There is no better way to strengthen interest in science, mathematics or engineering than by working on a research project under the mentorship of a faculty researcher. It is here that students are able to undertake detailed, focused investigation of challenging problems and to participate in many dimensions of the research process—opportunities rarely possible in schools. While these apprenticeships require great commitment, students who undertake them report that they are more enjoyable, more challenging, and more intellectually motivating.

If you are a high school sophomore or junior with a keen interest in science, math or engineering and the ability to work independently and responsibly, you might be interested in the High School Honors Science/Mathematics/Engineering Program (HSHSP), a non-credit enrichment program sponsored by the Department of Teacher Education of Michigan State University, with generous support from the Siemens Foundation and Pfizer Global Research and Development. Founded in 1958, the HSHSP is the oldest, continuously running program of its kind in the United States.

Located on a beautiful arboretum campus, Michigan State University is one of the top 50 research institutions in the United States, and is an important center for teaching and research. While in residence at the university, participants spend the majority of their time working on research in one of the life sciences, physical sciences, engineering or mathematics.

The participant fee for the 2005 HSHSP will be $2,600. This fee covers room, board, and some instructional costs. Participants must provide their own transportation between home and campus at the beginning and end of the program, Sunday evening meals, and other incidentals. Scholarships based on financial need are available. Students interested in such assistance should complete the financial aid statement available on the program website or attached to this form. Applications and supporting materials should be postmarked by April 1, 2005. To find out more about this program, visit the website or contact:

Dr. Gail Richmond, HSHSP Director
319 Erickson Hall
Michigan State University
East Lansing MI 48824-1034
517.432.4854
hshsp@msu.edu

http://www.msu.edu/~hshsp

We encourage applications from qualified minorities and disabled individuals

Michigan State University is an Equal Opportunity Institution
1. ELIGIBILITY
Admission to the seven-week program is based upon scholastic ability, maturity, evidence of interest in science, engineering, or mathematics and completion of specified high school courses in science and mathematics. At the time of application the student must be a sophomore or junior in high school, and be in the upper 20 percent of high school classes, with 3 years of college preparatory mathematics and at least 2 years of science (biology and chemistry preferred). Approximately 24 participants, usually 15-17 years of age, will be selected. Room and board scholarships will be available to individuals based on financial need. Keep in mind also that financial aid to participants is sometimes available from schools, businesses, and service organizations in your community, and you may wish to investigate these possibilities.

Candidates for admission are required to provide the following credentials:
 a. A completed application form
 b. A 300-600 word, applicant written essay describing your interests, what you hope to learn by participating in the program, and what you feel you can contribute should you be selected as a participant.
 c. A list of books and magazines you have read the past year. (Those assigned by teachers should be listed separately.)
 d. Letters of recommendation from at least two high school science or mathematics instructors. Please ask them to include in their letter a phone number and, if possible, an e-mail address at which they may be contacted.
 e. A certified transcript of high school grades and standardized test scores. If the student has not taken standardized tests such as ACTs, PSATs, or SATs, an official statement to this effect by the guidance counselor should accompany the transcript.

2. MAJOR OBJECTIVES
This program is designed as an enrichment program, not as an accelerated program. It will provide experience that will not be duplicated in high school or the first years of college. The primary objective of the program is to help students develop a deeper understanding of the process of inquiry. Other objectives also characterize the program. These include having students experience living away from home with peers who have diverse backgrounds but similar interests; acquainting students with life on a university campus; giving students the opportunity to make use of the intellectual, social, and other resources afforded by a university institution and community; to assist students in learning about various careers and with the academic requirements for such careers.

High ability students frequently suffer from an absence of exposure to authentic experiences and challenge in their science and mathematics curriculum. Even in the best of high school science programs, there is not usually the opportunity for students to investigate in depth a problem of interest. The HSHSP attempts to identify and nurture interest and potential by providing numerous opportunities for participants to test their own talents, motivation, and emotional maturity and to experience growth in all of these areas. Our program has provided a needed stimulus and over the years has received
outstanding reviews from participants with respect to the way it prepares them, academically and emotionally, for the program of study they choose in college and beyond.

The HSHSP is not designed to be a program that offers participants a fail-proof project which can be entered into subsequent science competitions. Its purpose is to give its participants the unique experience of carrying out research in a university setting and interacting, not only with professional scientists, but with peers who also have interests in science. That said, over the past years, many of our participants have subsequently done well in a variety of local, state, regional, and national science competitions. For example, 24 former HSHSPers won trips to Washington D.C. as finalists in the Intel and Siemens Competitions, including one student in 1988, 1989, 1993, and 1997, and two in 1999 and 2004. A 1979 participant won first place, a 1983 participant won third place, and two students in 2004 finished fourth in the nation in the Siemens Competition. Over the last six years, an average of six HSHSP participants per year have been named as semifinalists in these prestigious competitions. Many participants also fare well in the International Science and Engineering Fair. More than 95% of HSHSP participants go on to major in science, mathematics or engineering, attending such outstanding colleges and universities as Harvard, MIT, Cal Tech, Princeton, Brown, Dartmouth, University of Michigan, Stanford, Williams, Columbia, Cornell, Michigan State, and others. The Director maintains contact with HSHSP alumni via an electronic network which is continually increasing in size.

Comments of former participants include the following:
I have encountered a situation which most people would not normally experience until their graduate studies.... The interaction with others who shared my interests and capabilities was unique and wonderful.... Lectures and discussions provide a view of other areas of science, thus making the program well rounded.... The social atmosphere was very relaxed and comfortable.... The research experience is exceptional. Being on a college campus prepares you for college.... I now have an incredible respect for researchers: for their perseverance, intuition, and character.... The HSHSP represents a once-in-a-lifetime experience! I have learned things that I will use for a long time to come, and I have made friends I will treasure forever....

3. PROGRAM DESCRIPTION
Students spend the day working individually in their research areas. The time schedule follows:

- Research - Individual research projects in laboratories
  Approx. 8:30-12:00, 1:00-5:00 pm
- Discussions, Seminars, Class & Special Activities
  7:00-9:00 pm Monday, Wednesday
- On/Off-Campus Field Trips
  Scheduled throughout summer (half- and full-days)

Each participant, once accepted, will indicate a preference for a research area from a list of general descriptions. Subsequent discussion with the faculty advisor will determine the specific research project and procedure. Each participant works on one
individual research project which is different from all other projects. The participant is guided by faculty, staff and doctoral students who themselves are researchers in this area. Only one student is placed in any given laboratory.

The following are examples of possible choices in research areas. Specific topics will vary from year to year depending upon faculty available as research mentors.

**Agricultural Engineering.** Testing a DNA-based biosensor for *Escherichia coli* detection in water samples

**Biochemistry.** The docking effect of hairpin ribozymes

**Chemistry.** An Investigation in the Structural Relationship of Transcription Factors BRE and TEIJIB. Expanding the Borohydride Ion: Creating a New Hydride Partner for Dihydrogen Bonding.

**Computer Science.** Stress Strain Behavior of Exfoliated Clay Nylon Nanocomposites. Content-Based Audio Information Retrieval In Large Databases. A Comparison of SARA (X) with Q-Learning in Partially Observable Environments.

**Crop & Soil Science.** Analyzing the Course of NO₃ Through Soil Aggregate Erosion After Appliance. Development and Evaluation of Bt-transgenic Potatoes


**Forensics.** Effect of darkness conditions on the egg-laying habits of the black blow fly, *Phormia regina*. (Diptera: Calliphoridae)

**Genetics.** Development of a DNA-Based Test for the Pembroke Welsh Gorgi Gene for Long Hair.

**Genetics.** Transformation of Arabidopsis GCN5 and ADA2 genes into yeast cells to resolve whether they complement yeast GCN5 and ADA2 genes.

**Horticulture.** Phylogenetic Analysis of *Heterodera* spp. and *Meloidogyne* spp. DNA to Determine Inter-family and Inter-order Relationships.

**Medical Technology.** Isothermal Rolling Circle Amplification’s Detecting Ability of Factor V Leiden and other Mutations

**Nuclear Physics.** Detection of jets and neutral pions in Au-Au collisions and assembly of fiber optics cables for the STAR Electro-Magnetic Calorimeter.

**Taxonomy.** Developing Morphological and Genetic Criteria for Defining Species in Unicellular protists

**Veterinary Med.** The Presence of Myofibroblasts in Ligament: A potential etiology for tendon contracture in foals.

Additional program activities include:

a. daily record keeping and writing a research report
b. use of the science reference library, use of lab safety procedures
c. a visit to the superconducting cyclotron and campus observatory and planetarium
d. field trips to a major pharmaceutical research company, a field biology research station, the National Superconducting Cyclotron
e. discussions about college admissions and scholarships and careers in science
f. discussions of careers in science and personal factors which govern career choice
g. discussions of scientific responsibility and implications of scientific discovery
h. oral research reports by students and program evaluation

Students will be required to give a presentation in their high school science class or another appropriate forum, about their research project and program experience upon returning home. Preparation of their project for a local or national science fair also will be encouraged.

4. PROGRAM DIRECTOR
Dr. Gail Richmond, Associate Professor of Biology & Science Education, Colleges of Education and Natural Sciences.

In addition to Dr. Richmond, there is a senior faculty advisor or mentor for each participant. The faculty mentor is central to the orientation of the participant’s research. (S)he selects lab techniques for the project and may assign supervisory personnel. The participant learns different methods to attack the problem, how to define a scientific problem, how to recognize errors when they occur, and to benefit from them. The mentor is the one who outlines the objectives of research and best explains theory. Students will also likely work on a daily basis with other researchers in the mentor’s research group. These individuals may include postdoctoral research associates, graduate students, undergraduate science majors, and technicians.

5. AVAILABLE FACILITIES
Available campus activities include visiting lecturers, dramatic events, musical performances, films, and planetarium programs. There are facilities for canoeing, swimming, tennis, and team sports. The participants, counselors, and the program director plan together for a number of activities.

Participants will be housed in a residence hall in which there are common lounge, recreational, and dining areas. The living and recreational aspects of the program will be under the direction of the head advisor, a graduate student who is selected by University Residence Halls. The head advisor will select two undergraduate counselors who will live in rooms in the wings with the participants. Also assisting students will be two undergraduate students majoring in one of the sciences or mathematics who are former HSHSP participants and who will live in the dorm and participate in all program activities.

Students will be housed in the residence hall, two per room, near students attending other academically-oriented programs. Applicants should be aware that residence hall social regulations are much less permissive for high school programs than for college undergraduates. Residence hall regulations are strictly enforced. Any serious infraction of these rules will result in the participant being sent home.
6. SUMMER YOUTH DORMITORY REGULATIONS
Participants who violate these regulations will be subject to disciplinary action, which may include being sent home.

a. Use or possession of alcoholic beverages, illegal drugs, fireworks or other explosives, dangerous weapons or substances, is strictly prohibited.
b. Intentional damage or theft of university or personal property is strictly prohibited. Disciplinary action will include remuneration.
c. Members of the opposite sex, excepting parents or guardians, are not permitted in participants' living areas. The formal lounges and public meeting rooms are not considered part of the living area.
d. The residence halls will be closed at 11:00 pm. All program participants must be inside the hall by this time, as the building will be locked.

If this program is to have the advantage of living on campus, there is no alternative to accepting these rules. Personal lifestyle is an important consideration, and we hope that yours is compatible with the program as described.

7. MICHIGAN STATE UNIVERSITY
The 5,100-acre East Lansing campus is one of the most beautiful campuses in the nation. The Red Cedar River bisects the northern 2,000 acres which encompass the most developed area of the campus. Much of the southern portion functions as experimental farms, forests, and natural areas for instruction and research.

Biological research at MSU has focused on molecular biotechnology, food production, genetic diseases, environmental toxicology, new man-made plant species, and pest control systems that reduce hazards to the environment. MSU is the site of a national plant biology center supported by the US Dept. of Energy. It is the site of the Michigan Agricultural Experiment Station with more than 400 research projects and over 300 scientists, and it is the site of the interdisciplinary Center for Microbial Ecology, which is supported by the National Science Foundation. Four medical colleges are located here. Research in the physical and chemical sciences also encompasses a wide variety of fields. The nation's premier National Superconducting Cyclotron is located on the campus, as well as a Center for Material Sciences, Electron Optics Center, several biotechnology and plastics technology centers, and a new, state-of-the-art Biophysical Sciences Building.

The university is accessible by car, Amtrak, or transcontinental bus. Capitol City Airport is about 8 miles west of the campus. Flight time from New York is about 3 hours. Daily flights by U.S. Air, Midway, Northwest, Continental, Delta, and United Airlines to and from Atlanta, Pittsburgh, Detroit, Newark and Chicago connect the airport to every major metropolitan area.

8. IMPORTANT DATES

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<tr>
<th>Date</th>
<th>Event</th>
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<tr>
<td>April 1</td>
<td>Students should mail their applications by this date. As evaluation of each application is completed, notification of status will be mailed.</td>
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<tr>
<td>April 1</td>
<td>Need-based financial assistance forms due.</td>
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<tr>
<td>May 10</td>
<td>The program should be filled by this date.</td>
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<tr>
<td>June 1</td>
<td>All program fees due.</td>
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<tr>
<td>June 19</td>
<td>Registration and orientation. Students may arrive at any time in the</td>
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afternoon but no later than 6 pm. Orientation begins promptly at 7 pm.

**August 6**  
Program ends. Students may leave any time on this date before 3 pm.

**9. INSTRUCTIONS FOR APPLICANTS**

Please check that you send:

a. A completed 'Application to Program' on the attached form (or copy of the form), or via the Web site, http://www.msu.edu/~hshsp

b. A personal essay of 300-600 words. The essay must be neat and should address your interests in science and in attending the HSHSP; what do you think you can contribute and any other significant related events in your life that you feel would be helpful to the Director in evaluating your application. *(I do not want to receive an essay that details your lifetime awards and honors, but rather an honest and compelling story about why you want to spend 7 weeks of your summer doing full-time research and begin away from your friends and family.)*

c. List the following:
   i. courses you currently are taking (for which you have not yet received a grade).
   ii. books or magazines you have read during the past year that were not assigned by a teacher. (Include non-science readings.)

d. Recommendations from at least two teachers. Select science or mathematics teachers who have had you as a student. Please remind them that their letter does make a difference and should speak to your unique strengths as an individual—and should NOT simply be a recap of your resume. *(that doesn't tell me anything about how and what they know about you as an individual.)* It is rare that more than two students are accepted into the program from a given school. **Remind your teachers of this fact before they write your letter of support.**

e. High school transcript including all standardized test scores. Be sure to request that your school send PSAT scores and rank in class (if available). If no test scores are available, have a statement to that effect sent by your school. The absence of some type of standardized test might handicap the applicant in the selection process.
Recent participants are an excellent source of information and can answer questions if you wish to contact them.

AMERICAN SAMOA  Pago Pago  Henrietta Molesi  684-688-1255
ARIZONA  Flagstaff  Thomas Barnes  928-522-0567
CALIFORNIA  Los Angeles  Lawrence Fernandez  213-746-1041  Pasadena  Madelaine Grossman  626-798-3691
FLORIDA  Orlando  Merhawit Negussie  407-382-2019
OHIO  Westlake  Amy Hollinger  440-871-5208
OKLAHOMA  Oklahoma City  Matthew Garber  405-947-2416
PENNSYLVANIA  Haverford  Justin Komisarof  610-645-5822

For inquiries Dr. Richmond can be reached at 517.432.4854 or hshsp@msu.edu.

THE APPLICATION, ESSAY, LETTERS OF RECOMMENDATION, AND HIGH SCHOOL TRANSCRIPT SHOULD BE POSTMARKED BY APRIL 1, 2005. Later applications will be considered if space is available. Applications for financial assistance should be submitted along with the program application, if possible, but no later than April 1 2005. Requests for financial assistance do not influence the selection process; in the past the Director has always been able to provide support for those who indicate such need.