



HAVERFORD COLLEGE

KOSHLAND INTEGRATED NATURAL SCIENCES CENTER

ANNUAL REPORT, 2010

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The Marian E. Koshland Integrated Natural Sciences Center (KINSC) catalyzes and facilitates programs that maintain Haverford's position at the leading edge of academic excellence in the sciences. To this end, the KINSC promotes scientific scholarship involving close collaboration between faculty and students and provides opportunities for these collaborations to expand beyond the borders of the Haverford campus, through purposeful engagement with the national and international scientific communities.

Our diverse programs promote the ambitions of faculty and students, including travel grants for training and development. Students may apply for summer research externships within their discipline or as part of a multidisciplinary program in collaboration with the Center for Peace and Global Citizenship (CPGC) and the Hurford Humanities Center (HHC). Special grants are available to support larger-scale disciplinary

and interdisciplinary initiatives involving faculty-student partnerships. The Center funds interdisciplinary areas of interest such as public health, science and society, and environmental studies. We also administer a portfolio of institutional grants that support the sciences at Haverford, including funding from the Howard Hughes Medical Institute (HHMI) as well as a variety of other privately funded activities.

DIRECTOR'S OVERVIEW

The last two years have been a critical time in the development of the KINSC, as we recently received an endowment to support new academic and research programming opportunities for students and faculty. No longer is the Center primarily represented by the building where we reside, which brings together the sciences to foster our strengths in interdisciplinary training and research; today, the KINSC administers a budget specifically to support the ambitions of faculty and students through scholarship, and we have developed a theoretical framework for these activities. I place these ambitions in the context of the current portfolio of grants (both institutional and personal) that have made our Science Division so successful amongst our peer institutions.

In the past year, we have re-established stronger communication with the two other Centers on campus, the CPGC and HHC. We have continued our commitment to synergistic and creative projects involving all three Centers over two exhilarating years, and we now need to sustain this forward momentum in directions that will provide the greatest impact not only institutionally, but also in our global community, where we strive to increase our presence through the good works of Haverford faculty and students.

—Robert Fairman

OPPOSITE: The entryway rotunda of the KINSC building is a hub for interdisciplinary science and research on the Haverford campus.

COVER: Lee Flaherty '12 interned at Seawater Greenhouse near Port Augusta, South Australia, thanks to a KINSC student scholarship.



▶ 25 Students Working Locally,
12 Working Internationally

▶ 14 Student Research Stipends
Awarded

▶ 23 Student Travel Stipends
Awarded

ENCOURAGING INNOVATIVE STUDENT SCHOLARSHIP

STUDENT SUPPORT

Student awards were given for a broad range of experiences, both domestic and international. The selection process for awarding these fellowships was very competitive in 2010, and awards were given to applications that offered a high degree of success both in the research outcomes and in the experiences and knowledge that students would bring back to the Haverford community. In the second year of funding, students designed truly creative and innovative projects.

SUMMER RESEARCH STIPENDS

These stipends were created to support students pursuing summer research projects outside of Haverford College. Stipends were awarded to students to do both domestic and international projects. Ten of these fellowships were granted for the summer of 2010.

TRAVEL STIPENDS

These stipends were created to enable students to travel to scientific conferences and labs, both at home and abroad. Some of the travel awards involved joint activities with a Haverford faculty member, but most were student-initiated projects. Over the past two years, the KINSC has awarded 23 travel stipends, the majority of which were made in the 2009-10 academic year.

Students in their own voices:

Shanaye Jeffers '12

Medical International Service Learning, Costa Rica and Nicaragua

I was graciously awarded a grant to participate in the International Service Learning Health Program in Costa Rica and Nicaragua during the winter break of 2010. I received hands-on training in basic clinical studies and action. We traveled to Costa Rica and participated in two days of clinic in the Alajuela community. After arriving in Nicaragua five days later, we took part in three days of clinic in the Veracruz community. Throughout the trip, I learned more about the political history of both countries and gained a better understanding of how their current circumstances came about. I received a first-hand education on people's lack of rights, representation and suffering due to an absence of resources.

Though these history lessons were frequent, the majority of our time was devoted to meeting with patients in a triage setting, taking vital signs and speaking with the patients to learn their personal histories and, of course, their main complaints. Embarking on this journey gave me more than I had anticipated, building my confidence and making me truly believe that I am capable of achieving my goal of becoming a doctor.

Adam Subhas '09

Deep Sea Coral Research Cruise, The South Pacific

The month-long research cruise with Jess Adkins (HC '90) began in Hobart, Tasmania. We traveled on the Southern Ocean, looking for deep-sea corals and mapping the sea surface, as well as collecting

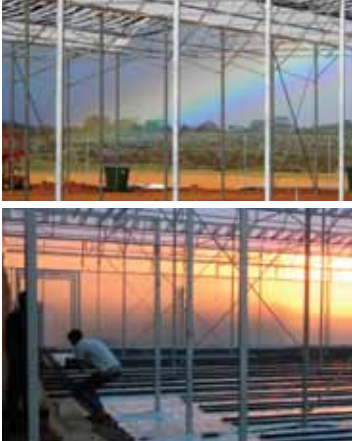
“Embarking on this journey gave me more than I had anticipated, building my confidence and making me truly believe that I am capable of achieving my goal of becoming a doctor.”

—Shanaye Jeffers

OPPOSITE: The Loggerhead Sea Turtle was the subject of conservation research by Elizabeth Willis '13 in Greece.

BELOW: Researchers including Adam Subhas '09 sought and sorted deep-sea corals during a month-long trip in the South Pacific.





Lee Flaherty '12 was actively involved in constructing elements of the innovative Seawater Greenhouse during his internship in South Australia.

“The environment and ethos at NSI encourage not only expertise in one’s field but openness to and concern for the research of co-workers. This creates an unimaginable hotbed for innovative neuroscience, and it made for an inspiring, stimulating 11 weeks.”

—Genna Cherichello

oceanic data such as salinity and nutrient levels. We used Autonomous Benthic Explorers (ABEs) to find and retrieve the deep-sea corals, as well as to map the sea floor. The deep-sea corals are used for two main projects in the Adkins lab; the first is as a record of climatological events and ocean circulation in an attempt to reconstruct past climate change events and predict future ones. The second uses these specimens to investigate how the corals make their skeletons in the first place.

► See more of Adam’s blog at news.haverford.edu/blogs/researchcruise/

Lee Flaherty '12

Seawater Greenhouse Building, near Port Augusta, Australia

The Seawater Greenhouse is a simple and elegant engineering concept that harnesses the hydrologic cycle for use in the confines of a modified greenhouse. Personal interest drove me to secure an internship at Seawater Greenhouse Australia to investigate the viability of diverse options for increasing efficiency in this already efficient system. The work that earned me this internship was a review of the use of alternative pollinators in the greenhouse, but other options include: the use of alternative ways to raise condensation yields, new planting schemes, the implementation of sustainable climate control, and ways to use/dispose of concentrated brine. However, the insight I gained into the Seawater Greenhouse process was useful, and my presence during construction and assembly provided yet more avenues to raise efficiency.

Working from sunrise to sundown, through weekends, I helped to assemble and raise 1,300 heat exchanging capillaries, 20 evacuated tube manifolds, 20 photovoltaic panels, 600 condenser manifolds and almost 100 meters of hydroponic gutters, and to prepare over 5,000 condenser tubes. I personally assembled 75 condenser segments. This work took up the remaining two months of my time, up until the day I left. Thanks to the KINSC for its support; this internship was an excellent experience.

► See more of Lee’s blog at news.haverford.edu/blogs/outback/

Genna Cherichello '11

Music Cognition Research on Neonates, the Neurosciences Institute (NSI) in San Diego

My experience at the NSI did not feel like an internship. I worked with the doctors to study the effect of soothing music, specifically lullabies, on the physiological measures of stress in neonates. As a research assistant, I performed tasks vital to the success of the NICU study. I helped researchers to finalize the procedure for the study as well as make a clear study protocol for all individuals at the hospital who would lend patients to the study. I also created a questionnaire for the parents of study participants that would determine how much music, and what kind of music, the neonates were exposed to before birth.

I was granted many opportunities to explore fields of research outside my position. My bosses and the extended NSI community accepted me as a scholar and a friend from the moment I arrived. The environment and ethos at NSI encourage not only expertise in one’s field but openness to and concern for the research of co-workers. This creates an unimaginable hotbed for innovative neuroscience, and it made for an inspiring, stimulating 11 weeks. I came away from each day at the Institute having learned something, whether it was from a journal article on music therapy or neurodevelopment, a Fellow’s Journal Club presentation on fear, a conversation with an engineer about brain-based devices, or a dialogue over lunch about olfaction.

► See more of Genna’s blog at news.haverford.edu/blogs/nicu/

Emily Northrop '13

*Chemistry Research, Dept. of Earth & Planetary Sciences,
Harvard University*

My research studied the evolution of Earth's early atmosphere by analyzing sulfur isotopes in rock samples. Sulfur undergoes ultraviolet (UV)-driven reactions that result in sulfur products with specific isotope ratios. These reactions, and therefore sulfur isotopes, are affected by the presence of oxygen and ozone in the atmosphere because these two gases have the ability to shield UV. By studying samples for evidence of these UV-driven reactions, we can fine-tune our understanding of early oxygen levels and life forms. This project brings chemistry into an Earth and planetary sciences lab, and given that I am interested in both of these areas, working in this lab helped me understand how the two approaches are combined.

Having this experience before sophomore year will help me make an informed decision when it comes time to choose my major, and I know I will be able to find more practical meaning in all of my future lab classes, as I recognize principles and procedures that my colleagues and I applied to long-term research projects. I was able to meet mentors of all ages including undergraduates, graduate students and postdoctoral fellows. Several other female undergraduates were working on their own projects, and I was thrilled to share our experiences as women in science. I had the individual support that I have come to expect at Haverford, but I gained a sense of how labs are run at a large research institution.

Elizabeth Willis '13

Sea Turtle Conservation, Greece

This summer I worked with two organizations in Greece at conserving and protecting the Loggerhead Sea Turtle. I worked with the Katelios Group in Kefalonia for the month of June and ARCHELON in Kyparissia during July and August. I was able to learn and observe two different approaches to conservation of the same turtle species, taking into account the different circumstances and environment of the two locations. I learned a tremendous amount about working in the field

and the unpredictable nature of this type of work. My research addressed many different questions, such as the average number of times a turtle will return to nest in a season, the average number of eggs that a turtle lays in a clutch, the percentage success rate of hatching, the percentage of nests that are relocated in a season, and the percentage of nests that are predated in a season. I found it fascinating that these conservation projects could address all these questions using morning and night surveys to collect data efficiently. The daily work always followed the same procedure, but its application was always different. Turtles never responded the same way, and every nest was unique. The variable nature of data collection helped me understand the importance of consistent and thorough notes for proper interpretation of the data.

I gained insight into the ways in which veterinary science can be combined with conservation biology. Since these are potential career paths and ideas for graduate school, my summer research was a great help in solidifying my desire to explore these fields further.

► See more of Elizabeth's blog at news.haverford.edu/blogs/seaturtles/



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—Elizabeth Willis

Elizabeth Willis '13 (below) learned about two different approaches to conservation of the Loggerhead Sea Turtle during her summer research in Greece.





CULTIVATING A VIBRANT FACULTY

FACULTY SUPPORT

Since its establishment, the KINSC Faculty Support program has provided over \$47,000 in funding for domestic and international projects.

DEVELOPING SCHOLARSHIP

The Faculty Support program provides funding to faculty members to travel to conferences, professional meetings or collaborating institutions to further their research and scholarship. Since 2008, the KINSC has supported faculty members in many of the natural science disciplines.

FACULTY/STUDENT DOMESTIC AND INTERNATIONAL PROJECTS

This longer-term grant (3–5 years) gives faculty an opportunity to pursue research and academic projects with domestic or international collaborators. Faculty members have the opportunity to travel to other institutions with students to learn new skills and techniques. The KINSC is currently funding two international projects:

- Iruka Okeke, Department of Biology, a collaboration with the University of Ghana and Obafemi Awolowo University in Nigeria;
- Karin Åkerfeldt, Department of Chemistry, a collaboration with Professor Sara Linse at Lund University, Sweden.

RIGHT: Laura VanArendonk '10 (center) and Amy Labar '10 (left) served as teaching assistants at a molecular biology workshop in Nigeria.

OPPOSITE: Haverford Biology Professor Iruka Okeke (3rd from left) oversaw student Amy Labar '10 (far left) and medical and doctoral students in molecular biology research projects at Obafemi Awolowo University, Nigeria.

“As molecular biology capacity is extremely limited in West Africa, our collaborative initiative makes it possible to explore research areas that have not previously been addressed in the region. In addition to meeting important research objectives, this work has begun an important process of molecular biology capacity-building in Nigeria and Ghana, and allowed a number of Haverford students to engage in cross-continental research and technology transfer.”

—Iruka Okeke





Karin Åkerfeldt, Department of Chemistry



Iruka Okeke, Department of Biology

OPPOSITE TOP: Winifred Johnson '09 (far left) and Catherine Divizio '12 (far right) did research in biophysical chemistry at Lund University in Sweden.

OPPOSITE BOTTOM: Haverford students joined Nigerian students and faculty in molecular biology research at Obafemi Awolowo University.

“The program provided opportunities for Haverford faculty, students and staff to participate in an international research program.”

—Karin Åkerfeldt

KARIN ÅKERFELDT

Department of Chemistry

The specific aims were to establish a program for Haverford students to perform mentored summer research in Sweden with my collaborator Sara Linse (Department of Biophysical Chemistry, Lund University). The program provided opportunities for Haverford faculty, students and staff to participate in an international research program.

I have enjoyed a long and fruitful collaboration with Professor Linse. Together, we have published nine manuscripts in major peer-reviewed journals. These manuscripts represent a series of larger investigations focused on understanding an important problem in biology focused on protein structure and function, looking specifically at a particular class of calcium binding proteins, proteins involved in regulating the availability of calcium, an important biological metal. Proteins contain a well-known structural motif for binding calcium called EF-hands, and the focus has been on characterizing the biological and chemical properties of this motif.

Our research efforts are currently focused on the EF-hand protein calmodulin, which is involved in calcium signaling pathways in eukaryotic organisms and is known to regulate many other proteins by directly binding to them. With the support of a travel grant from the KINSC, Winifred Johnson '09, a senior research student in my lab, spent fall break (2008) at Lund University in Linse's lab, and her work there resulted in important and exciting findings. Over the next three years, two students from Haverford will travel to Sweden each summer to work in the Linse lab at Lund University, and then will continue their research at Haverford during the academic year.

IRUKA OKEKE

Department of Biology

As molecular biology capacity is extremely limited in West Africa, our collaborative initiative makes it possible to explore research areas that have not previously been addressed in the region. In addition to meeting important research objectives, this work has begun an important process of molecular biology capacity-building in Nigeria and Ghana, and allowed a number of Haverford students to engage in cross-continental research and technology transfer. The current program builds on Haverford's strengths and aspirations in molecular biology, student research and social justice, and has also been an important influence on my teaching and scholarship as well as on the education of our students.

This request included support for summer research experiences for two to five Haverford students in Nigeria or Ghana each year. The students worked on projects associated with ongoing research on antimicrobial resistance and molecular epidemiology. These studies were performed in collaboration with Professor Mercy Newman and Japheth Opintan at the University of Ghana and with Professor Adebayo Lamikanra and Dr. Oladipo Aboderin at Obafemi Awolowo University, Nigeria. Both sites have strong microbiology research programs and faculty to co-mentor students. The program allows our students to gain skills in applied microbiology that they might not otherwise receive within Haverford's focused curriculum, and they perform molecular aspects of their work in facilities that we have set up in the last three years. Working alongside Nigerian and Ghanaian students further increased the opportunity for technology transfer and intellectual exchange.





► MAST PARTICIPANT REFLECTIONS

- “The labs gave me a chance to experience something I haven’t before, and I thank the MAST Program for that.” (MAST student, spring 2010)
- “MAST showed me that tutoring is more than just teaching students to learn a specific subject or concept; tutoring is helping students learn to learn.” (Haverford student, MAST tutor)
- “I loved getting to know all the MAST students and working hard to find ways to relate the science topics to everyday life. I learned a lot from my students about how to teach and how to be flexible. Doing this program makes me want to continue tutoring and teaching in the future.” (Haverford student, MAST tutor)
- “I also gained experience working with a dynamic and interesting group of kids. It was so fun to get to know them and learn about their aspirations while watching them move forward.” (Haverford student, MAST tutor)
- “The MAST Program captured our son’s interests and sparked excitement for learning more about science.” (parent of MAST student, spring 2010)
- “My daughter benefited greatly from her time at Haverford. She is a stronger, more confident writer and wants to participate in other science programs.” (parent of MAST student, spring 2010)

Comments gathered from anonymous feedback surveys.

CREATING SYNERGIES IN SCHOLARLY ADVANCES

THE MAST PROGRAM

Mentoring and Student Teaching (MAST) is a longstanding outreach program supported by the KINSC. This program provides laboratory experience and writing tutorials for 40–50 Philadelphia area high-school and middle-school students who may not otherwise have access to hands-on lab work and writing instruction. Under the guidance of faculty mentors, Haverford and Bryn Mawr College students prepare the course curricula, devise and teach science experiments and writing workshops, and work with students, one-on-one, as tutors. Annually, more than 50 Haverford and Bryn Mawr students participate in this program, which has become part of the fabric of Haverford.

TRICENTER COLLABORATIONS

The KINSC has collaborated with the CPGC and HHC on projects of common interest. In 2008, the Directors of the three Centers pledged to support symposia that would be of interest to the wider community. In March of that year, Haverford hosted a two-day symposium on the global water crisis and created a website to describe the program (<http://www.haverford.edu/news/watersymposium/>). Six experts spoke on topics such as issues with pollution in local water sources and problems of access to water in Africa and China. In 2009, the Centers organized a two-day symposium on environmental studies to help develop an academic program and advise the departments that would be hiring in this area (Chemistry, Anthropology and Biology). Again, the three Centers collaborated to bring together noted experts representing wide-ranging perspectives on environmental studies (for more on the symposium visit <http://www.haverford.edu/news/environmental/environmental.php>).

The KINSC plans to continue offering community symposia that examine other highly interdisciplinary topics, such as public health. The Directors of the three Centers meet several times each semester to discuss possible projects and have continued to jointly support faculty- and student-initiated curricular efforts that are not a formal part of the College's academic program. Since 2008, the KINSC has worked with the CPGC each year to fund student-led seminars on the topic of social medicine.

ENGAGING THE BROADER HAVERFORD COMMUNITY

KINSC programming takes place within the broader context of the numerous research activities at Haverford year-round. Virtually all students in the Science Division write a senior thesis that emerges from scholarly work, usually as a collaborative effort with their faculty research advisor. As a result, Haverford has an active 12-month research program, with much of the activity happening during the summer months. These students are funded from a variety of sources outside the KINSC, including provostial funds and institutional grants. All of these sources fund projects that ultimately complement KINSC programs.



OPPOSITE AND ABOVE: Haverford students work hands-on with middle- and high-school students as part of the MAST program.

Haverford has responded to a recent call from HHMI to strengthen the disciplinary connections between computer science, mathematics and biology. In response, a new concentration in Scientific Computing has been created, and select faculty in Biology and Mathematics have developed new courses that highlight the significant overlaps between these disciplines.

ADDITIONAL FUNDING OPPORTUNITIES

Grant from Howard Hughes Medical Institute (HHMI)

Haverford has been continuously funded by HHMI's Undergraduate Science Education Program since the program's inception in 1988, and received \$1.2 million for 2008–2010 (for a complete description of HHMI-funded activities, visit <http://www.haverford.edu/kinsc/HHMI/>). Funding for students includes a summer research stipend for interdisciplinary science scholars and stipends for students who participate in the Multicultural Scholars Program (MSP), which supports students who belong to various underrepresented groups. These are scholarships for students who choose to work in interdisciplinary research programs on campus involving biology in some way. More recently, support from the HHMI grant has placed three students in international laboratories (in France, Germany and Israel). Overall, for the summer of 2010, Haverford's HHMI program awarded stipends to 26 students.

In the areas of curriculum and faculty development, Haverford has responded to a recent call from HHMI to strengthen the disciplinary connections between computer science, mathematics and biology. In response, a new concentration in Scientific Computing has been created, and select faculty in Biology and Mathematics have developed new courses that highlight the significant overlaps between these disciplines. The HHMI grant has funded travel for faculty involved in these initiatives, giving them the opportunity to share and learn best practices, which they can then use to enhance their teaching at Haverford.

Mellon Foundation Environmental Studies Program

The Mellon Foundation has awarded a significant grant to Haverford to develop an Environmental Studies program. This grant will help endow funds to support three new tenure-track positions in the Departments of Chemistry, Biology and Anthropology. In the past year, an Environmental Studies Working Group, including faculty and administrators throughout the institution, has met regularly to develop a new Concentration in Environmental Studies. In 2009, the Chemistry Department hired Dr. Helen White, an environmental chemist who studies the chemical, physical, geological and biological processes that govern the

composition of the Earth's environment. Rounding out the Environmental Studies program will be environmental biologist Jon Wilson and environmental anthropologist Nikhil Anand, who both join the faculty in the fall of 2011.

Beckman Scholars Program

The Arnold and Mabel Beckman Foundation has awarded Haverford four successive grants over the past 10 years to offer scholarships to exceptional students with an interest in the chemical and biological/medical sciences. To date, 15 Haverford College students have been designated as Beckman Scholars. The scholars are required to work for two summers and one full academic year (usually falling between the two summer experiences). Students in this program have enhanced opportunities to engage in original research, working closely with their faculty mentor to craft a curriculum and research plan that encompasses more than one (and, in some cases, two) full years at Haverford. Beckman Scholars also participate in a number of summer academic enrichment programs and a multi-college research symposium.

Sherman Fairchild Foundation Summer Research Program

The Sherman Fairchild Foundation awarded Haverford a grant to support undergraduate summer science research for 2007–2010. The funds from this grant supported the cost of research stipends for 10 students each year. The bulk of the stipends has supported students interested in physics and astronomy research.

OPPOSITE: The KINSC is a welcoming facade on the Haverford campus.

LOOKING AHEAD

As a consequence of the generous donation from the Koshland family, the KINSC has been able to fund a wide variety of new projects, focusing on support for faculty and student partnerships in scholarly and curricular advances. We expect to continue expanding our collaborative projects as we support the nascent Environmental Studies program, faculty and student interest in public health, and general issues of science and society. The KINSC is in a rapid state of growth, with a strong organizational structure to attract future funding. This funding will continue to support the vital and energetic community of faculty and students who perform scholarship at the highest levels, while also providing students with opportunities to apply their academic training in a wide variety of venues, whether in service to the global community or their own professional development.





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