Advancing the Frontiers of Knowledge: The Science Honors Innovation Program

American economic strength and national security depend on our Nation’s rich tradition of innovation.

— Office of Science and Technology Policy
Executive Office of the President of the United States

<table>
<thead>
<tr>
<th>Request</th>
<th>On behalf of its College of Science and Mathematics (CSAM), Montclair State University respectfully requests your support to create the Science Honors Innovation Program.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Importance of the STEM Disciplines</td>
<td>To ensure continued technological leadership in the world, the American Competitiveness Initiative (ACI) was created in 2007 to invest in basic research in science and engineering because, “… research develops and advances knowledge and technologies that are used by scientists in nearly every other field.”</td>
</tr>
<tr>
<td></td>
<td>These fields, collectively known as the STEM disciplines (science, technology, engineering, and mathematics), were singled out because of their potential to increase American competitiveness through innovation in pure and applied science in conjunction with the economic benefit derived from innovation in these fields.</td>
</tr>
<tr>
<td></td>
<td>The 2009 report to Congress from the President of the National Academy of Science notes:</td>
</tr>
<tr>
<td></td>
<td>Recent unexpected challenges to our economy and industrial base have again placed a spotlight on the overarching need we identified in our 2005 report <em>Rising Above the Gathering Storm</em>. The United States must take the steps necessary to keep the nation viable and competitive in the globalized economy.</td>
</tr>
<tr>
<td></td>
<td>President Barack Obama has announced that “it is time we once again put science at the top of our agenda and work to restore America’s place as the world leader in science and technology.”</td>
</tr>
<tr>
<td>A Critical Research Agenda</td>
<td>The College of Science and Mathematics has a well-established tradition of preparing intelligent, ambitious students for graduate work and careers in technical fields. Changes in the global economy have made it clear that we must go further, to inspire creativity in the STEM disciplines by creating cohorts of researchers who will advance innovation and technological leadership in this country.</td>
</tr>
<tr>
<td>The MSU Response</td>
<td>In response to the increasingly obvious need for such science professionals, Montclair State proposes the creation of the Science Honors Innovation Program (SHIP), a 10-year program to create an annual cohort of 12 highly skilled CSAM graduates trained and fully prepared for careers in innovative science.</td>
</tr>
</tbody>
</table>
This program will strengthen our ability to offer our most promising students an upper level honors program in the sciences that hones them for their “next step” through intensive research programs and opportunities to promote innovation, while grooming them for major national and international awards and recognition.

Program Features

Researchers are made, not born. Although a student may have the inclination towards leadership-level creativity in the STEM disciplines, that spark must be ignited by the proper conditions: basic knowledge, training in the rigor of research methods, and exposure to opportunities and innovative minds. The Science Honors Innovation Program provides all of these aspects, as detailed below.

Recruitment

The Science Honors Innovation Program will be available to junior and senior students enrolled in any of the majors in the College of Science and Mathematics. The University already has an Honors Program open to all majors, but this program only runs for the freshman and sophomore years. The primary pool of candidates for SHIP will emerge from CSAM students already enrolled in the University Honors Program: those who have already gone through the University selection process, have maintained their enthusiasm for the sciences, and hold strong potential for future success.

A SHIP committee composed of faculty members from each CSAM department will develop acceptance criteria and application processes and will form the team to recruit actively to the Program. The basis for acceptance to the program will be focused on individual student’s
potential for future doctoral program success and potential to obtain a major national predoctoral award. Thus students will be accepted to the program based on writing abilities, oral presentation potential, quality of their progress in college to date, letters of support, and science/mathematics research potential and prowess. Interviews with the Committee will be required. The first cohort will be 12 students entering their junior year. The program will double in the second year and be capped at 24, with a distribution of 12 students in their junior and 12 in their senior years.

**Orientation**

Our SHIP students will be oriented to opportunities for their Honor’s thesis through a research faculty seminar rotation program that will include discussion of ongoing research and general methodologies of successful research programs, plus tours of our research laboratories.

**Leadership**

SHIP will be led by a new Program director, hired by Montclair State specifically for the purpose of leading an interdisciplinary, upper-level CSAM Honors organization. This individual will be recruited in a unique faculty search that will have the discipline open and will select the individual with the best credentials regardless of specific STEM discipline. The candidate will, in addition to being an outstanding scientist and teacher, have an interdisciplinary focus and experience grooming undergraduate science students for national and international awards.

**Faculty Mentor**

Special mentoring from research faculty with support from external professionals in relevant industries: In addition to the individual student’s Honors thesis, which will be mentored by an individual faculty member within CSAM, the student will also have full access to that faculty member’s research facilities, library and other resources as well as lines of communication (direct and electronic) to leading professionals in STEM industries. The faculty mentor, in addition to the Program director and industry partner, will help guide the student towards a publishable honor’s thesis and guide him/her towards successful applications to graduate programs and/or appropriate STEM positions.

**Regular Contact with CSAM Leaders**

To insure our SHIP students have full opportunities to recognize the growing need for inter- and transdisciplinary approaches to the sciences, we will insure they have regular opportunities to meet with our CSAM Institute and Center directors. These institutes/centers (e.g. Institute for
Sustainability Studies, Passaic River Institute, Bristol-Myers Squibb Center for Science Teaching and Learning) are founded on interdisciplinary approaches to solving some of the most vexing issues in the sciences today.

Research Study

The primary focus of the program will be the generation of an innovative research study that yields a written thesis and offers the students insight into the process of innovation and the importance of entrepreneurial insight. This research will be guided by a faculty mentor, with additional guidance by professional colleagues from surrounding STEM industries. The program will make funds available to the student for the research. These funds can be used for supplies, small equipment, and research-based (field) travel. Students will start preparing for their research experience as a Junior, when they will do a literature search and draft a proposal for approval. The actual research experience would begin in the summer between their junior and senior years.

Research Presentation

Each SHIP student will be required to present their research at the annual MSU Student Research Symposium. This occurs each year in the late spring and offers our students a comfortable and familiar venue for presenting their research in poster or oral format.

Our SHIP students will also be required to submit and present their accepted research at a national or international STEM conference. At this conference they will be required to compete for the “best student paper/presentation” award. These competitive awards are standard practice at most professional science/math conferences and recognize outstanding achievements by students pursuing and presenting (oral or poster) their research at the conference. Funds are requested to help support student travel to these conferences.

SHIP Students as Mentors

As our SHIP students refine their approach to science, we also want to see them refine their thinking processes. One of the best approaches to deep learning is through teaching. Nothing prepares an individual better than the opportunity to try to effectively transmit concepts to others. In the spirit of “giving back” to the STEM community, the SHIP students will, during their Junior-Senior transition summer help mentor precollege students in the Weston Science Scholars Program.
The Weston Science Scholars Program, now in its tenth year, offers selected ninth, tenth, and eleventh graders from Montclair High School the opportunity to learn science “by doing science.” The program specifically recognizes high achieving students with significant potential in science, mathematics, and related fields, thus the blending with our SHIP students makes for a very effective community. Our SHIP students will mentor these budding scientists by helping with laboratory and field research efforts and honing the skills of the Weston Science Scholars in writing and presenting scientific materials.

**Special Seminars**

Students will be required to attend at least one CSAM-based seminar per month during each academic year. Within the College we offer departmental, program and College-wide seminars as well as special lecture events such as the Margaret and Herman Sokol Science Lecture and our Visiting Science Professional series. For each seminar we will insure that our Science Honors Innovation Program students have opportunities to meet with the speaker in distinct student-speaker sessions.

**Capstone Course**

A unique capstone course will bring all senior honors students together for an interdisciplinary experience. During this course the students will hone their research thesis and skills for professional presentations.

**National Awards**

The high caliber of students recruited into this program will make them strong candidates for national/international awards for national/international awards such as Fulbright, Goldwater, or Wilson scholarships. These highly competitive awards mandate careful grooming, as the awards require not just superior scholarship and grades, but strong writing and presentation skills. Awardees have almost always been groomed for the awards as they progress along their undergraduate programs. Our SHIP program Director will take the lead in grooming our Honors students towards applying for, preparing for, and receiving these honors.
Sustainability

We are requesting a minimum ten-year commitment to support the Science Honors Innovation Program. During this time period and led through the program Director, redundant efforts will seek additional external (Federal, State, Foundation) support for the program. Additional funding during the ten years of initial programming will go towards a larger cohort and/or extended program support. The SHIP will also be supported annually by a match from the University and College of Science and Mathematics that includes salary and fringe benefits for the program Director, additional travel funds for the students, and a full master’s level Graduate Assistant.

CSAM

As Montclair State University has grown from a teachers college to a comprehensive college to a research active university, we have seen not just student enrollment grow, but also our ability to compete for the strongest science and math students grow. Today the College of Science and Mathematics alone has more than 2,400 students, approximately 100 faculty members, 75 adjunct faculty members, and 40 staff members. The College has five departments:

- Biology and Molecular Biology
- Chemistry and Biochemistry
- Computer Science (including Information Technology)
- Environmental Management (including Geography)
- Mathematical Sciences (including Physics, Applied Mathematics, Statistics, and Mathematics Education)
The College also contains:

- The New Jersey School of Conservation (the oldest and largest such school for K-12 environmental education in the country)
- The Sokol Institute for Pharmaceutical Life Sciences
- The Institute for Sustainability Sciences
- The Bristol-Myers Squibb Center for Science Teaching and Learning
- The Passaic River Institute
- The Institute for Remote Sensing

Degrees offered range from bachelor’s to doctorate, the latter including a PhD in Environmental Management and an EdD in Pedagogy with a concentration in Mathematics Education.

With a 39% growth in undergraduate enrollment in the past five years, the College has kept pace through numerous student support initiatives. These include a CSAM Residency Floor (the first such academic residence program at MSU), a CSAM Student Advisory Council, CSAM Science Professional Series, an array of seminar programs, and a variety of opportunities to support student research.
Recently ranked by *Forbes* magazine as the top public institution of higher learning in New Jersey, Montclair State University is the state’s second-largest public university, with over 18,000 students in close to 300 degree and certificate programs. Acclaimed by publications as varied as *U.S. News and World Report*, *The Princeton Review*, and *Hispanic Outlook*, Montclair State boasts one of the highest graduation rates among its peers.

Montclair State University was named one of the 10 top schools in the nation for teacher preparation by *Edutopia*, the voice of the George Lucas Educational Foundation. The University’s College of Education and Human Services was lauded for its innovative programs for teacher preparation and for its interdisciplinary approach to innovations based on the needs of public schools.

At the undergraduate and graduate levels, MSU provides close to 300 majors, minors, concentrations and certificate programs, while remaining accessible and affordable. Our six schools and colleges prepare students to lead productive, rewarding and responsible lives in society and the world.