with students from the new program.
2. It may be perceived as exploitative of students, since the fee charged will be far higher than the marginal cost of teaching.
3. The company 2U will do recruitment and marketing (page 41). Other existing for-profit colleges have reputations for unethical sales and recruiting.
4. When students and the public discover that 70% of tuition payments go straight to a for-profit company, there may be an outcry.

Summary.

A master's level degree in data science is a very worthwhile effort. Embracing online education is also to be praised. However, any such degree offered by the University of California should be genuinely postgraduate-level, and should not be delegated mostly to a for-profit company. Concretely, the degree should be at least 12 months full-time or two years part-time, it should require and teach serious programming skills, and vendors should be suppliers, not managers.

With best wishes,

Charles Elkan
Professor

Divyakant Agrawal
Professor of Computer Science, UCSB
Member of the UC Coordinating Committee on Graduate Affairs

May 16th, 2013

Dear Professor Agrawal:

As per your request, I reviewed the proposal for a new Master of Information and Data Science program by the School of Information at the University of California at Berkeley. Overall, I believe this is a timely program that addresses a real need for professionals who are well-versed in dealing with the challenge of "Big Data". I am thus supportive of this new program. Below please find my comments on the various issues you asked me to consider:

- Quality and academic rigor of the program
  The program as explained in the proposal is of high quality. Here are some of my suggestions:
  1. On the admission prerequisites. Even though the program follows a more information management approach to the degree, I feel that in addition to programming and statistics, a basic undergraduate course on information management or database management (taken from IS or CS departments) would better prepare the students for this MSc.
  2. The program offers an optional career week at the end of the MS degree. I feel that such career fair would better prepare the students if it is placed in the middle of the program (maybe after the first semester) so that students prepare early for the job search. Moreover, the mock interviews, and other best practices that the career management services would offer during this week, could be videotaped and offered to ALL students (in which case this becomes a requirement, and some students can attend at the campus while others on-line).
  3. The discussion about the help to find internships is not clear; can the program help 500+ students to find internships?
  4. With respect to the required courses, I feel that the course on storing and retrieving data contains too much material for a single course. I would suggest that this course provide the basics and then add as a core course one of the planned elective courses (not developed yet) on "Really Big Data: Scaling and Parallelism". The current core course simply "touches" the issues on big data (map-reduce etc). I feel the Really Big Data course is a *must* for this program (I am probably influenced by my view of big data). In the current program there is emphasis on learning ML, statistics and visualization which are definitely needed, however, performing those on really big data would probably be different than applying those methods on simply large data. If the program wants to retain a limit on 6 core courses, I would probably combine the statistics and ML courses and add the Really Big Data course among the core courses.
  5. I would also consider making the course on Privacy, Security and Ethics a core course.
  6. The program discusses various collaborations with relevant units at UCB; however this discussion seems premature. Having the video lectures available does not mean that the

MIDS students will watch them, or that the available videos would be at the appropriate level for the MIDS students.

- Effectiveness of using online methods (as proposed) for content delivery for advanced graduate degree
  Using the 2U.com company surely will eliminate many organizational issues from the program. It introduces however a large financial overhead (14K per semester) which could make the whole program too expensive for what it offers. While pricing for on-line programs varies, I recently heard on NPR about a 7K on-line MSc degree in CS by GeorgiaTech in collaboration with Udacity, an on-line course provider. That is the cost for the whole MSc degree and it is rather low, but it shows the direction of on-line degree pricing.
  See: http://www.forbes.com/sites/troyonink/2013/05/15/georgia-tech-udacity-shock-higher-ed-with-7000-degree/
- Adequacy of the number and expertise of faculty to administer the program
  The number of faculty administering this program is appropriate. As for the expertise, I would suggest to add faculty related with big data (probably from the CS Dept).
- Adequacy of the facilities and budgets
  Appropriate.
- Applicant pool and placement prospects for the graduates
  The program has done adequate research to identify applicants; the placement prospects for the graduates are very good.
- Adequacy of the administrative structure
  Appropriate.

Sincerely,

UC Reviewer

This is an innovative proposal to launch a program in a "hot area". The set of faculty involved are well-renowned, the administration appears to be very meticulous, and the demand is no doubt there. I am generally supportive, and even enthusiastic, though I do have a few concerns noted below.

First, the modality. In the brave new era of online courses, it is important that traditional universities figure out how best to navigate uncharted territory. This program attempts a nice cross between impersonal online instruction and a full campus experience. I don't know if the brief in-person interaction proposed strikes the right balance, but it well might, and it is definitely worth trying. The proposers have clearly thought hard about the issues and the trade-offs. The choices they have made seem to me to be well-reasoned.

Courses have very high delivery costs -- $14,000 per student per semester just for the online platform and related support. The proposers recognize that this is high, but are willing to accept it. In addition, they will have in-house costs, such as processing admissions and counseling, and hosting campus visits. And all of this does not even include faculty time and effort in course development, teaching, and advising. With all these costs, this program seems to me not to have a profit margin that makes it attractive from a business perspective. However, it is unlikely to lose money either. I am satisfied with the due diligence of the proposers, and happy to recommend approval if they feel it makes financial sense.

I also worry about too much dependence on one external vendor. The proposers recognize this problem too, and have contingency plans developed.

In short, the mechanics and modality of instruction are non-traditional but carefully thought through. Though not without risk, there is a good chance of success. Experiments such as this are to be commended.

Turning now to the curriculum and the intellectual content, I wish the proposers had paid the same degree of attention to this as to administrative matters. As I will detail below, there are several unanswered questions about the program. Since there are many highly respected and experienced faculty associated with the program, I am confident that good choices will be made. However, I wish these had been made prior to pushing the proposal this far.

My central concern regarding intellectual content is that there does not appear to be a consistent vision of what background the students will have before admission and what skills they will have learned when they graduate. One way to think of Data Science is that there are three legs that support it. The first leg is programming skill, to be able to extract and manipulate data of interest. The second leg is statistical skill, to be able to run meaningful analyses on the data and interpret the results. The third leg is domain knowledge, to know what questions to ask, to understand the implications of the answer, and to extract value from the analysis. (There are additional global areas of skill, which should be and are included in the

program, such as presentation skills, ethics, and so on). An ideal data scientist would be a domain expert with additional degrees in Computer Science and Statistics. Of course, this ideal is unlikely to be realized in practice. So we have real data scientists with different mixes of ability along the three dimensions. The proposed program is for people who already have jobs and presumably have good knowledge of their respective domains. The intention appears to be to give them enough knowledge of CS and Stats to be able to function as data scientists, with fairly low expectations of CS and Stats ability at the time of admission. But this is not explicitly spelled out, and I worry that this may not be the vision shared by all concerned faculty.

This absence of a consistent vision manifests itself in multiple places. For example, when we look at admission standards, there is mention of programming ability at one place and mention of an introduction to computing class as a requirement in another place. These two are not synonymous – what skills are learned can be very different depending on which flavor of introduction to computing is used. Similarly, there is mention of a knowledge of probability and of introductory statistics. These are quite different. If I were teaching in this program, I would be keen to know what I can assume about students coming into my class.

If one looks at course descriptions, this variance in expectations becomes evident. I will mention just one, that was a big surprise to me: the course on storing and retrieving data certainly starts talking about massively parallel computations, and using MapReduce/Hadoop. Really?? I see no reason to expect students will be capable of writing serious parallel programs. I would think it is more realistic for this class to teach them rudimentary SQL and scripting languages to perform data wrangling. MapReduce can be deferred to the elective course on Really Big Data.

An additional consequence of the absence of a consistent vision is that it is easy to indulge in wishful thinking and imagine that students graduating from the program will have greater skills than is realistic. I think there are difficult conversations that must take place to determine what is the minimum level of skill required in Computer Science and in Statistics for someone to be a data scientist. One can then make sure that the core classes in the curriculum build up to this level of skill, and work backwards to determine what minimum training will be required of students entering the program.

Once questions such as the ones above have been asked, my sense is that they will conclude they need more traditional classes, and more training, in Stats and CS. [For instance, most of the target job postings in the appendix ask for advanced degrees in computer science or statistics]. These classes may be offered by existing IS faculty, by adjuncts/lecturers explicitly hired for this purpose, or through arrangements with the Stats and EECS departments at Berkeley.

Following this analysis, it is also my view that core classes should have smaller skill development assignments that teach students at least basic usage of a broad range

of relevant tools. Current course descriptions are mostly centered around open-ended course projects – these can provide tremendous learning once a solid foundation is in place, and indeed are typical in graduate level courses – however, we need to recognize that many of the students will be lacking the foundation, and will likely graduate without crucial skills if they are not compelled to develop them by suitable class assignments.

In summary, I am supportive of this innovative proposal. With some tweaking, I hope to see it succeed and fill an important need.

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Smith School of Business
UMIACS and the Department of Computer Science

University of Maryland
College Park, MD 20742

May 21 2013

Professor Divyakant Agrawal
Department of Computer Science
University of California, Santa Barbara

Dear Professor Agrawal,

I am pleased to provide a review of the MIDS program to the University of California Senate's CCGA. As a multi-disciplinary data scientist with interests in many domains (biomedical, finance, disasters, social), I am very excited to see such programs emerge. I have been involved at the Smith School of Business in developing a business data analytics competency and I have been leading a national effort sponsored by the National Science Foundation to develop a research agenda in *data science for finance*.

Wearing all of these hats and with this background, I am qualified to address the following issues:

- Quality and academic rigor of the program.
- Adequacy of the number and expertise of the faculty.
- Applicant pool and placement prospects.

To keep this brief, I will summarize my reactions. I will then use two of the faculty (Hearst and Larson) and the planned courses - *Storing and Retrieving Data* and *Introduction to Machine Learning*, as well as current offerings, INFO 257 and INFO 290, to make some specific comments.

Reactions:

- The motivation for this program, the identification of the need for analysts and consumers of data across domains and the comprehensive multi-disciplinary approach to data science is very well thought out and described.
- Section 5 provides a very clear roadmap of the core classes, the topics to be covered, and how they build upon each other to train students for the following:
    - Frame the dataset;
    - Ask the right set of questions;
    - Develop analytical solutions.
- This is a very ambitious set of learning objectives for one year. The expectation that students may be able to complete this on a part-time basis appears to be unrealistic.

- The capstone project is a key part of the program. It will be critical to demonstrate the students' mastery of a diverse set of skills. Expecting to complete this while learning the skills appears to be unrealistic.
- Are the majority of the students expected to be resident in the US during this program? Would they have had prior work experience in US companies? I have less concerns about the online delivery of material but I do have significant concerns about the cultural and social experiences that are a significant component of asking the right questions about the data *in context* where the context must include the application domain, the organization, and cultural and social context.
- I have a concern about the small number of about a dozen faculty who are involved. Presumably they have other responsibilities in the school, they teach in other programs, are active in research, etc.? The current faculty may well be overwhelmed if they have to maintain all of their current activities and play a leading role to launch this ambitious program.
- I understand the need to make this program a standalone and unique experience that is differentiated from the other programs in the school and on campus. I also understand that the online nature of this program makes it more difficult to integrate with other programs. However, I have a concern about developing programs in silos and more important, not being able to benefit from current existing excellent courses on campus.

My conclusion is that the program is well designed and appears to meet the learning objectives and has high quality and rigor. I have specific concerns about the following (as detailed above):

- Ability of students to achieve all learning objectives within a year including the capstone project.
- The quality of cultural and social aspects of the student experience.
- The impact on the small number of faculty.
- Developing a program in a silo when the campus has a richness of relevant programs.

To complete my review, I visited the websites for INFO 257and INFO 290. INFO 257 appears to be the typical *Overview of Data Management* class that is offered in most Information Systems and MIS programs in I Schools and B Schools. As a *hard-core database management educator* who has invested a huge amount of effort to teach database management to non-programmers, I had many concerns about the material covered, the depth of discussion, exercises, textbook, etc. I am confident that Professor Larson will make significant changes to INFO 257 to meet the demands of the new MIDS core course. Based on my own long journey to master the skills needed to teach such material to non-programmers, I am concerned about the demands that MIDS will place on the current faculty including Professor Larson.

INFO 290 taught by Professor Hearst seemed to be a very successful data science course and I was at first very confused about the learning objectives and achievement gap between these two courses. I then realized that this course was targeting a very specific group of students.

> *Undergraduates must be upper-division computer science or electrical engineering majors, or must have taken significant advanced programming courses including CS 162 and math courses including CS 70 or equivalent.*
> *Completion of a statistics course is also strongly recommended.*
> *Graduate students must be comfortable with systems programming and be able to pick up new software programming tools with little structured support and be comfortable with basic math topics such as graph theory, statistics, and probability theory.*

Is this the expectation for the incoming MIDS students? Section 2.1 of the MIDS document does not provide such details or requirements.

I also noted that the material covered in this course appears to be offered by academics at other institutions? I am sure that Professor Hearst will develop her own teaching material so that the program has a Berkeley signature. However, this again goes back to the question of the impact of launching such a program on the existing faculty workload and commitments.

Despite these concerns, I am very positive about this program and I hope that it will be very successful.

Louiqa Raschid
Professor, Smith School of Business, Center for Bioinformatics and Computational Biology,
UMIACS and the Department of Computer Science
Robert H. Smith School of Business

ACM Distinguished Scientist

Responses from Pamela Jennings regarding CCGA requests from the May 1 meeting:

1. CCGA requested a report showing the decline in funding from institutions such as the NIH and NSF as a result of federal sequestration.

Answer: The report specifically referenced was a draft chapter of the 2013 Accountability Report. It is still not final so it is not yet ready to be shared. Once approved it will be published and made available online (each year the Accountability Report is posted to the website). Charles Drucker from IR has been working in this area and while the accountability report chapter cannot yet be shared, for additional insight on this matter Charlie has shared the Q213 Award Update report (attached). He also suggested the other two reports attached to this message: AAAS Brief: Federal R&D and Sequestration in the First Five Years, and ACE: The Likely Impact of Sequestration on Higher Education. These documents may be helpful to any CCGA member who would like greater insight on the sequestration issue as it impacts higher education.

Regarding the attached Quarterly Award Update for Q2 of FY 2012-13, Charles shared the following:
The most significant finding is that federal funding for the year to date remains nearly $220 million behind last year's total, a drop of about 12%. Sponsorship from non-federal sources is about where it was last year, so with $2.79 billion received during the first two quarters, UC's award total is about $200 million below this time one year ago.

Although the sequester did not officially take effect until March 1, 2013, it is evident that federal agencies began to change funding patterns months in advance of that date, conserving their appropriations in anticipation of the inevitable reductions. The fiscal impact of the sequester on UC—and on research institutions nationwide—has been estimated to range from 6 to 8% of the previous level of federal support. Our best estimate for the impact on UC is from $200 to $240 million annually, as long as appropriations remain at current levels.

The year-to-date shortfall in federal funding is just halfway between those amounts. Award data for Q3 of the current fiscal year should provide more clarity regarding sequester's long-term effects.

If any CCGA members have additional questions, they are welcome to contact Charles Drucker directly: (charles.drucker@ucop.edu)

2. CCGA requested information about the causes of "unknowns" in the interdisciplinary fields in the graduate student summary.

Please note that while the percentages are comparatively high at around 25%, the numbers are low (4 to 5 "unknown" students out of a total of 18 in interdisciplinary programs). The unknowns were distributed among three different campuses. To put this in context, out of a total 3,629 PhD graduates, 356 (10%) across all disciplines were "unknown."

The methodology for collecting the data was generally for the campus graduate division staff to solicit current (one-year-after- graduation) employment information from departments/programs for their cohort of 2010-11 PhD recipients. In the cases where graduate division was unable to get data from the departments, they filled in the blanks as best they could using online and social media sources. Some individuals could not be found either way and were thus coded unknown.

It could be that the issue is exacerbated due to the nature of interdisciplinary programs not having a "home" department, but that doesn't explain why the graduates wouldn't be found online. As this was the first systemwide survey and the numbers are so low, it is not possible to know if this result is common. We will continue to monitor this in subsequent surveys and will continue to share the results with CCGA.

Contracts & Grants Q213 Award Report

Year-to-date Federal Funding Still Lagging

Summary

UC's award funding for the second quarter of FY 2012-2013 totaled about $1.02 billion, exceeding the amount reported for Q2 a year ago by about $65 million, or 7%. For the year to date, though, the award total of $2.79 billion is still nearly 7% below last year's amount. This difference is due to the very substantial drop in federal funding experienced during the first quarter of this year.

Federal base funding to UC during Q113 was $320 million below the amount reported during Q1 of the previous year. To date, federal funding still lags behind last year's pace by nearly $220 million, but much of this $100 million positive change in UC's federal funding position is a reporting artifact. Changing funding requirements at the National Institutes of Health, which took effect during Q113, pushed the reporting of many awards from that quarter into the fiscal year's second quarter.

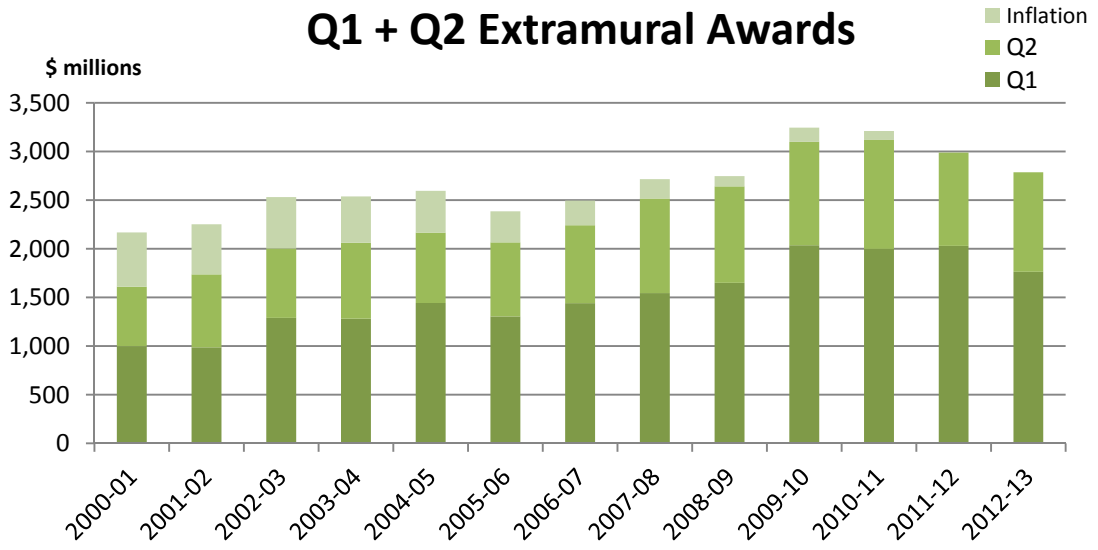
Reporting anomalies aside, federal funding is still far behind last year's pace, and is likely to remain so. It has been apparent for some time that federal agencies have been preparing for appropriations cutbacks by conserving funds, issuing fewer and/or smaller awards, and in some cases providing less than the initially budgeted award amount. These changes have already contributed to a climate of uncertainty regarding federal support, which is only likely to deepen as the full impact of the sequester begins to be felt.

Key findings for Q213 are as follows:

- Federal funding to date, for awards of all types, is running about $220M below last year, a drop of just over 12%.
- Of the $1.02 billion UC received in extramural awards during Q213, research awards, including clinical trials, amounted to $815M, or 79.9% of the aware total, compared to 77% for Q212. Federal research funding for the year to date is running about $224M below last year, a decline of about 14.6%.
- While most locations reported declines in federal and overall funding for the first two quarters, UC San Francisco reported an increase of $116M in award funds over last year. This contrary result is partly an artifact of procedural and funding changes at NIH, and partly the result of reporting changes at UCSF that moved some FY 2012 awards into FY 2013.
- Award funding for UC's first two fiscal quarters is generally about 55% of the annual total. FY 2013, however, is likely to be an anomalous year because of federal budget uncertainties.
- Current estimates for the annual decline in federal funding range from 6.5 to 7.6. This could result in a reduction in UC's annual federal support of $200 to $240M.

I. Quarterly Performance Metrics

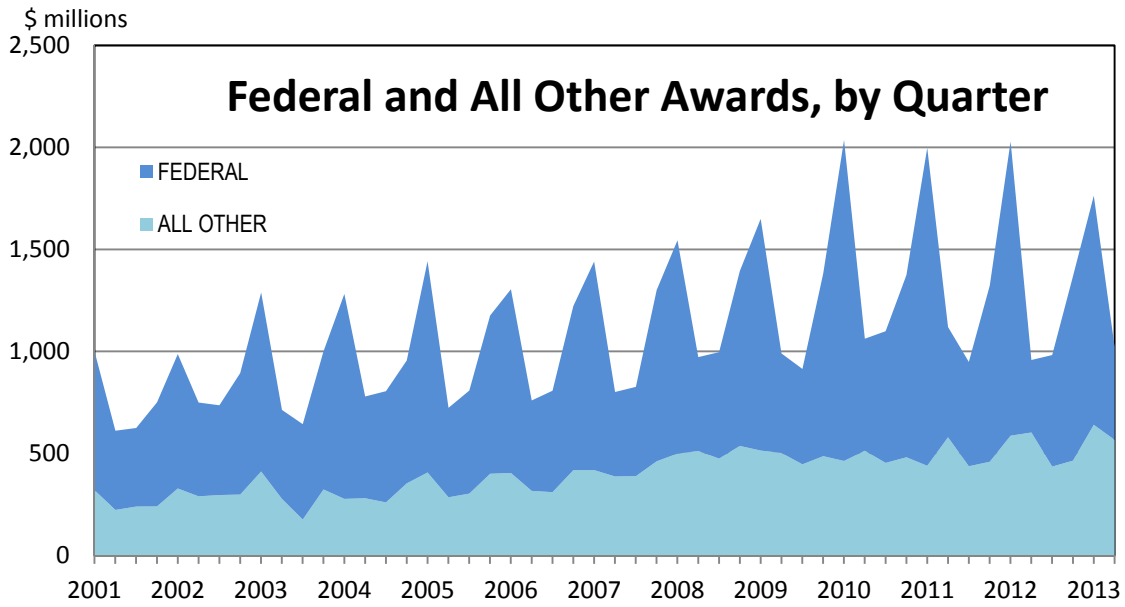
Extramural awards for Q213 totaled about $1.02 billion, $65 million (6.79%) above the amount reported during Q212. Year-to-date, however, funding is 6.74% below last year's total.



Quarterly Extramural Awards, FY 2001 – 2013 ($ millions)

PERIOD	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Q1	999	987	1,290	1,282	1,442	1,305	1,440	1,545	1,650	2,037	1,998	2,030	1,763
Q2	612	750	713	780	724	760	802	972	991	1,063	1,120	958	1,023
Q3	625	737	644	805	809	808	826	997	915	1,099	949	982	-
Q4	750	894	1,002	956	1,177	1,223	1,301	1,395	1,383	1,374	1,324	1,369	-
FY	*2,986*	*3,367*	*3,649*	*3,823*	*4,151*	*4,096*	*4,370*	*4,909*	*4,938*	*5,574*	*5,391*	*5,340*	*2,787*

Award totals for UC's first fiscal quarter are always the highest for the year, followed by Q4. This is a function of the federal funding cycle, which awards the largest amounts in the final quarter of the federal fiscal year (corresponding to UC's Q1). With direct federal sponsorship providing about two-thirds of all UC's awards, this produces sharp quarterly spikes in funding.



II. Award Trends by Sponsor Category

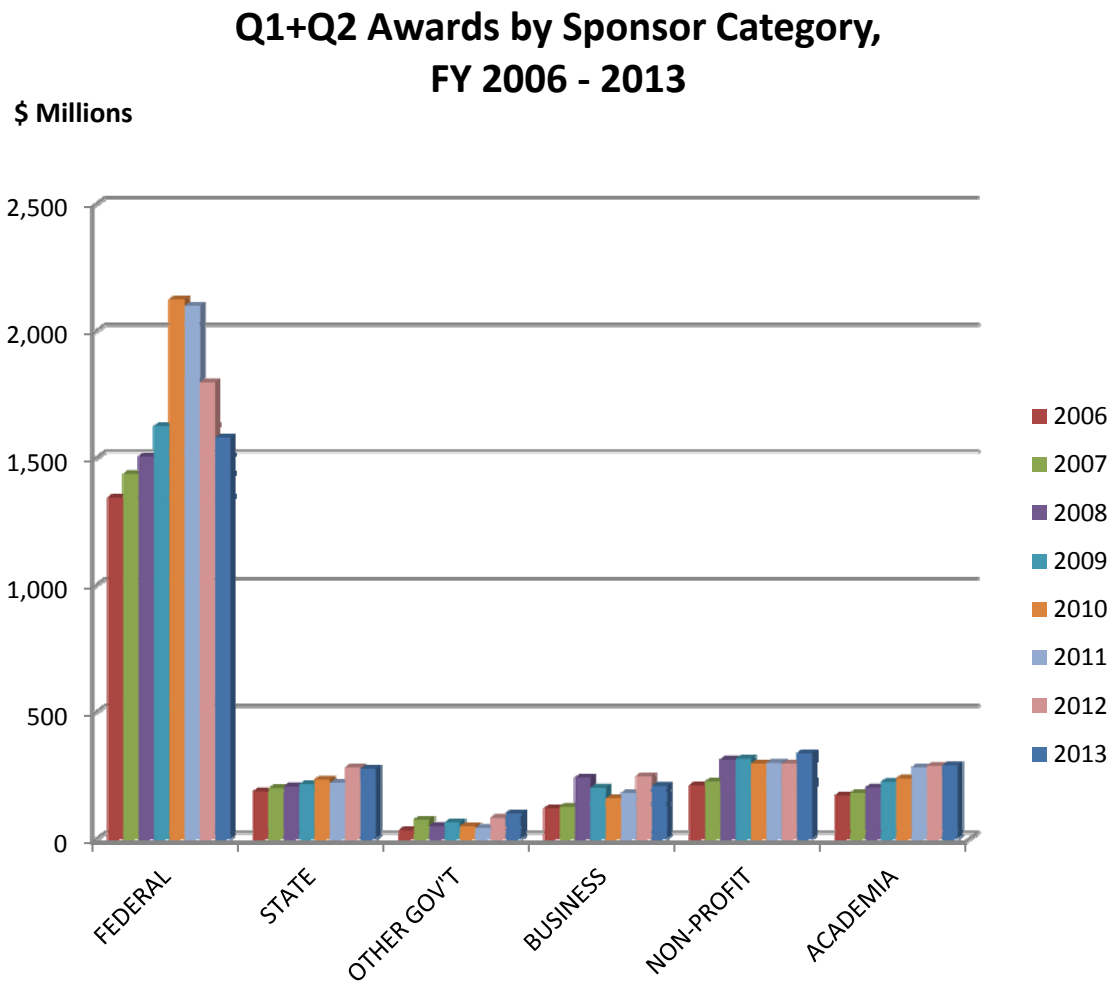
The decline in overall funding for the fiscal year to date is due to cutbacks in federal agency support. Direct federal award funding for Q1 and Q2 amounted to about $1.58 billion, or about 57% of the award total, compared to nearly $1.8 billion a year ago, or about 60%. The peak in federal funding during 2010 and 2011 was due principally to Recovery Act (ARRA) awards.

Q1-Q2 Awards by Sponsor Category, FY 2006-2013

($ Millions)

SPONSOR	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Federal	1,344	1,436	1,505	1,623	2,123	2,098	1,797	1,578
State	187	198	207	214	233	219	280	274
*Other Gov't**	33	76	51	64	50	42	82	101
Business	120	127	240	202	159	179	246	208
Non-Profit	211	224	312	314	297	299	295	337
*Academia***	171	181	202	223	238	281	288	289
TOTAL	***2,065***	***2,242***	***2,517***	***2,641***	***3,099***	***3,118***	***2,988***	***2,787***

** Other Gov't includes Agricultural Market Order Boards.*
***Academia includes the categories of Higher Education, DOE Labs, Campuses and UCOP.*

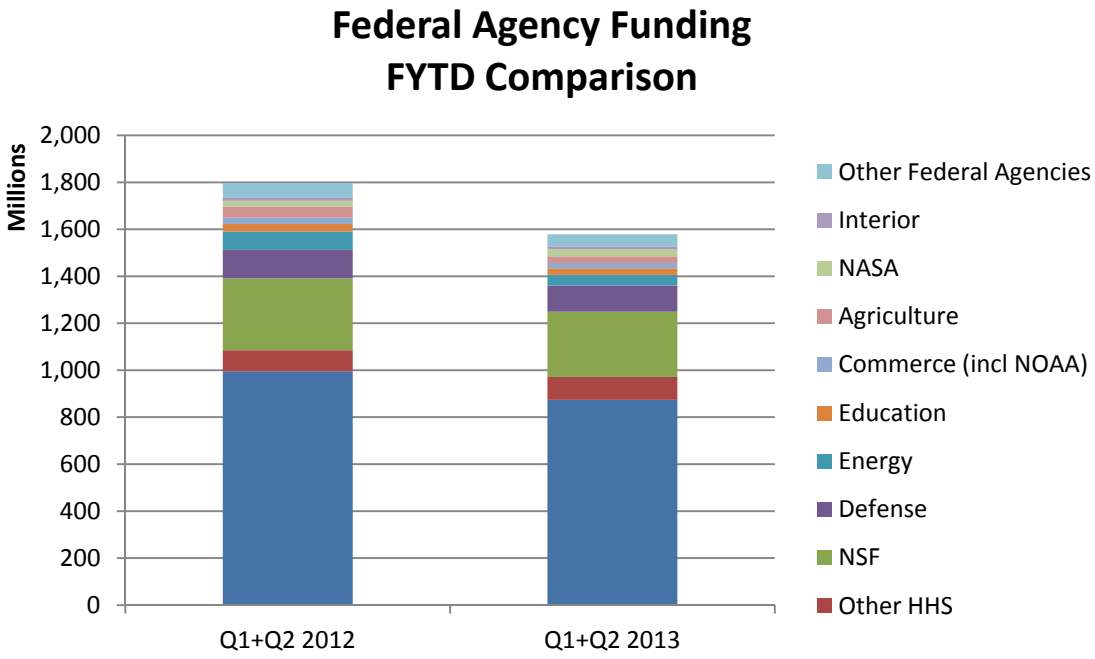


III. Federal Agency Award Trends

Much of the decrease in federal award funding reported for the fiscal year to date is attributable to the National Institutes of Health, which is UC's largest single source of project funds. NIH generally provides nearly 60% of UC's federal funding, and any changes in NIH appropriations or funding practices will inevitably have a significant impact on UC.

NIH funding during FY 2012-13 is proving to be extremely uncertain, largely in response to federal budget issues and the looming sequester. But some of the variability in NIH award reporting is also due to changes in the Department of Health and Human Service's Conflict of Interest requirements, which negatively affected Q113 award reporting. Implementing these new requirements lengthened the award processing cycle on several campuses (notably UCSF and UCLA), and as a consequence, many awards received late in the first quarter of FY 2013 were not reported until Q213. This reporting delay increased the federal funding total for Q213, accounting for essentially all of the $65 million positive difference between the Q213 award total of $1.02 billion and the Q212 total of $958 million.

NIH reporting issues aside, it has been clear for some time that nearly all federal agencies, operating under budgetary constraints and anticipating the sequester, have reduced their levels of funding.



Q1+Q2 Federal Agency Funding, FY 2012 and 2013

AGENCY	*Q1+Q2 2012*	*Q1+Q2 2013*	*$$ DIFFERENCE*	*% CHANGE*
NIH	995,094,552	874,145,957	-120,948,595	-12.2%
Other HHS	90,187,623	97,144,286	6,956,663	7.7%
NSF	305,838,101	277,804,452	-28,033,649	-9.2%
Defense	121,243,930	111,021,490	-10,222,440	-8.4%
Energy	78,405,780	45,935,918	-32,469,862	-41.4%
Education	32,010,895	27,821,932	-4,188,963	-13.1%
Commerce (incl. NOAA)	26,890,243	22,234,419	-4,655,824	-17.3%
Agriculture	46,676,760	29,113,494	-17,563,266	-37.6%
NASA	25,177,963	29,751,808	4,573,845	18.2%
Interior	14,870,019	11,968,478	-2,901,541	-19.5%
Other Federal Agencies	60,865,650	51,787,328	-9,078,322	-14.9%
TOTAL	***1,797,261,516***	***1,578,729,562***	***-218,531,954***	***-12.2%***

The decline in federal funding to UC spans nearly all agencies. The percentage decrease for non-HHS funding, at 14.7%, is actually slightly higher than for HHS alone. This suggests that the reporting delays due to new HHS procedures have largely cleared the system, and that the $218 million decrease in federal support for the fiscal year to date reflects budgetary and not timing issues. Award data for Q3 of FY 2013 may provide more clarity.

IV. Award Trends by Project Type

Research awards during Q213 amounted to $815 million, including $68 million in clinical trial sponsorship. Training, service and other awards came to about $208 million. The increase in research funding compared to last year is due in large part to the previously described delays in HHS/NIH reporting, which pushed some awards from Q113 into Q213.

Q2 Award Amounts by Project Type, FY 2006-2013 ($ millions)

PROJECT TYPE	*Q206*	*Q207*	*Q208*	*Q209*	*Q210*	*Q211*	*Q212*	*Q213*
Research	613	556	691	724	847	806	682	747
Clinical Trials	27	35	66	38	39	40	55	68
Training	46	48	52	46	48	48	40	47
Service	36	95	64	94	77	100	90	89
Other	39	67	99	88	52	126	91	73
TOTAL	***760***	***802***	***972***	***991***	***1,063***	***1,120***	***958***	***1,023***

V. Major Awards Over $5M

During Q213, UC received 19 awards for amounts of $5M or more. Most awards of this magnitude are intended to support ongoing programs, centers, or affiliation agreements rather than specific research projects, and may involve funding that extends over several fiscal years.

LOCATION	SPONSOR CATEGORY	SPONSOR	PROJECT TITLE	AMOUNT
Davis	Federal	U.S. Agency For International Development	Predict: USAID Avian And Pandemic Influenza And Zoonotic Disease Program - Wildlife S.M.A.R.T. Surveillance	21,500,000
San Francisco	State	California Emergency Medical Services Authority	California Poison Control System 2012 - 2014	16,457,142
Berkeley	State	California Office of Traffic Safety	Sobriety Checkpoint Program 2012-2013	13,930,555
Berkeley	DOE Labs	Lawrence Berkeley Lab	Digital Resource Licenses	12,025,563
San Francisco	State	California Department of Public Health	STD Prevention Training Center	8,693,376
San Francisco	Federal	National Institute of Neurological Disorders & Stroke	POINT: Platelet-Oriented Inhibition in New TIA and Minor Ischemic Stroke	8,288,178
San Francisco	Federal	National Cancer Institute	Cancer Center Support Grant	7,831,070
Office Of The President	Foundation	Gordon and Betty Moore Foundation	Completion of Early Construction Phase of the Thirty Meter Telescope (TMT)	7,500,000
Los Angeles	Other Gov't	Los Angeles County Children & Families First	First 5 LA 21st Century Community Dental Homes Project	7,489,521

San Diego	Federal	National Institute of General Medical Science	Lipid Maps	7,153,421
San Diego	Federal	National Institute on Aging	Alzheimer's Disease Cooperative Study (ADCS)	6,081,533
San Francisco	Corporate	Merck & Co., Inc.	Phase I Study of Single Agent MK-3475 in Patients with Progressive Locally Advanced or Metastatic Carcinomas and Melanoma	6,052,693
Los Angeles	Federal	National Cancer Institute	AIDS Malignancy Clinical Trials Consortium (AMC)	6,010,333
Berkeley	Foundation	Gordon And Betty Moore Foundation	An Optical Nanoscope for Imaging Beyond Diffraction Limit	6,000,000
Los Angeles	Federal	PHS (SAMHSA) Prevention - Center for Substance Abuse Prevention	National Center for Child Traumatic Stress	5,998,110
Berkeley	Federal	NASA Goddard Space Flight Center	Time History of Events and Macroscale Interactions During Substorms (THEMIS)	5,783,400
San Francisco	Federal	National Inst. of Allergy and Infectious Diseases	Sexually Transmitted Infections Clinical Trials Group (STICTG)	5,397,861
Davis	State	California Department of Social Services	Resource Center for Family Focused Practice	5,263,800
Davis	Federal	National Institute for Food and Agriculture	Improving Barley and Wheat Germplasm for Changing Environments	5,000,000

VI. Award Trends by Recipient Location

Award totals for the first two quarters of FY 2012-13 were about 6.7% under last year. This drop was unevenly divided, and the large increase in award totals for UCSF was due to internal technical reporting issues.

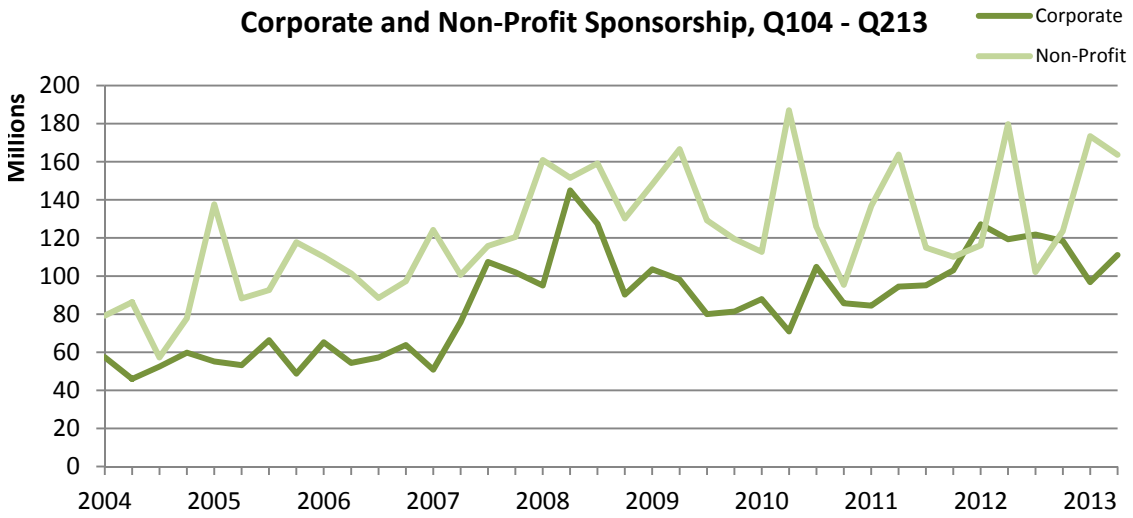
Q1 + Q2 Awards by Location

UC LOCATION	*FYTD 2012*	*FYTD 2013*	*Change*
BERKELEY	483,534,822	443,231,503	-8.3%
SAN FRANCISCO	543,973,741	660,333,872	21.4%
DAVIS	443,195,059	392,623,489	-11.4%
LOS ANGELES	499,664,783	376,963,484	-24.6%
RIVERSIDE	64,009,225	54,094,611	-15.5%
SAN DIEGO	488,890,973	454,475,615	-7.0%
SANTA CRUZ	79,801,092	71,522,456	-10.4%
SANTA BARBARA	111,274,978	86,065,873	-22.7%
IRVINE	158,643,421	141,350,150	-10.9%
MERCED	10,335,839	12,182,321	17.9%
UCOP	27,710,461	24,900,902	-10.1%
LBNL	70,107,957	60,184,645	-14.2%
AG & NAT RES	7,149,628	9,040,992	26.5%
TOTAL	***2,988,291,979***	***2,786,969,913***	***-6.7%***

(*Technical Note:* The only large location showing a substantial increase over 2012 is UCSF. This countervailing trend is mainly due to a one-time reporting issue experienced only by this location. Staffing and system changes during Q412 lengthened the award reporting cycle for UCSF during that quarter, pushing a number of awards from Q412 into the Q113 reporting period. This is why UCSF, unlike the other locations heavily dependent on NIH funding, did not show a large decrease in federal funding during Q113, when the NIH reporting delay occurred. As a consequence, UCSF's award total for the 2013 fiscal year is larger than it would have been under normal reporting. This also means that the systemwide federal funding drop of $320 million in Q113, compared to the previous year, would have been even larger had it not been for the inclusion of some UCSF awards that were not reported during the previous fiscal year.)

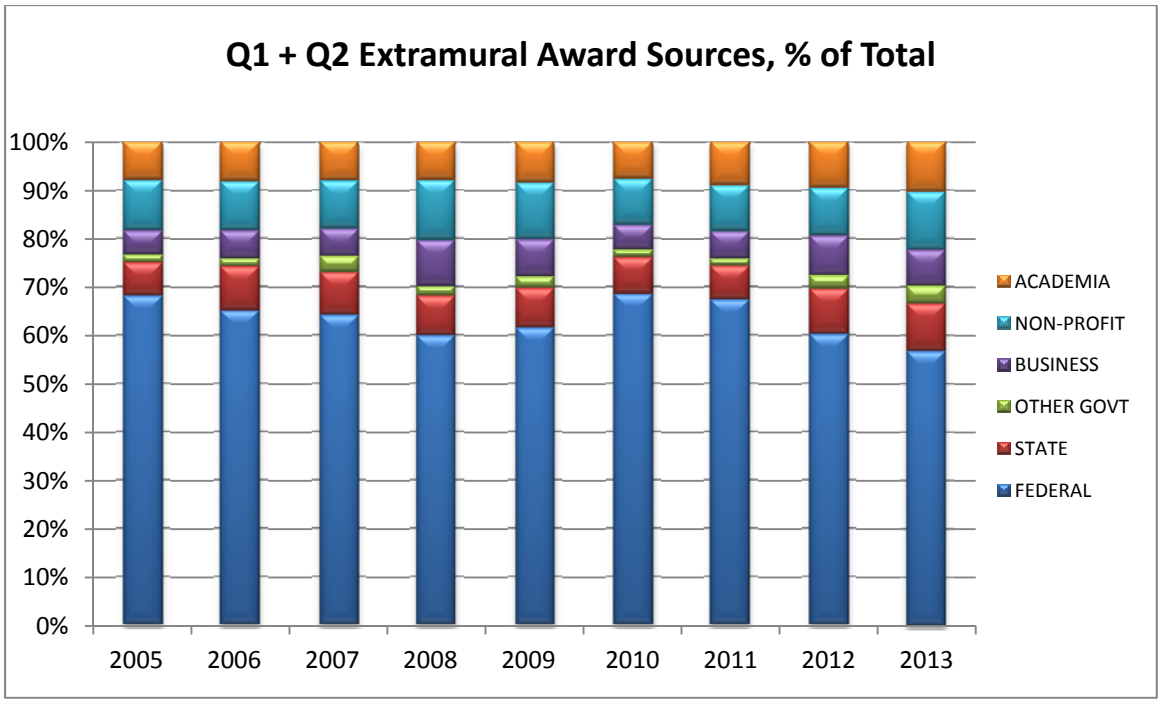
VII. Shifts in Funding and the Effect of the Sequester

With direct federal awards significantly below last year's total to date, private sources are once again increasing in relative importance as a source of extramural funding. Private funding sources from industry and the non-profit sector for the first two quarters of FY 2012-13 totaled nearly $545 million, or about 1% above where they stood last year. With the sharp decline in agency funding experienced for Q113, the federal contribution has fallen to a record low for the first two fiscal quarters of 56.6%.



Q1+ Q2 Extramural Funding Sources, % of Total

	2005	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
FEDERAL	68.0%	65.1%	64.0%	59.8%	61.5%	68.5%	67.3%	60.1%	56.6%
STATE	6.9%	9.0%	8.9%	8.2%	8.1%	7.5%	7.0%	9.4%	9.8%
OTHER GOV'T	1.5%	1.6%	3.4%	2.0%	2.4%	1.6%	1.4%	2.7%	3.6%
BUSINESS	5.0%	5.8%	5.6%	9.5%	7.6%	5.1%	5.7%	8.2%	7.5%
NON-PROFIT	10.4%	10.2%	10.0%	12.4%	11.9%	9.7%	9.6%	9.9%	12.1%
ACADEMIA	8.1%	8.3%	8.1%	8.0%	8.5%	7.6%	8.9%	9.6%	10.3%



Given that the reduction in federal agency funding is likely to continue for some time, it is critical to assess the magnitude of the sequester's impact on the nationwide academic R&D effort generally, and specifically on UC. The American Association for the Advancement of Science has estimated that federal support for non-defense R&D would be reduced by about 7.6% per agency. Assuming that federal agency support for activities other than research (such as training and service) would be reduced proportionately, it seems reasonable to estimate the annual effect of the sequester on UC at about 7.6% of the federal award total. Last year, this amounted to $3.25 billion, suggesting a decline in UC's federal support of about $240+ million annually.

Other estimates of the sequester's effect on academic R&D, including from the National Cancer Institute, forecast reductions of 6-6.5% per agency, which would translate into about a $200M decrease in federal funding for UC. Currently, with two quarters of award information, the drop in federal funding stands at $218M, or right between these two estimates.

Award data are imperfect early indicators of future trends, and the federal funding picture for the remainder of this year and beyond is still unclear. What is certain, though, is that federal agencies are reducing their support for academic R&D and related activities; that UC and other research institutions will all share these cutbacks; and that the result of these cuts will be reduced research activity, reduced staffing levels, and reduced support for graduate and post-doctoral training.

Charles Drucker
Institutional Research
May, 2013

ADVANCING SCIENCE, SERVING SOCIETY

Brief: Federal R&D and Sequestration In The First Five Years

By Matt Hourihan

KEY FINDINGS:

- Through 2017, **sequestration could reduce federal R&D expenditures by $57.5 billion, or 8.4 percent**. The reduction would average $11.5 billion per year, and total $12.1 billion in the first year.[1]
- **Defense R&D** could be reduced by a total of $35.6 billion, or 9.1 percent, averaging $7.1 billion per year. This would be roughly equivalent to FY 2002 levels.
- Nondefense R&D, including funding at the **National Institutes of Health,** the **National Science Foundation,** the **Departments of Energy and Agriculture,** and **NASA,** could be cut by a total of $21.9 billion over five years, or 7.6 percent per agency. The budgets for many agencies would be at their lowest point in a decade or more.
- Under a **nondefense-only scenario**, nondefense R&D could be cut by $50.8 billion, or 17.2 percent, averaging $10.2 billion per year total.[i]

Sequestration – the large, automatic, across-the-board reductions in federal funding set to begin in January of 2013 – remains a major concern for many inside and outside Washington. The cuts, established in the Budget Control Act of 2011, are intended to reduce the federal deficit by $1.2 trillion over the next decade. These savings will be achieved through annual cuts of $55 billion to defense discretionary spending and up to $38 billion to nondefense discretionary spending. In the first year, these cuts amount to 9.4 percent for defense and 8.2 percent for nondefense; over nine years, actual spending cuts would amount to $984 billion. Cuts of this magnitude would no doubt have significant impacts on federal funding of science, research, and innovation. They also come at a time when

Estimated R&D Cuts Under Balanced Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total Cut	5-Year Percent
Dept of Defense	-6,928	-6,818	-6,696	-6,585	-6,495	-33,524	-9.1%
HHS	-2,528	-2,429	-2,333	-2,241	-2,155	-11,685	-7.6%
NIH	*-2,439*	*-2,343*	*-2,251*	*-2,162*	*-2,079*	*-11,274*	*-7.6%*
Dept of Energy	-972	-944	-916	-889	-865	-4,585	-8.2%
Natl Sci Foundation	-456	-438	-421	-404	-388	-2,106	-7.6%
NASA	-763	-733	-704	-676	-650	-3,527	-7.6%
Dept of Agr	-189	-182	-175	-168	-161	-875	-7.6%
Dept of Commerce	*-103*	*-98*	*-95*	*-91*	*-87*	-474	-7.6%
Dept of the Interior	*-65*	*-62*	*-60*	*-57*	*-55*	-299	-7.6%
EPA	-46	-44	-43	-41	-39	-213	-7.6%
Homeland Security	-50	-48	-46	-44	-43	-232	-7.6%
Total R&D Cut	**-12,099**	**-11,796**	**-11,488**	**-11,196**	**-10,939**	**-57,519**	**-8.4%**

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act. Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.

[1] Note: sequestration extends through 2021, but we only cover the first five years to allow for adjustment for inflation, based on OMB's price deflators through 2017.

federal R&D has already declined by 10 percent in real dollars since FY 2010. Much of the attention has focused only on next year, when in reality, the challenge is long-term. This brief will attempt to illuminate these potential cuts by estimating budgetary impacts for most key R&D agencies, and the funding ramifications by state, over the next five years.

SEQUESTRATION BASICS

First, we briefly review some key concepts about how sequestration will work.

The Budget Control Act (BCA), signed into law in August 2011, was intended to set the stage for sweeping deficit reduction over the next decade while authorizing increases in the debt ceiling. In terms of actual spending, it essentially took two steps. First, it established multiyear caps for defense and nondefense discretionary spending. Discretionary spending covers about a third of the federal budget, and includes virtually all federal R&D funding along with many other expenditures, but excludes entitlements like Social Security and Medicare. These caps would constrain discretionary spending by an amount approaching $1 trillion below projections from FY 2012 to FY 2021. Factoring in inflation, the caps would keep discretionary spending essentially flat at these reduced levels over the next decade.

Second, the Budget Control Act established a two-step process for reducing spending by an additional $1.2 trillion over nine years from FY 2013 to FY 2021. Initially, the law gave responsibility to the Joint Select Committee on Deficit Reduction – popularly dubbed the "Supercommittee" – for developing legislation to close the deficit through some mix of spending cuts and revenue increases, with a November 2011 deadline and a built-in contingency. With the failure of the committee, the contingency kicked in: the automatic across-the-board reductions now known colloquially as the sequestration (though technically, only in the first year would an actual "sequestration" take place; subsequent years would simply be a sharp reduction in allowable spending levels under the caps).

To achieve this $1.2 trillion savings, the BCA divides nearly all federal discretionary spending into two categories: "security" and "nonsecurity," also known as defense and nondefense. It then allocates funding in these categories, following the overall spending levels established by the caps described above. The actual allocation is shown in the table below; note these are in nominal dollars, not adjusted for inflation.

Discretionary Spending Caps Under the Budget Control Act
(budget authority in billions of current dollars)

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Defense Category *Includes DOD and DOE Atomics.*	546	556	566	577	590	603	616	630	644
Nondefense Category *Includes most other discretionary spending.*	501	510	520	530	541	553	566	578	590
Total Cap	1,047	1,066	1,086	1,107	1,131	1,156	1,182	1,208	1,234

Regarding R&D, the defense category includes both Department of Defense (DOD) R&D and atomic defense-related R&D within the Department of Energy (DOE), including mainly the National Nuclear Security Administration. The nondefense category includes R&D spending at virtually every other department and agency like the National Science Foundation (NSF), the National Institutes of Health (NIH), NASA, and DOE's science and energy technology programs, though there are a handful of exempt items, including Department of Veterans Affairs spending.

The act assumes 18 percent of the mandated $1.2 trillion savings – or $216 billion – is saved via interest payment reductions, from reduced borrowing. This leaves $984 billion in remaining spending cuts below the current caps, which the Office of Management and Budget (OMB) is to allocate evenly between the two categories over nine years. A portion of the cuts in the nondefense category would apply to Medicare and other such mandatory programs. Thus, the cuts to discretionary spending – which again covers virtually all R&D – work out to $55 billion on the defense side, and $38 billion on the nondefense side.[ii] A handful of discretionary programs would be exempt; by far the largest of these are Veterans Affairs (VA) activities, including VA R&D.

There remains interest in some quarters, especially in the House, in protecting the defense side of the equation and shifting some or all cuts onto the nondefense side. Most notably, such a proposal passed the House as part of the FY 2013 Budget Resolution, developed under House Budget Committee Chairman Paul Ryan (R-WI),[iii] and efforts to pass similar legislation continue.[iv] While such a scenario appears highly unlikely to either pass the full Congress or avoid a Presidential veto at this time, some support for a version of such a plan continues. As such, we will include a scenario in which the full sequestration amount for defense programs is shifted onto nondefense, in what might be called a worst-case but rather unlikely outcome for the nondefense side.

Estimating the Cuts

Developing a baseline. This analysis will extend through 2017, the last year for which OMB provides price deflators, thereby allowing us to adjust for inflation. The process by which we can estimate a baseline, and then the potential cuts, is fairly straightforward. The first step is to determine how baseline R&D spending might increase or decrease from now until FY 2017. We do not have such estimates readily available, but we do have a yardstick of *total* spending we can use: the BCA's discretionary spending caps, which allow for steady but very small increases over the decade. In real-dollar terms, the caps only barely allow spending to increase faster than inflation: Each year, both defense and nondefense spending would see an increase of only one or two tenths of a percent, after adjusting for inflation.

For argument's sake, we assume that all individual budget accounts will grow at the pace allowed by the caps; essentially, we assuming both that the mix of individual discretionary accounts *within* these caps will not change, and that the ratio of R&D to non-R&D funding *within each account* also won't change. The latter assumption is fairly reliable, as the ratio of R&D to non-R&D has surprisingly changed only slowly over time in most accounts and overall. In other words, according to recent history, as overall discretionary spending goes, so goes R&D.

The first assumption – that the mix of accounts will not change – is perhaps less sure, because over time clear and obvious trends of relative growth or decline do emerge at the agency level.[v] However, it is also important to remember that prior funding decisions in recent years have been made mostly in fiscal environments that lacked the type of discretionary cap established by the BCA. Introducing these caps, and thus restricting the total pool of available budgetary resources, could easily constrain future funding decisions such that variation in budgets from year-to-year is reduced. It is also worth noting that small variations of two or three percent in agency budgets consistent with historical trends would not have a large impact on our overall estimates, since there is little solid ground upon which to assume an agency might receive a relative increase in a world *without* sequestration, but a small increase in a world *with* sequestration. Assuming larger growth in one agency's baseline R&D budget would simply mean larger cuts under a sequestration regime. Of course, any such future decisions are dependent upon who controls the White House, Congress, and appropriations bodies, and how their priorities may evolve. In light of such uncertainty, the BCA caps present as good a baseline for spending growth as any other.

Estimating R&D funding. Once we have adopted these growth rates, we can apply them to current R&D funding levels. Again, it is entirely possible – and indeed likely – that in some instances, R&D funding will grow faster or slower than total funding within some accounts; but recent history suggests that such changes will likely not be large.

We base our projections on AAAS estimates of current (FY 2012) R&D funding coupled with some modifications based on the FY 2013 continuing resolution recently passed by Congress. We avoid using the figures in the President's FY 2013 request for a few obvious reasons. First and foremost, given the continuing resolution's extension through March 2013, the Administration's proposals do not apply at the moment, and may not apply at all depending on the outcome of fiscal cliff negotiations. Second, as any appropriator will tell you, the Administration's proposed budget can change dramatically as Congress considers its disparate elements during the appropriations cycle. Neither the Administration's FY 2013 request nor its proposed outyear funding levels have been fully through this Congressional vetting process, and thus only reflect Administration priorities. Conversely, the modified FY 2012 figures have been through the Congressional ringer, and thus more accurately account for both Administration and Congressional priorities.

Thus, we start with our FY 2012 R&D estimates,[vi] and adjust upward slightly by 0.61 percent to account for the overall increase provided in the continuing resolution. The continuing resolution also grants additional increases to accounts in DOE's atomic weapons R&D portfolio, and we incorporate these in our baseline as well. For argument's sake, we assume these levels extend for the full year, rather than six months as prescribed in the resolution.

It is also worth noting that we are leaving out a few R&D accounts for ease of calculation. The largest of these is the Department of Transportation. Due to the agency's budgeting structure, R&D qualifies under a mix of discretionary and nondiscretionary spending, and separating out the potential impacts is problematic. We are also leaving out R&D at the Department of Education, the Smithsonian, the FBI, and assorted other accounts that together add up to roughly $1 billion, but individually are quite small. Our analysis covers more than 98 percent of all federal R&D.

We take our current estimates with the adjustments described above, adjust for inflation in FY 2013, and then apply the annual growth rate for discretionary spending under the caps for each year. The results of this step are shown in Appendix Table 1. Essentially, the average growth in all accounts rounds off to 0.2 percent per year, similar to the overall growth rate allowable under the BCA caps.

Estimating funding levels under sequestration. Once we have these amounts in hand, we can estimate the new funding levels under sequestration, and determine the amounts cut. Again, there are two scenarios: one with defense and nondefense cuts allocated equally, and one with all cuts shifted onto nondefense discretionary (NDD) spending.

Under the equal allocation scenario, we know per the Congressional Budget Office (CBO) that the *relative* size of the cuts will decline at a fairly steady rate every year, since the BCA caps will increase while the amounts to cut will not.[vii] We also know, per OMB's September estimates, that the first year of cuts will include 8.2 percent for nondefense discretionary spending and 9.4 percent for defense discretionary spending. These funding levels include exemptions for veterans, military personnel, and other select items. Marrying OMB's first-year cuts to CBO's expected rate of decline yields average cuts of 7.6 percent and 9.1 percent for defense and nondefense, respectively, with the largest proportional cuts coming in the first year.

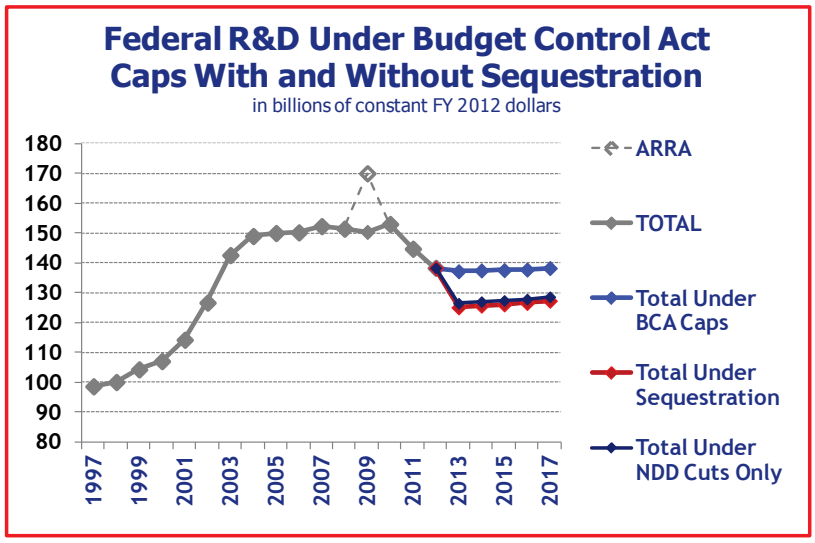
For the nondefense discretionary-only (NDD) scenario, we start by reallocating the $55 billion annual defense cuts onto nondefense. According to OMB's September report, 87.2 percent of the sequestrable nondefense base is discretionary spending, with the rest falling under mandatory spending. We multiply

this ratio by the $55 billion reallocated sequestration amount each year, under the assumption that it will still roughly apply, and add the new totals to the annual nondefense reductions previously derived. We then divide these new annual figures by the nondefense discretionary base identified by OMB, adjusted for expected growth under the BCA caps, to determine the percentage cuts every year. Under this NDD-only scenario, the cuts for most nondefense agencies would average 17.5 percent per year, with the highest (18.5 percent) in the first year.

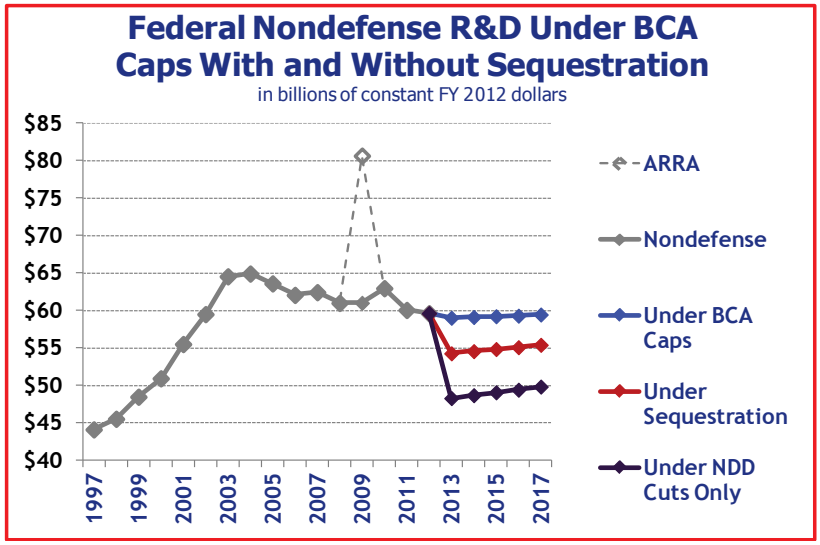
RESULTS

The full results are shown in Tables 2 and 3 in the Appendix (page 15), and summarized in the graphs below. All figures are presented in inflation-adjusted 2012 dollars.

In the **equal allocation scenario**, total R&D could be cut by 8.4 percent, or $57.5 billion, below the baseline over five years (see graph at right). Defense R&D could be cut by a larger real dollar amount ($35.6 billion) and by a greater percentage (9.1 percent). However, nondefense R&D could still take a 7.4 percent cut of $21.9 billion.[viii] At the agency level, NIH could receive a 5-year cut of $11.3 billion, averaging $2.3 billion less per year for research. DOD could average $6.7 billion less for R&D per year for a five-year cut of $33.5 billion total; based on current trends, we might expect $6.1 billion of those cuts to come from the DOD science and technology budget, including basic and applied research. NSF could receive $2.1 billion less over five years.



In the **NDD-only scenario,** total R&D could be cut by 7.4 percent, or $50.8 billion below the baseline, of course with all cuts coming from nondefense agencies (see graph at right). This sum could equal 17.2 percent of total nondefense R&D funding through FY 2017; individual agencies subject to the cuts could actually lose 17.5 percent of R&D funding over five years. The agency figure is higher than the total figure due to the Veterans Affairs exemption. For NIH, this could amount to $26.1 billion, or an average of $5.2 billion per year. DOE's Office of Science could lose $3.9 billion total for research, or $775.9 million per year; NSF could lose $4.9 billion for research, or $976.0 million per year below the baseline.



For additional detail, we will briefly review the six largest agencies next. First, an important note: while it is tempting to estimate additional impacts on university grants awarded, researchers employed, patents generated, or other such effects, there is significant uncertainty in such estimation, since the agencies will likely have a fair level of discretion in how they may adapt to specific funding reductions over time. In some instances, the number of grants may be reduced proportionally. In others, agencies may choose to modify grant terms to reduce the value of individual grants but keep the number of awards higher than it would be otherwise, as NIH has done recently.[ix] Agencies may also reduce or terminate select programs, capital projects, or overhead, and each of these choices may have diverse effects on researchers or contractors depending on the nature of the project. As such, this level of prognostication is best left to others – especially the agencies themselves or OMB. In many ways, we won't really know what the agencies will do until they do it, or at least make known their plans. What we do know, in any event, is that agencies will undoubtedly have less to spend on R&D – in some instances, much less.

Thus, each section below will review our estimates of cuts, and then draw comparisons with funding levels for individual offices or programs, to attempt to place these abstract numbers in context for the reader.

Department of Defense

As the largest R&D funder with twice the resources as the next-highest funder, it should be no surprise that DOD would have the most to lose under balanced allocation. Over five years, DOD could lose $33.5 billion in R&D funding, a 9.1 percent cut below the baseline across all accounts (see table at right). Given that the large majority of DOD R&D is devoted to development of weapons systems and related platforms (under accounts 6.4 to 6.7 in the DOD research, development, test and evaluation, or RDT&E, classification system), one could expect the bulk of the cuts to come from these accounts, which could average $6.7 billion in reductions per year. This funding generally flows to industrial defense contractors.

Department of Defense R&D Cuts Under Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

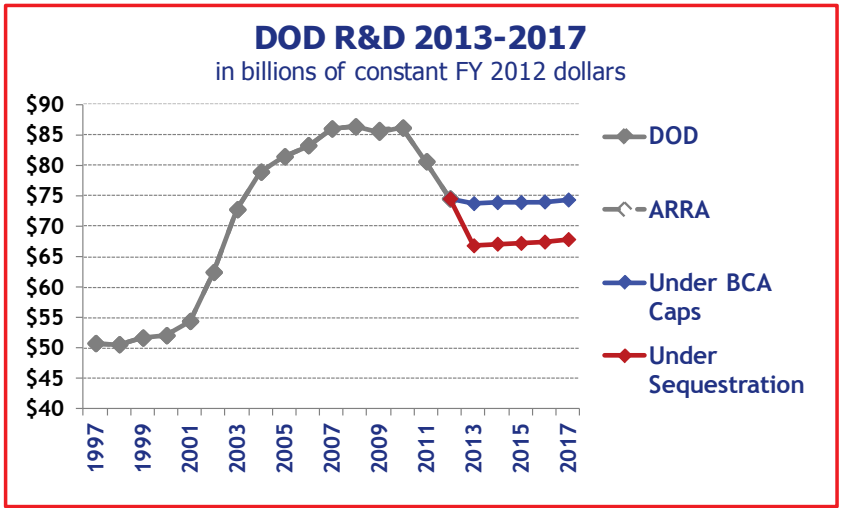
	2013	2014	2015	2016	2017	Total
Department of Defense	-6,928	-6,818	-6,696	-6,585	-6,495	-33,524
Science and Technology 1/	-1,259	-1,239	-1,217	-1,197	-1,180	-6,091
DARPA	*-262*	*-258*	*-254*	*-249*	*-245*	*-1,268*
Weapons RDT&E	-5,549	-5,461	-5,363	-5,274	-5,202	-26,849
Other 2/	-120	-119	-116	-115	-113	-583

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.
The five-year cuts would amount to 9.1 percent below the baseline.
1/ Science and Technology includes basic and applied research and medical research.
2/ Includes chemical agents and munitions destruction.

More important to the university research community is the funding found in DOD's science and technology (S&T) budget, which houses basic research (6.1), applied research (6.2), early-stage technology development (6.3), and medical research performed within the Defense Health Program, a program popular with Congressional appropriators. Typically, roughly half of the science and technology budget is devoted to basic and applied research, including all research funded by the Defense Advanced Research Projects Agency (DARPA). The science and technology account would be reduced by $6.1 billion over five years, averaging $1.2 billion in cuts per year.

As a result of these cuts, DOD's overall R&D budget would be left at its lowest point since FY 2002, when the post-September 11 defense spending buildup was just underway (see graph below). The S&T budget would reach its lowest point since FY 2003. Under the NDD-only scenario, of course, DOD's R&D funding would remain untouched. Generally, DOD R&D has been declining in recent years with the declines in overseas combat operations, and in accord with prior historical instances of defense buildups and rollbacks.

For context, what DOD programs receive funding of an equivalent magnitude to these figures? On the S&T side, $1.2 billion per year is about half of what DOD spends on basic research every year. It is about equivalent to the total annual R&D funding for the multi-office Defense Research Sciences program, and more than three times what DOD spends on university research partnerships. It is also about even to Defense Health Program research funding. On the weapons side, $6.7 billion per year is about what the military will likely spend on RDT&E across all new aircraft this year, including combined R&D funding on the Air Force's Predator/Reaper systems, the Joint Strike Fighter, the F-22 Raptor, the KC-46A tanker program, and the P8-A Poseidon aircraft. It is also larger than the Missile Defense Agency's current R&D budget, and more than twice what DOD will spend on R&D for space-based communications, navigation, and sensing platforms this year.



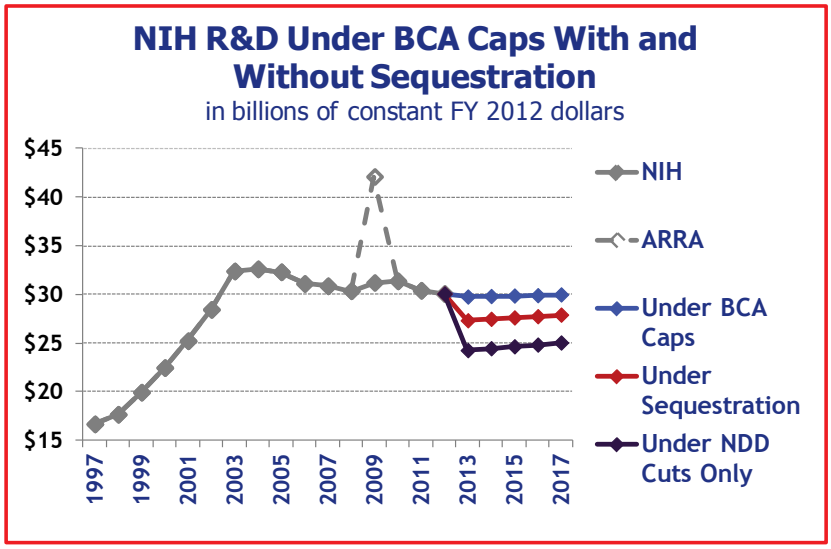
National Institutes of Health

Like DOD, NIH's size – it is the largest funder of nondefense R&D, as well as the largest funder of both basic and applied research – means that the absolute real dollar amounts NIH would lose under sequestration are quite large. Specifically, NIH would stand to lose a total of $11.3 billion in R&D funding over the next five years according to our estimates, averaging a loss of $2.3 billion per year (see table at right). This would amount to a 7.6 percent cut under an equal allocation of sequestration. Under the NDD-only scenario, NIH would lose 17.5 percent or $26.1 billion of projected R&D funding over five years, averaging $5.2 billion per year.

National Institutes of Health R&D Cuts Under Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total
NIH R&D Budget Cuts						
Under Balanced Sequestration	-2,439	-2,343	-2,251	-2,162	-2,079	-11,274
NDD-Only Sequestration	-5,509	-5,365	-5,220	-5,078	-4,944	-26,116

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.
The five-year cuts would amount to 7.6 percent below the baseline under the balanced scenario, and 17.5 percent below the baseline under the nondefense-only scenario.



About half of NIH's R&D funding is designated for extramural Research Project Grants (RPGs),

issued by individual institutes within NIH. Most NIH R&D funding ultimately goes to universities, and is split roughly evenly between basic and applied research. NIH experienced a Congressionally-driven and White House-supported budget doubling between 1998 and 2003, though since then agency funding has flattened out and the agency has experienced an inflation-adjusted R&D decline of 8.7 percent. Under the equal allocation scenario, NIH funding would be returned to roughly FY 2002 levels. The NDD-only scenario would return NIH R&D funding to below FY 2001 levels, erasing much of the prior doubling (see graph above).

For context, what NIH programs receive funding of an equivalent magnitude to these figures? OMB has already estimated that the first year of cuts could result in 700 fewer research grants,[x] while the Department of Health and Human Services puts the figure over 2,000.[xi] Several other organizations have also performed their own estimates of the potential impacts of NIH cuts.[xii] The $2.3 billion figure for average cuts under the balanced scenario is more than the agency spends for research on any one of several fields, including diabetes, neurological disorders, child health, or mental health; twice what it spends on either aging or drug abuse-related research; and more than three times what it devotes to vision research, arthritis research, or studies of the human genome. Under the NDD scenario, the $5.3 billion figure is larger than the annual research budget for the National Cancer Institute, NIH's largest individual research institute.

DEPARTMENT OF ENERGY

DOE boasts a rather diverse R&D portfolio. In the current fiscal year, roughly 20.6 percent of funding is designated for activities in the Energy Programs basket. This account consists of cutting-edge energy technology programs in nuclear power, fossil energy, renewables and efficiency, and the Advanced Research Projects Agency-Energy (ARPA-E), and is primarily applied research and development. Roughly 40.5 percent – the largest R&D account – funds basic research at the Office of Science. The remaining 38.9 percent funds departmental R&D in naval reactors, nuclear stockpile management, and nonproliferation, functions performed by the National Nuclear Security Administration (NNSA). The first two accounts are nondefense, while the NNSA account is classified as defense. DOE is the only agency in which there is an internal defense/nondefense split.

Department of Energy R&D Cuts Under Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

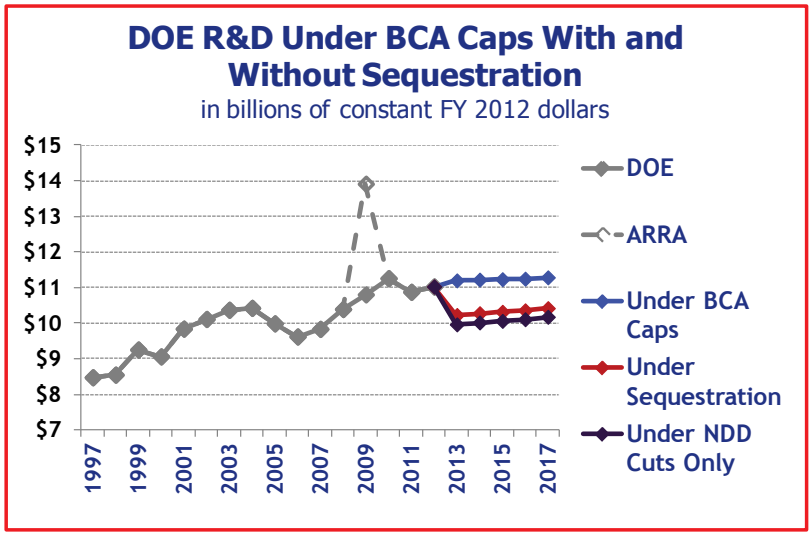
	2013	2014	2015	2016	2017	Total
Balanced Scenario						
Department of Energy	-972	-944	-916	-889	-865	-4,585
Office of Science	*-362*	*-348*	*-334*	*-321*	*-309*	*-1,675*
Energy Programs 1/	*-185*	*-177*	*-170*	*-164*	*-157*	*-854*
Atomic Defense 2/	*-425*	*-418*	*-411*	*-404*	*-398*	*-2,057*
NDD-Only Scenario						
Department of Energy	-1236	-1203	-1171	-1139	-1109	-5,857
Office of Science	*-818*	*-797*	*-775*	*-754*	*-734*	*-3,879*
Energy Programs 1/	*-417*	*-406*	*-395*	*-385*	*-374*	*-1,977*
Atomic Defense 2/	*0*	*0*	*0*	*0*	*0*	*0*

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.
For nondefense programs, the five-year cuts would amount to 7.6 percent below the baseline under the balanced scenario, and 17.5 percent below the baseline under the nondefense-only scenario. For Atomic Defense, the five-year cuts would amount to 9.1 percent below the baseline under the balanced scenario, and no cuts under the nondefense-only scenario.
1/ Includes fossil, nuclear, renewables, efficiency, ARPA-E, and other research.
2/ Includes National Nuclear Security Administration.

Under the balanced allocation scenario, DOE could lose $4.6 billion for R&D over five years, averaging $917.0 million per year. Energy programs could average cuts of $170.7 million per year for R&D, while the Office of Science could average cuts of $334.9 million per year. Due to the higher proportional cuts to defense programs under the BCA caps, NNSA could lose 9.1 percent R&D funding through 2017, compared with 7.6 percent losses for energy science and technology activities. If atomic defense activities were protected and only NDD programs were subject to the sequestration, DOE could lose $5.9 billion over five years, or 10.4 percent of R&D funding under the BCA baseline. Under this scenario, the Office of Science

could lose $3.9 billion over five years, and Energy Programs could lose $2.0 billion over five years. Both totals would represent a 17.5 percent reduction in program funding (see table above).

DOE's R&D budget has experienced steady growth over the past several years. The Office of Science was tabbed for large increases under the America COMPETES Act beginning in 2007, and the department's energy technology and atomic defense programs have risen in profile given the nation's concerns over energy security, climate change, and international terrorism. The balanced sequestration scenario could take DOE's total R&D budget back to roughly FY 2002-2003 levels. More specifically, Energy Programs R&D could return to roughly FY 2008 levels under the balanced allocation scenario, and below FY 2007 levels under the NDD-only scenario. Office of Science R&D could return to roughly FY 2008 levels under balanced sequestration, and roughly FY 2000 levels under NDD-only sequestration. Balanced sequestration would also reduce the atomic defense R&D budget to FY 1998 levels, which would predate the creation of NNSA (see graph at right).



For context, what DOE programs receive funding of an equivalent magnitude to these figures? At the Office of Science, an average cut of $334.9 million under the balanced scenario is somewhat smaller than the total Fusion Energy Sciences program budget, and about even with the Materials Sciences and Engineering division or the Biological Systems Sciences division budgets. This figure is also roughly even to the Administration's combined 2013 funding proposal for most major facility construction projects, such as the international fusion energy project (ITER) and the National Synchotron Light Source-II at Brookhaven Lab. The average cut under the NDD-only scenario, $775.9 million per year, is greater than the total budget for any single program except Basic Energy Sciences, and about even with High-Energy Physics.

Within Energy Programs, an average R&D cut of $170.7 million per year under the balanced scenario is about twice the budget for DOE's Wind Energy program, or about a third of the current Fossil Energy R&D program budget. It is also about two-thirds of ARPA-E's budget, or about one-fifth of the Nuclear Energy program budget. The average cut to Energy Programs under the NDD-only scenario, $395.5 million, is greater than DOE funding for each of solar, wind, biomass, or vehicle efficiency R&D, and a little more than half the budget of the nuclear energy R&D program. With Atomic Defense activities, an average cut of $411.3 million per year under the balanced scenario is greater than the entire budget for the Nonproliferation and Verification R&D program, and about a third of the Naval Reactors program budget.

National Science Foundation

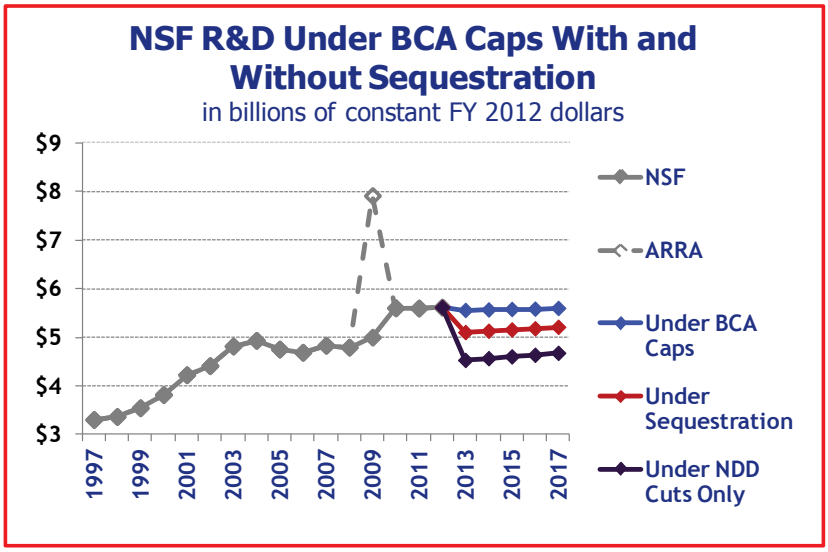
NSF funds research across an array of disciplines and national priority areas, and like DOE's Office of Science has enjoyed steady budgetary growth over the past decade after being slated for increases by the America COMPETES Act. The vast majority of NSF's R&D funding goes to competitively awarded university-based basic research, distributed to university researchers around the country.

Under the balanced sequestration scenario, NSF could lose a total of $2.1 billion or 7.6 percent of R&D funding below the BCA baseline over five years, averaging $421.3 million per year. Under the NDD-only sequestration scenario, NSF could lose $4.9 billion or 17.5 percent of R&D funding below the BCA baseline over five years, averaging $976.0 million per year (see table at right).

National Science Foundation R&D Cuts Under Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total
NSF R&D Budget Cuts						
Under Balanced Sequestration	-456	-438	-421	-404	-388	-2,106
NDD-Only Sequestration	-1,029	-1,002	-975	-949	-924	-4,880

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.
The five-year cuts would amount to 7.6 percent below the baseline under the balanced scenario, and 17.5 percent below the baseline under the nondefense-only scenario.



Cuts of this size could return NSF's R&D budget to roughly FY 2009 levels under a balanced allocation. Under an NDD-only allocation, NSF's R&D budget could shrink to roughly FY 2002-2003 levels (see graph at right).

For context, what NSF programs receive funding of an equivalent magnitude to these figures? The average cut under the balanced scenario, $421.3 million per year, is about equivalent to half the Engineering Directorate budget, roughly two-thirds of the Biological Sciences Directorate budget, or half the size of the Education and Human Resources directorate. It is also an amount equivalent to the agency's spending on polar programs, and larger than the current individual budgets for several cross-agency initiatives, such as the Faculty Early Career Development program, the Graduate Research Fellowship program, or advanced manufacturing or sustainability research funding initiatives. In FY 2012, NSF grants averaged about $161,000 per year, and so $421.3 million could have funded about 2,600 of these in FY 2012. Under the NDD-only scenario, an average cut of $976.0 million per year is larger than the current year budgets for any single directorate except for the large Mathematical and Physical Sciences Directorate.

NASA

NASA's budget has remained roughly flat over the past decade, but the mix of funding has changed in that time. With the Space Shuttle retirement and need to develop next-generation spaceflight capability, funding has increased substantially in the Exploration Systems mission area, while funding for Space Operations (which includes both the Space Shuttle and the International Space Station) has declined. Meanwhile, both the Science and Aeronautics mission areas have declined to their present points.

Under the balanced allocation scenario, NASA's R&D budget could be reduced by a total of $3.5 billion or 7.6 percent below the BCA baseline over the next five years across all accounts, averaging $705.3 million per year. As the largest accounts, the Science and Exploration Systems missions would stand to lose the most, averaging cuts of $246.6 million and $256.7 million per year, respectively. Under the NDD-only allocation scenario, NASA's R&D budget could lose $8.2 billion or 17.5 percent below the BCA baseline over

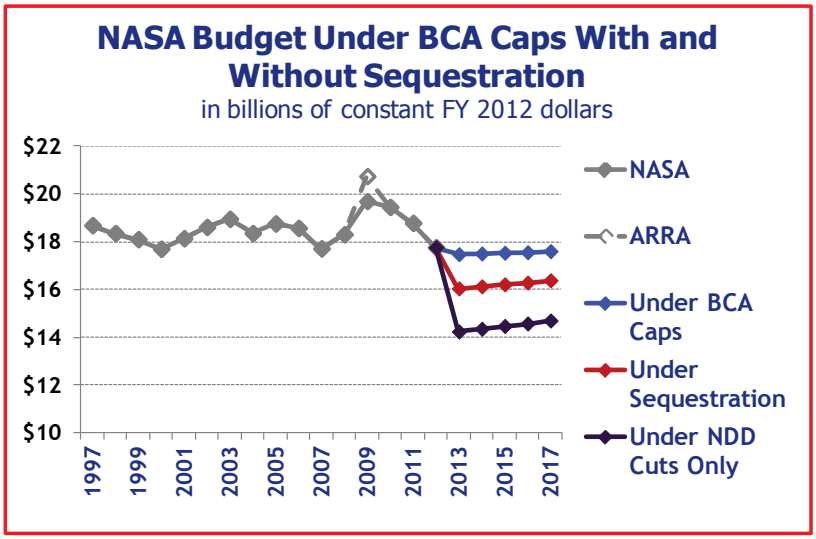
the next five years, averaging $1.6 billion per year. The Science and Exploration Systems mission areas could average annual losses through 2017 of $571.3 million and $594.7 million, respectively (see table at right).

NASA has changed budget structures and accounting methods over the past several years, making apples-to-apples comparisons of historical R&D budgets difficult. However, using OMB's estimates of NASA's *total* discretionary budget as the baseline, the balanced allocation scenario would return NASA's budget to roughly FY 1988 levels. The NDD-only allocation scenario would return NASA's budget to roughly FY 1983 levels.

NASA R&D Cuts Under Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total
Balanced Scenario						
NASA	-763	-733	-704	-676	-650	-3,527
Science	*-267*	*-256*	*-246*	*-236*	*-227*	*-1,233*
Space Ops	*-138*	*-133*	*-128*	*-123*	*-118*	*-639*
Aeronautics	*-38*	*-37*	*-35*	*-34*	*-33*	*-177*
Exploration Systems	*-278*	*-267*	*-256*	*-246*	*-237*	*-1,284*
Other	*-42*	*-40*	*-39*	*-37*	*-36*	*-194*
NDD-Only Scenario						
NASA	-1723	-1678	-1633	-1589	-1546	-8,170
Science	*-603*	*-587*	*-571*	*-555*	*-541*	*-2,856*
Space Ops	*-312*	*-304*	*-296*	*-288*	*-280*	*-1,480*
Aeronautics	*-87*	*-84*	*-82*	*-80*	*-78*	*-411*
Exploration Systems	*-627*	*-611*	*-594*	*-578*	*-563*	*-2,974*
Other	*-95*	*-92*	*-90*	*-87*	*-85*	*-449*

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.
The five-year cuts would amount to 7.6 percent below the baseline under the balanced scenario, and 17.5 percent below the baseline under the nondefense-only scenario.



For context, what NASA programs receive funding of an equivalent magnitude to these figures? An average cut of $703.5 million per year under the balanced scenario is more than the James Webb Space Telescope budget in FY 2012, nearly half of the current Earth Sciences budget, and more than the entire Mars Exploration program budget. It is also a greater figure than the total budget for Aeronautics Research, and nearly as large as the Space Flight and Support account, which includes funding for the Florida-based Space Launch Complex. Under the NDD-only scenario, an average cut of $1.6 billion is larger than any single science mission program budget except Earth Science, and more than twice the Astrophysics or Heliophysics budgets. It is a greater level of funding than what NASA spends on either Multi-Purpose Crew Vehicle or Space Launch System heavy-lift launch vehicle development.

U.S. Department of Agriculture

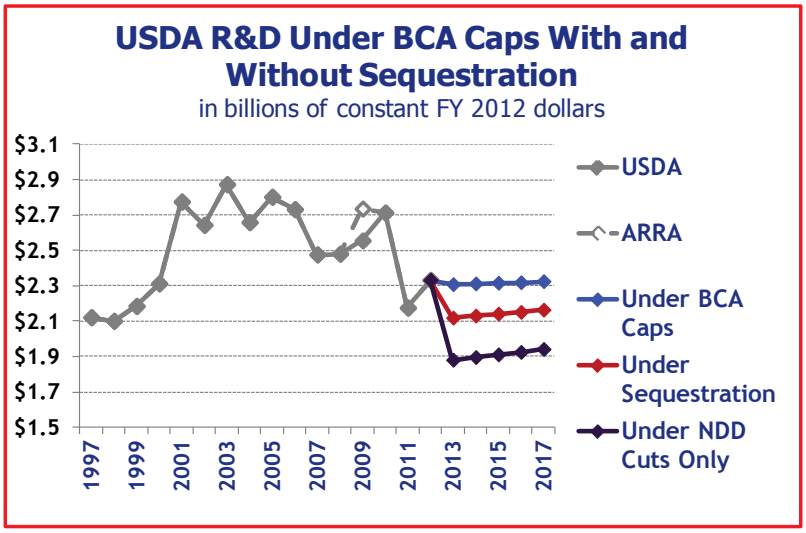
USDA's research, which covers a variety of diverse areas including crop and livestock productivity, food safety, conservation and sustainability, biotechnology, bioenergy, biodefense, and nutrition and health, is divided between intramural and extramural research. Intramural research is carried out by the Agricultural Research Service (ARS), with over 100 facilities and research centers in nearly every state. Extramural research is funded by the National Institute of Food and Agriculture (NIFA), through competitive and formula grants to universities, state research stations, and other entities.

Under the balanced allocation scenario, USDA R&D funding could be reduced by $874.6 million or 7.6 percent below the BCA baseline over five years, averaging $174.9 million per year. Under this scenario, ARS could receive average annual cuts of $84.5 million in R&D funding, while NIFA could receive average annual cuts of $53.3 million through 2017. Under the NDD-only scenario, USDA R&D could be reduced by $2.0 billion or 17.5 percent below the BCA baseline over five years, averaging $405.2 million per year. Under the NDD scenario, ARS could be subject to average annual cuts of $195.8 million, while NIFA could be subject to average annual cuts of $123.4 million (see table at right).

U.S. Department of Agriculture R&D Cuts Under Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total
Balanced Scenario						
USDA	-189	-182	-175	-168	-161	-874.6
Agr Research Service	*-91*	*-88*	*-84*	*-81*	*-78*	*-422*
Natl Inst of Food and Agr	*-58*	*-55*	*-53*	*-51*	*-49*	*-266*
Forest Service	*-27*	*-26*	*-25*	*-24*	*-23*	*-125*
Other	*-13*	*-13*	*-12*	*-12*	*-11*	*-60*
NDD-Only Scenario						
USDA	-427	-416	-405	-394	-384	-2,026
Agr Research Service	*-206*	*-201*	*-196*	*-190*	*-185*	*-979*
Natl Inst of Food and Agr	*-130*	*-127*	*-123*	*-120*	*-117*	*-617*
Forest Service	*-61*	*-60*	*-58*	*-56*	*-55*	*-290*
Other	*-30*	*-29*	*-28*	*-27*	*-26*	*-140*

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.
The five-year cuts would amount to 7.6 percent below the baseline under the balanced scenario, and 17.5 percent below the baseline under the nondefense-only scenario.



Under the balanced sequestration scenario, USDA's R&D budget could shrink to roughly FY 1998 levels. Under the NDD-only sequestration scenario, USDA R&D would reach its lowest point since roughly FY 1989 (see graph at right).

For context, what USDA programs receive funding of an equivalent magnitude to these figures? An average cut of $174.9 million per year under the balanced scenario is equivalent to two-thirds the budget of the Agriculture and Food Research Initiative (AFRI), a key extramural competitive research program. It is also about two-thirds the amount provided under the Hatch Act formula funding, which funds research at State Agricultural Experiment Stations, based primarily at land-grant universities in each state. Under the NDD-only scenario, an average cut of $405.2 million is larger than the amount of R&D performed by the Forest Service. It is equivalent to more than a third of current R&D funding provided by the ARS, and nearly two-thirds of R&D funding provided by NIFA.

Impacts on Federal Funding By State

To further illustrate what might happen under the two sequestration scenarios, estimates follow for funding impacts on each state and the District of Columbia. Every state receives some form of federal research funding, though some far more than others, given variations in size, resources, university systems, and local investments in innovation and research capacity. Further, there is wide variety in funding by agency.

To develop a baseline, we start with the five-year agency R&D estimates we estimated earlier under the BCA discretionary cap growth rates. NSF's National Center for Science and Engineering Statistics reports

historical agency funding data broken down by state. We can use this data from FY 2003 to FY 2008 (leaving out FY 2009, the most recent year for which data are available, to avoid distortion from Recovery Act funding) to develop averages, and apply these averages to agency estimates through FY 2017. This provides a working baseline. We can then apply these averages to the lower spending levels under a balanced allocation sequestration to estimate what might happen.

The reader should note that we are refraining from attempting state-level estimates under the NDD-only scenario, due in part to the complex nature of DOE funding. More than a third of DOE's R&D funding falls under the defense category, and thus would not be touched under the NDD-only scenario. However, the state distribution of DOE's defense and nondefense R&D can vary widely, and while general appropriations data are available, exact R&D data are not. For instance, New Mexico will receive approximately $4.5 billion in DOE funding in FY 2012, the vast majority of which is related to atomic weapons activities at the two major labs there, Los Alamos and Sandia. On the other hand, states like Idaho, Illinois, and Colorado will receive billion-dollar funding allocations, but with a much greater focus on nondefense functions like nuclear and renewable energy or fundamental science. Different sequestration scenarios would impact these states in very different ways, and small changes in the estimates can have big impacts for any individual state, but without accurate defense/nondefense R&D funding data, estimation becomes difficult. Thus, we focus specifically on balanced sequestration in the next section.

Results. Under the balanced sequestration scenario, $57.4 billion of the $57.5 billion in R&D cuts below the baseline would be allocated to the states through FY 2017, with the remaining cuts coming from territories, outlying areas, and overseas offices. The table at right shows the top 20 states ranked by size of lost federal R&D through 2017; see Table 4 in the Appendix for the full list.

Top 20 States by Lost Federal R&D
Five-year total reductions due to sequestration, in millions of constant 2012 dollars.

State	Total	Percent Below Baseline
California	-11,315	-8.5%
Maryland	-5,440	-8.1%
Virginia	-4,256	-8.8%
Massachusetts	-3,140	-8.4%
District of Columbia	-2,877	-8.6%
Texas	-2,822	-8.6%
New York	-2,401	-8.2%
New Mexico	-1,880	-8.4%
Pennsylvania	-1,754	-8.2%
Washington	-1,661	-8.5%
Florida	-1,566	-8.7%
Alabama	-1,439	-8.7%
Ohio	-1,434	-8.5%
Arizona	-1,337	-8.8%
Colorado	-1,157	-8.1%
New Jersey	-1,142	-8.7%
Connecticut	-1,054	-8.7%
Missouri	-1,039	-8.6%
Illinois	-1,015	-8.0%
Georgia	-907	-8.4%

A keen-eyed observer will note that the percentage reductions within this list vary within a small range, from a low of 8.0 percent for Illinois to a high of 8.8 percent for Arizona and Virginia. This is unsurprising, given that under a balanced scenario, defense R&D could be reduced by a greater proportional share than nondefense R&D. Thus, states with a higher share of defense R&D would expect to receive a higher proportional reduction under this scenario, while states that receive more nondefense R&D funding might expect smaller proportional cuts.

California tops the list, given its enormous size, its large university system, and its status as the largest recipient of federal R&D. DOD also maintains an extensive presence throughout the state: California would lose $7.3 billion in R&D funding from DOD alone. Other prominent federal research centers include DOE's Lawrence Berkeley and Lawrence Livermore national labs and the SLAC National Accelerator Laboratory at Stanford, and NASA's Ames Research Center, Dryden Flight Research Center, and the Jet Propulsion Laboratory.

Generally speaking, DOD R&D reductions would account for the largest share of cuts for most states on this list. While Maryland is a major recipient of DOD research funding, cuts to NIH R&D would account for the greatest share of its $5.4 billion reduction in federal R&D funding. Reductions in NASA R&D would also

contribute a large share given in part the presence of Goddard Space Flight Center, as would cuts to the Department of Commerce (primarily the National Institute of Standards and Technology and the National Oceanic and Atmospheric Administration). In contrast, reductions in federal R&D for Maryland's neighbor Virginia are almost entirely due to DOD-related cuts, given the prominence of both the military and military contractors in the state. The District of Columbia is in much the same boat.

As one of the more innovative regions in the country with strong universities, Massachusetts would be disproportionately impacted by both NIH and NSF funding reductions, as would New York. The Empire State is also home to Brookhaven National Lab, a major performer of fundamental science research. New Mexico is somewhat unique given the presence of Sandia and Los Alamos national labs, described above. Because of these facilities, DOE R&D cuts might be larger here than anywhere else. Illinois' profile is also somewhat unique, given low levels of DOD funding relative to other agencies like NSF and the presence of Argonne National Laboratory and Fermilab. Otherwise, expected cuts to DOD and NIH would be the main drivers of R&D reductions in most other states on the list.

The Cuts in Context

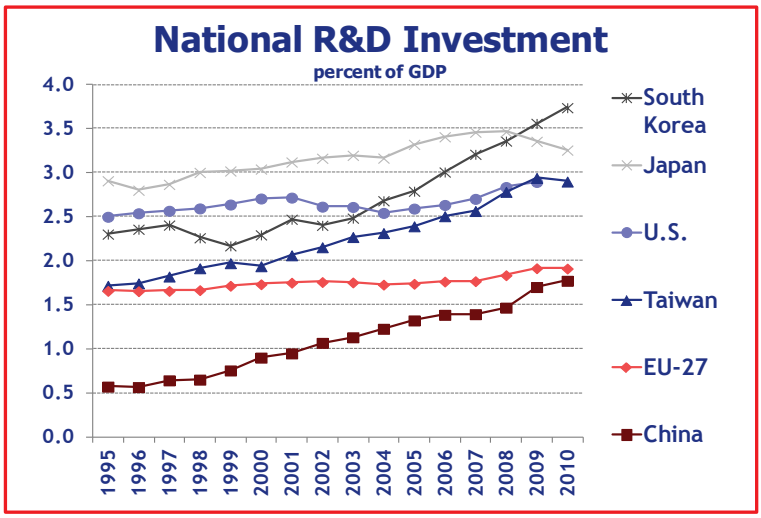
Even without the sequestration, the discretionary spending caps have reduced expected future spending by $1 trillion, and have begun to depress federal spending, including R&D. Between FY 2011 and FY 2012 – the first year the caps were put in place – federal R&D declined by 4.4 percent, adjusted for inflation. This was primarily driven by a decline in defense R&D – especially for weapons development – but nondefense R&D also declined slightly, by .8 percent. These declines followed a 5.4 percent overall cut between FY 2010 to FY 2011, and a 4.5 percent cut to nondefense R&D. In FY 2012, estimated federal funding for R&D is at its lowest point since 2002, adjusted for inflation.

In the regular appropriations cycle, aggregate federal expenditures for R&D have remained largely flat for the past decade. There is of course one major exception to this pattern: federal R&D funding in the American Recovery and Reinvestment Act. This funding amounted to $19.6 billion for R&D in inflation-adjusted dollars for FY 2009, though of course it was paid out over a multiyear period. Roughly half of this amount went to NIH, while DOE, NSF, and the National Oceanic and Atmospheric Administration received most of the rest. The additional R&D funding provided by the Recovery Act is equal to slightly less than two years' worth of estimated cuts under balanced sequestration. Stated differently, over five years, estimated R&D cuts under sequestration would amount to roughly three times the Recovery Act R&D funding amount.

As regular appropriations for R&D funding have either remained flat or declined for most of the past decade, federal R&D as a share of the economy has also declined – partly because the economy has simply grown faster, but more recently due to the decline of actual dollars. As a share of the economy, federal R&D is 16.7 percent smaller than it was a decade ago, and 29.7 percent smaller than it was in the 1970s. Massive growth of the NIH budget in the late 1990s and early 2000s helped to slow this decline. At the same time, private sector R&D has grown significantly, in large part supplanting public R&D.

In one sense, we should consider private-sector R&D growth a good thing: an innovative economy requires the dynamic creation and application of knowledge, and R&D investment is one of the primary contributors to that function, wherever it may originate. As such, private R&D is a vital component of the national innovation ecosystem. But at the same time, it is important to remember that three-quarters of private R&D is focused on latter-stage product development oriented towards nearer-term rewards, whereas public R&D – especially nondefense R&D – is far more focused on basic and applied research, which necessarily requires longer-term investments and higher tolerance for risk and uncertainty, and a willingness to accept knowledge spillovers. Federal funding is a central lifeline for fundamental research at the cutting edge of every key knowledge area. Reduced public R&D means fewer investments in the pursuit of fundamental

knowledge and ways to apply it. Such a move would run counter to the advice of major experts and bodies as diverse as the National Academies and the Bowles-Simpson deficit reduction commission.[xiii]



Further, such declines in public research spending would come at a time in which other nations are looking to ramp up their own investments in innovation. A common measure for comparing international competitiveness is research intensity, or research investment as a percentage of GDP. In recent years, Asian tigers like South Korea, Taiwan, and China, along with select European economies like Germany and Finland, have managed to increase their research intensities substantially – and at a far faster pace than the United States, albeit from a less research-intensive base. In 2010, as part of the Europe 2020 strategy, the EU set a goal of attaining an EU-wide R&D intensity of 3 percent by 2020; President Obama has set the same target in the U.S. As of 2009, U.S. R&D intensity stood at 2.9 percent. Enacting near-term reductions of 8.4 percent does not have quite the same impact on total R&D intensity as it once did, given the rise in industrial R&D, but public R&D remains a quarter of the national total, and such cuts would undoubtedly set the nation against the trends seen elsewhere.

Acknowledgements

Kelly Anderson, Kavya Devarakonda, and Sara Spizzirri contributed to this report. Thanks to staff at the Association of American Universities and to William Bonvillian for review and feedback. Any errors are the author's alone.

[i] Why does the nondefense-only estimate not match the balanced estimate? The primary point of divergence between the two is the fact that we assumed a portion of any additional nondefense cuts would come from nondefense mandatory funding, in accord with OMB's Sequestration Transparency Act report. This funding contains little R&D, and thus is not reflected in reduction estimates. Removing this assumption increases the size of the estimated R&D cut under the nondefense scenario, closing most of the gap.

[ii] Per OMB's September 14 sequestration report: http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/stareport.pdf

[iii] See http://budget.house.gov/fy2013prosperity/; see also, "Paul Ryan's Fiscal Year 2013 Budget: The Details," Bipartisan Policy Center, March 21, 2012. http://bipartisanpolicy.org/blog/2012/03/paul-ryan%E2%80%99s-fiscal-year-2013-budget-details

[iv] For instance, "National Security and Job Protection Act" (HR 6365), http://hdl.loc.gov/loc.uscongress/legislation.112hr6365

[v] See AAAS historical tables, http://www.aaas.org/spp/rd/guihist.shtml

[vi] Available at http://www.aaas.org/spp/rd/fy2013/total13c.pdf

[vii] Congressional Budget Office, "Estimated Impact of Automatic Budget Enforcement Procedures Specified in the Budget Control Act," September 12, 2011, http://www.cbo.gov/sites/default/files/cbofiles/attachments/09-12-BudgetControlAct.pdf

[viii] The percentage reduction figures over five years are less than those projected for FY 2013 alone because, as stated, the proportion of annual funding cuts is expected to decline relative to the BCA caps over time.
[ix] See AAAS Report XXXVII: R&D in FY 2013, Chapter 7, http://www.aaas.org/spp/rd/rdreport2013/13pch07.pdf
[x] *Under Threat: Sequestration's Impact on Nondefense Jobs and Services*, Sen. Harkin (D-IA), http://harkin.senate.gov/documents/pdf/500ff3554f9ba.pdf
[xi] Letter from HHS Assistant Secretary for Financial Resources Ellen Murray to Rep. Ed Markey (D-MA), June 29, 2012, http://markey.house.gov/sites/markey.house.gov/files/documents/HHS%20response%20on%20sequester%20cuts.pdf
[xii] For a list of these, see http://publichealthfunding.org/index.php/ndd_united1/impact_examples_health/
[xiii] National Academies, *Rising Above the Gathering Storm, http://www.nap.edu/catalog.php?record_id=11463*; National Commission on Fiscal Responsibility and Reform, http://www.fiscalcommission.gov/news/moment-truth-report-national-commission-fiscal-responsibility-and-reform

APPENDIX

Table 1: Estimated R&D Funding Under the BCA Caps, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total	Average Annual Growth
Dept. of Defense	73,704	73,862	73,869	73,974	74,298	369,707	0.2%
HHS	30,825	30,881	30,933	30,971	31,052	154,661	0.2%
National Institutes of Health	*29,739*	*29,793*	*29,843*	*29,880*	*29,959*	*149,213*	*0.2%*
DOE	11,191	11,213	11,224	11,239	11,276	56,143	0.2%
Energy Programs	*2,252*	*2,256*	*2,260*	*2,262*	*2,268*	*11,298*	*0.2%*
Office of Science	*4,417*	*4,425*	*4,433*	*4,438*	*4,450*	*22,164*	*0.2%*
Atomic Defense	*4,522*	*4,531*	*4,532*	*4,538*	*4,558*	*22,681*	*0.2%*
NSF	5,557	5,567	5,576	5,583	5,598	27,880	0.2%
NASA	9,303	9,320	9,336	9,347	9,372	46,677	0.2%
Science	*3,252*	*3,258*	*3,264*	*3,268*	*3,276*	*16,319*	*0.2%*
Aeronautics	*468*	*469*	*470*	*470*	*472*	*2,349*	*0.2%*
Space Ops	*1,686*	*1,689*	*1,692*	*1,694*	*1,698*	*8,457*	*0.2%*
Exploration Systems	*3,386*	*3,392*	*3,398*	*3,402*	*3,411*	*16,989*	*0.2%*
Space Technology	*382*	*383*	*383*	*384*	*385*	*1,917*	*0.2%*
USDA	2,307	2,311	2,315	2,318	2,324	11,576	0.2%
Agr Research Service	*1,115*	*1,117*	*1,118*	*1,120*	*1,123*	*5,592*	*0.2%*
National Inst of Food and Agr	*703*	*704*	*705*	*706*	*708*	*3,526*	*0.2%*
Forest Service	*331*	*331*	*332*	*332*	*333*	*1,659*	*0.2%*
Commerce	*1,250*	*1,252*	*1,254*	*1,256*	*1,259*	6,272	0.2%
NIST	*549*	*550*	*551*	*552*	*553*	*2,756*	*0.2%*
NOAA	*575*	*576*	*577*	*578*	*579*	*2,885*	*0.2%*
Interior	*788*	*789*	*791*	*792*	*794*	3,953	0.2%
US Geological Survey	*668*	*669*	*670*	*671*	*673*	*3,352*	*0.2%*
EPA	562	563	564	565	566	2,821	0.2%
Veterans	1,152	1,154	1,156	1,158	1,161	5,781	0.2%
DHS	611	612	613	614	615	3,064	0.2%
Total R&D	**137,250**	**137,524**	**137,631**	**137,815**	**138,316**	**688,536**	**0.2%**
Defense	78,225	78,393	78,401	78,513	78,857	392,388	0.2%
Nondefense	59,024	59,130	59,230	59,303	59,459	296,147	0.2%

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.

Table 2: Estimated R&D Cuts Under the Sequestration, FY 2013-2017

(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total Cut	5-Year Percent Cut
Dept. of Defense	-6,928	-6,818	-6,696	-6,585	-6,495	-33,524	-9.1%
HHS	-2,528	-2,429	-2,333	-2,241	-2,155	-11,685	-7.6%
National Institutes of Health	*-2,439*	*-2,343*	*-2,251*	*-2,162*	*-2,079*	*-11,274*	*-7.6%*
DOE	-972	-944	-916	-889	-865	-4,585	-8.2%
Energy Programs	*-185*	*-177*	*-170*	*-164*	*-157*	*-854*	*-7.6%*
Office of Science	*-362*	*-348*	*-334*	*-321*	*-309*	*-1,675*	*-7.6%*
Atomic Defense	*-425*	*-418*	*-411*	*-404*	*-398*	*-2,057*	*-9.1%*
NSF	-456	-438	-421	-404	-388	-2,106	-7.6%
NASA	-763	-733	-704	-676	-650	-3,527	-7.6%
Science	*-267*	*-256*	*-246*	*-236*	*-227*	*-1,233*	*-7.6%*
Aeronautics	*-38*	*-37*	*-35*	*-34*	*-33*	*-177*	*-7.6%*
Space Ops	*-138*	*-133*	*-128*	*-123*	*-118*	*-639*	*-7.6%*
Exploration Systems	*-278*	*-267*	*-256*	*-246*	*-237*	*-1,284*	*-7.6%*
Space Technology	*-31*	*-30*	*-29*	*-28*	*-27*	*-145*	*-7.6%*
USDA	-189	-182	-175	-168	-161	-874.6	-7.6%
Agr Research Service	*-91*	*-88*	*-84*	*-81*	*-78*	*-422.5*	*-7.6%*
Nat Institute of Food and Agr	*-58*	*-55*	*-53*	*-51*	*-49*	*-266.4*	*-7.6%*
Forest Service	*-27*	*-26*	*-25*	*-24*	*-23*	*-125.3*	*-7.6%*
Commerce	*-103*	*-98*	*-95*	*-91*	*-87*	-474	-7.6%
NIST	*-45*	*-43*	*-42*	*-40*	*-38*	*-208*	*-7.6%*
NOAA	*-47*	*-45*	*-44*	*-42*	*-40*	*-218*	*-7.6%*
Interior	*-65*	*-62*	*-60*	*-57*	*-55*	-299	-7.6%
US Geological Survey	*-55*	*-53*	*-51*	*-49*	*-47*	*-253*	*-7.6%*
EPA	-46	-44	-43	-41	-39	-213	-7.6%
Veterans	0	0	0	0	0	0	0.0%
DHS	-50	-48	-46	-44	-43	-232	-7.6%
Total R&D Cut	**-12,099**	**-11,796**	**-11,488**	**-11,196**	**-10,939**	**-57,519**	**-8.4%**
Defense	-7,353	-7,237	-7,107	-6,989	-6,894	-35,580	-9.1%
Nondefense	-4,746	-4,560	-4,381	-4,207	-4,046	-21,938	-7.4%

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.

Table 3: Estimated R&D Cuts Under Nondefense-Only Sequestration, FY 2013-2017
(budget authority in millions of constant 2012 dollars)

	2013	2014	2015	2016	2017	Total Cut	5-Year Percent Cut
Dept. of Defense	0	0	0	0	0	0	0.0%
HHS	-5,711	-5,561	-5,411	-5,264	-5,124	-27,070	-17.5%
National Institutes of Health	*-5,509*	*-5,365*	*-5,220*	*-5,078*	*-4,944*	*-26,116*	*-17.5%*
DOE	-1,236	-1,203	-1,171	-1,139	-1,109	-5,857	-10.4%
Energy Programs	*-417*	*-406*	*-395*	*-385*	*-374*	*-1,977*	*-17.5%*
Office of Science	*-818*	*-797*	*-775*	*-754*	*-734*	*-3,879*	*-17.5%*
Atomic Defense	*0*	*0*	*0*	*0*	*0*	*0*	*0.0%*
NSF	-1,029	-1,002	-975	-949	-924	-4,880	-17.5%
NASA	-1,723	-1,678	-1,633	-1,589	-1,546	-8,170	-17.5%
Science	*-603*	*-587*	*-571*	*-555*	*-541*	*-2,856*	*-17.5%*
Aeronautics	*-87*	*-84*	*-82*	*-80*	*-78*	*-411*	*-17.5%*
Space Ops	*-312*	*-304*	*-296*	*-288*	*-280*	*-1,480*	*-17.5%*
Exploration Systems	*-627*	*-611*	*-594*	*-578*	*-563*	*-2,974*	*-17.5%*
Space Technology	*-71*	*-69*	*-67*	*-65*	*-64*	*-336*	*-17.5%*
USDA	-427	-416	-405	-394	-384	-2,026	-17.5%
Agr Research Service	*-206*	*-201*	*-196*	*-190*	*-185*	*-979*	*-17.5%*
Nat Institute of Food and Agr	*-130*	*-127*	*-123*	*-120*	*-117*	*-617*	*-17.5%*
Forest Service	*-61*	*-60*	*-58*	*-56*	*-55*	*-290*	*-17.5%*
Commerce	*-232*	*-226*	*-219*	*-213*	*-208*	-1,098	-17.5%
NIST	*-102*	*-99*	*-96*	*-94*	*-91*	*-482*	*-17.5%*
NOAA	*-107*	*-104*	*-101*	*-98*	*-96*	*-505*	*-17.5%*
Interior	*-146*	*-142*	*-138*	*-135*	*-131*	-692	-17.5%
US Geological Survey	*-124*	*-121*	*-117*	*-114*	*-111*	*-587*	*-17.5%*
EPA	-104	-101	-99	-96	-93	-494	-17.5%
Veterans	0	0	0	0	0	0	0.0%
DHS	-113	-110	-107	-104	-102	-536	-17.5%
Total R&D Cut	**-10,721**	**-10,440**	**-10,158**	**-9,882**	**-9,620**	**-50,822**	**-7.4%**
Defense	0	0	0	0	0	0	0.0%
Nondefense	-10,721	-10,440	-10,158	-9,882	-9,620	-50,822	-17.2%

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.

Table 4: Estimated State R&D Cuts Under Sequestration, FY 2013-2017

(Five-year totals expressed as budget authority in millions of constant 2012 dollars)

	DOD	DOE	HHS	DHS	NASA	NSF	DOI	USDA	DOC	EPA	Total	Percent
Alabama	-1,168	-7	-125	-2	-112	-11	-1	-10	-2	0	-1,439	-8.7%
Alaska	-116	-4	-6	0	-4	-15	-12	-10	-10	0	-178	-8.5%
Arizona	-1,114	-5	-73	-5	-47	-73	-6	-12	-1	0	-1,337	-8.8%
Arkansas	-10	-1	-35	0	-1	-5	-1	-15	0	0	-68	-7.8%
California	-7,313	-920	-1,381	-40	-1,205	-339	-39	-51	-22	-5	-11,315	-8.5%
Colorado	-453	-85	-147	-1	-246	-104	-39	-17	-63	-2	-1,157	-8.1%
Connecticut	-803	-16	-191	-5	-9	-22	-1	-4	-3	-1	-1,054	-8.7%
Delaware	-17	-3	-13	0	-5	-10	0	-3	-1	0	-53	-8.0%
District of Columbia	-1,996	-218	-108	-15	-342	-63	-2	-106	-2	-25	-2,877	-8.6%
Florida	-1,216	-10	-158	-2	-59	-58	-14	-24	-18	-6	-1,566	-8.7%
Georgia	-548	-24	-238	-4	-15	-41	-5	-29	-1	-3	-907	-8.4%
Hawaii	-142	-2	-28	0	-9	-15	-4	-12	-7	0	-220	-8.5%
Idaho	-19	-110	-6	-2	-2	-5	-4	-10	-1	0	-158	-8.1%
Illinois	-174	-371	-314	-6	-11	-107	-2	-25	-4	-2	-1,015	-8.0%
Indiana	-127	-12	-88	-1	-6	-43	-2	-8	-1	0	-287	-8.2%
Iowa	-97	-24	-88	0	-5	-17	-1	-27	0	0	-260	-8.1%
Kansas	-77	-6	-36	0	-3	-15	-2	-8	0	0	-147	-8.3%
Kentucky	-27	-3	-61	-1	-2	-9	-1	-7	0	0	-113	-7.9%
Louisiana	-76	-3	-66	0	-7	-13	-8	-20	-1	0	-195	-8.1%
Maine	-68	-1	-32	0	-2	-7	-1	-3	-1	0	-115	-8.4%
Maryland	-2,071	-16	-2,531	-31	-463	-52	-7	-70	-196	-3	-5,440	-8.1%
Massachusetts	-1,843	-60	-956	-11	-90	-143	-6	-11	-15	-4	-3,140	-8.4%
Michigan	-372	-20	-246	0	-10	-67	-3	-11	-7	-3	-739	-8.3%
Minnesota	-238	-6	-191	-1	-6	-32	-2	-16	-1	-7	-500	-8.2%
Mississippi	-329	-2	-19	-1	-15	-6	-3	-37	-5	0	-417	-8.7%
Missouri	-769	-5	-214	0	-9	-24	-5	-14	0	0	-1,039	-8.6%
Montana	-17	-3	-58	0	-5	-9	-4	-11	0	0	-108	-7.8%
Nebraska	-29	-1	-33	0	-1	-10	-1	-14	0	0	-90	-8.0%
Nevada	-58	-145	-10	-1	-6	-7	-2	-1	-1	-7	-239	-8.3%
New Hampshire	-127	-1	-40	-4	-10	-9	0	-4	-8	0	-204	-8.4%
New Jersey	-885	-45	-118	-6	-22	-48	-1	-4	-12	-2	-1,142	-8.7%
New Mexico	-611	-1,150	-50	-20	-23	-14	-4	-5	-2	-1	-1,880	-8.4%
New York	-932	-390	-835	-4	-40	-167	-2	-18	-9	-3	-2,401	-8.2%
North Carolina	-100	-12	-485	-2	-7	-49	-3	-18	-7	-66	-750	-7.7%
North Dakota	-14	-8	-8	0	-2	-3	-2	-14	0	0	-52	-8.0%
Ohio	-919	-20	-304	-6	-91	-40	-1	-11	-2	-38	-1,434	-8.5%
Oklahoma	-103	-6	-36	0	-7	-10	-1	-9	-8	-5	-185	-8.4%
Oregon	-42	-10	-121	0	-5	-26	-7	-21	-3	-8	-244	-7.8%
Pennsylvania	-758	-244	-603	-1	-20	-96	-3	-25	-3	-1	-1,754	-8.2%
Rhode Island	-245	-2	-58	-1	-3	-15	-1	-1	-1	-6	-333	-8.6%
South Carolina	-99	-17	-57	-1	-3	-15	-1	-8	-8	0	-209	-8.3%
South Dakota	-5	0	-8	0	-4	-3	-6	-4	0	0	-31	-7.8%
Tennessee	-150	-290	-180	-14	-90	-18	-3	-11	-1	0	-757	-8.1%
Texas	-2,025	-28	-483	-2	-165	-67	-6	-39	-5	-1	-2,822	-8.6%
Utah	-324	-6	-67	0	-54	-17	-3	-12	0	0	-484	-8.5%
Vermont	-61	-1	-29	0	-1	-4	0	-4	-1	0	-102	-8.4%
Virginia	-3,590	-63	-178	-30	-247	-74	-57	-7	-6	-4	-4,256	-8.8%
Washington	-1,056	-118	-353	-10	-15	-50	-6	-20	-30	-2	-1,661	-8.5%
West Virginia	-83	-64	-18	0	-11	-3	-2	-14	-1	0	-196	-8.3%
Wisconsin	-35	-20	-163	0	-8	-39	-6	-21	-2	-1	-295	-7.7%
Wyoming	-3	-2	-4	0	-1	-5	-2	-4	0	0	-19	-7.8%
Other*	-70	0	-37	0	-1	-10	-1	-13	-1	0	-133	-8.3%
Total R&D Cut	**-33,524**	**-4,585**	**-11,685**	**-232**	**-3,527**	**-2,106**	**-299**	**-875**	**-474**	**-213**	**-57,519**	**-8.4%**

Source: AAAS estimates of R&D, based on CBO and OMB analyses of the Budget Control Act.
Constant dollar conversions based on OMB's GDP deflators from the FY 2013 budget.
*Includes territories, outlying areas, and offices abroad.

American Council on Education
Leadership and Advocacy

The Likely Impact of Sequestration on Higher Education

Recent attention in Washington and throughout the country has focused on the so-called "fiscal cliff." The fiscal cliff was comprised of two major components: the expiration of a number of significant tax incentives, and a massive, across-the-board reduction in federal spending through the budget process known as sequestration. As has been well covered in the media, a last-minute deal to avoid "going over the cliff" was struck after high-stakes negotiations, resulting in the American Taxpayer Relief Act of 2012 (H.R. 8).

The fiscal cliff deal resolved a number of key tax provisions by either making those provisions permanent or extending them for a number of years. On the spending side, it modified the impact of the sequester and delayed its implementation until March 1.

What is less well known is exactly what this deal means for programs of interest to higher education. This paper will review what is happening and the implications for these programs.

First, some brief background on how we got here. Sequestration is simply the name for a scheduled reduction in federal spending by fixed percentages across almost all federal programs (with a number of key exemptions). While the sequestration process has been used by the federal government a number of times in the past, the current spending cuts are the result of a political dispute centered around congressional opposition to raising the federal debt ceiling. In August 2011, that specific dispute was resolved with the passage of the Budget Control Act (or BCA). The BCA established a series of goals the government would need to meet to reduce the federal debt by between $1.2 and $1.5 trillion over 10 years and included the threat of automatic sequestration should those goals not be met.

While a number of goals were met, Congress ultimately failed to produce a comprehensive debt reduction package. As a result, a process combining sequestration in 2013 and restrictions on spending over the subsequent nine years would have been automatically triggered on Jan. 2, 2013. The total debt reduction would have been $1.2 trillion through caps in the discretionary budget levels (fixed annual spending levels known as "spending caps") to reflect total cuts of $600 billion from defense spending and $600 billion from non-defense spending. This works out to reductions of $55 billion from defense and $55 billion from non-defense spending per year (additional savings to be realized from debt service not incurred).

Sequestration was scheduled to occur on Jan. 2, 2013, early in fiscal year (FY) 2013. The process is somewhat complicated, but it works like this. The Office of Management and Budget (OMB) examines the total level of funding needed to meet the mandated amount. OMB then examines the total funding of the programs that will be cut. Finally, OMB determines an overall percentage that each category must be reduced to meet the specified reduction. Prior to the passage of the American Taxpayer Relief Act (also known as "the cliff deal"), OMB determined that discretionary funding (which constitutes the bulk of federal spending that reaches campuses) would have been reduced 8.2 percent. Mandatory spending would need to have been reduced 7.6 percent.

Not all federal programs would be reduced under sequestration. Most notably, almost all of the entitlement programs, which account for the vast majority of all federal spending, would not be cut. In addition, a number of programs have been specifically excluded from the cuts, primarily those serving low-income populations. The exempt program of greatest interest to higher education is the Pell Grant

Program, which provides around $35 billion in need-based grant aid to students annually. The administration has also indicated they will not impose the cuts on current military benefits or veterans' benefits.

As mentioned above, negotiations over the fiscal cliff ultimately produced a compromise bill that dealt with the tax issues while delaying the sequester cuts by two months. It did this by "paying" for the delay, at a cost of $24 billion. This $24 billion reduction was paid for with $12 billion from changes to tax provisions of Roth IRA plans, and the remaining $12 billion was found by changing the spending caps for FY13 and FY14. It reduced the FY13 caps for defense and non-defense spending by $2 billion each, and the FY14 caps for defense and non-defense spending by $4 billion each. The $24 billion reduction means that less money will be cut through sequestration in FY13. Accordingly, the sequester percentage cuts are smaller as well, dropping from 8.2 percent to approximately 5.1 percent for discretionary-funded programs, and 7.6 percent to approximately 5.3 percent for mandatory-funded programs.

How This Impacts Higher Education

For students and institutions, there are two major areas where the impact of sequestration will be felt: research funding and student aid. These two categories are by no means inclusive of all programs with funding implications for higher education, but they do comprise the overwhelming majority of federal funding to campuses. All programs in these areas will be reduced by roughly 5.1 percent under sequestration.

Research Funding

The federal government's support is critical to the pursuit of scientific research and development (R&D) on university campuses. The National Science Foundation (NSF) estimates that in FY11 (the most recent year for which there is data), the federal government provided $40.8 billion to institutions for research and development, which comprises 62.6 percent of all higher education R&D funding. Six federal agencies are responsible for almost all of this support: NSF, the National Institutes of Health, the Department of Defense, the Department of Energy, the Department of Agriculture and the National Aeronautics and Space Administration.

The chart below shows the likely impact of sequestration under H.R. 8 on R&D funding at these agencies. It is important to note that not all of the R&D funding at these agencies goes to campuses, so the cuts do not equal a dollar-for-dollar loss in research support. In addition, it is not entirely clear at this writing how agencies plan to address reduced funding in terms of modifying existing grants or making new grants.

R&D by Agency	FY11 Actual (in millions)	FY12 Estimate (in millions)	Sequester %	Post-HR 8 Level (in millions)	HR 8 Cut (in millions)
Defense (R&D)	$79,112	$74,464	5.1	$70,666	$3,798
S&T (6.1-6.3, incl. medical)	$12,751	$13,530	5.1	$12,840	$690
All Other DOD R&D	$66,361	$60,935	5.1	$57,827	$3,108
Health and Human Services (R&D)	$31,183	$31,143	5.1	$29,555	$1,588
National Institutes of Health	$29,831	$30,046	5.1	$28,514	$1,532
All Other HHS R&D	$1,352	$1,097	5.1	$1,041	$56

Energy (R&D)	$10,673	$11,019	5.1	$10,457	$562
Atomic Energy Defense	$4,081	$4,281	5.1	$4,063	$218
Office of Science	$4,461	$4,463	5.1	$4,235	$228
Energy Programs	$2,131	$2,275	5.1	$2,159	$116
NASA (R&D)	$9,099	$9,399	5.1	$8,920	$479
National Science Foundation (R&D)	$5,494	$5,614	5.1	$5,328	$286
Agriculture (R&D)	$2,135	$2,331	5.1	$2,212	$119
Totals	$137,696	$133,970		$127,138	$6,832

Source: AAAS

Student Aid

Perhaps the most important aspect of sequestration concerns a program that won't be impacted by it. As mentioned above, the Pell Grant Program, which is the largest federal student aid program, is exempt from sequestration. No funding for Pell Grants will be reduced in FY 2013 as a result of sequestration. In addition, recent estimates by the Congressional Budget Office have shown Pell Grants as being fully funded at their maximum award level through FY 2013 as well as the next fiscal year (FY 2014).

For the other student aid programs, the impact is more direct. The chart below demonstrates what the H.R. 8 sequester cuts would mean for program funding. While it is difficult to determine precisely how an individual student will be impacted, the Student Aid Alliance has estimated that for high-need students, sequestration under the terms of H.R. 8 would mean a loss of $765 in academic year 2013-14. In addition, as part of the deal that delayed sequestration until March 1, the FY 2014 spending caps for discretionary funding (the category of funding that covers student aid) were further reduced by $4 billion. This reduction will makes it increasingly difficult for program funding to be increased in future years.

Post-HR 8 Sequester Cuts for Student Aid Programs (in millions)										
Program	**FY12 Funding**	**FY13 CR Adjustment**	**Adjusted Funding Level**	**HR 8 Seq Cut**	**Post-HR 8 Level**	**HR 8 Cut Amt**	**BCA Seq Cut**	**Post-BCA Cut Level**	**BCA Cut**	**Diff. btw cuts**
SEOG	$734	0.612	$738.49	5.1	$701	$38	8.2	$678	$61	$23
FWS	$977	0.612	$982.98	5.1	$933	$50	8.2	$902	$81	$30
TRIO	$840	0.612	$845.14	5.1	$802	$43	8.2	$776	$69	$26
GEAR UP	$302	0.612	$303.85	5.1	$288	$15	8.2	$279	$25	$9
GANN	$31	0.612	$31.19	5.1	$30	$2	8.2	$29	$3	$1
Total						$148			$238	$90

Finally, while interest rates on federally-issued student loans (both PLUS and Stafford) will not be increased under sequestration, and terms of their availability have not changed, student borrowers will see a very modest one-year increase in their loan origination fees. Those changes are detailed below.

Changes in Origination Fees Under Sequester					
Program	**Origination Fee**	**HR 8 Seq %**	**Post HR 8 O-fee**	**BCA Seq. %**	**BCA O-fee**
Stafford Loans	1.00%	5.3	1.053%	7.6	1.076%
PLUS Loans	4.00%	5.3	4.212%	7.6	4.304%

Originally published Jan. 30, 2013

Revised Feb. 7, 2013

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May 28, 2013

Chair Ruth Mulnard
Coordinating Committee on Graduate Affairs (CCGA)

Re: Request to Renew the Interim Individual Graduate Program (IIGP)

Dear Chair Mulnard:

The Graduate and Research Council (GRC) unanimously voted to renew the Interim Individual Graduate Program (IIGP). The IIGP was put in place to incubate disciplinary and interdisciplinary graduate programs at UC Merced. For two years the graduate student population has grown by more than 100 students each year. In addition, this academic year the IIGP program has produced three CCGA graduate program proposals, in Political Science, Interdisciplinary Humanities, and Applied Math.

Further, at least three graduate program proposals are being developed in Physics, Mechanical Engineering, and Electrical Engineering & Computer Science. GRC anticipates that all three proposals will be submitted to CCGA by the end of Spring 2014.

Given the support that the IIGP has provided in successfully growing the graduate programs at UC Merced, GRC requests an extension of the IIGP for AY 2013-2014.

Sincerely,

Valerie Leppert
Chair, Graduate and Research Council

CC: Donald Mastronarde, Vice Chair, Coordinating Committee on Graduate Affairs
Eric Zarate, Senior Policy Analyst, Coordinating Committee on Graduate Affairs
Fredye Harms, Acting Committee Analyst, Coordinating Committee on Graduate Affairs
Tom Peterson, Provost and Executive Vice Chancellor
Annette Garcia, Assistant Chancellor and Chief of Staff
Chris Kello, Acting Dean of the Graduate Division
Laurie Herbrand, University Registrar
Laura Martin, Accreditation Liaison Officer
Peggy O'Day, Chair, Academic Senate
Graduate Research Council