

**02 INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and
co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS**

Submit only ONE copy of this form for each PI/PD and co-PI/PD identified on the proposal. The form(s) should be attached to the original proposal as specified in GPG Section II.C.a. Submission of this information is voluntary and is not a precondition of award. This information will not be disclosed to external peer reviewers. **DO NOT INCLUDE THIS FORM WITH ANY OF THE OTHER COPIES OF YOUR PROPOSAL AS THIS MAY COMPROMISE THE CONFIDENTIALITY OF THE INFORMATION.**

PI/PD Name: Catherine M Mader

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

Race:
(Select one or more)
 American Indian or Alaska Native
 Asian
 Black or African American
 Native Hawaiian or Other Pacific Islander
 White

Disability Status:
(Select one or more)
 Hearing Impairment
 Visual Impairment
 Mobility/Orthopedic Impairment
 Other
 None

Citizenship: (Choose one) U.S. Citizen Permanent Resident Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name):

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project

Ethnicity Definition:

Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.

Race Definitions:

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PI/PD Name: Anna Bonnema

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

Race:
(Select one or more)
 American Indian or Alaska Native
 Asian
 Black or African American
 Native Hawaiian or Other Pacific Islander
 White

Disability Status:
(Select one or more)
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 Visual Impairment
 Mobility/Orthopedic Impairment
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PI/PD Name: Herbert L Dershem

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

Race:
(Select one or more)
 American Indian or Alaska Native
 Asian
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List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:

Not Listed

REVIEWERS NOT TO INCLUDE:

Not Listed

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, lobbying activities (see below), responsible conduct of research, nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 11-1). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency?

Yes

No

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

The following certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding \$100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

- (1) community in which that area is located participates in the national flood insurance program; and
- (2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

- (1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
- (2) for other NSF Grants when more than \$25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)

(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research.

The undersigned shall require that the language of this certification be included in any award documents for all subawards at all tiers.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE	DATE
NAME Tracey Nally		Electronic Signature	Aug 8 2011 11:24AM
TELEPHONE NUMBER 616-395-7316	ELECTRONIC MAIL ADDRESS Nally@hope.edu	FAX NUMBER 616-395-7111	

* EAGER - EARly-concept Grants for Exploratory Research

** RAPID - Grants for Rapid Response Research

NATIONAL SCIENCE FOUNDATION
Division of Undergraduate Education

NSF FORM 1295: PROJECT DATA FORM

The instructions and codes to be used in completing this form are provided in Appendix II.

1. **Program-track** to which the Proposal is submitted: **S-STEM: SCHLR SCI TECH ENG & MATH**

2. Name of **Principal Investigator/Project Director** (as shown on the Cover Sheet):

Mader, Catherine

3. Name of submitting **Institution** (as shown on Cover Sheet):

Hope College

4. **Other Institutions** involved in the project's operation:

Project Data:

A. Major Discipline Code: **99**

B. Academic Focus Level of Project: **UP**

C. Highest Degree Code: **B**

D. Category Code: **--**

E. Business/Industry Participation Code: **NA**

F. Audience Code:

G. Institution Code: **PRIV**

H. Strategic Area Code:

I. Project Features:

Estimated number in each of the following categories to be directly affected by the activities of the project during its operation:

J. Undergraduate Students: **23**

K. Pre-college Students: **0**

L. College Faculty: **10**

M. Pre-college Teachers: **0**

N. Graduate Students: **0**

Project Summary

This project provides scholarships for students with financial need who transfer to Hope College from a community college to major in biology, chemistry, computer science, engineering, geological and environmental sciences, mathematics, or physics. Scholarships of \$10,000 per year are offered to up-to seven transferring students each year over four years. The scholarships are renewable for a second year if the student meets eligibility requirements.

The objectives of this project are to (1) improve the collaboration between local community colleges and Hope College STEM programs; (2) recruit to Hope College STEM students at community colleges who would not ordinarily consider attending Hope; (3) increase the number of community college students who transfer into STEM programs at Hope College; and (4) increase the retention of community college transfers in STEM disciplines at Hope.

This project will identify and recruit students on seven community college campuses in Hope's geographic region. Scholarship recipients will be selected after personal interviews and review of their college admissions packets. Selection is based on promise for academic success and potential for the scholarship to affect career choice.

All students supported by these scholarships will be given the opportunity to participate in a summer research project at Hope College in the summer before they begin studies at Hope. They will also be supported in their study at Hope by intensive faculty advising, timely and appropriate academic assistance, and education, internship and research opportunities. In addition, S-STEM Transfer Scholars will be participants in the Fostering a Community of Excellence in Science (FACES) program, which was launched for a cohort of incoming freshmen in the Fall of 2010. This program provides peer mentoring, career counseling and community building activities for STEM majors to help them make the transition to Hope College and prepare for a career in STEM fields.

Intellectual Merit: This project will build upon the nationally recognized Hope STEM programs, the current Hope CSEMS and S-STEM program, the FACES mentoring program and the college's extensive infrastructure for student support to enable 23 students to transfer to Hope and pursue degrees in one of the STEM disciplines.

Broader Impacts: This project especially targets community college students who usually do not consider attending a private liberal arts college like Hope, thus increasing economic and racial diversity in STEM fields at Hope. A significant number of Hope STEM alumni pursue post-graduate studies in science and engineering fields. Thus 23 young adults with strong STEM educations from Hope will not only enter the workforce, but many of them are likely to pursue post-graduate degrees in STEM fields.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.B.2.

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	1	_____
Table of Contents	1	_____
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) (Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	15	_____
References Cited	1	_____
Biographical Sketches (Not to exceed 2 pages each)	16	_____
Budget (Plus up to 3 pages of budget justification)	6	_____
Current and Pending Support	3	_____
Facilities, Equipment and Other Resources	4	_____
Special Information/Supplementary Documents (Data Management Plan, Mentoring Plan and Other Supplementary Documents)	10	_____
Appendix (List below.) (Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	_____	_____
Appendix Items:		

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

Project Description

Table 1: Summary of Results from Hope College CSEMS Project DUE-0422388. The college data reported in the last row reflect data for the 2006 entering class. Reporting of underrepresented status is optional, so the reported % may under report the actual values.

Start	N	Retention at Hope				Retention in CSEMS Field				Ave GPA	Female	URM^
		1 yr	2 yr	3 yr	4 yr	1 yr	2 yr	3 yr	4 yr			
2004	6	100%	100%	100%	100%	83%	83%	83%	83%	3.29	50%	17%
2005	16	94%	94%	94%	94%	100%	94%	81%	81%	3.56	25%	13%
2006	12	100%	92%	92%	92%	100%	92%	92%	83%	3.44	25%	8%
Total	34	97%	94%	94%	94%	97%	91%	85%	82%	3.47	29%	12%
College	3203	88%	82%	80%	77%					3.30		4%

a. Results from Prior NSF Support

Hope College has previously received NSF support for a CSEMS project DUE-0422388, "CSEMS Scholarship Program in Computer Science, Engineering, and Mathematics" and two S-STEM projects DUE-0728574 and 0966191. The CoPI for this current S-STEM proposal is the PI for the first two of these grants and the PI of the proposed project is the PI of the third.

The **CSEMS project**, completed in July 2010, supported 34 undergraduate students in the study of computer science, engineering, and mathematics at Hope College. These students were enrolled in a focused first-year seminar and received additional counseling and assistance through the CSEMS program. The goal of this CSEMS project was to increase the retention of students and the enrollment of underrepresented groups in the CSEMS disciplines at Hope College. Assessment data for this project are included in Table 1 above. Noteworthy in the table are the following:

- Retention at Hope of CSEMS participants significantly exceeded the overall campus retention percentage. (**94% to 78%** for 4 years)
- CSEMS participant GPAs exceed the institutional average, even though academic excellence was not a selection criterion and CSEMS course work is more demanding than that of the typical Hope College student. (**3.47 to 3.30**)
- The percentage of females in CSEMS exceeds the average in CSEMS disciplines. (**29% to 23%**)
- The percentage of CSEMS students from minority groups greatly exceeds the institutional percentage. (**12% to 4%**)

All of these figures point to success in meeting the goals of the CSEMS project.

The proposed project is a revised continuation of an ongoing **S-STEM project (DUE-07288574)** that just admitted its fourth and final cohort. This ongoing project provides scholarships exclusively for transfer students from two-year colleges. Retention and graduation data for this project are included in Table 2 below. Noteworthy details in this table include:

Table 2: Summary of Results from Hope College S-STEM Project DUE-0728574: S-STEM for Transfer Students (S-STEM-TS).

Start	N	Retention at Hope		Retention in STEM field		Ave GPA	% to Grad School	Female	URM
		1 yr	2 yr	1 yr	2 yr *				
2008	6	83%	83%	83%	67%	3.23	33%	83%	17%
2009	7	86%	86%	86%	86%	3.41	29%	0%	28%
2010	6	100%		83%		2.97		17%	0%
2011	7							57%	29%
Total	26	89%	85%	84%	77%	3.26	31%	41%	19%

* Includes Baccalaureate degree received

- While the GPA threshold for selection and continuation in this program is low (2.50), the average GPA attained by S-STEM-TS participants significantly exceeds this and is effectively the same as the campus average in 2010. (3.26 to 3.32)
- The percentage of S-STEM-TS students from minority groups greatly exceeds the institutional percentage in the academic year 2010. (19% to 7%)
- The fraction of S-STEM-TS graduates pursuing graduate degrees in STEM fields is comparable to the overall average for STEM majors at Hope College. (31% to 33%)

In addition to these quantitative results presented in the table, there are other items of note. While the S-STEM-TS program directly supported 26 students over four years, it also impacted several other students. In 2010, three transfer students who were recruited through the S-STEM-TS program are not reported in Table 2. These students did not qualify for financial aid and thus are not technically S-STEM participants. However, the college did provide all other support that S-STEM recipients receive to these students (additional mentoring and a paid research experience the summer before enrolling at Hope).

The success of this ongoing project can be seen in the conclusion to the 2010 evaluation from the Frost Center at Hope College: *“Results from the survey and focus groups paint a similar picture of the benefits and challenges seen in the S-STEM scholarship program. Participants appreciated the opportunity to engage in research, valuing both the lab skills and social relationships they developed. The scholarship’s financial aid was instrumental in students being able to afford transferring to Hope. Transferring in as an upperclassman presented some obstacles, including difficulty in transferring credits, acclimating to a more demanding academic pace, and integrating into a social setting where others were already in established friendship networks. All S-STEM students were very pleased with the program overall, felt it did a good job of preparing them for their future goals, and would recommend it to others.”* Additional comments from the participants, including their career aspirations can be found on the program website (<http://www.hope.edu/academic/sstem/CCSSTEM/people.html>).

The S-STEM-TS program success reaches beyond just the formal participants that evaluated the program. All transfer applicants interested in STEM fields were made aware of the program and received additional support throughout the application process from coPI Dershem. In part due to the success of the S-STEM-TS program, all transfer students with a 3.8 GPA at their previous institution are eligible for merit scholarships. Merit awards are considered BEFORE need based awards, so some transfer students may find their need met before being considered for the S-STEM-TS scholarships.

Another current S-STEM project (DUE-0966191) was funded in Spring 2010 and the first cohort of students has been recruited. Its objectives are to increase recruitment of students from Holland, Michigan area high schools into Hope College science programs. Because of the

Table 3: Summary of Results from Hope College S-STEM Project DUE-0966191: S-STEM for First Year College Students (S-STEM-HS). The college data reported in the last row reflect data for the 2011 academic year. Since the first academic year has not yet started, there are no data to report in most fields below. Reporting of underrepresented status is optional, so the reported % may under report the actual values.

Start	N	Retention at Hope				Retention in STEM Field				Ave GPA	Female	URM [^]
		1 yr	2 yr	3 yr	4 yr	1 yr	2 yr	3 yr	4 yr			
2011	6										67%	83%
College	3202											7%

diversity of most of the Holland area schools far exceeds the diversity of the Hope College student body, we anticipate that the diversity of the STEM major population will also increase. The details available on the participants in the program are shown in Table 3 above.

Selection of high school S-STEM participants was done AFTER all merit scholarships were awarded. Thus many potential candidates whose financial need was met by merit scholarships did not apply to the S-STEM-HS program. All of the S-STEM-HS recipients demonstrated full financial need. These students will participate in the Fostering a Community of Excellence in Science (FACES) mentoring program with other STEM majors. This program will be described in more detail in **section g** below.

In summary, the three scholarship programs at Hope have been successful in recruiting students to attend Hope College and major in STEM fields. These students were unlikely to have attended Hope without the financial support provided by the programs. In fact, because of the existence of these scholarship programs, students are applying to Hope College and are discovering that they can afford to attend, even without these scholarships. In addition, the mature programs have shown that these students completed their STEM degree program at the same high rate as the general Hope population. They are also pursuing graduate studies at the same high rate as Hope STEM degree recipients.

b. Project Objectives and Plans

The objectives of the proposed project are:

1. To improve the interface between local community colleges and Hope College STEM programs.
2. To generate applications to Hope College from community college students who intend to major in a STEM discipline and who would not ordinarily consider attending Hope College.
3. To increase the number of community college students who transfer into STEM programs at Hope College.
4. To increase the number of community college transfer students who graduate from Hope College with a major in a STEM discipline.

Program Plan

In 2006, Hope College established formal relationships with six Michigan community colleges by constructing documents listing courses at each community college that prepare students to transfer into each STEM program at Hope College. In the following four years, 26 students were recruited to participate in the Hope College S-STEM-TS program. The proposed project is a continuation of this prior program with a number of enhancements. Like its predecessor, this project will identify and recruit qualified community college students from a set of target schools so that they might pursue degrees in science, engineering, or mathematics at Hope. In addition, any students interested in transferring to Hope and pursuing a degree in a STEM field will be made aware of the program and will be encouraged to apply. Thus all STEM transfer candidates will receive support throughout the application process by not only admissions and financial aid staff, but also from the S-STEM-TS leadership team. This includes assisting students in choosing the appropriate courses at their community colleges to prepare them for a smooth transition to the corresponding Hope College STEM program and placing these students in contact with Hope STEM faculty members who have interests similar to those of the students.

Once the students are enrolled at Hope College, the S-STEM-TS program will provide financial support and facilitate success through the establishment of a cohort group of S-STEM-TS

Scholars, guaranteed research opportunities, faculty and student mentoring, and enhanced academic advising. These activities, which build upon those provided by the previous project, will not only seek to ensure academic success to graduation, but also to assist the S-STEM-TS scholarship recipients in preparation for post-graduation employment and graduate studies.

Program activities

All S-STEM-TS scholarship recipients will participate in project activities with the purpose of facilitating their transition to a four-year college environment and increasing retention of these students in one of the target disciplines. These activities will include undergraduate research, faculty advising, academic assistance, peer and faculty mentoring, community-building events, information about research and internship opportunities, and career planning seminars.

c. Significance of Project and Rationale

How this project supports the goals of the S-STEM program

1. Improved educational opportunities for students.

Community college students rarely consider continuing their studies in science, engineering, or mathematics at a four-year private liberal arts college like Hope because of the expense of such institutions.[1] For this reason, such students are unable to take advantage of many of the documented benefits[2] of such colleges, including undergraduate research and the overall success of such institutions in preparing leaders in the STEM fields. See **Section h** of this proposal for a description of some specific benefits at Hope College. This project will provide financial assistance to transferring community college students to allow them to consider pursuing a degree in science, engineering, or mathematics at Hope College. This financial assistance and the project recruiting activities will encourage students who might not otherwise consider pursuing STEM disciplines in a liberal arts environment to do so.

2. Increased retention of students to degree achievement.

The retention rate of transfer students is known to be lower than that for native students both because of lower grades[3] and less engagement.[4] The financial incentive, the opportunity to participate in undergraduate research, the close faculty-student working relationships at Hope, and the activities included in the Hope College S-STEM program are designed to improve retention in the Hope degree program and the STEM disciplines.

3. Improved student support programs at institutions of higher education.

The cohort group development, faculty advising, and peer and faculty mentoring activities of this project will build upon and improve present support activities for Hope College students, especially students with the special qualifications required of S-STEM scholars. In addition, Hope College's support services for all transferring students, including articulation, will be improved by procedures implemented through the S-STEM program.

4. Increased numbers of well educated and skilled employees in technical areas of national need.

Students who begin their studies at a community college are underrepresented in the STEM fields.[5] This project will meet this objective by creating programs to support and encourage at least 23 students to successfully prepare for careers in science, engineering, or mathematics. It will also continue to develop an infrastructure that will support and encourage an increase in the

Table 4: Hope College Cumulative Retention Rates for the cohort beginning Fall 2004, which is the last year for which all 6 years are available.

At end of Year 1	At End of Year 2	At End of Year 3	At End of Year 4	At End of Year 5	At End of Year 6
89.5%	81.8%	80.4%	77.2%	77.0%	78.0%

number of students entering these disciplines in the future. This infrastructure will accomplish this by strengthening the linkages through which the pool of student talent at community colleges gains access to continued study at a four-year, liberal arts institution.

Information on Institutional Demographics

The most recent 6-year retention data for the general student population at Hope College is shown in Table 4 above. Based on the prior experience with the CSEMS and S-STEM-TS grant programs, retention rates for participants will meet or exceed the current college-wide percentages. In fact, this newly proposed program for the Hope S-STEM-TS will build upon a successful new mentoring program (FACES, described in **Section g** below) which will enable even more of the transfer students to successfully complete their STEM degrees.

Students graduating from Hope College who transfer from community colleges are shown in Table 5 above. The table shows that the number of Hope College graduates who transfer from community colleges is very low. Over the period of the first S-STEM-TS program, the fraction of graduates who began their college careers at community colleges has increase. However, the fraction graduating with STEM degrees has increased even more rapidly, more than tripling since 2007.

Hope College financial aid data indicate that 60% of entering first-year Hope students have financial need at the level required for S-STEM scholarship recipients. Although corresponding data are not available for all Hope College transferring community college students, our experience with the first three cohorts of the previous project showed that 90% of the applicants to that program were eligible for the maximum S-STEM scholarship.

The number of graduating seniors for each of the participating departments over the past five years is shown in Table 6. All departments have the capacity to serve additional students participating in the Hope STEM Scholars program.

Rationale for number of scholarships and scholarship amount

We propose funding seven or eight incoming students each year of the project for the amount of unmet need up to a maximum of \$10,000. (See Table 7 below.) This will maximize the effectiveness of this project as an incentive to targeted community college students and allow Hope College to establish a strong connection with our partner community colleges. With the

Table 5: Hope College Graduating Transfers by Year

Year	Graduates Total	Graduates: CC transfers		Graduates: CC transfers & STEM major	
2007	659	10	1.5%	1	0.2%
2008	716	13	1.8%	2	0.3%
2009	717	17	2.4%	5	0.7%
2010	722	16	2.2%	9	1.2%
2011^	676	15	2.2%	4	0.6%

The 2011 values do not include “summer” graduates, thus the reported fractions of cc transfer graduates (STEM and total) are underestimated.

Table 6: Graduating STEM Majors by Year

Department	2006	2007	2008	2009	2010	Ave	% female
Biology	30	31	54	44	41	40.0	53.0%
Chemistry	29	36	46	55	43	41.8	49.3%
Computer Science	7	7	9	10	7	8.0	21.9%
Engineering	14	12	22	24	18	18.0	21.1%
Geol & Envir Sciences	3	7	7	7	4	5.6	50.0%
Mathematics	16	11	19	27	18	18.2	58.2%
Physics	7	5	2	2	1	3.4	23.5%

previous S-STEM grant we were able to average 9 applicants and 7 participants per year. The project proposed here, with the addition of new target institutions and improvements in recruiting will be able to meet the goal of 8 students per year.

This plan is based on the assumption that there will be no attrition among the scholarship recipients. Any scholarship funds made available through attrition will be distributed as described in Section e under the heading *Eligibility and Replacement Process*.

d. Activities on Which the Current Project Builds

Undergraduate Research: All Hope STEM departments have had long-established undergraduate research programs, including support from the NSF REU program. In the summer of 2010, 154 undergraduate students participated in scientific research on the Hope campus plus 23 high school students in the Research Experience Across Cultures (REACH) program funded through HHMI and private Foundations, Exxon Mobil and DTE Energy. In 2011, Hope had five active REU site programs (Biology, Chemistry, Computer Science, Mathematics, and Physics). These undergraduate research programs have been effective tools in the recruitment and retention of talented students to Hope College. The Chemistry REU program actively supports research collaboration with faculty and students at Grand Rapids Community College. In the summers of 2008-11 a total of 22 S-STEM awardees participated in summer research with partial support from the previous S-STEM grant. All S-STEM scholarship recipients in the proposed project will be offered a summer undergraduate research position in their discipline in the summer before they begin their study at Hope. Programs which include collaborative research experience with faculty have been shown to improve retention rates in STEM programs.[5,6]

Hope College participation in NSF Undergraduate Research Centers program with Harold Washington College: The chemistry department at Hope College invites four to five students from Harold Washington College in Chicago to participate in their summer research program. Their participation is a part of the NSF-URC program at Harold Washington. This serves as a model for the proposed participation of the S-STEM students in research across all of the STEM disciplines. In the previous S-STEM project, four of our awardees had previously participated in the URC program.[7]

Table 7: Estimated number of participants over the grant period.

	2012-13 Year 1	2013-14 Year 2	2014-15 Year 3	2015-16 Year 4	Total
Incoming student scholarships	8	8	7	0	23
Second-year student scholarships	0	8	8	7	23
Total scholarships awarded	8	16	15	7	46

Academic Support Center: The Hope College Academic Support Center assists students in the transition to college and helps them improve their study habits, learning skills, and class performance. It provides services to all Hope students, individually or in small groups. These services include individual peer tutoring at all levels, small group help sessions, workshops, academic counseling, and a mathematics and statistics lab.

FACES Mentoring Program: In 2010, Hope College created the FACES (Fostering a Community of Excellence in Science) mentoring program will include working with students on making a smooth transition to college for both first year college students and new transfer students. Co-PI Anna Bonnema, HHMI-funded Director of Mentoring, directs this program. In the Fall of 2010, FACES provided both social and academic support to first year students from underrepresented groups who are enrolled in STEM courses and were intending to major in STEM fields. The first cohort FACES participants were paired with STEM major mentors. The program includes activities to assist students in developing study skills, finding research and internship opportunities, setting and obtaining post-graduate and/or career goals. Student participants are matched with peer mentors and, as the program progresses, will become mentors themselves. Co-PI Bonnema has also developed mentor training activities and the new class of mentors and returning mentors will be trained in August 2011.

Of the 13 FACES participants, 11 are persisting in their pursuit of a STEM majors, 1 has changed majors and one has left the college. While these rates of retention are quite good (85% in STEM, 92% at Hope), the program leadership team has learned from this experience and is adapting the program in hopes of improving the retention rates even more.

In the Fall of 2011, new S-STEM Scholarship recipients (both first year and transfer students), will participate in the FACES program regardless of their ethnic/racial background. Many of the S-STEM-TS participants from 2010 will serve as mentors to the incoming class. As the program matures, returning scholarship recipients continue to participate in FACES. Serving as Mentors when appropriate and helping to guide program offerings to meet the needs of the transfer students, some of which may be different than those of the first year students participating in FACES.

e. S-STEM Project Management Plan

Personnel

This project will be led by the PI, Dr. Catherine Mader, Professor of Physics, coPI Dr. Herb Dershem, Director of Institutional Research and Professor of Computer Science and coPI Anna Bonnema, Director of FACES. Both William VanderBilt, Vice President for Admissions and Phyllis Hooyman, Director of the office of financial aid will work closely with the PI and coPIs to ensure all eligible students are aware of the S-STEM scholarship. The PI will have overall responsibility for the entire program. Co-PI Dershem will lead the activities directed toward recruiting students from the two-year colleges. Co-PI Bonnema will lead the mentoring program and other activities directed toward supporting scholarship recipients as they make the transition to Hope College.

Both PI Mader and coPI Dershem will participate in academic year activities as a part of their academic faculty roles supported by Hope College. PI Mader will be supported by the grant during the summer months to complete reports and plan for the following academic year. coPI Bonnema will be supported during the academic year for the additional activities she will take on to support the mentoring components of the S-STEM-TS program.

In addition, a steering committee of Hope STEM faculty will advise the PIs and help to provide a seamless and coherent set of programs for Hope STEM-TS scholars. The steering committee will include: Moses Lee, Dean of Natural and Applied Sciences and Professor of Chemistry, Tom Bultman, Professor of Biology, Ryan McFall, Professor of Computer Science, Brian Bodenbender, Professor of Geology and Environmental Sciences, Roger Veldman, Professor of Engineering, Tim Pennings, Professor of Mathematics, Graham Peaslee, Professor of Chemistry and Environmental Science.

Each STEM department at Hope College has a faculty representative on this committee. This representative will serve as a liaison between the S-STEM-TS project and his academic department. Most of these faculty members were on the Steering Committee of the prior S-STEM-TS project.

Recruiting

Recruiting S-STEM-TS scholars will be coordinated by co-PI Dershem working closely with the PI and the Steering Committee. Recruiting efforts will focus on seven community colleges that are either located near Hope College or from which Hope has traditionally received the largest number of transfer students. The following community colleges are the target institutions at the present time:

Michigan Colleges	Illinois Colleges
Grand Rapids Community College (Grand Rapids)	Harold Washington College (Chicago)
Muskegon Community College (Muskegon)	William Rainey Harper College (Palatine)
Kellogg Community College (Battle Creek)	
Northwestern Michigan College (Traverse City)	
Lake Michigan Community College (South Haven)	

The first four Michigan colleges were target institutions for the prior S-STEM-TS project. Lake Michigan College-South Haven has been added because of strong interest in the Hope S-STEM-TS project by people on that campus. The two Illinois institutions have been added because of their strong connections with Hope College through joint participation in the Undergraduate Research Collaborative (URC) project (see **Section d**). Four participants in the prior Hope S-STEM-TS project were from these two schools. Students from community colleges not on this list will be recruited through referral from the Hope College admissions office as these students inquire about Hope College.

The co-PI will maintain contact with each of the target institutions through contacts with community college faculty in the STEM disciplines and community college counselors and articulation officers to identify students who are candidates for a Hope S-STEM-TS award. The co-PI will visit each campus at least once each year for recruiting purposes and will facilitate visits of other Hope College faculty and students to the community college campuses and visits of community college faculty and students to Hope College. The successful strategies of the prior S-STEM-TS project will be continued and extended to the three newly-added institutions.

As part of the prior project, the co-PI, in consultation with representatives from the targeted community college campuses, prepared course equivalency documents for each of the community colleges in each of the STEM disciplines at Hope, as well as for the Hope general education requirements. These documents define which community college courses fulfill requirements for a Hope College degree, aiding the students in planning their community college course selections and facilitating their transition to Hope. Prior to this time, no such documents

existed. The co-PI coordinated the production of these documents with the articulation officers of the participating community colleges, the Hope STEM department chairs, and the registrar at Hope College. These documents are made available to the community college students through their counseling offices and institutional web sites and will be updated periodically by the counseling offices. Additional documents will be developed for the three new target institutions.

Selection

Scholarship recipients must be admitted to Hope College and be interested in pursuing a bachelor's degree in a STEM field. Identified candidates for scholarships on each of the seven community college campuses will be invited to submit online applications for the Hope S-STEM-TS scholarships. The deadline for the applications will be March 1 of each year. All candidates will be invited to the Hope campus, interviewed by the co-PI, and given a tour of the appropriate campus facilities, including laboratories. In addition, each applicant will be asked to provide contact information for a community college instructor, who will provide a reference for that applicant. The Steering Committee will review all of the application materials submitted by the candidates, including the candidates' applications to Hope College. The Steering Committee will apply the eligibility and selection criteria given in **Section f** to determine the recipients of the scholarships. An ordered list of qualified alternates will be maintained as a pool of recipients in the cases where successful applicants decide not to attend Hope. The target date for notification is April 1.

Applications from students who attend community colleges that are not in our target group of seven will also be considered, though the project recruiting strategies will not be implemented beyond the target institutions. If there are not eight qualified community college applicants for this program in a given year, the remaining scholarships will be awarded to transfer students in the following year.

Record Maintenance and Reporting

The PI will be responsible for collecting all data needed for eligibility determination, assessment of the project, reporting to the Hope College Steering Committee, and reporting to the National Science Foundation. She will be assisted in these efforts by the Hope College Frost Center for Social Science Research, Registrar's Office, Admissions Office, and Financial Aid Office.

Student Support Programs Oversight

The support programs of the S-STEM-TS project, described in **Section g**, will utilize services already present on the Hope campus. In many cases, Hope students who could benefit from these services fail to do so because they fail to take the initiative required, do not know a service exists, or are unaware that they could benefit from the service.

The PI and coPI Bonnema will be responsible for making all S-STEM-TS recipients aware of the support services provided by the college in conjunction with the S-STEM-TS program. This will occur in the FACES program events and several special events planned for the transfer students and their mentors.

The PI will also coordinate mentoring, research, and internship activities with the seven STEM departments by working closely with co-PI Bonnema, the department chairs, each department's internship coordinator, and each department's undergraduate research coordinator.

Eligibility and Replacement Process

At the time of the selection and at the conclusion of each semester, the PI will determine if each S-STEM-TS candidate or scholar meets the eligibility requirements listed in **Section f**.

When an S-STEM-TS scholar becomes ineligible to continue receiving the scholarship, the remaining funds for that scholar will be reallocated by action of the Steering Committee to one of the following:

- An S-STEM-TS student who previously lost eligibility, but has since regained it.
- A student who transfers to Hope in a succeeding year who is eligible for an S-STEM-TS scholarship.
- A student who is already enrolled in her third or fourth year in one of the STEM departmental programs and who meets the eligibility requirements.

Replacement scholarships will be awarded for at least one year, but will not necessarily be for the full \$10,000 nor renewed for a second year, even if eligibility requirements continue to be met. Recipients of replacement scholarships will not necessarily be given an opportunity to participate in undergraduate research.

Evaluation and Assessment

The assessment and evaluation plan described in **Section i** will be directed by the PI in consultation with the Hope College Frost Center for Social Science Research.

Rationale for Size of Program

The Hope College STEM departments can easily support an additional eight students per year within their present infrastructure. The departments of Computer Science, Geological and Environmental sciences, Mathematics, and Physics are all operating far below their capacity for upper-level students. The other departments are also able to accommodate additional students in upper-level courses.

f. Student Selection Process and Criteria

While only the seven regional community colleges will be targeted through articulation and recruitment, applications will be considered from students transferring from any community college. Community college students will be eligible for an S-STEM-TS scholarship if they meet the following criteria:

1. The student must meet the eligibility requirements for citizenship and financial need as specified in the S-STEM-TS guidelines.
 2. The student must be transferring from full-time study at a community college.
 3. The student must have a community college GPA of 3.0 or better, been accepted for admission to Hope College, and have adequate preparation to pursue a major in a STEM field at Hope College.
 4. The student must have demonstrated an interest in pursuing a major in one of the STEM disciplines.
- Each candidate for an S-STEM-TS scholarship will be required to submit a statement indicating her academic and career goals and stating how the S-STEM-TS scholarship will benefit the student in attaining those goals. Each candidate will also be required to submit the name of a community college instructor who will serve as a reference for the student. In addition, the candidate will be interviewed by the co-PI and one other member of the Steering Committee during a visit to the Hope College campus.

Students who are awarded an S-STEM-TS Scholarship will be selected from among qualified applicants by the Steering Committee using the following criteria:

1. Promise of academic success.
2. Interest in an academic and professional career in one of the STEM disciplines.

3. Perceived impact the scholarship will have on the student's pursuing a major in a STEM discipline at Hope College.

Preference will be given to candidates from underrepresented groups when they meet all of the above criteria.

Scholarship Renewal

At the completion of each semester of their academic program, recipients of the S-STEM scholarships must meet the following criteria in order to retain their scholarship for the following semester:

1. The student must maintain an overall GPA of 2.5 or better on a 4.0 scale. This level is intentionally lower than the requirement for most scholarships at Hope College to emphasize that this scholarship is not strictly awarded for academic excellence, but to encourage students at all satisfactory levels of achievement to obtain their degrees in STEM disciplines at Hope College.
2. The student must have declared a major in one of the STEM disciplines and be progressing satisfactorily toward completing that major.
3. The student must have been an active participant in S-STEM-TS sponsored student activities during the semester just completed.

g. S-STEM Student Support Services and Programs

Undergraduate Research

All S-STEM-TS scholars will be offered an opportunity to participate in an undergraduate research project in the summer before they begin studies at Hope. This will enable these students to become acquainted with a group of Hope students and a faculty member in their field and to become familiar with the work done in a research lab at Hope. It will also result in a possibility that they can continue working in that lab during the academic year. S-STEM-TS scholars will receive a stipend for their summer research participation and on-campus housing will be provided at a reduced rate. Both of these will be consistent with what is provided to all Hope summer undergraduate researchers. Experience with the prior S-STEM-TS project has shown that this undergraduate research experience is a major attractor for the students and an effective and nurturing first experience with Hope College.

Student Housing

The PI will work with the Hope College Housing Office to house, whenever possible, the incoming S-STEM-TS scholars in the same Hope College housing unit during their first year. This will help to establish a spirit of community among the S-STEM-TS scholars.

Faculty Advising

Each S-STEM-TS scholar will have a faculty advisor, who is a member of one of the STEM departments. In addition, the PI will monitor the students' academic progress, successful integration into the four-year college environment, and progress in career planning.

FACES Program

Each S-STEM-TS scholar will begin their career at Hope as a member of the Fostering a Community of Excellence in Science program. This program will include the components listed below.

Peer Mentoring

Each S-STEM-TS scholar will be paired with an S-STEM-TS scholar who is in her second year at Hope College. The S-STEM-TS scholars will interact with their mentors individually for at least two hours each month during their first year at Hope.

Community Building

Events to foster community and provide information will occur at least once a month. Most of these events are relevant for both first year students and upper level students. During the 2011 academic year, these events included:

- Meetings with STEM scientists visiting campus to discuss **career path** options.
- Presentations with Hope Community members (including academic support staff) focusing on **academic skill building** such writing lab reports or presenting posters.
- **Professional development** discussions with Hope Community members (such as career service staff) such as how to find on-campus summer research and internship opportunities.
- **Community service** events engaging local k-12 students in hands-on science activities.

In 2012, it is anticipated that these programs will be repeated. The 2011 mentors found these programs as valuable as the first year students, though they took away different lessons from these experiences. Thus we anticipate that the transfer students will find them valuable and they will be encouraged to participate in these events. We also anticipate that the returning students and transfer students will have additional interests, such as how to find off-campus internship/research opportunities, how to find/fund graduate education opportunities and how to find a job after graduation. These topics will be added to the FACES program in 2011 and will continue to be available for all future FACES participants.

Community Space

In 2010, the FACES participants requested a space where they could meet in the evening to work together on course work. Such a space was created and the students (first year students and their mentors) formed ad-hoc study groups. Beginning in 2011, an effort will be made to facilitate the study group formation so that FACES participants will know when groups will be gathering to work on specific STEM coursework. Because the transfer students are likely to be in upper level courses not taken by the first year students, an adjacent room will be reserved to allow them to work with their study groups.

S-STEM-TS Scholar Community Dinners

All S-STEM-TS scholars will be required to attend a weekly dinner meeting during their first semester on campus. Through this seminar the scholars will become acquainted with Hope College and its facilities. The PI and/or coPI will attend these meetings as will the mentors. The informal setting will allow them to discuss how their semesters are progressing. In addition, guests will be invited to join the dinners to help students learn about campus services that first year students typically learn about in their First-Year Seminar course. Typical guests will include staff from the Library, the Office of Career Planning and Placement, Academic Support, Multicultural Life, the Registrar, and Residential Life. This type of orientation program has proven beneficial at other institutions.[8]

Personal Academic Support

The Hope College Academic Support Center provides tutoring in specific courses and assistance with a variety of academic skills. The faculty advisors will refer the S-STEM-TS scholars to the

Center as appropriate. In addition, the PI and FACES director will encourage the formation of S-STEM-TS study groups in courses where such groups will be helpful.

h. Quality Educational Programs

The Division of Natural and Applied Sciences at Hope includes the departments of Biology, Chemistry, Computer Science, Engineering, Geological & Environmental Sciences, Mathematics, Nursing, and Physics and totals over 60 FTE faculty members. Hope College has a long-standing commitment to provide students opportunities to learn cutting-edge science in coherent and rigorous laboratory courses that stress hands-on, research-based modes of learning, and to work in an interdisciplinary and collaborative manner with faculty in research. The Division of Natural Sciences at Hope is recognized by Project Kaleidoscope as a whole "Program that Works" and as a model for other institutions, and is one of only 10 liberal arts institutions to be recognized by the NSF with an Award for the Integration of Research and Education. Additionally, the undergraduate research program at Hope has been identified in *U.S. News & World Report* as among the leading programs in the nation consistently for each of the last 5 years (ranked 4th among all institutions in 2003). For the 10 year period between 1999 and 2008, Hope College is in the top 6% of all US liberal arts and undergraduate institutions for the number of graduates that obtain PhDs in STEM fields.

Hope College has received a fifth consecutive award for student research from the Arnold and Mabel Beckman Foundation of Irvine, Calif., the only college or university in the nation to have received continuous support through the program since it started.

Hope holds five awards through the National Science Foundation's "Research Experiences for Undergraduates" program, in biology, chemistry, computer science, mathematics and physics. Among all institutions nationwide, including major research universities, only 20 hold more of the grants.

The mission of the program in science and mathematics at Hope mirrors that of the college to provide an **innovative curriculum**, which intertwines **student learning** and **faculty development**. We operate on the principle that undergraduate research is an essential component of good teaching and effective learning. The collegial culture within the Division of Natural Sciences is the key ingredient in sustaining an intellectually vital learning community for faculty and students. In the past five years, Hope science faculty/administrators received awards totaling greater than \$2,400,000 annually in new resources from extramural sources to support our research, educational and outreach programs. Included among current awards are 5 separate NSF-REU site awards to support undergraduate research.

We seek to identify and retain students who have diverse ethnic backgrounds. To assist us in this regard we have formed a unique partnership with the University of Michigan to cooperatively recruit students of color for fully-supported undergraduate education at Hope College followed by fully-supported graduate and/or medical education at the University of Michigan. This highly successful program, along with outreach programs to K-12 students representing traditionally underrepresented groups in science and mathematics, work together to assist us in our goal to provide opportunities for science/mathematics education to all individuals.

An unusually high number of students (~40%) enter Hope with an interest in science and mathematics. During their time at Hope, students are integrated into a supportive community of

learners in an environment rich in research-based learning opportunities. Each summer over 150 undergraduates conduct research with faculty, supported in part by separate NSF-REU site awards. Although we do not have a research requirement, ~85% of Hope science and mathematics majors do research. Approximately 33% of seniors graduate with a degree in science or mathematics. Of these, ~30% enter graduate school. About 35% of our science-mathematics graduates seek to enter professional school. The 10-year acceptance rate for these students is 71%, and it is 90% for students who engage in research while at Hope. The remaining students enter the workforce directly upon graduation, with many entering the teaching profession as K-12 educators.

Faculty and students sustain vitality by engaging in research. Hope College faculty rank 4th of all liberal arts institutions for numbers of faculty research publications and 14th overall for highest impact of those publications as measured by the Science Citation Index. Since 1990 over 300 undergraduate students have co-authored research publications with faculty.

i. Assessment and Evaluation

Formative Assessment

The following will be used for formative assessment during the project. All data will be used for evaluation purposes by the steering committee, which will meet at the end of each academic year to evaluate assessment data and recommend adjustments to the program.

1. *Tracking data for S-STEM participants.*

Data collected will include progress toward degree, academic performance, participation in internship and research, retention in the major, graduation rate, job placement, and percentage of minorities and females. The data for S-STEM-TS participants will be compared to results prior to S-STEM-TS support and to the results for non-S-STEM-TS supported majors in STEM disciplines during the period of this project. We will also track the change in the number and source of transfers to Hope College during the years of the S-STEM-TS program.

2. *Annual survey of all participants.*

All participants in this program (students, Steering Committee members, and faculty advisors) will be surveyed annually to determine the impact of the program. Student participants will also be surveyed prior to their arrival on the Hope campus.

3. *Exit survey.*

All participants, when exiting the program, will be asked to complete a survey. There will be separate surveys for students who depart the program prior to graduating and for those who graduate as S-STEM-TS scholars.

4. *Applications from students at targeted community colleges.*

The number of applications to Hope College from students at the targeted community colleges will be collected each year and compared with counts from years prior to the S-STEM-TS program.

Summative Assessment

The objectives of this project are listed below along with the assessment data that will be used to evaluate each one.

1. *To improve the interface between local community colleges and Hope College STEM programs.*

This will be evaluated by the number of applications for admission to Hope received from the students at the targeted community colleges. In addition, counselors at the community colleges will be interviewed at the completion of the project.

2. *To generate applications to Hope College from community college students who intend to major in a STEM discipline and who would not ordinarily consider attending Hope College.* Applications to Hope College from community college students will be tabulated during and after the project and compared with corresponding data in years prior to the project.

3. *To increase the number of community college students who transfer into STEM programs at Hope College.*

All transfer students in STEM disciplines will be counted and compared with data collected in years prior to the project.

4. *To increase the number of community college transfer students who graduate from Hope College with a major in a STEM discipline.*

Retention and graduation data will be collected during and after the project and compared with similar data from before the project.

All data collection and survey design will be coordinated by the PI in consultation with the Hope College Frost Center for Social Science Research. Similar instruments already exist for the assessment and evaluation of the prior Hope College S-STEM-TS programs and these will be adapted for use in this S-STEM-TS project.

j. Dissemination

Results of this program will be disseminated through the construction of a project web page. This web page will contain complete information about the project, including all assessment data. The availability of this web page will be announced through the web pages of all of the participating departments and the web page of the Hope College Natural and Applied Sciences Division.

In addition, this S-STEM-TS scholarship program will be a part of a larger initiative to broaden participation in STEM fields at Hope and as such, will be included in all presentations and publications related to broadening STEM participation that faculty and staff at the College produce. For example, the prior Hope S-STEM-TS scholarship program for transfer students has been described a chapter of the book "Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact" published by the Council on Undergraduate Research. Several Hope STEM faculty were invited to write the chapter [9] that discusses all aspects of our programs, including the S-STEM scholarship. Several other presentations at professional STEM society meetings [10, 11] have included information about our prior S-STEM-TS program and we envision additional such presentations in the future. In addition, we hope to continue to share the story of our efforts to broaden participation through the Council on Undergraduate Research, Midstates Consortium for Math and Science, and American Association of Colleges and Universities publications and meetings.

k. Summary

This project will provide an effective way to attract to and retain in the STEM programs at Hope College a group of students who would not ordinarily consider attending Hope. These students will have an opportunity to benefit from the strong Hope College STEM programs. As a result of this project, pipelines will be established between the community colleges and Hope College that will benefit all institutions beyond this project's time frame. In addition, all students and faculty at Hope College will benefit from the resulting increase in student diversity.

References

- [1] Dowd, A.C., Cheslock, J.J., Melguizo, T. (2008) Transfer access from community colleges and the distribution of elite higher education, *The Journal of Higher Education* 79, 442-472.
- [2] Cech, T.R. (1999) Science at Liberal Arts Colleges: A Better Education? *Daedalus* 128, 195-216.
- [3] Thurmond, K.C. (2007). Transfer Shock: Why is a Term Forty Years Old Still Relevant? Retrieved July 1, 2010 from NACADA Clearinghouse of Academic Advising Resources Web site: <http://www.nacada.ksu.edu/Clearinghouse/AdvisingIssues/Transfer-Shock.htm>
- [4] Terris, B. (2009). Transfer Students Are Less Likely to Take Part in ‘High Impact’ Activities. Retrieved July 1, 2010 from Chronicle of Higher Education Web site: <http://chronicle.com/article/Transfer-Students-Are-Less/49070/>.
- [5] Russell, S.H., Hancock, M.P., McCullough, J. (2007) Benefits of undergraduate research experiences. *Science* 316, 548-549.
- [6] Seymour, E., Humber, A., Larsen, S., Deantoni, T. (2004) Establishing the benefits of research experiences for undergraduates in sciences: first findings of a three-year study. *Science Education* 88, 493-534.
- [7] Higgins, T.B., Brown, K.L., Gillmore, J.G., Johnson, J.B., Peaslee, G.F., Stanford, D.J. (2011) Successful Student Transitions from the Community College to the Four-Year College. Facilitated by Undergraduate Research. *CUR Quarterly* 31(3) , 16-22.
- [8] Perry, C. (2010). Big-Impact Seminar Experience for Small College Transfer Students. Retrieved July 1, 2010 from AAC&U Web site: <http://www.aacu.org/meetings/annualmeeting/AM10/documents/BigImpactSeminarExperienceHandout.pdf>.
- [9] Pearson, K., Brown, K., Dershem, H., Winnett-Murray, K. Barney, C. (2009) “Enriching a Culture of Research Extending Opportunities to a Broader Community,” Chapter in Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact, Boyd, M. and Wesemann, J. editors. Washington D.C.: Council on Undergraduate Research.
- [10] Stewart, J., Brown, K., Dershem, H. (2010) “Engaging transfer students in undergraduate research at Hope College.” 239th ACS National Meeting, San Francisco, CA, Mar 22, 2010.
- [11] Banks, O., Brown, K., Higgins, T. (2010) “Transformative educational and professional development experiences through the NSF Undergraduate Research Collaborative.” 239th ACS National Meeting, San Francisco, CA, Mar 21, 2010.

CATHERINE MADER

Professor of Physics
Department of Physics, Hope College
Holland, Michigan 49423
(616) 395-7114, EMAIL:MADER@hope.edu

PROFESSIONAL PREPARATION

Michigan State University, Ph.D., Physics, 1993.

Equilibrium and Non-Equilibrium Models for Particle Production in Heavy Ion Collisions

Colorado School of Mines, M.Sc., Engineering Physics, 1989.

Sub-Coulomb Deuteron-Nucleus Collisions Using the Cayley Equation

Colorado School of Mines, B.Sc., Engineering Physics, Nuclear Energy (minor) 1987.

APPOINTMENTS

Hope College

Professor	2009 – present
Chair, Department of Physics	2006 – 2009
Chair, Department of Physics & Engineering	2005 – 2006
Acting Chair, Department of Physics & Engineering	2004 – 2005
Associate Professor	1999 – 2009
Assistant Professor	1994 – 1999
Visiting Assistant Professor	1993 – 1994

American Physical Society

Education Project Consultant

2007 - present

Lawrence Berkeley National Laboratory

Visiting Scientist

2000 - 2001

PUBLICATIONS

(UNDERGRADUATES INDICATED WITH *)

C. M. Mader, ed. “The Physics Research Mentor Training Seminar” manual, American Physical Society, 2011. <http://www.aps.org/programs/education/undergrad/faculty/mentor-training.cfm>

John Krupczak, Jr., Joseph Kaloust, Michael Misovich, Janice Pawloski, Roger Veldman, Paul DeYoung, Peter Gonthier, Catherine Mader, and Mark Little, “Results from Replacing General Physics with Introduction to Engineering in the First Year”, Proceedings of the American Society for Engineering Education Annual Conference (2004).

C. M. Mader, A. Chappars*, J. B. Elliot, L. G. Moretto, L. Phair, G. J. Wozniak, “The three-dimensional Ising model: A paradigm of liquid-vapor coexistence in nuclear multifragmentation”, Phys. Rev. C68, 064601 (2003).

- L. G. Moretto, J. B. Elliot, L. Phair, G. J. Wozniak, C. M. Mader, A. Chappars*, “Theoretical approaches and experimental evidence for liquid-vapor phase transitions in nuclei”, AIP Conference Proceedings, April 2, 2002 610, 182-196 (2002).
- G. F. Peaslee, C. M. Mader, P. L. Jolivette, P. A. DeYoung, “The Restructured Advanced Laboratory at Hope College - A Step Toward Independence”; Application of Accelerators in Research and Industry: 15th International Conference, AIP Press 475, 1110-1113 (1999).

SYNERGISTIC ACTIVITIES

Reviewer for NSF-REU, RUI, CCLI, STEP and MSP programs; Research Corporation; Project SPIN; Am. Journal of Physics; several textbooks; External Departmental review team member for several colleges

Project Kaleidoscope Faculty 21

Council on Undergraduate Research (2006-present), CUR Physics and Astronomy Councilor and Nominations Committee member (2006-2009)

Society of Physics Students - Zone Councilor SPS (2005-2007)

American Physical Society – Committee on Careers and Professional Development member (2009-2011), chair (2010, 2011)

National Physics REU Leadership Group, Founding member (2009), Executive committee member, chair (2009 - 2011)

COLLABORATORS AND OTHER PROFESSIONAL AFFILIATIONS

Theodore Hodapp, Monica Plisch, Wolfgang Bauer, James McNeil, Graham Peaslee, Drew Isola

Anna K. Bonnema

(616) 994-7477

bonnema@hope.edu

EDUCATION:

Secondary teaching certification and Masters of Arts in Education, 1999

University of Michigan

Bachelor of Science in Zoology, 1997

Michigan State University

EMPLOYMENT:

Instructor, Hope College, 2010-present

Instructor for Biology 240 (Cells and Genetics) and First Year Seminar courses.

FACES Director, Hope College, 2010-Current

Fostering A Community of Excellence in Science: Created a peer mentoring program for incoming freshmen from underrepresented backgrounds interested in pursuing a degree in the STEM fields. In addition to underrepresented minority students, this program is being expanded in the Fall of 2011 to include students with high financial need and transfer students.

PATH Biology Teacher, Hope College, 2008-Current

- Taught accelerated high school biology curriculum to 7-8th grade students.
- Created unique lessons implementing labs and projects to challenge and instruct eager, enthusiastic learners.
- Created and planned a gifted and talented science camp at Hope.

Integrated Science Teacher, West Ottawa Public Schools, 2001-2003

- Taught unique science units to 8th grade honors, and 9th grade students.
- Leader of cross-curricular team and member of school leadership committee.

Zoo Education Instructor, John Ball Zoo, Summers 2000-2002

- Taught young children in week-long summer zoology camps.
- Inspired children to love animals and science.
- Collaboration with education as well as zoo staff.

Biology Teacher, Muskegon Public Schools, 1999-2001

- Taught unique science lessons to 9th grade honors, and 10th grade students.
- Selected as science department representative to attend "Career Academy" training provided by Johns Hopkins University in Maryland.

SYNERGISTIC ACTIVITIES:

- **Speaker/presenter at International Mentoring Association Midwest Regional Conference at Ohio State University, May 2011:** “Creating a STEM mentoring program”
- **Participant in workshop at Hope College, June 2011:** “Creating a More Inclusive Community: Greater Understanding and Purposeful Action”
- **Speaker at Women’s Enrichment Forum Luncheon,** “The World without Us”
- **Holland Junior Welfare league,** 6-year member including a year as recording secretary.
- **Girls on the Run,** volunteer coach

Biographical Sketches

Co-Principal Investigator: Herbert L. Dershem

(i) Professional Preparation

B.S. University of Dayton, 1965

M.S. (Computer Science) Purdue University, 1967

Ph.D. (Computer Science) Purdue University, 1969

(ii) Appointments

Hope College, Assistant Professor, 1969-1974, Associate Professor, 1974-1981,
Professor, 1981-present, Chair, Computer Science Dept, 1976-2003, Interim Dean
for Natural Science, 2005, Director of Institutional Research, 2007-present.

United States Air Force Academy, Distinguished Visiting Professor, 1993-1994

Boston University Overseas Program, Visiting Professor, 1982-1983

Oak Ridge National Laboratories, Visiting Research Scientist, 1977-1978

(iii) Publications

Up to 5 publications most closely related to the proposed project:

Pearson, K.N., Brown, K.L., Dershem, H.L., Winnett-Murray, K., Barney, C.C., and
M.N.F. Lee, "Enriching a Culture of Research: Expanding Opportunities to a Broader
Community, chapter in *Broadening Participation in Undergraduate Research:
Fostering Excellence and Enhancing the Impact*, editors Mary K. Boyd and Jodi L.
Wesemann, Council on Undergraduate Research, Council on Undergraduate
Research, 2009.

Dershem, H.L., McFall, R.L., and N. Uti*, "A Linked List Prototype for the Visual
Representation of Abstract Data Types," *Interactive Multimedia Electronic Journal of
Computer-Enhanced Learning*, 4,2(Oct, 2002).

Dershem, H.L., McFall, R.L., and N. Uti*, "Animation of Java Linked Lists," *SIGCSE
Bulletin*, 34,1(Mar, 2001), 53-57.

Dershem, H.L., Dykstra*, J., and K. Suppes*, "An Abstract Window Toolkit Visualizer
for Computer Science Instruction," *Proceedings of the 33rd Midwest Instruction and
Computing Symposium (CD-ROM)*, April 14-15, 2000, Minneapolis, MN.

Dershem, H.L., Parker*, D.E., and R. Weinhold*, "A Java Function Visualizer," *Journal
of Computing in Small Colleges*, 15,1(Oct, 1999), 221-230.

Up to 5 other significant publications, whether or not related to the proposed project:

Dershem, H.L. and J. Vanderhyde*, "Java Class Visualization for Teaching Object-
Oriented Concepts," *SIGCSE Bulletin*, 30,1(Mar, 1998), 53-57.

Dershem, H.L. and P. Brummund*, "Tools for Web-Based Sorting Animation," *SIGCSE
Bulletin*, 30,1(Mar, 1998), 222-226.

Dershem, H.L., Barth*, W., Bowsher*, C., and D. Brown*, "Data Structures with Ada
Packages, Laboratories, and Animations," *Proceedings of the First Australasian
Conference on Computer Science Education*, July, 1996, 32-38.

Dershem, H.L. and M.J. Jipping, *Programming Languages: Models and Structures:
Second Edition*, PWS Publishing Co., 1995.

McFall*, R. and Dershem, "Finite State Machine Simulation in an Introductory Lab,"
SIGCSE Bulletin, 26,1(Mar, 1994), 126-140.

(iv) Synergistic Activities

a. Previous grants awarded:

- Co-director, "Introduction of the Computer in the Statistics Curriculum", NSF Office of Computing Activities, 1971-1973, \$45,800.
- Director, "A Modular Approach to the Introductory Course in Computer Science", NSF Local Course Improvement Program, 1978-1980, \$14,200
- Co-Director, "A Microcomputer Laboratory for use in Teaching Statistics", NSF Instructional Scientific Equipment Program, 1979-1980, \$10,315.
- Director, "CSNET Membership in Support of Computer Science Research", NSF RUI Program, 1987-1990, \$9,375.
- Director, "Computer Science Undergraduate Research Program", NSF REU Program, 1992-1994, \$86,550; 1995-1997, \$114,393; 1998-2000, \$146,700; 2001-2003, \$163,213, 2004-2008, \$352,000.
- Director, "Use of Ada, Laboratories, and Visualization in the Teaching of Data Structures and Discrete Mathematics", DARPA Curriculum Development Grant, 1993- 1994, \$23,010.
- Director, "Curriculum and Textbook Development Using Ada 9X for the Teaching of Object-Oriented Concepts", US Air Force Contract, 1995-1996, \$34,464.
- Co-Director, "An Integrated Classroom/Laboratory for Introducing Students to Object Oriented Concepts", NSF ILI Program, 1996-1998, \$46,356.
- Director, "Computer Science, Engineering, and Mathematics Scholarship Program", NSF CSEMS Program, 2005-2008, \$398,040.
- Director, "Scholarships for Transfer Students in Science, Engineering, and Mathematics", NSF S-STEM Program, 2007-2012, \$564,360.

(v) Collaborations and Other Affiliations

a. Collaborators and Co-Editors

A list of scientists collaborated with on projects over the last 48 months would include:

Scott Grissom (Grand Valley State University), Michael Jipping (Hope College), Ryan McFall (Hope College), Myles McNally (Alma College), Thomas Naps (University of Wisconsin-Oshkosh), Samuel Rebelsky (Grinnell College), Henry Walker (Grinnell College).

b. Graduate and Postdoctoral Advisors

Robert E. Lynch (Purdue University)

c. Thesis Advisor and Postgraduate-Scholar Sponsor

None

Graham F. Peaslee

Education and Training

Princeton University	Chemistry	A.B., 1981
State University of New York, Stony Brook	Chemical Physics	Ph.D., 1987
Post-doctoral Fellow, Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA,		1988-1990
Post-doctoral Fellow, National Superconducting Cyclotron Lab., E. Lansing, MI,		1990-1993

Research and Professional Experience:

Elmer Hartgerink Chair of Chemistry, Hope College	2011-present
Chair, Chemistry Department, Hope College	2008-present
Professor of Chemistry & Environmental Science, Hope College,	2007-present
Visiting Scientist, Counterterrorism and Forensic Science Research Unit, FBI Academy, Quantico VA	2007-2008
Assoc. Professor of Chemistry & Environmental Science, Hope College,	2000-2007
Visiting Scientist, Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, Livermore, CA,	2000-2001
Asst. Professor of Chemistry & Environmental Science, Hope College,	1996-2000
Assistant Professor of Chemistry, Hope College,	1993-1996

Publications

151 peer-reviewed publications since 1983, 37 with 104 undergraduate co-authors.*

1. Thomas B. Higgins, Kenneth L. Brown, Jason G. Gillmore, Jeffrey B. Johnson, Graham F. Peaslee, Daniel J. Stanford, Successful Student Transitions from the Community College to the Four-Year College Facilitated by Undergraduate Research, *CUR Quarterly* 31, (2011) 16-21.
2. D.T. Restrepo, C. Greibel, K. Giesler, E.j. Buke, D.K. Silletti*, S. A. Brokus*, G. Peaslee, R. G. Blair (2011) Mechanochemically enhanced synthesis of isomorphously substituted kaolinites. *Applied Clay Science*, 52, 386-391.
3. W. A. Peters, T. Baumann, B. A. Brown, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, K. L. Jones, J.-L. Lecouey, B. Luther, G. F. Peaslee, W. F. Rogers, A. Schiller, M. Thoennessen, J. A. Tostevin, and K. Yoneda, (2011) Neutron knockout of ^{12}Be populating neutron-unbound states in ^{11}Be . *Phys. Rev. C* 83, 057304.
4. L.J. Jisonna, P.A. DeYoung, J. Ferens*, C. Hall*, J.M. Lunderberg*, P. Mears*, D. Padilla*, G.F. Peaslee and R. Sampson* (2011) Forensic analysis of tempered sheet glass by particle induced X-ray emission (PIXE). *Nuclear Instruments Methods* B269:1067-1070
5. P. DeYoung, C. Hall*, P. Mears*, D. Padilla*, R. Sampson*, G. Peaslee (2011), Comparison of Glass Fragments Using Particle Induced X-Ray Emission (PIXE) Spectrometry. *Journal Forensic Science* 56: 366-371.

6. J.D. Warner*, P.A. DeYoung, L.A. Ellsworth*, L.M. Kiessel*, M.J. Rycenga*, and G. F. Peaslee; "Quantitative analysis of a metalloprotein compositional stoichiometry with PIXE and PESA"; *Nucl. Instr. Meth. B268* (2010) 1671-1675.
7. J.S. Vogel, J. Ognibene, G.S. Bench, G.F. Peaslee (2009) System for Trapping and Storing Gases for Subsequent Reduction to Solids. US Patent 7,611,903 B2. 3 Nov 2009.
8. E. F. Aguilera, E. Martinez-Quiroz, P. Rosales, J. J. Kolata, P. A. DeYoung, G. F. Peaslee, P. Mears*, C. Guess*, F. D. Becchetti, J. H. Lupton, and Yu Chen "Hindrance of complete fusion in the $8\text{Li}+208\text{Pb}$ system at above-barrier energies"; *Phys. Rev. C* 80, (2009) 044605.
9. Book: "*Watershed Investigations: 12 Labs for High School Science*"; Jennifer Soukhome, Graham Peaslee, Carl Van Faasen, and William Statema*, NSTA Press, Arlington, VA 2009.
10. J.M. Lunderberg*, R.J. Bartlett*, A.M. Behm*, C. Contreras, P.A. DeYoung, N.L. Hoogeveen*, A.J. Huisman*, G.F. Peaslee, J.K. Postma*; "PIXE as a complement to trace metal analysis of sediments by ICP-OES"; *Nucl. Instr. Meth. B266* (2008) 4782-4787.

Synergistic Activities

Assuring a Future U.S.-based Nuclear Chemistry Expertise Committee,
 National Academies of Science, Washington DC, Woods Hole, MA. 2011
 Council on Undergraduate Research, Chemistry Division Councilor. 2009-2011.
 ACS Division of Nuclear Chemistry & Technology; Education Committee, 2000-present
 Panelist, IAEA Panel on Enhancing Nuclear Science Education and Training
 using Accelerators, Accra, Ghana 2007
 Chair, Committee on Qualifications & Membership, Sigma Xi National, 2002-2005
 Member and Chair, Chemistry REU Leadership Group, 2003-2008
 Member: American Chemical Society (Division of Nuclear Chemistry & Technology) and American Physical Society (Division of Nuclear Physics) 1983-present
 Undergraduate Research Students Supervised: 113 1993-present

Collaborators and other Affiliations

Collaborators: T. Bauman (Michigan State), R. Blair (U. Central Florida), K. Brown (Hope College), J. Buscaglia (FBI Academy), P. DeYoung (Hope College), E. Hansen (Hope College), J.J.Kolata, (Notre Dame), C.M. Mader (Hope College), G. Murray (Hope College), R. Rediske (Grand Valley State U), M. D. Seymour (Hope College), A. Steinman (Grand Valley State U), M. Thoennesen, (Michigan State),

Graduate and Postdoctoral Advisors: John Alexander (SUNY Stony Brook), G.J. Wozniak (Lawrence Berkeley National Lab), C. K. Gelbke (Michigan State).

Thesis Advisor and Postgraduate-Scholar Sponsor: L. Picq (MS - WMU), D. Cooper (MS - VCU), L. Jisonna (Postdoctoral researcher at Hope College).

Brian E. Bodenbender

Education and Training

The College of Wooster	Geology, with honors	B.A., 1987
The University of Michigan	Geological Sciences	M.S., 1990
The University of Michigan	Geological Sciences	Ph.D., 1994
University Postdoctoral Fellowship, The Ohio State University		1995-1996

Research and Professional Experience:

Chair, Department of Geological & Environmental Sciences, Hope College	2007-present
Associate Professor of Geological & Environmental Sciences, Hope College	2002-present
NSF Summer Program Fellow, The State University of New York College at Brockport	1997
Assistant Professor of Geological & Environmental Sciences, Hope College	1996-2002
Lecturer II, Department of Geological Sciences, University of Michigan	1995
Instructor, TA Training Program, University of Michigan	1994
Instructor, Department of Geological Sciences, University of Michigan	1993

Publications

1. B.E. Bodenbender and T.M. Demko, Multidisciplinary field investigations: using shared logistics to increase research productivity. *CUR Quarterly* 25 (2005), 156-161.
2. B.E. Bodenbender and E. J. Hiemstra, A reconnaissance of skeletal crystallography in rhombiferans, diploporans, and paracrinoids. *Journal of Paleontology*, 78 (2004), 1153-1161.
3. D.C. Fisher and B.E. Bodenbender, Blastoid stratocladistics – reply to Sumrall and Brochu. *Journal of Paleontology*, 77 (2003), 195-198.
4. B. E. Bodenbender, Facing the About: Why Disciplines are Essential to the Liberal Arts. *Liberal Arts Online* 3 (2003). <http://www.liberalarts.wabash.edu/lao-3-10-discipline-crit-think/>
5. B.E. Bodenbender and D.C. Fisher, Stratocladistic analysis of blastoid phylogeny. *Journal of Paleontology*, 75 (2001), 351-36p.
6. B.E. Bodenbender and W.I. Ausich, Skeletal crystallography and crinoid calyx architecture. *Journal of Paleontology*, 74 (2000) 52-66.
7. B.E. Bodenbender, E.C. Hansen, G.F. Peaslee and J.W. Peterson, The Environmental Science Minor: a disciplinary approach to interdisciplinary studies with a grounding in undergraduate research. *CUR Quarterly* 21 (2000), 72-76.

Synergistic Activities

Co-Editor for *Michigan Academician* 2006-present
Member: Geological Society of America; Palaeontological Association; Paleontological Society; Society of the Sigma Xi; National Center for Science Education; Michigan Karst Conservancy; Michigan Academy of Science, Arts, and Letters

BIOGRAPHICAL SKETCH

Thomas Bultman

a. Professional Preparation:

Hope College Biology A.B., 1978

University of Cincinnati Biological Sciences M.S., 1981

Arizona State University Zoology Ph.D., 1985

b. Appointments:

Visiting Research Scientist, ETH, Zurich, Switzerland, 2008

Professor and Chair of Biology, Hope College, 2001-Present

Visiting Professor, ETH, Zurich, Switzerland, 2000

Visiting Research Scientist, AgResearch, Lincoln, New Zealand, 1996-1997

Visiting Research Scientist, Silwood Park, Ascot, UK 1996

Associate Professor of Biology, Truman State University, 1994-2001

Assistant Professor of Biology, Truman State University, 1988-94

Lecturer, University of Texas-Austin, 1986-1988

c. Publications: (undergraduate co-authors underlined)

i. Publications Most Closely Related to Proposed Project

Bultman, T.L., T.J. Sullivan, M.H. Cortez and T. Pennings. 2009. Extensions to and Modulation of Defensive Mutualism in Grass Endophytes. Pp. 301-317 in *Defensive Mutualism in Symbiotic Associations*. Torres, M. and White, J.F., Jr. (Eds.). Taylor & Francis Publ.

Bultman, T.L., J.L. Rodstrom, K.R. Radabaugh, J.D. VanDop, J.M. Librizzi, L.L. Longwell, C. Pulas, L. Grant and T.J. Sullivan. 2009. Influence of genetic variation in fungal endophyte of a grass on an herbivore and its parasitoid. *Entomologia Experimentalis et Applicata* 130: 173-180..

Simons, L., T.L. Bultman and T.J. Sullivan. 2008. Effects of Methyl Jasmonate and an Endophytic Fungus on Plant Resistance to Insect Herbivores. *Journal of Chemical Ecology* 34:1511-1517.

Gonthier, D.J., T.J. Sullivan, K.L. Brown, B. Wurtzel, R. Lawal, K. VandenOever, Z. Buchan, and T.L. Bultman. 2008. Stroma-forming endophyte *Epichloë glyceriae* provides wound-inducible resistance to its grass host. *Oikos* 177:629-633.

Sullivan, T.J., J. Rodstrom, J. Vandop, J. Librizzi, C. Graham, C. L. Schardl and T.L. Bultman. 2007. Symbiont-mediated changes in defensive strategy in the invasive grass *Lolium arundinaceum*: evidence from changes in gene expression and foliar elemental composition. *New Phytologist* 176:673-679.

ii. Other significant publications:

Bultman, T.L., A. Leuchtman, T.J. Sullivan, and A. Dreyer. In press. Do *Botanophila* flies provide reproductive isolation between two species of *Epichloë* fungi? A field test. *New Phytologist*.

Bultman, T.L., A.A. Aguilera and T.J. Sullivan. In press. Influence of Fungal Isolates Infecting Tall Fescue on Multitrophic Interactions. *Fungal Ecology* (accepted with revision).

- Bultman, T.L. and A. Leuchtman. 2008. Biology of the *Epichloë-Botanophila* Interaction: an Intriguing Association between Fungi and Insects. *Fungal Biology Reviews* 22:131-138.
- Bultman, T.L., C. Pulas, L. Grant, G. Bell, and T.J. Sullivan. 2006. Effects of endophytic fungal isolate and plant cultivar on host preference by two insect herbivore species. *Environmental Entomology* 35:1690-1695.
- Bultman, T.L., G. Bell and W. Martin. 2004. A fungal endophyte mediates reversal of wound-induced resistance and constrains tolerance in a grass. *Ecology* 85:679-685.

d. Synergistic Activities

1. Chair of Biology Graduate Recruitment at Truman State University 1993-1996; Kirksville
2. Sigma Xi Chapter Secretary 1989-1991, 1999-2001
3. Panelist for NSF-POWRE Program 1998, 1999
4. Panelist for Murdock Trust Faculty Grants Program in the Life Sciences 1999-Present
5. CUR Councilor 2001-2007
6. Co-Chair of Symposium at XXI International Entomological Congress 2000, Iguassu Falls, Brazil
7. Reviewer of manuscripts for several scientific journals and proposals for the NSF and USDA.
8. Chair, Biology Department, Hope College, 2001-Present
9. Editorial advisor, *New Phytologist* 2008-Present
10. Panelist for NSF Evolutionary Ecology Program 2009

e. Collaborators and other Affiliations:

- 1. Collaborators:** Dr. Stephen Goldson, Dr. Adrian Leuchtman, and Dr. Mark McNeill, Dr. Timothy Pennings, Dr. Chris Schardl, Dr. TJ Sullivan
- 2. Graduate and Postdoctoral Advisors:** Dr. George Uetz (M.S.), and Dr. Stan Faeth (Ph.D.)
- 3. Thesis Advisor and Postgraduate-Scholar Sponsor:** Patrick Mathews, Stephens College; John Murphy, Missouri Dept. of Conservation. Total = 2.
- 4. Undergraduate Research Students Supervised:** 85

BIOGRAPHICAL SKETCH

Moses Lee

Dean for Natural and Applied Sciences (NAS) & Professor of Chemistry

A. Professional Preparation:

B. Sc. (Honors) Biochemistry, University of Guelph, Guelph, Canada, 1983.

Ph.D. Organic Chemistry, University of Guelph, 1986.

Postdoctoral Associate, University of Alberta, Canada, 1986-1987.

B. Appointments:

Dean for NAS Division & Professor of Chemistry, Hope College, 2005 – present

Adjunct Professor of Chemistry, Georgia State University, 2002 – present

Full Professor & Rose J. Forgione Chair of Chemistry, Furman University, 1998 – 2005

Camille and Henry Dreyfus Scholar, 2002 - 2005

Visiting Professor, University of Guelph, Guelph, Canada, 2002 - 2003

Visiting Associate Professor, National University of Singapore, 1995 -1996

Associate Professor of Chemistry, Furman University, 1994 - 1998

Henry Dreyfus Teacher - Scholar, 1994 - 1999

Henry and Ellen Townes Assistant Professor, 1992 - 1994

Assistant Professor of Chemistry, Furman University, 1989 – 1994

Research Scientist, Synphar Laboratories Inc., Edmonton, 1987 - 89

C. Publications: (159 published and accepted)

(i) *Five Recent Publications (undergraduate co-workers are underlined, high schooler*)*

1. *Design, Synthesis and Biological Evaluations of 2,5-Diaryl-2,3-dihydro-1,3,4-oxadiazoline Analogs of Combretastatin-A4.* L. Lee,* L. M. Robb, M. Lee,* R. Davis, H. Mackay, S. Chavda, B. Babu, E. L. O'Brien, A. L. Risinger, S. L. Mooberry, and M. Lee, *J. Med. Chem.* **2010**, 53, 325-334.

2. *Topoisomerase II α Promoter with a Formamido-pyrrole–imidazole–pyrrole H-pin Polyamide.* A. Franks, C. Tronrud, K. Kiakos, J. Kluza, M. Munde, T. Brown, H. Mackay, W. D. Wilson, D. Hochhauser, J. A. Hartley and M. Lee, Targeting the ICB2 Site of the *Bioorg. & Med. Chem.* **2010**, 18, 5553-5561.

3. *Investigating the Effects of the N-Formamido Moiety on the Binding of Pyrrole- and Imidazole-Containing Triamides with their Cognate 5'-ACGCGT-3' Sequence.* L. Westrate, J.A. Sutterfield, R. Leblanc, T. Brown, Jerome Kluza, J. A. Hartley, B. Nguyen, D. Wilson and M. Lee, 2009, *Biochemistry* **48**, 5679–5688.

4. *Sequence Specific and High Affinity Recognition of 5'-ACGCGT-3' by a Rationally Designed Pyrrole-Imidazole H-pin Polyamide.* H. Mackay, T. Brown, P. B. Uthe, L. Westrate, A. Sielaff, J. P. Lajiness, J. Kluza, C. O'Hare, B. Nguyen, C. Bruce, W. D. Wilson, J. A. Hartley and M. Lee, *Bioorg. Med. Chem.* **2008**, 16, 9145-9153.

5. *The Use of 2-Aminopurine-Cytosine Containing Oligonucleotides and Fluorescence Spectroscopy to Investigate DNA-Polyamide Binding.* A. Sielaff, H. Mackay, T. Brown and M. Lee, *Biophys. Biochem. Res. Commun.* **2008**, 369, 630-634.

6. *Characterization of the DNA sequence selective adenine alkylation, mechanisms of adduct repair and in vivo antitumour activity of the novel achiral seco-amino-CBI analogue of duocarmycin AS-I-145.* K. Kiakos, A. Sato, T. Asao, P.J. McHugh, M. Lee, J.A. Hartley. *Molecular Cancer Therapeutics* **2007**, 6, 2708-2718.

(ii) **Books edited:** 2 [M. Lee, Ed. In *Topics of Heterocyclic Chemistry: Heterocyclic Antitumor, Antibiotics*. Springer, Berlin, 2006; and M Lee and L. Streckowski, Eds. In *Synthetic and*

Biophysical Studies of DNA binding Compounds. Research Signpost. 2007.]

(iii) Patents: 4 since 1988 (1 this year).

(iv) Presentations: 173 total, 82 since 2002, all with student co-presenters. *Invited Talks:* 85 total, 53 since 2002.

D. Synergistic Activities:

- Consultant for Research Corporation Department Developmental Award Program, June 2004 – present.
- American Chemical Society PRF Advisory Board 2002 – 2008.
- Editorial Board of **Medicinal Chemistry** 2004 – present, **Heterocyclic Communications** 2002 – present, **The Open Cancer Journal** 2006 – present, **Current Bioactive Compounds** 2008 – present.
- NSF-NIH Workshop on Instrument Design, Washington, DC, 2008.
- Panel member for Academic Leadership Conference, Research Corporation, Az, 2004
- Co-organizer NSF Workshop Undergraduate Research Centers, Washington, DC, 2003.
- NSF-REU Leadership Group, 2001-2003
- Expert Consultant, Division of Chemistry, NSF, Arlington, VA, 2002 - 2003
- Steering Committee for Summit on Undergraduate Research 2002 – 2003
- Panelist: NSF-URC 2004, NSF-CAREER, 2000, 2001, NSF-ILI 1996, NSF-CRIF 2008
- Research Corporation Advisory Committee member, 1996-2000
- Member, American Chemical Society, and the American Association for Cancer Research
- Program Chair, Division of Medicinal Chemistry, SE Regional ACS Meeting, fall 2002
- Chair for organizing symposia on small molecule-DNA interactions, SE regional ACS meeting (October 1996 and November 2003), Wake Forest University (March 2001)
- Consultant: Spirogen (UK), 2001 – present, Taiho Pharmaceutical Co. (Japan), 1999 – 2005
- Milliken Company (SC), 2000 – 2002; Enzacta (UK), 1997 – 2000.
- Developed laboratory exercises for organic and biochemistry; *J. Chem. Ed.* and *Chemical Education Resources*.
- Review proposals for the NSF, ACS-PRF, Research Corporation, NC Biotech Center, Murdock Trust, Big C Cancer Research Fund.
- Reviewer of manuscripts for *Biochem.*, *Bioorg. Med. Chem.*, *Bioorg. Med. Chem. Lett.*, *Med. Chem.*, *Med. Chem. Res.*, *J. Am. Chem. Soc.*, *Chem. Commun.*, *J. Med. Chem.*, *J. Org. Chem.*, *Org. Lett.*, *J. Chem. Ed.*

E. Collaborators and other Affiliations:

(i) Collaborators: Professor John Hartley and Professor Daniel Hochhauser, Royal Free & University College Medical School, UK; Professor David Thurston and Dr. Phil Howard, University of London, School of Pharmacy, UK; Professor Terry Spithill, Charles Sturt University, Australia; Dr. Stephanie Yanow, Laboratory for Provincial Health, Alberta, Canada; Professor Armando Jardim, McGill U, Canada; Professor Hiroshi Sugiyama, U of Tokyo, Japan; Professor W. David Wilson, Georgia State University; Dr. Jerry Collins and Dr. Joe Covey at the National Cancer Institute, MD; Drs. Mike Walla and Bill Cotham, U of South Carolina, Columbia, SC; Professor Kim Opperman-Pacheco, U of Northern Colorado, CO; Professor Chrystal Bruce, Erskine College, SC; Professor Phil Bowen, UNC, Greensboro, NC; Professor Herman L. Holt, Jr. UNC, Asheville, NC; Professor Haizhen Zhang, U of Nebraska, Omaha.

(i) Mentors: Professor G.L. Lange (Ph.D. Advisor); Professor J.W. Lown (Postdoctoral Advisor)

(ii) Postdoctoral Advisor (11 since 1990; 8 in last 6 years): Drs. Natalie Brooks; Stephen Mayalarp; Sharon Jennings; Angela DiFrancesco; Atsushi Sato; Hari Pati, Karen Buchmueller, Toni Brown, Hilary Mackay; Sameer Chavda; Balaji Babu.

(iv) Graduate Research/Thesis Advisor (M.S.) (32 since 1990; 24 in the last 9 years)

(v) Undergraduate Research/Thesis Advisor (228 since 1990; 146 in the last 9 years)

Ryan L. McFall

Education and Training

Hope College	Math/Computer Science	B.S., 1993
Michigan State University	Computer Science	M.S., 1995
Michigan State University	Computer Science	M.S., 1995

Research and Professional Experience:

Associate Professor of Computer Science, Hope College	2006-present
Assistant Professor of Computer Science, Hope College	2000-2006
Graduate Teaching Assistant, Michigan State University	1996-2000
Visiting Instructor of Computer Science, Hope College	1995-1996

Publications

1. R. L. McFall, H.L. Dershem, and D. Davis, Experiences Using a Collaborative Electronic Textbook: Bringing the Guide on the Side Home With You. Thirty-seventh SIGCSE Technical Symposium on Computer Science Education, 38(2002), 339-343.
2. H.L. Dershem, R.L. McFall, N. Uti, A linked List Prototype for the Visual Representation of Abstract Data Types. Interactive Multimedia Journal of Computer-Enhanced Learning, 4 (2002).
3. R. L. McFall, Evaluation of a Prototype of an Electronic Textbook Application. Paper presented at the World Conference on Educational Multimedia, Hypermedia & Telecommunications, Lugano, Switzerland (2004).
4. R. L. McFall, Electronic Textbooks That Transform How Textbooks Are Used. The Electronic Library, 23(2005), 72-81.
5. C. Spielvogel, L.G. Spielvogel, and R.L. McFall, Role-Playing and the Future of the Textbook. International Journal of Learning and Media, 1(2009). 11-16. doi: doi:10.1162/ijlm_a_00031
6. R.L. McFall, R.L. and C. Cusack, Ray Tracing as an Object-Oriented Example for CS 1. The Journal of Computing Sciences in Colleges (2010).
7. R.L. McFall, and M. DeJongh, Increasing Engagement and Enrollment in Breadth-First Introductory Courses Using Authentic Computing Tasks. Proceedings of the 2011 SIGCSE Technical Symposium on Computer Science Education (2011).

Synergistic Activities

Author of open source, online survey software. Used at Hope and Michigan State University.
Panels Coordinator, SIGCSE Annual Conference on Computer Science Education, March 2003.
Invited Workshop Participant, Microsoft Research Tablet PC in Education workshop, August 2004 and August 2005.
Author of PhotoMatch, computer implementation of board game "Memory" using digital photos.
Member, Association for Computing Machinery (ACM); ACM Special Interest Group in Computer Science Education (SIGCSE); The Institute of Electrical and Electronics Engineers (IEEE)

Timothy J. Pennings

Education and Training

University of North Dakota	Mathematics	B.S., 1979
University of North Dakota	Physics	B.S., 1981
University of North Dakota	Mathematics	M.S., 1981
Iowa State University	Mathematics	Ph.D., 1987

Research and Professional Experience:

Professor of Mathematics, Hope College	2004-present
Associate Professor of Mathematics, Hope College	1993-2004
Assistant Professor of Mathematics, Hope College	1988-1993

Publications

1. T.J. Pennings, J. Peters, Dynamical systems from function algebras. Proc. Amer. Math. Soc. 105, no. 1 (1989), pg 80-86.
2. T.J. Pennings, J. VanEeuwen, Pseudo-orbit shadowing on the unit interval. Real Analysis Exchange, Fall, 1990.
3. T.J. Pennings, J. Peters, Chaotic extensions of dynamical systems by functions algebras. Journal of Mathematical Analysis and Applications, 1991.
4. T.J. Pennings, Do Dogs Know Calculus?. The College Mathematics Journal, Vol. 34, No. 3, May 2003.

Synergistic Activities

Reviewer: The College Mathematics Journal, PRIMUS

Member: American Mathematical Society, Mathematics Association of America, Michigan Section of MAA

Roger Veldman

Education and Training

Hope College	Engineering Science	B.S., 1989
Western Michigan University	Mechanical Engineering	M.S.E, 1995
Western Michigan University	Mechanical Engineering	Ph.D, 2001

Research and Professional Experience:

Professor of Engineering, Hope College	2010-present
Associate Professor of Engineering, Hope College	2005-2010
Assistant Professor of Engineering, Hope College	1998-2005
Manager-Advanced Product Development, Donnelly Corporation, Holland, MI	1996-1998
Senior Product Development Engineer, Donnelly Corporation, Holland, MI	1994-1996
Associate Scientist – Materials R&D, Donnelly Corporation, Holland, MI	1991-1994
Manufacturing Engineer, Herman Miller, Inc., Holland, MI	1989-1991

Publications

1. R. L. Veldman, J. Ari-Gur, C. Clum, Response of Pre-Pressurized Reinforced Plates Under Blast Loading. *International Journal of Impact Engineering*, April 2008, 35(4), pp. 240-250.
2. R. L. Veldman, J. Ari-Gur, C. Clum, A. DeYoung, J. Folkert, Effects of Pre-pressurization on Blast Response of Clamped Aluminum Plates. *International Journal of Impact Engineering*, Oct. 2006, 32(10), pp. 1678-1695.
3. U.S. Patent No. 7,914,188 Interior rearview mirror system for a vehicle (March 2011).
4. U.S. Patent No. 7,867,263 Implantable bone plate system and related method for spinal repair (January 2011).
5. U.S. Patent No. 7,658,521 Interior rearview mirror system for a vehicle (February 2010).

SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
				CAL	ACAD	SUMR	
1. Catherine M Mader - Professor of Physics				0.00	0.00	0.50	\$ 4,400
2. Anna Bonnema - Director of FACES				0.00	1.00	0.00	4,400
3. Herbert L Dershem - Professor of Computer Science				0.00	0.00	0.00	0
4.							
5.							
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (3) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	1.00	0.50	8,800
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (8) UNDERGRADUATE STUDENTS							9,400
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							18,200
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							1,136
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							19,336
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL							0
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 80,000							
2. TRAVEL 0							
3. SUBSISTENCE 0							
4. OTHER 0							
TOTAL NUMBER OF PARTICIPANTS (8)							80,000
TOTAL PARTICIPANT COSTS							80,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							75
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							500
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							575
H. TOTAL DIRECT COSTS (A THROUGH G)							99,911
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							99,911
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 99,911 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet			Initials - ORG	

SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				Proposed	Granted		
				AWARD NO.			
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. Catherine M Mader - Professor of Physics				0.00	0.00	0.50	\$ 4,400
2. Anna Bonnema - Director of FACES				0.00	1.00	0.00	\$ 4,400
3. Herbert L Dershem - Professor of Computer Science				0.00	0.00	0.00	0
4.							
5.							
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (3) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	1.00	0.50	8,800
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (8) UNDERGRADUATE STUDENTS							9,400
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							18,200
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							1,136
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							19,336
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL							
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 160,000							
2. TRAVEL 0							
3. SUBSISTENCE 0							
4. OTHER 0							
TOTAL NUMBER OF PARTICIPANTS (16)							
TOTAL PARTICIPANT COSTS							160,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							75
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							500
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							575
H. TOTAL DIRECT COSTS (A THROUGH G)							179,911
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							179,911
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 179,911 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
		CAL	ACAD	SUMR			
1.	Catherine M Mader - Professor of Physics	0.00	0.00	0.50	\$ 4,400	\$	
2.	Anna Bonnema - Director of FACES	0.00	1.00	0.00	4,400		
3.	Herbert L Dershem - Professor of Computer Science	0.00	0.00	0.00	0		
4.							
5.							
6.	(0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0		
7.	(3) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	1.00	0.50	8,800		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	(0) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	0		
2.	(0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0		
3.	(0) GRADUATE STUDENTS				0		
4.	(7) UNDERGRADUATE STUDENTS				8,225		
5.	(0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0		
6.	(0) OTHER				0		
TOTAL SALARIES AND WAGES (A + B)					17,025		
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					1,136		
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)					18,161		
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT					0		
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)					0		
2. FOREIGN					0		
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS \$ <u>150,000</u>						
2.	TRAVEL <u>0</u>						
3.	SUBSISTENCE <u>0</u>						
4.	OTHER <u>0</u>						
TOTAL NUMBER OF PARTICIPANTS (15)				TOTAL PARTICIPANT COSTS	150,000		
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES				75		
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0		
3.	CONSULTANT SERVICES				500		
4.	COMPUTER SERVICES				0		
5.	SUBAWARDS				0		
6.	OTHER				0		
TOTAL OTHER DIRECT COSTS					575		
H. TOTAL DIRECT COSTS (A THROUGH G)					168,736		
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)					0		
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)					168,736		
K. RESIDUAL FUNDS					0		
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)					\$ 168,736	\$	
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				Proposed	Granted		
				AWARD NO.			
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. Catherine M Mader - Professor of Physics				0.00	0.00	0.50	\$ 4,400
2. Anna Bonnema - Director of FACES				0.00	1.00	0.00	\$ 4,400
3. Herbert L Dershem - Professor of Computer Science				0.00	0.00	0.00	0
4.							
5.							
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (3) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	1.00	0.50	8,800
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (0) UNDERGRADUATE STUDENTS							0
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							8,800
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							1,136
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							9,936
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL							
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <u>70,000</u>							
2. TRAVEL <u>0</u>							
3. SUBSISTENCE <u>0</u>							
4. OTHER <u>0</u>							
TOTAL NUMBER OF PARTICIPANTS (7)							
TOTAL PARTICIPANT COSTS							70,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							0
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							500
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							500
H. TOTAL DIRECT COSTS (A THROUGH G)							80,436
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							80,436
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 80,436 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.			
				Proposed	Granted		
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. Catherine M Mader - Professor of Physics				0.00	0.00	2.00	\$ 17,600
2. Anna Bonnema - Director of FACES				0.00	4.00	0.00	17,600
3. Herbert L Dershem - Professor of Computer Science				0.00	0.00	0.00	0
4.							
5.							
6. () OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (3) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	4.00	2.00	35,200
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (23) UNDERGRADUATE STUDENTS							27,025
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							62,225
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							4,544
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							66,769
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL							
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <u>460,000</u>							
2. TRAVEL <u>0</u>							
3. SUBSISTENCE <u>0</u>							
4. OTHER <u>0</u>							
TOTAL NUMBER OF PARTICIPANTS (46)							
TOTAL PARTICIPANT COSTS							460,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							225
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							2,000
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							2,225
H. TOTAL DIRECT COSTS (A THROUGH G)							528,994
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							528,994
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 528,994
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

C *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Budget Justification

Scholarships: The budget is calculated based on eight fully-funded participants the first year and seven or eight new fully-funded participants each of the next two years, yielding a total of 23 students. It is anticipated that students will receive the maximum stipend of \$10,000 for their two years at Hope College. If a student's financial need is less than \$10,000, the amount of the need will be awarded. The total amount requested is \$460,000. The requested amount is included on line **F1, Student Support Costs**.

Program Administration: The **PI** is supported for one-half month each summer for the amount of \$4,400 each year. This is support for administration of the project and its activities and preparation of reports. A total of \$17,600 is budgeted under category **A1, Senior Personnel**.

Fringe benefits at the rate of 18.15% are requested for personnel. The amount of \$799 (18.15% of \$4,400) is budgeted each year under category **C, Fringe Benefits**, with the total request of \$3,196.

Project assessment and evaluation will be carried out by the Frost Center for Social Science Research at Hope College. This is budgeted at \$500 per year under the category **G3, Consultant Services**. (See support costs below for description of remaining \$500 requested under G3.)

Supplies to recruit students and support program activities are budgeted at a total of \$225 under category **G1, Material and Supplies**.

The total Program Administration cost is \$23,021 which is 5% of the stipend request of \$460,000.

Student Support Costs: An amount of \$1,175 is budgeted per student/year to partially support their participation in the Natural and Applied Science Division summer research programs the summer prior to their first year at Hope College. The total amount of \$27,025 is requested on line **B4, Other Personnel, Undergraduate Students**.

The FACES program will incur additional costs associated with the STEM Transfer student mentoring and tutoring needs. The FACES director will be supported for approximately 80 hours of time each year (\$4,400) for the additional activities associated with S-STEM Scholarship recipient participation in the FACES program. A total of \$17,600 is requested under category **A1, Senior Personnel** for Co-PI Bonnema.

Fringe benefits at the rate of 7.65% are requested for co-PI Bonnema. The amount of \$337 (7.65% of \$4,400) is budgeted under category **C, Fringe Benefits** for the first year, with the total request of \$1,348.

The total Student Support cost is \$45,973 which is 10% of the stipend request of \$460,000.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.	
Investigator: Catherine Mader	Other agencies (including NSF) to which this proposal has been/will be submitted.
<p>Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title: Providing STEM Research Infrastructure for VanderWerf Hall at Hope College</p> <p>Source of Support: NSF</p> <p>Total Award Amount: \$ 347,069 Total Award Period Covered: 10/01/10 - 09/30/13</p> <p>Location of Project: Hope College</p> <p>Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.00</p>	
<p>Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title: Scholarships for Transfer Students in Science, Engineering, and Mathematics</p> <p>Source of Support: NSF</p> <p>Total Award Amount: \$ 528,994 Total Award Period Covered: 01/01/12 - 12/31/15</p> <p>Location of Project: Hope College</p> <p>Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.50</p>	
<p>Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title: Scholarships to support the Hope STEM Scholars Program participants</p> <p>Source of Support: NSF</p> <p>Total Award Amount: \$ 599,835 Total Award Period Covered: 06/01/10 - 05/31/15</p> <p>Location of Project: Hope College</p> <p>Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.50 Sumr: 0.25</p>	
<p>Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title: Physics REU Directors' Workshop</p> <p>Source of Support: NSF</p> <p>Total Award Amount: \$ 76,358 Total Award Period Covered: 05/01/08 - 04/30/12</p> <p>Location of Project: American Physical Society</p> <p>Person-Months Per Year Committed to the Project. Cal:0.50 Acad: 0.00 Sumr: 0.00</p>	
<p>Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title: Expanding High School - College connections in environmental research and education</p> <p>Source of Support: EPA</p> <p>Total Award Amount: \$ 99,998 Total Award Period Covered: 09/01/11 - 08/31/13</p> <p>Location of Project: Hope College</p> <p>Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Summ: 0.50</p>	
*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.	

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.	
Investigator: Anna Bonnema	Other agencies (including NSF) to which this proposal has been/will be submitted.
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Scholarships for Transfer Students in Science, Engineering, and Mathematics Source of Support: NSF Total Award Amount: \$ 528,994 Total Award Period Covered: 01/01/12 - 12/31/15 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 1.00 Sumr: 0.00	
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:	
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:	
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:	
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Summ:	

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Herbert Dershem

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: Current Pending Submission Planned in Near Future *Transfer of Support
 Project/Proposal Title: Scholarships to support the Hope STEM Scholars Program participants

Source of Support: National Science Foundation - S-STEM
 Total Award Amount: \$ 599,835 Total Award Period Covered: 06/01/10 - 05/31/15
 Location of Project: Hope College
 Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.00

Support: Current Pending Submission Planned in Near Future *Transfer of Support
 Project/Proposal Title: Scholarships for Transfer Students in Science, Engineering, and Mathematics

Source of Support: National Science Foundation - S-STEM
 Total Award Amount: \$ 564,360 Total Award Period Covered: 09/01/07 - 08/31/12
 Location of Project: Hope College
 Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.50

Support: Current Pending Submission Planned in Near Future *Transfer of Support
 Project/Proposal Title: Scholarships for Transfer Students in Science, Engineering, and Mathematics

Source of Support: NSF S-STEM
 Total Award Amount: \$ 528,994 Total Award Period Covered: 01/01/12 - 12/31/15
 Location of Project: Hope College
 Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.00

Support: Current Pending Submission Planned in Near Future *Transfer of Support
 Project/Proposal Title:

Source of Support:
 Total Award Amount: \$ Total Award Period Covered:
 Location of Project:
 Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: Current Pending Submission Planned in Near Future *Transfer of Support
 Project/Proposal Title:

Source of Support:
 Total Award Amount: \$ Total Award Period Covered:
 Location of Project:
 Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory: The STEM Departments occupy over 100,000 sq.ft. of space in the A. Paul Schaap Science Center (SSC) & VanderWerf Hall (VWH). These buildings house over 25 teaching laboratories and 35 research laboratories. Many teaching labs are used by research groups in the summer to expand capabilities.

Clinical:

Animal: Hope has filed an Animal Welfare Assurance Document (AWA No. A3971-01) with the Public Health Service. Greenhouse, mammal, aquatic & aviary facilities are housed in SSC. The Animal Care and Use Committee regulates research involving animals & ensures compliance with federal guidelines.

Computer: SSC and VWH have five general-use computer labs, a dedicated Geographic Information System lab, and a 16-station 100-parallel CPU supercomputer facility. In total, over 360 computers are available in laboratories for research and coursework.

Office:

Other: Hope College owns a 55-acre nature preserve and through a cooperative research & teaching agreement, has access to a 120-acre private nature preserve with laboratory facilities. Both are within 5 miles of campus.

Campus housing is available at reduced costs for summer research students.

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

The science and engineering programs have well equipped research and teaching laboratories which support over 40 different experimental research programs. Due to the close proximity and collegial nature of the small school, these research programs share many major resources.

-Hitachi TM-3000 SEM + EDS

-2 low-background Ortec HPGe gamma-ray counting facilities

-2 400 MHz high-field Varian NMR's

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

The seven STEM departments are assisted by 4.5 FTE secretaries. In addition, the departments are assisted by 3 FTE laboratory directors, a full-time machine and electronics technician, various departmental student workers, a computer information technology center for computer assistance, and one large division-wide stockroom. One full-time person maintains and operates the computational and modeling facility.

FACILITIES, EQUIPMENT & OTHER RESOURCES

Continuation Page:

LABORATORY FACILITIES (continued):

ANIMAL FACILITIES (continued):

COMPUTER FACILITIES (continued):

OTHER FACILITIES (continued):

MAJOR EQUIPMENT (continued):

- CITL Cathodoluminescence system w/ stereomicroscope & UV-Vis spectrometer
- Perkin-Elmer inductively-coupled plasma-optical emission spectrometer
- NEC 1.7 MV Tandem Pelletron Accelerator and nuclear microprobe
- Cephied Real-time PCR
- 2 Agilent gas chromatograph - mass spectrometer systems
- 5 Agilent High Performance Liquid Chromatography systems
- Agilent HPLC - mass spectrometer
- Agilent 1100 series LC-MSD with auto sampler and diode array, APCI and electrospray detection
- Agilent 8453 Diode Array UV-VIS Spectrometer with standard and biochemical/kinetics software
- 4 Varian SpectraAA-50 Atomic Absorption Spectrometers
- Cary 5E UV-Vis spectrometer
- Hewlett Packard Series 1050 HPLC System with ternary solvent system and variable wavelength detector
- Hitachi powder X-ray diffractometer
- Agilent/HP 8566B 22 GHz spectrum analyzer
- Agilent/HP 8719C vector network analyzer
- Agilent/HP 8757C scalar network analyzer
- Agilent/HP 8350B sweep oscillator
- Agilent E4421B 3 GHz signal generator
- Rhode & Schwarz SMB100A 6 GHz signal generator
- Agilent 8648C 3.2 GHz signal generator
- Amplifier Research 5S1G4 0.8 to 4.2 GHz power amplifier
- Microwave Power, Inc. L0505-41-T533 5 GHz Power amplifier
- Agilent/HP E3631A triple output power supply
- Lindberg tube furnace and controller
- K&S 4523 K&S deep access wire bonder

FACILITIES, EQUIPMENT & OTHER RESOURCES

Continuation Page:

MAJOR EQUIPMENT (continued):

- 2 Lakeshore 330 auto-tuning temperature controllers
- Lakeshore 321 autotuning temperature controller
- 3 Aisin TAC101JG helium refrigerator compressors
- 3 CTI M22 Gifford-McMahon cold heads
- 2 Cryo Industries of America custom liquid nitrogen cryostats
- Terra Universal Glove box
- 2 Hewlett Packard 6890A capillary gas chromatography systems
- LiCor Leaf Area Meter
- 2 Li-Cor LI-6400 portable photosynthesis systems
- CH Instruments Electrochemical Analyzer with EQCM Oscillator
- CH Instruments Model 602A Electrochemical Analyzer / Potentiostat with computer interface
- ESA Coulochem III for HPLC with Electrochemical Detection
- 3 Decagon AccuPAR light ceptometers
- MARS5 microwave-assisted digestion apparatus
- 2 Hitachi fluorometers
- Leica DM5000b combined brightfield(DIC)darkfield & fluorescentmicroscope
- 12 polarized light microscopes
- Nikon SMZ-2B reflecting light microscope
- Bausch&Lomb StereoZoom4 reflecting microscope
- Leica GZ6 reflecting microscope
- Solid Phase Peptide Synthesizer research instrument
- Branson 2510 ultrasonic cleaner
- Zeiss Axiovert 200 Fluorescence Microscope w/ Apotome Slider Assembly
- 4 Conviron E-15 controlled carbon dioxide growth chambers
- 2 two computerized sterotaxic surgery systems
- PX2 Thermal Cycler
- high resolution digital camera for tissue analysis of in situ hybridization and immunocytochemistry
- Leica CM1850 cryostat
- Respironics temperature telemetry system
- Columbus Instruments Oxymax system
- 2 400-MHz high-field Bruker NMRs
- Ocean Optics UV-VIS fiber optic spectrometer
- X/Torr XT100 100 AMU mass spectrometer
- SEAL Analytic Autoanalyzer system

OTHER RESOURCES (continued):

The Carl Frost Center for Social Science Research conducts program evaluation and assessment for both Hope and community organizations. They provide services to college programs at reduced rates.

Faculty members participating as mentors, advisory board members and program leaders will carry out their roles in this program as part of their contractual obligations to the college.

FACILITIES, EQUIPMENT & OTHER RESOURCES

Continuation Page:

OTHER RESOURCES (continued):

The FACES program (Fostering a Community of Excellence in Science) provides mentoring and professional development support throughout the academic career for STEM majors who are members of underrepresented groups or are participating in funded S-STEM programs.

The Natural and Applied Science Division hosts 7 STEM undergraduate research programs each summer, including 5 NSF funded REU site programs, and will provide the additional support needed for S-STEM participants to conduct research for 10 weeks during the summer before they begin taking courses at Hope.

Data Management Plan

Types of Data Gathered

The only data gathered for this project are related to program assessment and evaluation. Student demographic information, GPAs and graduation information will be gathered by the PI with assistance from the Registrar's office. Program evaluation data (through surveys and interviews) will be collected by the Frost Center for Social Science Research (FCSSR) staff.

Standards for Data format

The demographic information, GPAs and graduation data will be stored in the campus academic data database (an SQL database). Data gathered by the FCSSR staff is stored in either Word, Excel, or SPSS on a secure server. The PI will obtain yearly updates to this information during the grant period and will keep data in spreadsheet files (.xls) or pdf files on RAID-Array shared disk space provided by the College. The disk space is backed up nightly and retained by the College for six weeks to provide crash recovery and accidental deletion recovery.

Access to Data

Participant confidentiality is required based on the program approved by the Hope Human Subjects Review Board exemption for the evaluation plan. In addition, use of the data gathered by the Frost Center for Social Science Research is restricted to use for program improvement only, not publication.

Publication of Results

Program results will be disseminated in presentations and papers as described in the proposal. Use of demographic, GPA or graduation rate data gathered in these publications will only include aggregate results as long as participant anonymity can be maintained.



August 3, 2011

Program Director
S-STEM Program
National Science Foundation
Arlington, VA 22230

Re: Letter of Support for the S-STEM Proposal from Hope College

Dear Sir or Madam,

On behalf of Hope College, I am thrilled to provide my strongest support for the proposal submitted by Professor Catherine Mader, Professor Herb Dershem and Ms. Anna Bonnema to the S-STEM program. Hope College is committed to STEM education and to encourage more students to pursue careers in STEM areas. We will do so by providing time, space, and resources to enable our faculty and students to pursue publishable research and learn as a part of the S-STEM program. This application is especially exciting to me for these reasons:

First, the principal investigators are highly accomplished teacher-scholars and they have a proven record of successfully obtaining and implementing external grants, including many from the NSF. The proposed S-STEM program will provide scholarships of \$10,000 per year for two years to 23 students who will transfer to Hope College in a STEM discipline from the partnering 2-year community colleges. In addition, it will provide the students with an opportunity to complete their studies in a proven and successful curriculum that capitalizes on our strength in STEM education and undergraduate research within the context of a nurturing liberal arts college environment.

Second, Hope College is a national leader in STEM education; with more than 25% of our students graduating in these disciplines. About 30% percent of these students go on to pursue graduate degrees. We strongly feel that our success in producing a strong percentage of STEM majors is a direct result of our guiding teaching philosophy that is *learning science is done best by doing science*, i.e. to pursue undergraduate research. From numerous published studies, and according to the AACU-LEAP 2007 report "*College Learning for the New Global Century*," undergraduate research is now well established as one of the best practices for promoting student learning in higher education. Accordingly, our faculty and administration work tirelessly to provide state-of-the-art facilities and resources to promote high quality faculty-student collaborative research projects. The result is we have one of the largest summer undergraduate research programs among predominantly undergraduate institutions in the nation. In summer 2011, 179 students (seven of whom were students from 2-year community colleges) and 48 faculty members in the Division of Natural and Applied Sciences at Hope College participated in research and together they worked on 68 different projects. From the most recent data collected in 2010, our students and faculty produced more than 140 journal articles and books, and more than \$1.2 Million in external funding was received. I strongly feel that Hope College is an ideal institution to have an S-STEM award, so that we can provide this type of learning opportunities to the transfer students.

Third, this project addresses an imminent need for our country, and that is to encourage more students to pursue degrees in STEM fields, especially students from groups who are underrepresented in STEM

areas. I am enthused with the relationships we are developing with 2-year community colleges. These institutions have huge numbers of untapped, yet talented, students for STEM careers, and the majority of these students come from groups underrepresented in the sciences.

Fourth, for the nation to succeed in attracting new students to STEM fields, and in order to have a positive impact in the future, the program must be sustainable. Hope College has worked diligently in the past few years specifically to build relationships with 2-year colleges. Our relationship with the City Colleges of Chicago was initially funded by their NSF funded URC (undergraduate research collaborative) program in chemistry, which continues to thrive and grow. A similar relationship is growing between Hope College and Grand Rapids Community College with support from the NSF-REU Chemistry program. As part of our current S-STEM grant, we have established an active collaboration with five other community colleges in our geographical region.

Fifth, another novel aspect that is embodied in this proposal is the creation of a mentoring and learning community. We have established such a program and it is called FACES or "Fostering A Culture of Excellence in the Sciences." Its mission is to enable underrepresented students to grow and succeed in their education at Hope College. Such a learning community is another teaching and learning best practice according to the AACU-LEAP report. This fall, in its second year, FACES will have more than 20 students. The feedback thus far is positive and it is a key component of the proposed S-STEM program.

Finally, in 2005, we learned from such books as, *"The World is Flat,"* and *"Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future"* that it is imperative for the nation to motivate more students (especially from a diversity perspective) to embrace and pursue careers in the sciences. Sadly, in 2010 the *"Rising Above the Gathering Storm, Revisited"* revealed that while progress has been made in certain areas, our nation's outlook has worsened. This conclusion is alarming, and to rectify the negative trajectory we endeavor to increase opportunities and attract more students into STEM programs at Hope College. The objectives detailed in this S-STEM proposal will enable us to reach our goal of educating more STEM majors who will go on to graduate schools and take up careers in STEM fields. This is part of our strategy to contribute toward the nation's goal of producing more scientists, engineers, and mathematicians, and this, we believe, is the best safeguard for our nation's competitiveness globally.

In summary, Hope College enthusiastically supports the S-STEM proposal by Dr. Mader and Dr. Dershem. It creates a new model of productive collaboration between a large number of institutions, and it builds on the strengths of each partner. This synergistic effect will have a major impact in energizing a large number of students, who otherwise might not have access to research opportunities and to pursue careers in the STEM fields.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Moses Lee", with a horizontal line drawn underneath it.

Moses Lee Ph.D.

Dean of Natural & Applied Sciences
Professor of Chemistry



July 29, 2011

Herbert L. Dershem, Ph.D.
Hope College
35 East 12th Street
Holland, MI 49423-9000

Dear Dr. Dershem:

On behalf of Grand Rapids Community College, we enthusiastically offer this letter of support for Hope College's grant proposal to the National Science Foundation to renew its S-STEM project.

Grand Rapids Community College (GRCC) students have benefited greatly as a result of Hope College's previous S-STEM project. Hope College successfully recruited four cohorts of students into its program, and it graduated nine of those students, five of whom came from GRCC. Out of all four cohorts of incoming students, 12 of 30 have been from GRCC.

Renewal of Hope College's S-STEM grant, especially given the enhancements in on-campus student support the proposal includes, will equate to greater success for GRCC students, as well as others. Hope College's program, through its scholarships, has diminished the financial barriers to success that our students often face. The program also has provided rigorous educational experiences for students, coupled with the academic and social support they often need to meet those challenges.

The need for increased education in the fields of science, technology, engineering, and math in our state and our country is well documented. The Hope College S-STEM project promotes not only the future success of individual students, but it serves the greater interest of our state and country to maintain leadership in fields vital to our future success.

Sincerely,

A handwritten signature in black ink that reads "Laurie Chesley". The signature is fluid and cursive.

Laurie Chesley, Ph.D.
Dean, School of Arts and Sciences

A handwritten signature in black ink that reads "Jennifer H. Batten". The signature is fluid and cursive.

Jennifer H. Batten, Ph.D.
Department Head, Physical Sciences



143 Bostwick Avenue, NE • Grand Rapids, Michigan 49503-3295 • ph: (616) 234-GRCC • grcc.edu

VISION • As a college of distinction, GRCC inspires students to meet the needs of the community and the world.
MISSION • GRCC is an open access college that prepares individuals to attain their goals and contribute to the community.



Muskegon Community College

221 South Quarterline Road • Muskegon, Michigan 49442

July 19, 2011

S-STEM Program Officer
The National Science Foundation
4201 Wilson Blvd
Arlington, VA 22230

RE: Hope College Proposal, Solicitation 09-567

I am writing to offer Muskegon Community College's wholehearted support of Hope College's application to the S-STEM program. Three students from MCC have benefited through scholarships from Hope College's current S-STEM grant, and we know that more will participate if funding continues for Hope's program.

Muskegon Community College has an S-STEM grant as well, and many students have taken advantage of the scholarships at MCC since 2007. Several have gone to further study at public universities, and we continue to recruit promising students into our program.

The Hope grant provides the opportunity for these financially disadvantaged students to continue their education at an esteemed liberal arts college near home. The availability of scholarships, combined with excellent support by Hope College faculty and staff, should attract and retain significantly more MCC students in STEM programs of study.

MCC welcomes the continued opportunity for our students and enthusiastically supports the goals of the S-STEM proposal. We believe the processes outlined in the grant proposal will result in a high probability of success of MCC students if they choose to attend Hope College. The faculty and staff at MCC look forward to working with representatives of Hope College upon approval of funding, and we are excited about the opportunity these scholarships provide for our students.

Sincerely,

Teresa Sturuss
Vice President for Academic Affairs

Toby Moleski
PI Muskegon Scholars S-STEM
Professor of Physics and Physical Science



450 North Avenue, Battle Creek, MI 49017-3397 PHONE 269 965 3931 WEB www.kellogg.edu

S-STEM Program Officer

The National Science Foundation

Arlington, VA 22230

RE: Hope College Proposal, 09-567

July 28, 2011

It is our pleasure to offer our support for Hope College's S-STEM application.

Kellogg Community College is located in Battle Creek, and has regional sites in Hastings, Coldwater, and Albion, Michigan. Each location serves a very different population, but most of our students share a couple of common characteristics; they are first- generation college students, and they are financially challenged.

Hope College's S-STEM Program will allow our students in science, technology, engineering and mathematics to have an opportunity to attend a premier, selective-admission baccalaureate institution, and benefit from talented faculty, challenging program, and wrap-around support that the S-STEM Program provides.

Our country is currently seeing a growing decline in the number of students majoring in the mathematical and scientific fields. It is our job as educators to address this problem by improving the education that our current math, technology, engineering, and science students receive, as well as encourage new students to apply their abilities in these fields. The Hope College S-STEM Program does both.

It has been with great pride that Kellogg Community College has provided Hope College with several students who have taken advantage of the research opportunities at Hope. These students received excellent instruction and gained valuable experience while they worked on their degrees.

The S-STEM Program provides high quality students with high quality educational opportunities which may otherwise be outside their financial reach. One of our jobs as educators is to provide our students with as many options as possible. Support of this proposal will help us do so. We believe that the S-STEM Program will result in an increase in Hope graduates in these areas of study. This will benefit not only Hope and its students, but all of the surrounding area. On behalf of Kellogg Community College, we firmly support this proposal and the ideals that it represents.

Kevin Rabineau, Ph.D.

Dean of Arts, Sciences, & Regional Education

Rod Price

Physics Professor

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Northwestern
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College

1701 E. Front Street | Traverse City, MI 49686-3061
(231) 995-1000 | (800) 748-0566 | www.nmc.edu

July 13, 2011

To Whom It May Concern:

The Science and Mathematics Academic Area of Northwestern Michigan College (NMC) in Traverse City, MI, endorses the renewal of the Hope S-STEM project submitted by Herbert Dershem of Hope College. If granted, this project will continue to provide scholarships for community college students transferring to Hope College for degrees in science or mathematics.

The Science and Mathematics Academic Area at NMC is proud of the success our students have enjoyed at their transfer institutions. The vast majority of our students in the past, partly due to financial constraints, have transferred to public, state supported universities to complete their education. In the past three years, however, three outstanding NMC transfer students (one each year) have chosen to pursue their Bachelor's degree at Hope; these students were able to choose Hope College only because of the availability of this scholarship money through the NSF grant. Reports from these transfer students regarding Hope and this program have been very positive.

The faculty and staff in the Science and Math Academic Area at Northwestern Michigan College look forward to continuing to work with representatives of Hope College upon approval of this renewal, and are excited about the opportunities this program will continue to provide for our transfer students.

Sincerely,

Tony Jenkins
Mathematics Instructor

Ernest East
Academic Chair
Science and Mathematics



August 4, 2010

To Whom It May Concern:

Lake Michigan College is a Community College that serves both a rural and urban, diversely mixed population. Its three locations, Benton Harbor, Niles and South Haven, MI reach out to the surrounding areas of extremely rural, primarily agriculture industry driven communities. The college serves a significant number of African American, Hispanic, first generation, and displaced workers. Historically there have been few opportunities for dedicated, high achievement students to move forward with education. They can neither afford the cost nor the opportunity to move a great distance from their home community.

The S-STEM proposal, and Dr. Herb Dershem's tenacious dedication to advocate for and monitor the details, is an exceptionally rare prospect for our successful, high achieving and talented students. Under this program, LMC students in science, technology, engineering and mathematics have an opportunity to attend a competitive school, Hope College, and also benefit from the additional guidance, support and experiences the S-STEM program provides.

The research opportunities our students can experience because of the NSF supported S-STEM program are extremely valuable, giving them a competitive advantage in job placement. According to the Bureau of Labor Market Information & Strategic Initiatives of the State of Michigan, the job outlook for this region through 2016 is strong in all areas of engineering (8.7%-30% growth expected).

The unique opportunity for a small community college to partner with a very competitive transfer school to support the success of high achieving students is tremendously valuable. We are grateful for the support Hope College and Dr. Dershem have given us in recruitment, advising and consultation. Without hesitation we endorse the renewal of this proposal.

Most Sincerely,

Janice Varney, Executive Dean

Suzanne Trenkle, Director of Academic Services



30 EAST LAKE STREET • CHICAGO, ILLINOIS 60601-2420 • 312.553.5600

July 29, 2011

Dr. Herb Dersham
Hope College
35 E 12th Street
Holland, MI 49423-9000

Dear Herb:

We are happy to offer our support for your NSF S-STEM proposal entitled "Scholarships for Transfer Students in Science, Engineering, and Mathematics." Harold Washington College (HWC) has enjoyed a strong relationship with Hope College for the past six years and our students who have done summer research and transferred to Hope have thrived in its rigorous but personal academic environment.

Specifically we can offer to assist in identifying, recruiting, and mentoring community college students who have an interest in STEM careers, and to facilitate connections with Hope College faculty and staff. Through Dr. Higgins's position as Principal Investigator of an NSF-funded Undergraduate Research Collaborative (Award # CHE-0629174), we can also work with our colleagues to identify promising students at other Chicago-area community colleges, specifically the six other City Colleges of Chicago, William Rainey Harper College, Oakton Community College, and the College of DuPage.

We have every confidence that Hope understands the needs of community college transfer students. Since the onset of our collaborations six years ago, we know of 24 student in chemistry and biology from Chicago-area community colleges have done summer research at Hope and four have transferred and completed their baccalaureate degrees. These students are living examples of the positive impact we can have when we collaborate for our students' benefit.

Sincerely,

A handwritten signature in black ink that reads "Tom Higgins".

Thomas Higgins, Ph.D.
Professor of Chemistry

A handwritten signature in black ink that reads "John Metoyer".
John Metoyer
Vice President of Academic Affairs

ONE OF THE CITY COLLEGES OF CHICAGO

July 26, 2011

Herbert L. Dershem, Ph.D.
Director of Institutional Research
Hope College
Holland, MI 49423

Dear Dr. Dershem:

It is our pleasure to write this letter in support of Hope College's proposal for the National Science Foundation S-STEM grant. In the past, the grant has had a tremendous impact on our students who have transferred to Hope.

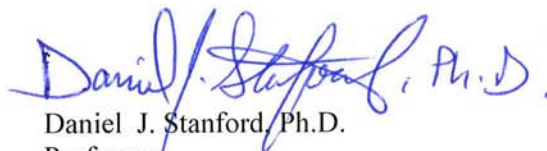
Harper College's Mathematics and Science Division has a strong relationship with Hope. Many of our students have had the opportunity to participate in Hope's Research Experience for Undergraduates (REU) program. These students have not only gained in their educational experiences but more so in the relationships they have formed with faculty and peers. These relationships have been a key to their success and will go forward with them throughout their careers. Students often remark at the end of their summer REU, "I don't want to leave Hope!" It is no surprise that Hope College is included as one of the forty written about in the book Colleges That Change Lives by Loren Pope.

Hope College provides the same small class sizes and personal interaction with faculty that our students experience at Harper. That is why many of our science faculty recommend Hope to our students pursuing a four-year science degree. Our past transfers to Hope note that Hope challenged them to grow academically and in many other areas of their lives.

We believe that Hope is one of the best colleges in the country to which we could send our science majors. The S-STEM scholarship program has been critical in providing that opportunity. We are certain that without the S-STEM scholarship, both of our students who received the award would have been forced to transfer to other, less-than-ideal, institutions due to finances. They wrestled with that very decision, clearly seeing the superior value of Hope College but torn by the financial strain. The S-STEM funds made that decision a no-brainer.

Our division is eager to partner with you in recruiting and maintaining STEM majors. The availability of scholarships through the S-STEM program will help future Harper science majors continue to experience what Hope College has to offer.

Sincerely,

James Roznowski
Dean
Mathematics and Science DivisionDaniel J. Stanford, Ph.D.
Professor
Department of Chemistry