

# 2015 Women in Science

Clark Science Center's  
Summer Research Fellows Program



# INTRODUCTION

**“The sciences at Smith will provide transformative opportunities for all students to engage with real problems while empowering them to generate innovative solutions that benefit our world.”**

Our vision for the future is grounded in a shared aim to “cultivate the scientist in the next generation of women leaders.” Our strategic plan for the sciences (*Vision for the Future, 2015*) builds on Smith College’s strength as a national leader in science research and education among liberal arts colleges. An increasing number of Smith students study sciences. In 2015, forty percent of our current students declared a science major, a rate at least double the national average for women. In disciplines in which women are most under-represented (e.g., computer science), our students major at rates up to three times the national average. At Smith, our approach to education in the sciences also represents a response to societal matters – lower female participation in STEM higher education and later in work, as well as academic, economic, and political leaders’ advocacy of full representation of women in all STEM fields as a matter of equity and good policy based on the benefits that flow from diversity.

**Ensuring access for all.** As its first principle of excellence, the Association of American Colleges and Universities’ Liberal Education and America’s Promise (LEAP; 2011) initiative tells us to “aim high—and make excellence inclusive” (p6). For the sciences at Smith, we are guided by understanding that persistence and the best scientific thinking emerge from healthy climates that promote and value a diversity of perspectives. As our strategic direction, we work to address disparities in gender, racial, and socioeconomic representation in the sciences by pairing rigorous learning expectations with robust support and community-building for our students.

**Engaging with the world.** Another essential principle of excellence in undergraduate education is to provide opportunities for students to engage with big questions and tackle real-world problems that connect their knowledge to solutions and action (AAC&U, 2011). At Smith, we are guided by the belief that interactions with bona fide scientific problems connecting our students to the larger world facilitate the best learning. As our strategic direction, the sciences at Smith will strive to engage our students with complex, real-world problems, ranging from local to global, that are often best understood through the multiple disciplinary lenses of the liberal arts.

## Strategic Directions

	Ensuring access for all
	Engaging with the world
	Developing knowledge and skills
	Fortifying agency and identity

**Developing knowledge and skills.** Research is a core practice of scientific education at Smith College. We are guided by a shared understanding that best-practices pedagogies and faculty-student research collaborations will result in optimal learning and future success for our students. As we move forward, we build on evidence that through rigorous coursework and undergraduate research opportunities that connect the work of students with cutting-edge faculty scholarship, we develop student mastery of the key concepts and competencies of our disciplines.

**Fortifying agency and identity.** Persistence and success in STEM rest not only on access, opportunity, and knowledge, but also on the actions taken by individual women in particular environments using specific social understandings. Smith faculty adopt a guiding principle that students’ mind sets, metacognition, and identity development are essential to learning as well as professional and personal fulfillment. We understand that through our cultivation of students’ agency, confidence, and resourcefulness in learning, we will foster their sense of identity as scientists.

**Undergraduate research is a high-impact educational practice in which the sciences at Smith have considerable expertise.** Research experiences and collaborative projects that occur in research labs, the Science Center's five multidisciplinary research centers, and our field research sites demand the applied and integrative learning that deepens student engagement and learning (AAC&U, 2011). The sciences at Smith have a strong history of providing meaningful research opportunities to students, with a thriving honors program, active faculty research labs in which students participate as collaborators, and almost 50 years of a vibrant Summer Research Fellowship (SURF) Program. Our students present their research in many venues, including at the annual campus-wide *Celebrating Collaborations* exhibition and *Smith in the World Conference*, in public honors thesis presentations, and at regional and national professional meetings in their disciplines. With at least one undergraduate student co-author on a third of science faculty members' peer-reviewed scholarship and SURF participation doubling the likelihood of our students pursuing a graduate degree (data provided, Smith College Institutional Research, 2015), we believe that challenging our students to work at the cutting edge of knowledge helps prepare them for their lives beyond Smith.

*Women in Science 2015* summarizes research done by Smith College's Summer Research Fellowship (SURF) Program participants. Ever since its 1967 start, SURF has been a cornerstone of Smith's science education. In 2015, 162 students participated in SURF (153 hosted on campus and nearby field sites), supervised by 60 faculty mentor-advisors drawn from the Clark Science Center and connected to its eighteen science, mathematics, and engineering departments and programs and associated centers and units. At summer's end, SURF participants were asked to summarize their research experiences for this publication.

#### **We have many reasons to be proud of our 2015 SURF researchers.**

- SURF researchers worked on some of the biggest research challenges of our times, including eradicating human disease, reexamining human life and the earth around us at the nano-scale, documenting climate change and its impact on the living world, testing and improving sustainable energy technologies, and developing materials and testing methods not just for earth but also for use in space.
- SURF research took place not just on the Smith campus, but in a wide variety of research settings in the wider world: including, locally (study of local forests, wild life, and water courses at the Ada and Archibald MacLeish Field Station in West Whately, MA and the study of building stones and waterfront plants on campus), nationally (projects on the Atlantic and Pacific coasts with NOAA scientists), and internationally (examination of coral reefs in Belize and Newfoundland, geological features in Australia and Scotland).
- Technical know-how, quantitative literacy, and presentation skills grew as students used state-of-the-art instrumentation, analyzed data with specialized software, and presented their results in lab meetings, posters, and conference presentations. In lunchtime workshops, students developed personal narratives and made presentations to peers and visitors.
- SURF students learned how to work with mentors and peers and, for some, across the boundaries of academic disciplines with other research teams. More experienced undergraduate researchers learned how to mentor others and take on research leadership roles.

#### **We are excited about what SURF participants say they learned from SURF.<sup>1</sup>**

- SURF research deepens students' understanding of research. They discover that scientific research requires flexibility and creative problem-solving, patience, and persistence.
  - *"It is clearer and clearer that being a scientist does not mean knowing everything, but means having the courage to face the unknown and the determination to reveal it."*
  - *"I learned to think of as many angles as possible from which to examine something, and then think of even more that I hadn't considered the first time around. I learned to identify and ignore my assumptions, as they would affect what patterns I noticed."*
  - *"I learned to add to and tailor [published experimental methods] to best suit my experiments."*
  - *"A Smith professor once told me that learning is first confronting the difficult parts, struggling and then having that 'ab-ha' moment [and] the sweet relief of finally figuring out the puzzle ..."*
  - *"This summer taught me about how much patience science can require, but also how exciting and rewarding it can be to make new discoveries."*

- *"I learned that it is important to pay attention to small details, because when people ignore subtle details they can miss things that are very important"*
- *"I learned how to bounce back when experiments fail or they don't go the way you want them to."*
- Each student commits substantial time to SURF research: typically, 30-40 hours per week for 8-10 weeks of the summer.
  - *"Summer research is more intense than during the academic year. I enjoyed putting my whole day into doing research."*
  - *"I was able to learn more during summer research because I was able to be more fully immersed in my project with more time and [fewer] distractions."*
  - *"[I] spend A LOT more time in lab in the summer when I'm not juggling classes, TA-ing, and [going] to extra jobs."*
  - *"I learned that hard work does pay off and even when it seems as though you have not accomplished anything on your project, you have done more than you think."*
  - *"[F]ield work takes a lot more time and effort than I originally perceived."*
  - *"[T]he sheer amount of time we spent immersed in lab was very valuable to my understanding of what research really entails."*
- Many students make a distinct contribution to a collaborative research project with a faculty member and often a joint publication is prepared.
  - *"I will be presenting my SURF research in a talk at Smith, a poster session (or talk) at a national conference as well as submitting a peer-reviewed article for publication."*
  - *"With the upcoming submission of a manuscript derived from my undergraduate thesis, including additional data I collected this summer ..., I will have ... executed what I intended to do with my SURF project."*
  - *"The paper that [my professors] and I hope to write is intended to serve as a guide for anyone interested in constructing a system similar to what we have made."*
- In many cases, SURF research contributes to the particular student's honors thesis or continues as a special studies project.
  - *"Because of my SURF experience, I feel more prepared about my senior year thesis."*
  - *"SURF enabled me to learn a totally new technique that ... will be the foundation for my thesis investigation."*
- Students discover the social aspects and interpersonal skills involved in research teamwork, as well as the value of communication.
  - *"[T]his summer, I really came to understand the true value of teamwork in a research setting. ... [W]e are strongest and most productive, and have the most fun, when we are working together with open minds."*
  - *"I ... learned that when working with a research team ... communication is of the utmost importance."*
  - *"Working in the same room as my coworkers not only let me practice communication and acclimate to a full-time working environment, but also built great relationships."*
  - *"I learned how to present the same information in multiple ways, so that my project would be comprehensible to my advisor, to my classmates, and even to friends with very little science background."*
  - *"The nature of my work pushed me to articulate my ideas and understanding in a succinct manner."*
- SURF is where students find direction for graduate school and future careers.
  - *"[SURF research] definitely inspired me to continue to pursue research as a career."*
  - *"My SURF research experience was exactly what I had hoped for. I was able to discover my interest in research and my desire to go to graduate school is stronger now."*
  - *"This summer I was able to work independently on my project in [a research] lab; this was a great introduction to what life as a graduate student will be."*

<sup>†</sup>The comments are drawn from two surveys SURF participants completed in August 2015. First was a Smith survey (unpublished) in which students were asked what they had learned and how they expected to build on their SURF experience. Second was the SURF III national survey administered by Grinnell College (Smith student comments extracted from an anonymous summary provided by the survey administrators). See the following reports of the SURF survey data across a large number of colleges and universities: Lopatto, D. (2004). Survey of Undergraduate Research Experiences (SURF): First Findings. *Cell Biology Education*, 3, 270-277 and Lopatto, D. (2007). Undergraduate research experiences support science career decisions and active learning. *CBE - Life Sciences Education*, 6, 297-306.

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\* Individual research grants to faculty members (include funds available to support SURF student research collaborations)

#### **Smith College offices and units:**

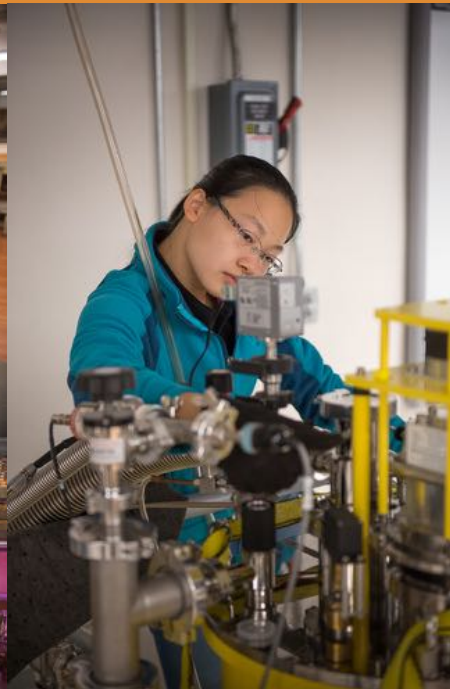
Center for the Environment, Ecological Design & Sustainability (CEEDS)  
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Some undergraduates were able to participate in summer research internships away from campus with support from the PRAXIS Internship Program.

We wish to recognize and express gratitude to the faculty members and staff who provided supervision, guidance, encouragement and support to SURF participants in the lab, doing field research, on-campus, and away from campus. SURF would not be possible without your devoted and generous contributions.

**Thank you, Smith College students, faculty, staff, friends, and benefactors.** It truly takes a diverse and dedicated community to sustain a program like SURF.

Margaret Lamb, Ph.D,  
Administrative Director, Clark Science Center



Photographs courtesy of Jim Gipe