HARVEY MUDD
COLLEGE

Harvey Mudd College
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www.hmc.edu

HMC 2020

Envisioning the Future

HARVEY MUDD COLLEGE 1955

A Message from the President

I am delighted to present the new Strategic Vision for Harvey Mudd College. In our own inimitable way, the HMC community has come together to examine all that we do in view of the challenges and changes in the world today. We are committed to maintaining our role as an educational innovator, our intimate, supportive and rigorous learning community, and our dedication to excellence. I want to particularly thank the many students, faculty, staff, alumni, trustees, parents and others who have contributed to the creation of this vision. We will be seeking further guidance and support from you as we focus our efforts on developing and implementing the concrete plans that will make these visions a reality.

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The Harvey Mudd College Strategic Vision features six themes designed to meet the needs of our students, our local community and the world at large.

Executive Summary

Harvey Mudd College opened its doors five years after the first hydrogen bomb test and just before the Sputnik I launch. At this time, many were wondering if technology was being pursued for its own sake rather than to improve the human condition. In response to these concerns, HMC made the commitment to educate a new generation of engineers, scientists and mathematicians who understood the impact of their work on society.

The problems facing the world today are more challenging and more complex: global warming and the related issues of sustainability and energy sources, the AIDS pandemic, globalization, and the social and environmental issues it engenders. HMC is poised to bring the focus and excellence it has come to be known for over the last half century to bear on the problems of this new century.

In order to maintain our leadership as an innovative educational institution, we began a strategic planning process for Harvey Mudd College last June. After countless hours of discussions by representatives from all of the college's constituencies, we have reached consensus around a strategic vision that will build on our successes, strengths and core values as a unique college providing a rigorous education across engineering, science and mathematics with a strong emphasis on the humanities and social sciences.

The Harvey Mudd College Strategic Vision features six themes designed to meet the needs of our students, our local community and the world at large. The six themes of the vision are:

I. Innovation, leadership and impact, especially in engineering, science and mathematics
II. Experiential and interdisciplinary learning
III. Unsurpassed excellence and diversity at all levels
IV. Nurturing and developing the whole person
V. Global engagement and informed contributions to society
VI. Infrastructure and resources to support our commitment to excellence and building community

This document describes how each theme relates to the HMC history and current experience and elaborates on how, through focusing on these six themes, we can achieve even greater success and meet the needs of the world tomorrow.

Our education will continue to include a strong emphasis on humanities and social sciences as well as an increased emphasis on interdisciplinary and experiential learning, so that our graduates are prepared to become leaders in their fields and to address major challenges facing the world. We will continue to expand our influence from regional to national to international. We will strongly value and support our alumni who apply their HMC education to contribute to society in any field or endeavor. We will expand our influence on society beyond the contributions of our graduates by broadly disseminating our knowledge and expertise in outstanding education.

While we will continue our deep, broad and rigorous education to exceptionally talented students, and to stress that technology should be developed with an understanding of the societal context, there will be changes. Our emphasis will increase in a number of areas, including diversity, flexibility, work-life balance, international experience, infrastructure and educational innovations. We have committed ourselves to ambitious objectives which we feel have compelling value. HMC is at a critical point. Many of the innovations we have introduced have been emulated by other institutions. Unless we continue to innovate to respond to the changing needs of the world, our uniqueness and role as an educational leader will diminish.

Today's challenges are real and difficult, but the HMC community is dedicated to surmounting them and continuing to make our small, young, exciting and innovative undergraduate institution the best place in the world for a rigorous and intimate undergraduate education emphasizing engineering, science and mathematics.

Introduction

In the middle of the 20th century, the United States needed brilliant and rigorously trained engineers, scientists and mathematicians who had a breadth of knowledge across these fields, who had a strong background in the humanities and social sciences, and who understood the impact of their work on society. Harvey Mudd College answered that call when it opened its doors in 1957, less than a month before Sputnik I launched the Space Age. Forty-eight students and seven faculty members constituted the pioneers who shaped this unique institution born of the generosity of mining engineer, entrepreneur and philanthropist Harvey Mudd, and the vision of Joseph B. Platt, nuclear physicist and first president of the college. The founders of HMC envisioned a distinctive coeducational experience for the college's students. The curriculum was designed to create excellent scientists and engineers with unusual breadth in their technical education accompanied by a firm grounding in the humanities and social sciences.

Another important distinction was the teaching model: class sizes were small, and the interaction between students and faculty members was high; academic programs were demanding, but the college fostered cooperation rather than competition through a student-directed honor code. The college benefited greatly from being a member of The Claremont Colleges (Pomona College, Claremont Graduate University, Scripps College, Claremont McKenna College, HMC, Pitzer College, and Keck Graduate Institute of Applied Life Sciences), with access to excellent library and student services, as well as the courses and faculty at the other colleges. All of these attributes are still at the heart of an HMC education. To capture a sense of the college's mission and purpose, President Platt drafted a mission statement in 1956 that continues to guide the college: **Harvey Mudd College seeks to educate engineers, scientists and mathematicians well versed in all of these areas and in the humanities and social sciences so that they may assume leadership in their fields with a clear understanding of the impact of their work on society.**

Today, HMC is a small residential college, with roughly 730 students and 80 faculty, that is widely recognized for its programmatic innovation, excellence and rigor. *U.S. News & World Report* consistently ranks HMC among the top 20 undergraduate liberal arts colleges; we were tied for 14th in 2006. The college has received many other honors within the last year, including being tied for first place in undergraduate engineering programs among U.S. non-doctoral institutions (2007 *U.S. News & World Report*, "America's Best Colleges"), being named one of the 25 "New Ivies" (2007 Kaplan/Newsweek), receiving the inaugural award for exemplary program or achievement by a mathematics department (American Mathematical Society), and having one of the best engineering design programs in the United States (2006 *BusinessWeek*).

Harvey Mudd College has one of the highest percentages of graduates who go on to earn Ph.D.s. In a 2002 Research Corporation study, we were ranked first in the number of science graduates earning a Ph.D. in the natural sciences within six years of graduation. The college's reputation is built upon the excellence of its faculty and students, its independent spirit and sense of fun, the quality and innovation of its programs, and the extraordinary caliber and achievements of its graduates.

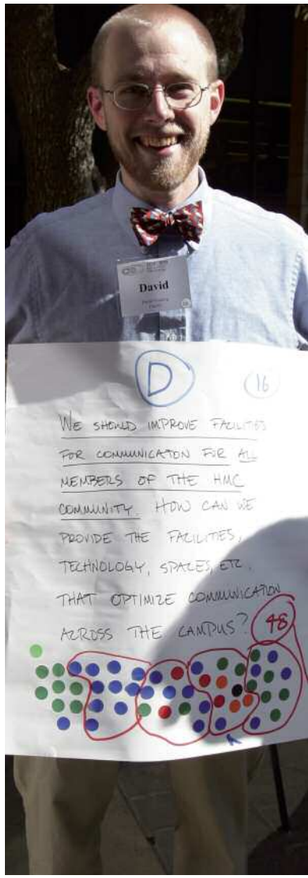
Planning for the future of Harvey Mudd College must take into account our role within the Consortium. As a group of seven outstanding educational institutions (five undergraduate and two graduate), with a unique level of shared resources, there are many opportunities for greater collaboration on both new and existing initiatives. In all six areas of our Strategic Vision, we will be seeking to strengthen our collaborations within the Consortium to better leverage and contribute to our shared resources.

The Strategic Planning Process

Preliminary work on HMC's Strategic Plan began with focus groups for parents, alumni, industry representatives and the on-campus community, and with a request to members of the HMC community to suggest possible topics for strategic planning workshops. The strategic planning steering committee, chaired by President Klawe and composed of trustees, faculty, staff, students and alumni, chose themes for four one-day workshops that were held during fall 2006: Responding to a Changing World; Maximizing Our Impact on Society; Optimizing the HMC Experience; and Looking Outside the Box. Planning committees, made up of members from each of the college's constituencies were formed for each workshop, with co-chairs selected from members of the steering committee. Each planning committee selected up to nine specific discussion topics within the main theme.

The week of Oct. 16, 2006 was set aside for the important task of institutional reflection. HMC classes were cancelled to allow faculty and students to participate fully and to hear the invited speakers who launched each workshop with inspiring talks related to innovation, global economics, diversity, education, collaboration and science, technology, engineering and mathematics (STEM) trends (video archives are available at www.hmc.edu, under "Office of the President"). Over four days, more than 400 people including trustees, students, alumni, staff, faculty, parents and other individuals listened to each others' ideas, commented, reflected and made recommendations relating to the topics. The planning committees then summarized the discussions and distilled them further for another round of workshops held during the annual retreat of the HMC Board of Trustees.

At that retreat, 110 participants — including trustees, alumni, faculty, students and staff — discussed 23 topics over the two days of workshops. The steering committee went to work again after that busy weekend to prepare the first draft outline of the strategic vision. The outline was presented to the HMC community several times between Nov. 16 and Dec. 9, and revisions were made in response to the feedback received. The six themes of the Strategic Vision are presented here.



Strategic Planning

Over four days, more than 400 people including trustees, students, alumni, staff, faculty, parents and other individuals listened to each others' ideas, commented, reflected and made recommendations relating to the topics.

I.

Innovation, Leadership and Impact, Especially in Engineering, Science and Mathematics

The United States has distinguished itself with revolutionary advances, particularly in engineering, science and mathematics. More than two centuries of creative thinking and innovative design have resulted in achievements that have transformed the way people live and work — from the cotton gin and magnetic resonance imaging, to the Internet. The U.S. has usually been responsible for the research and development of "the next big thing" while the rest of the world has followed its lead. This journey has brought this nation to the forefront of economic and social prosperity while also benefiting the economies and technological infrastructures of many other nations.

In a speech given on the HMC campus in 2006, National Science Foundation Director Arden Bement Jr. remarked that innovation today is not limited to one scientist or one nation. Instead, it is increasingly the result of connections that crisscross the globe. He said, "We can count on the solid foundations of our academic institutions, but we can no longer get by with narrow curriculum, static teaching techniques or teaching which does not inspire or motivate." The nations that pull ahead are those that quickly embrace new knowledge regardless of its source and propel its citizens along new economic and technological pathways.

Higher education in the U.S., then, needs to prepare for the demands of global citizenship, and HMC is well-positioned to be a leader. Our significant requirements in the humanities and social sciences, our Integrative Experience courses, our tradition of experiential learning and real-world projects, and our growing provision of opportunities for research and study abroad, set a trend that will gain importance as the U.S. prepares its students for this future.

Our commitment to undergraduate learning allows and motivates continued pedagogical innovation. Faculty members emphasize active learning through small-group seminars, student-led team projects and independent study. Students are engaged with faculty in research projects at all levels with access to state-of-the-art research equipment not often found at similar-sized institutions. Faculty are encouraged to do research in pedagogy as well as their specific disciplines. Nevertheless, like all highly successful institutions, HMC has developed some resistance to change and to taking risks. To continue to be as successfully innovative in the future as we have been in the past will require a new level of attention, effort and resources. We must ensure that our curriculum, our organizational structure and our processes for promotion, tenure and recognition support innovation and agility to move into important new areas. We must become more self-aware and deliberate about what we are doing and why. We will need to study the very process of innovation and use what we learn to inform our own departments and committees. We must offer programs that teach and stimulate creativity and innovation in our students and graduates.

We also need to increase the opportunities for our students who are interested in exploring areas such as economics, policy, education, communication and entrepreneurship, where their technical expertise in the STEM fields can be of significant value. There is a great societal need for more people working in such areas to have a strong understanding and appreciation of engineering, science and mathematics.

Given our expertise in inspirational teaching in STEM fields, and the tremendous need for such teaching in the U.S. and the rest of the world, we have a responsibility to share this more broadly. Our impact and influence can be increased by creating programs to host post-doctoral fellows and faculty from other institutions, and by expanding the conferences we offer in STEM education. Likewise, many teachers in high school and earlier grades, can benefit from summer programs where our faculty and students engage them in learning about exciting advances in engineering, science and mathematics, and collaborate in developing instructional resources appropriate for their students. Finally, we can better serve our community and ensure a pipeline of qualified applicants from less advantaged backgrounds by expanding and integrating summer programs for high school students with unusual ability but who lack access to excellent teaching in science and mathematics.

HMC has much to offer regarding innovative and effective education in the STEM fields. We need to be more proactive about celebrating, rewarding and sharing our achievements in these areas.

Dan Strenge '06 and Stephanie Feldman '06 examine a frog embryo with the OCM.

Interdisciplinary Innovation

Detailed motion pictures being created in the HMC physics lab show how frog embryos grow and change in the earliest stages of development. Using an optical coherence microscope (OCM), students have created three-dimensional pictures of cell activity below an organism's surface without cutting or otherwise damaging the organism. Their work, and that of their classmates and faculty advisers, is adding to our understanding of how cells interact as they differentiate into distinct parts of the body.

The OCM project at Mudd is noted for being highly interdisciplinary and has involved students and faculty from all six major programs. More than 100 student researchers have worked on the project, which has required designing and constructing the optical coherence microscope to study fundamental problems in developmental biology. In addition to the study of the frog (*Xenopus laevis*), the OCM is being used to study another model system, the plant *Arabidopsis thaliana*, which has potential importance to the agricultural industry.

Work began in 1996, when the OCM was acquired with a National Science Foundation award. Andrew Schile '01, in collaboration with Caltech professor and HMC Trustee Scott Fraser '76, produced the first time-lapse frog embryo movies by acquiring many successive 3-D images of gastrulation, at time intervals of 10 minutes, and splicing them together. In 2004, with Burton Bettingen Professor of Physics Richard Haskell, Sean Skelly '04 constructed an OCM operating at 1300 nanometers to improve depth penetration and resolution over the original OCM instrument that was operating at 850 nm. A faster CPU in the new instrument allowed researchers to enhance motion-sensitive images. In particular, researchers have been looking at internal cellular structures, at vegetal rotation and neural fold closing, all critical events in the early development of animals. The OCM is capable of non-invasively, non-destructively imaging cells or groups of cells located up to one millimeter below the surface of living tissue, regions rendered opaque using conventional microscopy techniques. Modern visualization software turns these OCM images into three dimensional, time-lapse movies of tissue development, an exciting outcome for developmental biologists and for undergraduates at HMC. The OCM research project has generated new HMC courses and course material in physics, engineering and computer science. Also, the design of the OCM and the application to plants and agriculture are sufficiently unique that the college has applied for a patent.

The Clinic Tradition

HMC's Clinic Program is a nationally recognized hallmark of the college that engages students in the solution of previously unsolved technical problems for clients in industry, government and other institutions. Founded as an innovation in engineering education, this program has expanded to other departments within the college and has been emulated by institutions worldwide. More than 1,000 projects have been undertaken over the 40 years since the program's founding.

Hot Research

According to the National Fire Protection Association, 968 firefighters died in the line of duty in the 10-year period ending in 1999. Eighteen percent of the fatalities that occurred in structure fires were due to the collapse of the structure.

Creating an early warning system for firefighters that will predict structure collapse is one of the projects currently being undertaken by Ziyad ("Zee") Durón '81, Jude and Eileen Laspa Professor of Engineering. Durón also is director of the Frank and Frances De Pietro Fellowship in Civil Engineering, created by Trustee Robert De Pietro '69 and his brother Dennis, which gives students an opportunity to participate in this research.

Using the HOBS (Health of Burning Structures) system, Durón and his fire research team mounted a series of monitors on an abandoned school building in Fillmore, a rural community in northern Los Angeles County, and gathered data as the building was allowed to "free burn." The researchers were pleased with the results of the Fillmore burn, the 13th since Durón began the research in 2001. The student team observed as data from sensors showed the changes in vibrations during the fire. Just like a heart rate monitor, the line on the monitor began to move downward as the fire compromised the structure. Five minutes before the collapse of an overhang, and before weighted trash cans fell through the roof, sensors detected changing vibrations.

The research is designed to provide firefighters with information that clearly indicates regions in a building where weakening is taking place, and to provide indicators that describe the rapidity of these changes. With this information, firefighters can proceed with informed caution and enhanced safety.

Imagining Math

The HMC Department of Mathematics regularly hosts mathematical activities, exploration and inquiry centered around an area of cutting-edge mathematics research. During a recent Imagine Math Day designed for high school mathematics teachers and students, participants explored graph theory through various applications of graphs. Together they learned enough about graph theory to participate in the main activity of the day, that of developing and exploring different notions of graph complexity. Students developed posters that explained their ideas and displayed them at the end of the event. The event was organized by the HMC Professional Development and Outreach Group, which has received funding from the Institute for Advanced Study/Park City Mathematics Institute and the Mellon Foundation.

> At Harvey Mudd College, we are not just training engineers, scientists and mathematicians who can do routine calculations. Society needs technical experts who can also be leaders, innovators and responsible decision makers."
>
> —Daniel Goroff, vice president and dean of the faculty

II.

Focus on Experiential and Interdisciplinary Learning

The traditional organization of learning in universities and colleges is by separate academic disciplines, and these disciplines have become increasingly specialized over the last century. The traditional ivory tower model of higher education isolates students from real-world issues. On the other hand, solving any of the important challenges facing the world requires insight and experience from several academic disciplines and practical knowledge.

Harvey Mudd College has challenged these traditions from its beginning. Founding President Joseph Platt, a research physicist, and the first faculty member, J. Arthur Campbell, a noted chemistry educator, merged their strengths to create a unique vision of learning science and engineering through the actual practice of these disciplines—that is, by conducting basic and applied research, and working on present problems. Students with this kind of education are far better prepared to move on to work or graduate research, having had an opportunity both to integrate their classroom knowledge and to develop specific skills and insights that will be required. The ability to conduct original investigations, to plan an approach to a problem and to see it through, is essential to success in any significant engineering, science or mathematics endeavor.

Experiential learning via Clinic projects, design courses and modeling competitions has been a large part of an HMC education for several decades. More recently it is increasingly a part of other HMC courses. For example, students are teaming up with local elementary and high school students to work on projects and to offer their technical expertise in areas including chemistry, mathematics, engineering and computer science. The tradition of students engaging in summer research at HMC also dates from our founding, and participation is increasing each year. As part of this vision, our goal is to offer a summer research, Clinic, internship, or community-engagement opportunity for every student who wants one. Our offerings must include introductory opportunities in interdisciplinary areas so that students can get a taste of research across a range of disciplines, as well as opportunities to do highly advanced work. We hope to establish a coordinating capacity to match students with faculty and organizations offering experiential learning opportunities, whether through course work, research or tangible projects.

Although our current curriculum is divided into four components: the Common Core, the major, the program in humanities and social sciences, and the Integrative Experience, it remains more integrated than that at many colleges, tied together with a strong emphasis on oral and written communications, the development of computational skills, and the social context of what is being studied and what is going on around the world. One of the four components, the Integrative Experience, is explicitly designed to connect the upper-level technical elements of major courses with advanced work in the humanities and social sciences. In engineering, the required systems sequence is unique, taught by faculty from electrical, mechanical, chemical and civil engineering disciplines, with contributions from physics and chemistry faculty. We have established several interdisciplinary majors — currently chemistry and biology, computer science and mathematics, and mathematical biology — though progress is still needed in fully integrating the learning experiences across disciplines.

Our goals for the future include increasing interdisciplinary learning in the core curriculum, expanding our interdisciplinary majors and research projects, and establishing centers to stimulate and support interdisciplinary learning and research in specific areas. One possible approach is to use themes, such as life sciences, computation or sustainability, as an integrating vehicle throughout the college. Whatever approach is taken, achieving our goals for interdisciplinary learning will require a commitment to eliminating the unintended barriers arising from the standard discipline-centric department structure.

Grad school for undergrads

An extraordinary number of students — off-campus students as well as those involved through Research Experience for Undergraduates programs in chemistry, computer science and mathematics — engage in summer research, a tradition at HMC for 50 years. In 2006 alone, 170 students and 50 HMC faculty participated in what has been deemed the "grad school for undergrads."

Nearly 120 projects spanning the fields of biology, chemistry, computer science, engineering, mathematics and physics were undertaken during the recent Summer Research Program.

"Faculty members work very hard for their research funding and they are vested in the outcomes of these projects," said Associate Dean for Administration Gerald Van Hecke '61, who oversees the college's Summer Research program. "The faculty and students here are true collaborators."

Established in 1960 with just six chemistry students, the 10-week Summer Research Program was originally funded by a National Science Foundation grant as part of a nationwide effort to promote undergraduate research. Since then, the program and its activities have only grown larger and more interesting.

"The excitement of discovery in a laboratory is a very different type of discovery from learning in the classroom," said Chemistry Professor Shenda Baker, who led a number of summer research projects. "The possibility of synthesizing something that no one else ever has, or seeing or creating a structure that no one else has made can be a very motivating force for students to get back into the classroom to learn more about why materials and chemicals behave the way they do."

Over the past few decades, a steady increase in both internal and external funding has enabled HMC's Summer Research Program to continue to grow. In addition to the many individual faculty research grants, the Summer Research Program is also supported by funds to the institution from NSF, the Howard Hughes Medical Institute, the HMC Arnold Beckman Research Endowment and the Baker Foundation, among others.

Service-learning lessons

To determine just how much impact local traffic has made on the environment, HMC is offering "Service-Learning in Chemistry: Lead in Soil from Vehicle Emissions," which is being funded by a grant from the National Science Foundation and with additional matching funds from the Ludwick Family Foundation and The Camille and Henry Dreyfus Foundation. The project contributes to the college's goal of educating students not only in the technical aspects of science and engineering, but also in the social responsibilities of scientists, and the interrelation of science and society.

Under the direction of Hal Van Ryswyk, professor of chemistry, students in the first-year chemistry laboratory plan, sample and test for lead in soils from vehicle emissions throughout the community. In the process, they are collaborating with students in a probability and statistics course, with fifth- and sixth-graders at Vista del Valle Elementary School in Claremont (whose students are predominately from groups traditionally underrepresented in science and technical fields), and with the California Childhood Lead Poisoning Prevention Program.

Students focus on the determination of lead in soils along roadways, in school playgrounds and in public parks adjacent to the major roadways bisecting Claremont. They perform the entire sample preparation in a single laboratory period using microwave-assisted digestion and a fast-sequential analysis atomic absorption spectrometer.

The data collected in this project is revisited by students in a core mathematics course in probability and statistics, allowing them to undertake more sophisticated analyses. The students' data will be ultimately aggregated with that of Jonathon E. Ericson, professor of social ecology, University of California, Irvine, in order to address ongoing questions in environmental science regarding the distribution of lead from vehicular emissions in the environment and the relationship between total lead and its bioavailability.

Strategic Vision Theme II Focus on Experiential and Interdisciplinary Learning

To augment community education regarding the hazards of lead poisoning in children in the neighborhoods surveyed, student researchers will report results to the wider community in partnership with the Los Angeles County Department of Health Services, which jointly operates the Los Angeles County Childhood Lead Poisoning Prevention Program.

Said Van Ryswyk, "Through this project, every HMC student will come face to face with questions regarding the impact of their technical work upon society while simultaneously developing tools to examine this relationship. This is a wonderful opportunity for our students to become engaged in our local community through promotion of science, mathematics and engineering to elementary school students."

Far from the Mudding Crowd

Students taking the course Dickens, Hardy, and the Victorian Age read eight novels by these authors that touch on various facets of the history of England in the nineteenth century. After lectures, discussions and reports on campus, they then travel to England with the course's professors to visit sites related to the authors and works. The visits to places like Dickens' London house deepen their understanding of literary history and creativity. At right, students learn how cathedrals were built.

Through the Lead Project (above), HMC students come face to face with questions regarding the impact of their technical work upon society while simultaneously developing tools to examine this relationship.

III.

Unsurpassed Excellence and Diversity at all Levels

While the STEM workforce in our country is a small fraction of the overall workforce, it has a disproportionate impact on society. Broadening STEM education to include more women, under-represented groups and people with disabilities will help to expand the nation's highly-skilled professionals while taking advantage of the rich variety of perspectives within the population. This goal is especially important in regions like Southern California where diverse ethnicities co-exist and groups previously considered "minority" have become the majority in some areas. A diverse STEM workforce is a competitive advantage that the U.S. is still struggling to develop. Higher education institutions that learn how to expand their reach to these groups have a strong advantage with respect to global competency as their graduates will be better prepared to work with the diverse people who define and interpret today's scientific and technological problems in many different ways. Throughout our work to significantly increase the diversity of the HMC community, we will maintain our commitment to the unsurpassed level of excellence in the achievements of our graduates, faculty and staff.

From its earliest days, HMC has attracted students of extraordinary ability. Typically, over 90 percent of HMC students were in the top 10 percent of their senior classes, and more than 20 percent were valedictorians or salutatorians. We enroll more National Merit Scholars than nearly every other U.S. undergraduate college, and the median SAT scores of our entering students are in the top five percent in the nation.

Faculty members, many of whom have established national and international reputations in their fields, continue to excel and garner awards and honors. A number are recipients of National Science Foundation CAREER Awards and Dreyfus Awards, and others hold prestigious posts on national boards and receive national recognition for their excellent teaching. Many present invited lectures at national and international conferences, further adding to the college's outstanding reputation.

Over the last decade, HMC has made substantial progress in recruiting women students, with women making up 29 percent of the student body in 2006–07 compared to an average of 20 percent during the 1990s. Even more impressively, we have increased the number of women faculty to 35 percent overall, with the engineering, mathematics, humanities and social sciences, physics and computer science departments being one-third female, while biology is one-half female. This places HMC at the top of institutions with leading undergraduate programs in these areas. Our success in increasing the number of women on campus is laudatory, but we still need to significantly improve our diversity with respect to race and backgrounds among trustees, faculty, staff and students.

Creating a campus that is equally accepting and supportive of all its members is consistent with the college's mission and honor code. In 2000, the college created the Blueprint for Diversity, which seeks to develop and implement programs to improve the campus climate for diverse populations. Since the early 2000s, HMC has developed new programs for education, advising and retention. Our work continues as we seek to promote discussions between people with different viewpoints and encourage training that will allow people to engage in positive and meaningful interactions. We seek curriculum, culture and community that enable the success of exceptionally talented people from all backgrounds.

Within the last few years, HMC has added student chapters of the National Society of Black Engineers and the Society of Hispanic Professional Engineers, both of which have been active on campus and in the community. The Society of Women Engineers is one of the most active organizations on campus and has received numerous "Best Chapter" awards for its activities. The contacts that students make within these organizations at the regional and national level expose them to a variety of individuals who have taken diverse paths to success.

At HMC, we must promote this same message for all our students, faculty and staff: excellence and success can be attained by many different paths. We must recognize and celebrate the wide range of achievements by all members of our community. We must also create a culture in which our members feel empowered to take the necessary risks that lead to greater success as well as to the failures that lead to greater learning and personal growth.

The Society of Women Engineers (SWE) has received a number of awards for its annual WEST conference, which has been lauded for effectively exposing pre-college students to available opportunities in engineering and science-related careers. Conferences each year are attended by over 100 students, parents and teachers. Participants choose workshops, one engineering and the other in a science field of their choice (biology, chemistry, computer science, mathematics or physics). They also hear keynote speakers from engineering and science fields.

Students from the National Society of Black Engineers (NSBE), Society of Women Engineers, and Society of Hispanic Professional Engineers regularly assist elementary school students with homework assignments in neighboring communities.

Below right, participants discuss cultural identity, personal bias, prejudice and discrimination while practicing listening skills during A Campus of Difference training program designed by the Anti-Defamation League (ADL). During fall 2005, 19 faculty, staff and students participated in five full days of train-the-trainer workshops tailored to the needs of HMC. The ADL, one of the nation's premier civil rights and human relations agencies, provided the train-the-trainer program as part of its A World of Difference Institute, which develops diversity education resources and conducts anti-bias training.

Harvey Mudd College, Blueprint for Diversity 2000
"We pledge to promote an atmosphere that values the dignity and upholds the rights of every individual, to raise the community's awareness and understanding of diversity issues, and to recruit and retain community members from diverse cultural and ethnic backgrounds."

IV.

Nurturing and Developing the Whole Person

HMC is dedicated to nurturing and developing the whole person and to supporting personal growth and the acquisition of skills in areas such as creativity, leadership, teamwork, ethics and communication, in both curricular and co-curricular endeavors. Encouraging growth in these areas is important for all members of our community. For our students, these skills are necessary in order to become effective leaders in their future careers and in all other areas of life. For our faculty and staff, they are an important part of their own professional development. In addition, for our faculty, staff and students to sustain their high levels of achievement over the long term, they must be able to maintain an appropriate work-life balance, and to have the time to reflect, to create and to pursue their passions.

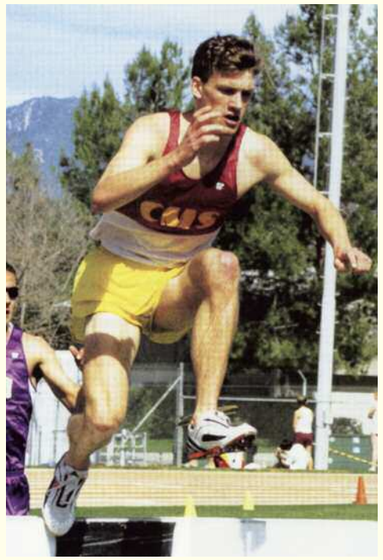
There are already many opportunities to pursue a wide range of artistic, spiritual, political, cultural, social, physical, emotional and professional interests through curricular and co-curricular activities available at The Claremont Colleges. However, the lack of flexibility and the time constraints of our curriculum make it difficult for people to take full advantage of these opportunities. In addition, the rigidity and intensity of our curriculum can hinder the energy and excitement that should be present in a learning environment, and can deprive students of taking a larger share of responsibility for the direction of their education. Recognizing this, we are committed to addressing both the workload and flexibility issues of students, faculty and staff, including revising our curricular model and modifying our culture to value achieving an appropriate work-life balance. We will, however, ensure that our level of intellectual rigor and excellence will be maintained and enhanced by any changes that are made.

We will also provide more support and formal opportunities for students to develop their creative, leadership, teamwork, ethical and communication skills. In addition, promoting more interaction — including mentoring, teaching and career preparation — among staff, faculty, alumni and trustees will provide students with a wider range of whole-person role models.

Scholar Athletes

A number of students have found a balance between their studies and their favorite sport activity, a plus for them and for the Claremont-Mudd-Scripps athletic program.

clockwise from top right: Jocelyn Wong '03 is a champion triathlete. Andrew Cox '08 is an NCAA champion swimmer. Michael Starr '10 is ranked first nationally in men's singles. Elisha Peterson '00, HMC's most recent Rhodes Scholar, was also a first-team, all-conference cross country runner. Nicole Esclamado '07 is a top-scoring athlete.



The Mudd Creative Collective, a student activity group, encourages the creative exploits of Mudd students. It has sponsored a number of events including regular chalking of the Booth Plaza area. Most recently, they joined Chalk4Peace to encourage HMC community members to express their personal statements for peace through illustrations on the pavement.

Robert Keller, Csilla and Walt Foley Professor of Computer Science and Director of the Computer Science Clinic (right), also instructs the popular Jazz Improvisation class. The class performs annually during Presentation Days, a showcase of student research and projects.

Faculty Experience Campus Life

The newest residence hall, Sontag, with its kitchen facilities, LEED (energy-efficient) certification, and plethora of single rooms also sports something else unique to the other residence halls — a faculty member in residence. In 2003, the administration was looking for ways for students to connect with faculty members outside of the academic setting. The faculty-in-residence idea became a reality in 2004 when a two-bedroom, first-floor, 980-square-foot apartment with private patio was filled by a faculty member.

While many faculty and staff members maintain late office hours, none remain on campus throughout the night (save the president who lives in Garrett House on the southeast edge of campus). The last time faculty resided on the HMC campus was in the college's early years. Roy Whiteker, assistant professor of chemistry and unmarried at the time, lived in the first dormitory (Mildred E. Mudd Hall/East) in 1957.

Creating a fun and relaxing atmosphere for students is part of the role of the faculty-in-residence. The two faculty members who have served in this role thus far have held study sessions, screened weekly foreign films, sponsored off-campus excursions and hosted a popular cook-off. In addition to being a good way to integrate junior faculty into the HMC culture, the faculty-in-residence experience gives these faculty members special insight into their students' lives outside the classroom.

An estimated four percent of the HMC student body participates in the Claremont Concert Orchestra, an auditioned ensemble of musicians specializing in the performance of repertoire from the 18th through the mid-20th centuries. HMC students usually make up about 40 percent of the orchestra and about half of the principal chairs.

Violinist Emily Vinding Nyden '06, left

Faculty-in-residence (2004–06) Vatche Sahakian and (2006–08) Susan Martonosi.

V.

Global Engagement and Informed Contributions to Society

From our beginning, HMC has attracted faculty, staff and students who wish to use their knowledge in engineering, science and mathematics to make positive contributions to society. Today, all aspects of our society function at a global level. Whether in industry or academia, engineers, scientists and mathematicians collaborate and compete across the world. Every major challenge operates at a global level: our transportation web enables diseases originating in remote locations to threaten everyone on earth; acts of terrorism affect even the most powerful nations, as do the effects of global warming. As a result, our research and education must take this new global reality into account.

Addressing the major global challenges, or even merely working in global science and engineering industries, requires individuals who are able to work with people from other cultures, and who have the language, organizational, leadership and communication skills to plan and carry out projects that may span nations, continents and oceans. Thus, we must increase the opportunities for HMC students, faculty and staff to develop such knowledge and skills.

We will expand opportunities for students and faculty to study and work abroad and increase our emphasis on global issues and their societal context in the curriculum, Clinics and research programs. We will increase the number of international students and faculty at HMC, and expand our collaborations with key institutions around the world. A superb example of what we can achieve in this direction is the Global Clinic Program that began last year in collaboration with the University of Puerto Rico at Mayagüez, Hewlett-Packard and Amgen.

It is also important that we continue to make contributions to society closer to home: on campus, in our local community, and in the United States. For example, in spite of having a campus that was mostly built long before sustainability became an issue, there is much that we can do to improve how we use resources. In recent years, a number of projects have allowed students to study the campus systems and suggest enhancements. We are committed to continuing and expanding this work, and to promoting sustainable culture, technologies and policies in our curriculum, research and Clinics, and local environment.

Mudders test a hot air balloon design they will build with local high school students.

We are also in a position to help address some of the weaknesses of the U.S. educational system. Despite a number of efforts and reforms to improve K–12 education, high school students are showing decreased interest in pursuing STEM careers, and this failure threatens America's ability to successfully compete and contribute to the world's economy. The shortage of prepared and interested elementary and high school students affects HMC's ability to successfully continue its legacy of educating scientists, engineers and mathematicians who can lead the world into the future. Our educational outreach programs to K–12 and community college institutions — targeted to both students and teachers — can help to encourage interest in the STEM fields and increase the number of prospective HMC students from groups that are currently underrepresented. HMC's proximity to many high-need and ethnically diverse neighborhoods in Southern California places it in a unique position to make a difference in these communities while also providing HMC students with more opportunities for community engagement.

HMC students and faculty have a long tradition of service to surrounding communities. They have helped with community projects, provided after-school tutoring in neighboring school districts and have offered STEM-related conferences and workshops for local school children and youth groups. Further afield, students have helped out in areas hit hard by disaster or poverty. The opportunities for experiences such as these locally and abroad will be a continued emphasis at HMC.

HMC's demonstration garden.

Center Focuses on Sustainability Issues

The HMC Center for Environmental Studies, an interdepartmental medium for creating and coordinating programs related to environmental studies, emphasizes interdisciplinary study of both natural and human-made environments. Established in 2000, the center has spearheaded efforts that have resulted in a weather station, a plan to re-landscape the campus' perimeter, and improved watering and fertilization techniques. The center has sponsored Clinics and has supported faculty and student projects related to sustainability issues. Its first Clinic project investigated the pros and cons of regional landscaping versus traditional Eastern or tropical landscaping, commonly seen in Southern California communities. That Clinic team's results have not only changed the way the HMC grounds crew irrigates and fertilizes, they also resulted in a demonstration garden located on the east end of campus.

Students Plug Face Plate Designs

Plugging something into an outlet that is behind a large piece of furniture or in a dark area is a challenge. For the vision impaired and the blind, outlets can be a frustration regardless of their location. First-year and sophomore students in Introduction to Engineering Design (E4) were charged with the task of designing a face plate for an electrical outlet that would make the plugging-in process easier. The non-profit client Christian Record Services, which offers free services for the blind and visually impaired, wanted a face plate that was adaptable to a two-prong and/or three-prong (grounded) plug. The blind and visually impaired feel with their fingers for the holes, then hope that they successfully line up the plug and outlet.

The six teams of students each presented their variations of a face plate design, some with moveable parts that also doubled as childproof outlet protectors. One design that stood out, and prompted one adviser to ask if the team had researched a possible patent for the device, was a simple E-shaped design. This prototype designed by first-year students allows users to slide prongs along horizontal edges that direct the hand toward the outlet holes but not beyond them. The liaison for Christian Record Services was impressed with all of the designs from the student teams and hopes that one day a local manufacturer that employs the disabled can turn one or more of the designs into a product that will prove useful for many.

Building and Rebuilding Community

Some of the best learning experiences happen outside of the classroom. In the course Building Community, all students are required to complete a 20-hour service-learning project. But as one student remarked recently, many students did much more "simply because we had such a great time." During spring 2006, several students traveled to a small Mexican village just outside San Antonio de las Minas, near Ensenada. For four days, they worked in an orphanage for disabled children, distributed food and clothing and helped build a church. While the trip was challenging to organize, it was ultimately rewarding, and it inspired one student to become involved in the organization Engineers Without Borders. Another group of students took part in the trip to the Gulf Coast region sponsored by Mudders Making a Difference and Katrina on the Ground (KOTG). Participants helped residents gut homes in preparation for refurbishment. In addition to the labor-intensive work, they observed, listened to the stories of survivors and learned about reconstruction efforts. Participants were urged to reflect on what they'd seen, tell it to others, and work on the Gulf's reconstruction.

HMC students helped with New Orleans clean-up efforts.

Clinic Goes Global

The HMC Global Clinic Program began in summer 2006 with two pilot projects in Puerto Rico. Company sponsors Hewlett-Packard and Amgen, both multinational firms with facilities in Puerto Rico, are working on two separate projects with teams of engineering students from HMC and the University of Puerto Rico at Mayagüez (UPRM). HMC is also partnering with Pitzer College, which has particular expertise in study abroad programs. HMC students spent one month in June at UPRM, and UPRM students spent one month in July on the Pitzer/HMC campuses. HMC students learned Spanish while in Puerto Rico, visited Amgen and HP facilities there and took course work in intercultural communications. UPRM students studied their second language (English) while in the U.S. and took a similar intercultural communications course. During the fall and spring semesters, student teams working on a liquid coating and imprinting process (HP) and characterization of disposable technologies (Amgen) were in weekly contact with each other via e-mail, video and teleconferencing, and multi-conferencing with the company liaison. Final reports in Spanish (written by HMC students) and English (written by UPRM students) and deliverables are due in May 2007, with a final presentation at the respective company.

In the past, the Clinic Program has attracted visiting students from ESIEE in Paris and Kogakuin University in Tokyo who work on HMC Clinic teams. HMC students also have spent summers in Tokyo working with Kogakuin students on projects sponsored by Japanese companies.

The Global Clinic Program was launched by John Leland Atwood Professor of Engineering Science Anthony Bright. HMC hopes to expand the program in the coming years.

President Klawe with 2006–07 Global Clinic participants.

VI.

Improvement of infrastructure and resources to support HMC's commitment to excellence and building community

Achieving and sustaining excellence and innovation in education and research in engineering, science and mathematics requires a high level of facilities, technical staff, equipment and information technology infrastructure. Similarly, access to the appropriate kinds of space and resources are essential to building a vibrant and creative intellectual community and to supporting whole-person development.

Many leading higher education institutions around the country and in other nations are building new research and classroom facilities that offer versatility, openness and visual appeal along with the most recent equipment. By comparison, many of our current facilities are cramped and restrictive. There are notable exceptions, like the new Engineering Project Design Studio and Instructional Center which has recently been renovated into a flexible studio environment that fosters small-group active learning, team-based projects, and informal and formal design reviews and presentations. Other recent renovations include a culture lab that offers space for students to study human behavior and the physics research laboratory where more than $1 million worth of state-of-the-art equipment for magnetic research was added in recent years. Yet much remains to be done to bring our classroom and research facilities up to the world-class standards our students and faculty need.

Our first step will be the creation of a comprehensive master plan for our facilities that incorporates technology and maintenance requirements. The plan will address the need for flexible classrooms and labs, enabling faculty to use both modern technology and pedagogical approaches that foster active learning, a sense of community and collaborative work, and to use flexible modes of teaching to address the different learning styles of our students. Our residence facilities also need improvements, including space for more students to relieve our constant overcrowding, more access to kitchens, and more suites so that we can expand our highly successful faculty-in-residence program. While the addition of Jay's Place and the Hoch-Shanahan Dining Commons have been a huge success, the campus still needs other kinds of social spaces, music practice rooms and areas for artistic expression. While we are fortunate to have access to many wonderful facilities through the Claremont University Consortium (CUC), there remains a need for more on-campus resources in these areas.

Improvements are also needed in several other areas of infrastructure. Information technology is playing an ever-increasing role in everything we do, from teaching to research to libraries to administration and student services. We must ensure that we have the software, hardware and technical staff to allow us to operate effectively and achieve the levels of excellence and innovation we seek. In all areas, we will continue to work to use our resources most effectively and to improve our level of effectiveness. Regular evaluation and feedback for faculty, staff, services and programs are essential, as is providing access for staff and faculty to appropriate training and personal development programs.

Planning for the future of our infrastructure is both complicated and enriched by the fact that much of it is held in common by the CUC. Strengthening our interactions with the other members of The Claremont Colleges will be key to both leveraging and developing shared facilities and programs, both of which are needed for reasons of economy, optimal utilization and educational effectiveness.

Model Teaching and Learning Space is Versatile and Functional

An Engineering Project Design Studio and Instructional Center was created this summer as the result of a $500,000 grant from The Ralph M. Parsons Foundation. The Parsons grant funded new facilities that were created from 3,000 square feet of existing classroom space in the west wing of the Parsons Engineering Building. The newly completed Design Studio and Instructional Center consists of a project design studio to be used for design classes and project work. It contains projection equipment and wireless network ports to enhance the room's functionality and a complimentary color scheme designed to foster creativity. An interactive teleconference and seminar room, which accommodates presentations for team projects, conferences and design reviews, was the site for a new economics course.

"This seminar — Economics 197: Science, Technology, and U.S. Economic Progress — uses the new room to bring our students, faculty and staff virtually face-to-face with leading scientists, engineers, economists and policy makers," said Dean of the Faculty Daniel Goroff, who hosted the bi-weekly interactive webcasts.

The videoconference room has the capacity to simultaneously tie in four video conference locations with cutting-edge equipment, including three LCD screens, a digital smart board, sound system and two cameras.

The lecture series, which also included audience participants at the National Science Foundation outside Washington, D.C., and at Harvard University in Cambridge, Mass., kicked off in September with Richard Freeman, one of the country's top labor economists, who spoke on what globalization of the scientific and engineering workforce means for American economic leadership.

Other speakers included physicist Lee Smolin, author of "The Trouble with Physics," who spoke about reorganizing academic research; engineer Neil Gershenfeld, director of MIT's Center for Bits and Atoms, who discussed Fab Labs and the challenges of institutionalizing innovations; and economist Pawan Agarwal of the Indian Council for Research on International Economic Relations, who spoke about global trends in the education and employment of scientists and engineers.

With each diverse topic of discussion, students, faculty and officials on both coasts are simultaneously taking active roles in dialogues they may not otherwise have an opportunity to participate in.

HMC's new lecture series is sponsored by the Sloan Foundation's Scientific and Engineering Workforce Project, co-directed by Dean Goroff and based at the National Bureau of Economic Research in Cambridge.

A Closer Look

A grant from the National Science Foundation enabled the purchase of a confocal fluorescence microscope, making HMC the only institution among The Claremont Colleges with such a device. High-resolution confocal fluorescence microscopy is a powerful tool for visualizing cellular dynamics. The shared microscope facility will advance research projects aimed at the visualization of dynamic processes in a diversity of experimental systems and timescales, including membrane lipids in the cold signaling response in plants and development of new technologies to visualize tissue remodeling.

Evaluating Progress

These six themes are the key directions in which our college community has agreed we must proceed. Our next step is developing the first round of concrete implementation plans over the next six to 12 months. We will include specific goals and metrics in each implementation plan so that we can measure progress toward meeting our goals. We will regularly reevaluate our plans and adapt our goals to best meet the needs of all our constituencies.

We must design and implement our programs with a view toward creating an ongoing culture of evidence-based decision making. Each program plan must contain its own evaluation mechanism that will help both to fine tune the program and judge its effectiveness once it is in place. HMC values the opinion of the academic community and specialists in engineering, science and mathematics from industry and government. Careful attention will be paid to the advice offered by these individuals and by national and international science organizations, professional societies and accreditation bodies as we formulate specific goals for specific programs.

While each program will have it owns goals and measures, every assessment plan will be developed with the understanding that we can learn from the results of everything we do. Such a system of continuous improvement will further HMC's potential as a learning organization and thus increase our leverage as we attack the problems of the early 21st century. Many of these problems are complex, and we will have to raise significant new resources to undertake them. We remain confident that the urgency of the problems and our proven level of excellence and track record for delivery will attract the funding necessary for HMC to aggressively move in the directions outlined here.

Conclusion

Harvey Mudd College is one of the great success stories in contemporary American higher education. Barely 50 years old, HMC has quickly become one of the foremost undergraduate institutions in the United States, ranking side-by-side with elite colleges that in many cases were founded more than a century earlier. At a time when educators, politicians and pundits bemoan the state of science education in our country, we are moving forward with a rigorous and creative curriculum in engineering, science and mathematics, and leading the way for other institutions with our emphasis on educational breadth and our strong curricular commitment to the humanities and social sciences. Our educational innovations such as Clinic, design labs and undergraduate research, have been widely emulated. We are blessed with extremely talented, creative, dedicated and humble students, faculty and staff. Our honor code yields a special combination of freedom, responsibility and security, and while everyone in our intimate and supportive residential college community works very hard, we have an unrivaled sense of humor about ourselves. We have an unswerving commitment to unsurpassed excellence and to making a positive impact on the world.

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