

Faculty Workshop “How to write a Successful NSF CAREER proposal” Notes

Panelists:

Yimon Aye, Chemistry and Chemical Biology
Lionel Levine, Mathematics
Nate Foster, Computer Science
Greg Fuchs, Applied and Engineering Physics
Susan Daniel, Chemical and Biomolecular Engineering
Ankur Singh, Mechanical and Aerospace Engineering
Katie Keranen, Earth and Atmospheric Sciences
Kathryn Dimiduk, McCormick Teaching Excellence Institute
Jamila Walida-Simon, 4H
Jami Joyner, Diversity Programs in Engineering

General CAREER proposal and anecdotal advice:

Greg Fuchs:

- Applied for the CAREER in his second year as an Assistant Professor, and got it awarded on the first try (“by the skin of my teeth!”).
- He had a good idea, but not much preliminary data, however the reviewers brought up this fact in their reviews of his proposal, and he was allowed to respond to them with new preliminary data to strengthen his case for funding.

Nate Foster:

- Applied for the CAREER in his second year here. Had initially planned to apply earlier, but pulled the plug, as he didn’t feel ready.
- Instead, he applied for another NSF large grant in his first year as Assistant Professor, and was funded. However, this made it more difficult to come up with a second large project to use for the CAREER proposal, and so he went with a project he started when he was in grad school. It’s a challenge to find a project ambitious enough for CAREER.
- The proposal was “not the best idea”, but in the writing process, tried to make it the best it could be.

Yimon Aye:

- She submitted her CAREER in her first year here, and was awarded it.
- Her work in at the interface of Chemistry and Biology, therefore she had to decide the best directorate to apply to for the CAREER- MPS for more chemistry-related, or MBG for more biology-related project.

Lionel Levine:

- Did not apply for CAREER immediately, as he had an NSF grant that carried over from his postdoc and wanted to wait for that to finish.

Proposal preparation advice:

- Use previous successful proposals as your guide. These can be extremely diverse in terms of approach, so read as many of them as you can get your hands on. Ask colleagues, or go to the NSF website and search for the summary and abstracts of previous successful proposals from your field.
- Decide which directorate to send your proposal to- for example, if you are on the cusp of two different directorates.
- Talk with the program manager early in your planning process. They love to talk about your ideas (generally). Nate's program manager brought him down to NSF for a panel review. If you are in DC, arrange to meet with them.
- Should be based on fundamental science, avoid words like "disease, cancer, etc.", especially if you're targeting MPS
- Preliminary data is great, but not absolutely necessary.
- Expect that your proposal might go one or two rounds before being funded.
- The one page summary is key for the panel to determine what you are doing and if it is right for the directorate. Make sure you go to the right directorate and division.
- Risky vs Safe- go for high innovation.
- Should be a broader proposal than a standard grant. Will be read by more generalists. Tell a story about where you want to be in ten years, with big, over-arching goals.
- Focus on things that can be illustrated well- i.e. choose math theorem that can be illustrated well with graphics.
- The words that you use are important, be proud of your accomplishments, use positive language and don't downplay your work.
- Panelists write summaries on all the proposals they review
- Help the panelists by highlighting the review criteria by which they will be evaluating your proposal – e.g. use phrases like, "This work is innovative because..."
- Chair's letter is VERY important- should show support for the PI, support for the project and support for the outreach efforts.

Review criteria and process:

- Depending on the directorate/division, Program manager may have no say in the winners, but will have lots of advice for applicants. Sometimes the program manager may be able to decide between the top applicants, or fund those on the last try that really need funding.
 - The review panel is made up of people connected to the program, is recruited by the program manager, and they will read, scour and discuss the proposals.
 - Some mail in reviewers may be used who are experts in the field.
 - Proposals will be ranked. Reviewers summarize the proposal they reviewed.
 - Review panel likes to see that you are making use of the NSF-funded resources/centers already at your disposal at Cornell for both outreach and science components.
 - Recommend that you suggest reviewers so that your proposal can get into the right hands.
A good number of CAREER panel reviewers tend to be more established names in the field compared to regular NSF proposal reviewers
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Outreach Component:

- The Outreach component of the proposal is very important. It won't get the proposal funded on its own, but a bad one will certainly kill a proposal.
- This has to be more than just setting up a new class and teaching it. Should be going above and beyond your normal activities as faculty. Should add value to the proposal.
- Very varied budget devoted to outreach- will depend upon the proposed work undertaken and how many resources already in place. Can be \$500-\$50,000 in budget.

Ankur Singh:

- Had three educational objectives
- Worked with Cornell Center for Materials Research (CCMR), they already had connections with teachers and school districts- helped him build a program where he brought in teachers and students.
- Specifically targeted areas of need- rural areas- and did a one day workshop with teachers and students. Educate teachers about interactive learning and how to bring some of those experiences into the classroom. Highlight the benefits.
- He contacted the program officer and got feedback on his outreach idea. Be clear about expectations, but don't propose something impossible- you won't change the curriculum of NYS.
- Reciprocal learning and mentoring- Won't have the resources to bring in the teachers, leverage resources from other areas. He used training from NYSTEM who were already bringing the teachers in- used the same teachers. Use grad students to help with the educational component.
- Leverage existing programs at Cornell. Make reviewers believe what you're proposing is possible.
- Add a figure to show resources leveraged, people affected and who is doing the work.

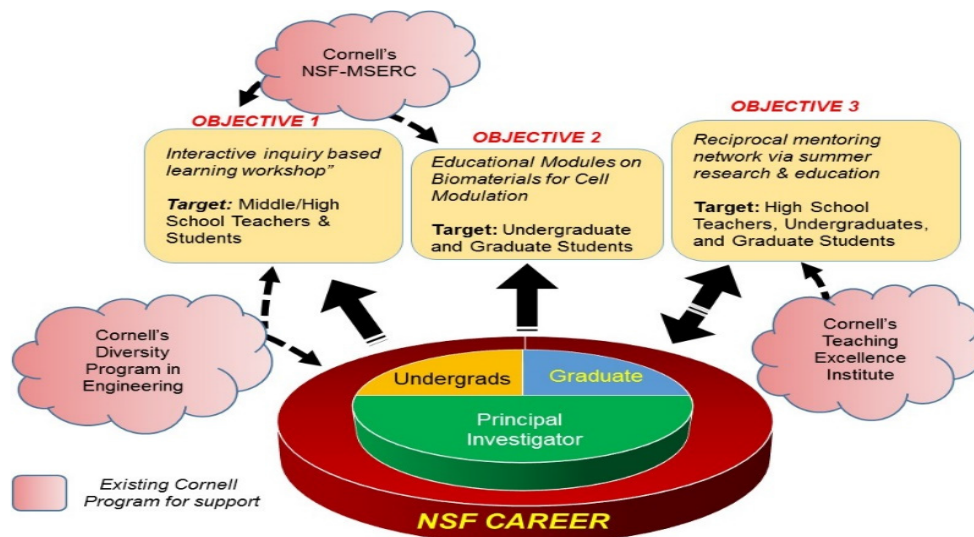


Figure 15. Schematic representing 3 education and outreach objectives of the CAREER proposal. Clouds represent collaborating outreach programs at Cornell.

- Evaluation of outreach should include formative and summative evaluations for each objective.
- Outreach is not a short term objective, should have long term goals, establish your outreach over the long term. Very little money set aside for outreach, so be realistic.

Susan Daniel:

- If you set up the outreach component of your CAREER proposal well, you can leverage it in all future proposals.
- Approach the outreach in a scholarly way. Format mirrored the research proposal outline- hypothesis about what she wanted to accomplish, Track record, Research approach, Educational approach (assessment piece), Expected outcomes – including an alternative approach if things don't go as expected. Integrate it with your research. Should have a complementary figure in the outreach section.

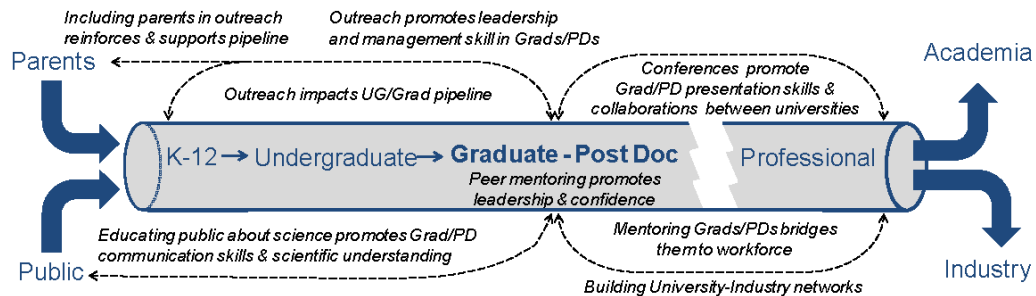


Figure 10.1. The break in the “pipeline” that limits the number of women filling top professional ranks is summarized in this cartoon, which captures the various aspects of the graduate-post doctoral professional development program that will be developed during this proposal. The dashed arrows show how the proposal objectives impact the graduates and post docs as well as link with other parts of the pipeline to strengthen it.

Reproduced with permission from S. Daniel

- Included outreach collaborator letters, one from Kathy Dimiduk etc.
- The proposal is about research you are starting that will span your career, same should be said for the outreach too.
- Approach was to get more women involved in STEM- put together a women’s professional development group in her department, cited some statistics about numbers of women in science, in department, in graduate school etc. Bring 10th grade girls and their families from outside of Ithaca to the lab to try research.
- Can use in every grant- tailor the outreach to the type of grant she is writing- she has proposed modules on virus infection, surface tension etc. Whatever the theme of the grant, she can integrate this into the Broader Impacts section.
- Be sure to leverage grad students in this section- it’s great for the grant because they’re already paid for, and it’s a great way for them to dovetail with their NSF fellowship applications.
- Some of the travel funds were used to send students to do educational activities or disseminate results.

Katie Keranen:

- It is important that the outreach section of the proposal is scientific in its approach.

- Make sure that the outreach is something you are passionate about.
 - In her proposal, Katie outlined outreach for stakeholders in rural areas impacted by induced seismicity. These included homeowners, media and regulators. Kathy Dimiduk helped to structure the outreach into different stakeholders affected.
 - In collaboration with the Energy institute at Cornell and the Cornell survey research institute to survey what people already know, educate them in various ways, and then survey them again after 3 years. Used Facebook and other social media.
 - Developed metrics and tested the hypothesis for the outreach component. Evaluated the outreach. Used social science at Cornell to aid the program.
 - She used prior literature on risk communication, did a lot of research before writing this section. Integrated these ideas throughout the proposal.
 - She had discussed her outreach activities with the program officer prior to submitting.
 - Had a \$50,000 outreach budget- large amount of the budget, but was required for the scope of the outreach project.
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Resources available at Cornell University

Jami Joyner:

- There are several key programs to engage faculty
- High School Summer Academies- Curie (high school women) and Catalyst (high school URM and 1st generation)
- About 50 students per session
- Engage in field sessions with faculty from Engineering- diverse field sessions help to broaden horizons of high school aged students. 9 different sessions per program, ask faculty to lead them.
- 5 day workshops over the summer on broad topics, i.e. optics, hands on learning opportunity, learn about the research process, and present their findings at the end of the week.
- Can be used as a recruitment tool for Engineering and Cornell.
- Engineering Summer Institute- supported by NSF, provide money and stipend for sophomore or junior students who have elected to take Math to participate in a class over the summer.
- Hosting Program- ask faculty to host lab sessions or join participants for lunch or dinner. Up to 250 students attend. Women in Engineering weekend, diversity weekend etc. Faculty may participate in this and use it as evidence that they have prior experience with this type of outreach.
- Diversity Programs in Engineering website:
<http://www.engineering.cornell.edu/diversity/about/index.cfm>

Jamila Walida-Simon:

- 4-H does co-operative extension around NYS. 190,000 youth affected by this program. Connects kids to Cornell. They serve to bring kids to campus all year. Form youth-adult partnerships.

- 3 big events- Career explorations (at Cornell), State Team action representative retreat (at Syracuse fairgrounds), NYS fair.
- State team action- faculty give a pitch to do a workshop at the event
- Career explorations- 100 year old program, middle school students have a general feeling of what college is like.
- Focus for Teens program- 3 day program, faculty and grad students take part.
- NYS fair- outreach to the community, meet the public, departments come to the fair and show their research.
- Urban, suburban, rural.
- 4-H camps, faculty members come and work during the summer.
- In school programs. After school programs.
- Science toolkits- an online resource that teachers and extension associates can access.
- Bronfenbrenner Center for Translational Research website: <https://www.bctr.cornell.edu/>

Jami and Jamila's programs will organize the logistics, find the participants, and pay for them to take part. Faculty can just take part.

Director:
Kathryn Dimiduk, PhD
klc78@cornell.edu
Olin Hall 167D
607-254-6514

Teaching Support:
Eva Luna
ejr89@cornell.edu
Mid-Semester Feedback Surveys
Equipment Lending Library

website: engineering.cornell.edu/tei

Education and Outreach Components of a CAREER Proposal

FACULTY PANELISTS

Name	Contact	Department
Assoc. Prof. Susan Daniel	sd386	Chemical and Biomolecular Engineering Creation of WOMENS group in CBE and WOMENS Event for rural high school girls
Asst. Prof. Ankur Singh	as2833	Mechanical and Aerospace Engineering Program and module for teachers on bioengineering
Asst. Prof. Katie Keranen	kmk299	Earth and Atmospheric Sciences Information on induced earthquakes triggered by human activities, for stakeholders including the general adult population

OUTREACH PANELISTS

Program	Contact	Description
Diversity Programs in Engineering (DPE)	Jami Joyner jami.joyner@cornell.edu	The Diversity Programs in Engineering (DPE) office operates programs at the high school, undergraduate, graduate, and faculty levels to facilitate the outreach, recruitment, retention, and overall success of underrepresented minorities, women, and other underrepresented groups in engineering.
4-H	Jamila Walida Simon jws62@cornell.edu (additional contact: Alexa Maille ask37@cornell.edu)	4-H helps kids to do better in school, learn to help others, and feel more capable and responsible. 4-H Clubs, camps, after-school programs, and trips help youth reach their fullest potential. Members have opportunities to connect to Cornell University, learn through hands-on activities, lead, be inspired, inspire others, and...so much more

CAREER PROPOSAL COMPONENTS:

Research:	Education:	Integration:	Letters of Collaboration:
	Idea	What is the link?	Not letters of recommendation
	Audience	What is the value added?	Required wording: "If the proposal submitted by Dr. [---] entitled [---] is selected for funding by the NSF, it is my intent to collaborate and/or commit resources as detailed in the Project Description."
	Venue	Is the workload realistic?	
	Learning Outcomes		
	Assessment		
	Dissemination		

POINTS TO REMEMBER:

- Your education component plan should be clearly stated and well written
- Clearly state the educational objectives or student learning objectives of your education component
- Include the target audience and how you will reach them
- Include how the education component will be evaluated (assessed) (doesn't have to be elaborate but does have to be included).
- If you have a plan to disseminate your work, include it.
- Clearly state the proposed impact of your education component (beyond specific objectives for attendees, impact on choices, impact on populations...)
- Include references for your education component
- Include any engineering education or science education papers you have written in your publications list
- Include a description of how your education component is integrated with your research
- Ask your chair or director to include in the letter of support something on your integrating research and education and how you are being mentored in that
- Consult with our McCormick Institute or diversity programs or an established outreach program as needed to leverage your time. Embedding your education component in an existing program may help with impact and dissemination.
- Your chair can use your consulting with our McCormick Institute as part of your being mentored in teaching.

MTEI ASSISTANCE with CAREER PROPOSALS:

CAREER Proposal workshops

Read and comment on Education component of proposal*

Assistance with writing outcomes and assessment plans*

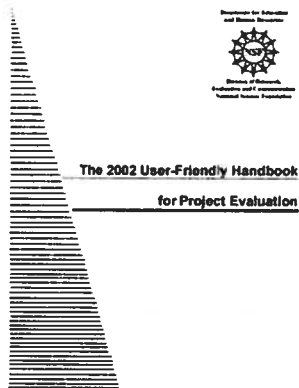
Course feedback surveys**

*For engineering faculty. Others as time permits.

**For engineering faculty. Others, contact Center for Teaching Excellence (CTE).

ONLINE RESOURCES:

**The 2002 User-Friendly Handbook
for Project Evaluation**



<http://www.nsf.gov/pubs/2002/nsf02057/nsf02057.pdf>

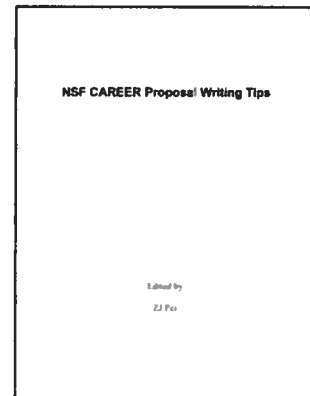
**One page of advice from a
CAREER Workshop**

**Writing an NSF
Career Award
proposal**

Notes from a May, 2000
workshop at the University of
Washington College of
Engineering
by Michael Ernst
(mernst@cs.washington.edu)

<http://homes.cs.washington.edu/~mernst/advice/career-grant.html>

**Compendium of Advice on writing
CAREER proposals, 16 articles and
good concrete advice**



<http://www2.clarku.edu/offices/research/pdfs/NSFProposalWritingTips.pdf>

Professional Societies STEM Education Resources – a few examples

Potential Venues for Learning from and for Disseminating Your Work


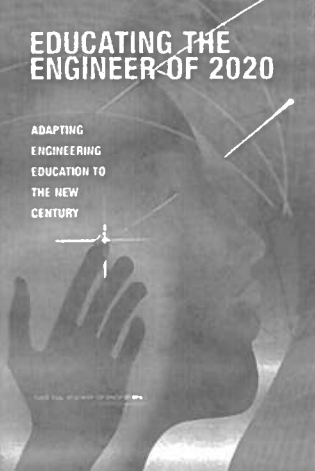
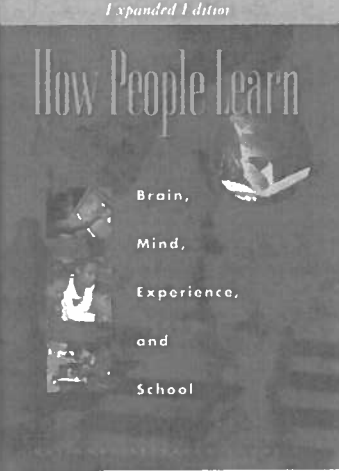
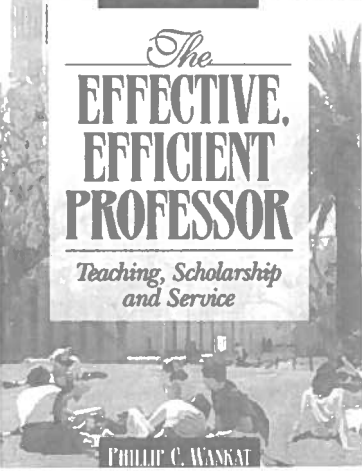
American Society for Engineering Education - ASEE

American Association of Physics Teachers – AAPT, college and HS level

Often other technical conferences will include an education track.

POTENTIAL REFERENCES:

Books available for loan:

<p>The Engineer of 2020, Visions of Engineering in the New Century.</p>	<p>Educating the Engineer of 2020, Adapting Engineering Education to the New Century</p>	<p>How People Learn, Brain, Mind, Experience, and School</p>	<p>The Effective, Efficient Professor, Teaching Scholarship and Service</p>
			
<p>National Academy of Engineering, National Academies Press, ©2004</p>	<p>National Academies Press, © 2005</p>	<p>National Research Council, National Academies Press, ©2000</p>	<p>Phillip C.Wankat, Allyn and Bacon © 2002</p>

Articles:

Prince, Michael, "Does Active Learning Work?" A Review of the Research", Journal of Engineering Education, 93(3), 223-231,) 2004). Also available online at:
http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Prince_AL.pdf

Felder, Richard, Many engineering education articles at:
<http://www4.ncsu.edu/unity/lockers/users/f/felder/public/RMF.html>

Wieman, Carl, "WHY NOT TRY A Scientific Approach to Science Education?", Change, September/October 2007. Teaching Resources website: <http://cwsei.ubc.ca/>

NOTE: Additional titles and links to articles on our website: engineering.cornell.edu/tei

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Examples of Education Figures to Support Your Premise

Figures from *Teaching for Quality Learning at University*, 3rd Ed. John Biggs, McGraw Hill

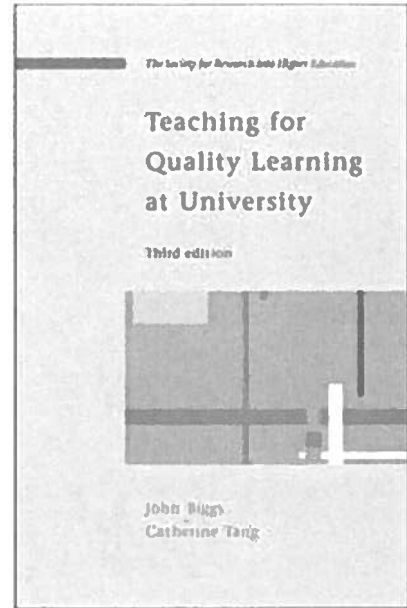
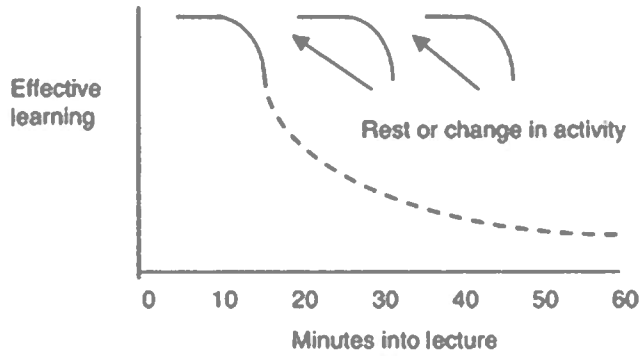


Figure 7.1 Effect of rest or change of activity on learning

Source: After Bligh (1972)

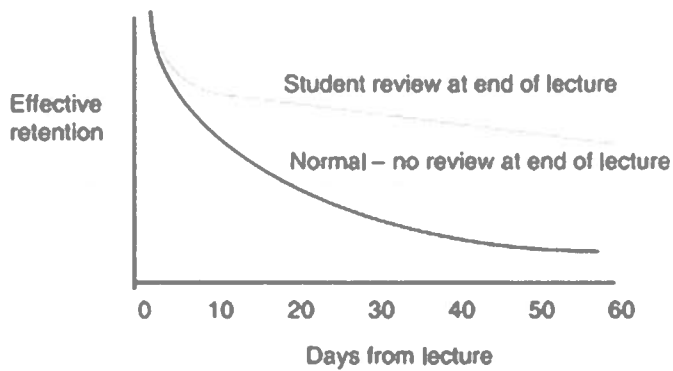


Figure 7.2 Effect of testing at end of lecture on retention

Source: After Bligh (1972)

SAMPLE OUTREACH PROGRAMS

Compiled by the College of Engineering - James McCormick Family Teaching Excellence Institute ©

Program Name	Program Description	Contact Person	Contact email	Department/Affiliation
CCMR (Cornell Center for Materials Research)	The Cornell Center for Materials Research (CCMR) supports interdisciplinary materials research and development at Cornell. Provides many educational resources, in addition to offering a wide array of hands-on programs for our local community, the greater New York community, and students and teachers across the nation and in Puerto Rico.	Nev Singhota	nks5@cornell.edu	NSF MRSEC
CIBT (Cornell Institute for Biology Teachers)	The Cornell Institute for Biology Teachers supports high school biology teachers with workshops, hands-on field tested lab activities and access to expensive molecular biology equipment and models.	Laurel Southard	les3@cornell.edu	CALS
Xraise Cornell	The outreach program for the Cornell High Energy Synchrotron Source (CHESS). Provides K-12 science engaging programs through local and national outreach. Also houses a physics lending library of lab investigations and equipment.	Lora Hine	lkh24@cornell.edu	NSF
Upward Bound	Upward Bound is a free college preparatory program for qualifying students. Upward Bound serves high school students from low-income families and high school students from families in which neither parent holds a bachelor's degree.	Jan Rudolph	jjlr343@cornell.edu	Cornell Public Service Center
GRASSHOPR Cornell (Graduate Student School Outreach Program)	The Graduate Student School Outreach Program (GRASSHOPR) pairs Cornell graduate students with teachers in Tompkins county and Geneva to teach 3- to 5-session mini-courses on topics related to the graduate student's field or interests.	Maja Anderson	mma86@cornell.edu	Cornell Public Service Center
BTI Outreach (Boyce Thompson Institute)	BTI Education and Outreach aims to link students, teachers and scientists in learning and teaching through inquiry and discovery in plant biology. We provide academic and career development opportunities to young people, teachers and mentors.	Tiffany Fleming	tfleming@cornell.edu	Cornell University
Lab of O Outreach (Ornithology)	The Cornell Lab of Ornithology is a world leader in the study, appreciation, and conservation of birds. Our hallmarks are scientific excellence and technological innovation to advance the understanding of nature and to engage people of all ages in learning about birds and protecting the planet.	Jennifer Fee	jms327@cornell.edu	CALS- Laboratory of Ornithology
PRI (Paleontological Research Institution)	The Paleontological Research Institution pursues and integrates education and research, and interprets the history and systems of the Earth and its life, to increase knowledge, educate society, and encourage wise stewardship of the Earth.	Ingrid Zabel	ihz2@cornell.edu	CALS- Earth and Atmospheric Sciences
Ithaca Physics Bus	Mobile exhibition of upcycled appliances--reimagined by kids--that showcase unfamiliar physics phenomena. The mission of the physics bus is to awaken interest and creativity in physics for all ages and walks of life -- especially those underserved by science enrichment.	Eva Luna	ejr89@cornell.edu	501c3

Mathematics Outreach	Our program has been engaged in outreach and building solid partnerships with local teachers and schools. Outreach activities fall into three broad categories: Teacher Development, Opportunities for Grades K-12 Students, and Promoting Mathematics Awareness.	Mary Ann Huntley	mh688@cornell.edu	CAS- Mathematics
Big Red Buddies	A Big Red Buddy is a Cornell University student who serves as a mentor to the children and a helper to the teacher.	Austin Fay, PreK-12 Program Coordinator	amf325@cornell.edu	
Learn To Be (LTB)	Learn To Be (LTB) is dedicated to providing free, one-on-one, online tutoring to K-12 students everywhere.	Austin Fay, PreK-12 Program Coordinator	amf325@cornell.edu	
New York City Service Initiative (NYCSI)	NYCSI is a student-run mentorship program that provides Cornell undergraduates with the opportunity and training to invest in mentoring relationships with students at high schools in New York City.	Austin Fay, PreK-12 Program Coordinator	amf325@cornell.edu	
YOURS (Youth Outreach Undergraduates Reshaping Success)	YOURS strives to provide opportunities for youth aged 7 to 17 living in or near mobile home parks in Freeville, NY to develop a positive self-image and future goals.	Leslie Yuen	ly8@cornell.edu	
Encourage Young Engineers & Scientists (EYES)	EYES is dedicated to promoting scientific literacy and advancing engineering and the sciences as potential career choices. Volunteers regularly travel to schools in the Ithaca area to enrich students' learning with engaging and educational science activities.	Elbert Mets	ejm245@cornell.edu	
AguaClara	AguaClara is a multi-disciplinary program at Cornell University that designs sustainable water treatment systems. Our gravity-powered, electricity-free technology is scalable to fit the needs of any community and currently provides clean water to over 40,000 people.	Monroe Weber-Shirk	mw24@cornell.edu	CALS Department of Biological and Environmental Engineering
ProDairy	The PRO-DAIRY dairy facilities program is responsible for identifying, developing, documenting, and introducing innovative methods in dairy housing that will enhance animal performance, well-being, efficiency, environmental compliance, and overall farm profitability.	Heather Darrow	hh96@cornell.edu	CALS Department of Biological and Environmental Engineering
Cornell Local Roads	The Cornell Local Roads Program LTAP Center provides training, technical assistance, and information to municipal officials and employees responsible for the maintenance, construction, and management of local highways and bridges in New York State.	David Orr	dpo3@cornell.edu	
Diversity Programs in Engineering (DPE)	Operates programs at the high school, undergraduate, graduate, and overall faculty levels to facilitate the outreach, recruitment, retention, and overall success of underrepresented minorities, women, and other underrepresented groups in engineering.	Jami Joyner	jami.joyner@cornell.edu	
4-H	4-H helps kids to do better in school, learn to help others, and feel more capable and responsible. 4-H Clubs, camps, after-school programs, and trips help youth reach their fullest potential. Members have opportunities to connect to Cornell University, learn through hands-on activities, lead, be inspired, inspire others, and....so much more	Alexa Maille	ask37@cornell.edu	