


2010

2010 Newsletter

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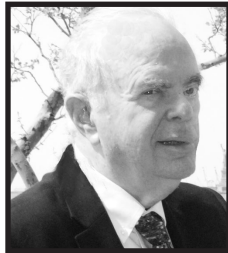
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FROM THE DIRECTOR MORTON STERNHEIM

SEEING THE DIGITAL LIGHT

I am pleased to announce a new NSF funded STEM Ed program entitled STEM Digital Images in Geoscience Investigations: Teaching Analysis with Light, or STEM DIGITAL. It will enable high school and middle school teachers and students to conduct environmental research aided by the analysis of images from digital cameras, scanners, and the Internet.

Image analysis plays a large role in the workplace and offers excellent career opportunities. Digital cameras are powerful tools for inquiry based curricula, classroom research, and learning about image analysis. They have become ubiquitous as their prices plummet and capabilities improve, making them affordable for classroom use. However, teachers and students mainly use digital images for documentation: creating PowerPoint presentations, handouts, posters, etc. There are good examples in the literature of how to use digital imaging as an investigative tool, but these are seldom seen in classrooms.

STEM DIGITAL will show how digital image analysis can be applied to environmental quality issues in ways that can readily be introduced into STEM courses, engaging students and encouraging them to think about related careers. The project will develop research agendas that will employ a variety of image analysis tools. The air quality theme, led by Steve Schneider (Astronomy), will focus on the three components of the atmosphere that primarily affect visible, infrared and ultraviolet light, respectively: particulates and aerosols, carbon dioxide, and ozone. The water quality theme, led by David Reckhow (Engineering) will look at the role of plant biomass on drinking water quality and on global carbon cycling. Arsenic is listed as number one in the US in terms of environmental contaminants that pose a potential threat to human health; research topics will include the identification and mapping of local arsenic contaminated sites and bioremediation possibilities. This will expand on the impressive arsenic outreach program of Julian Tyson (Chemistry).

STEM DIGITAL will use the AnalyzingDigitalImages software which provides free, easy-to-use tools for spatial, temporal, spectral, and intensity measurements. This package was developed by John Pickle, formerly at the Museum of Science in Boston and now at Concord Academy. There will be three cohorts of 30 teachers. The first two groups will attend one week summer institutes in 2011 and 2012.

STEM DIGITAL will show how digital image analysis can be applied to environmental quality issues in ways that can readily be introduced into STEM courses, engaging students and encouraging them to think about related careers.

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2010 INSTITUTE

The fourth STEM ED Nanotechnology Institute was held this summer at UMass. Sponsored by the Center for Hierarchical Manufacturing and funded by the National Science Foundation, this five day institute took place from June 28th through July 2nd in the newly constructed Integrated Sciences Building, directly across from the Hasbrouck Lab Building, where previous institutes were held. The Integrated Sciences Building is a \$115,000,000 new building on campus designed for the integration of the life, chemical, and physical sciences.

Thirty-three participants who completed the course came from seven different states, including Massachusetts, Rhode Island, Connecticut, New York, Ohio, Virginia, and Mississippi. The Institute offered housing to teachers in the North Residential Complex on campus.

Mort Sternheim, the Director of the STEM Education Institute headed up the staff along with Mark Tuominen, the Director of the Center of the Hierarchical Manufacturing and Jonathan Rothstein, (Mechanical Engineering). Longtime STEM ED staff members Holly Hargraves and Rob Snyder provided additional assistance in preparing activities and labs to assist teachers in learning how to integrate their understanding of nanotechnology concepts into their classrooms. This year, Amherst Middle School science teacher, Jennifer Welborn, joined the staff to replace retired STEM Ed staff member, Terry Dun.



Participants were given a tour of the Center for Hierarchical Manufacturing in Hasbrouck, which was followed by a “virtual tour” of the Clean Room Lab located in the Sylvio Conte Building. Teachers are expected to write and teach two lessons on nanotechnology in the fall and report on how they worked in December.

As has been done in previous institutes, all materials, presentations, and activities are online at: <http://umassk12.net/nano/materials/web2010/>.

Please visit the STEM Ed website for more information, including pictures, PowerPowerpoint lectures, and the Institute agenda. This course will be offered again in 2011 and information will be available by February. ■



This year's guest speaker was UMass Professor of Physics, Jenny Ross, who gave a well-received and lively presentation on the biological applications of nanotechnology.

Topics covered during this institute included the Powers of Ten, Diffusion, Atomic Force Microscope, Self Assembly, Magnetic Memory, Nano Particles, Nano Filtering, Nano Impact, Careers, and Applications, Lithography, Electrodeposition, and Nanomedicine.

A PARTICIPANT'S COMMENT:
“The Nanotechnology Institute was excellent! The material you offered will definitely help organize and write an “Intro to Nano” course at my school. Thank you for offering the class!”

2010 Nanotechnology Institute Participants - page 10

See “Nanotechnology Education” on page 10 for more on this topic.

STEM RAYS *After Four Years*

BY MARIE SILVER

As STEM RAYS finished its fourth year, we asked our students (grades 4-8) to tell us one thing they learned in the past year and the responses were enlightening, "... by working as a group to accomplish a goal you can do almost anything". This statement and many others like it were the responses we received. Surveyed during our annual student science conference after a year of doing authentic research after school, the students showed remarkable gains. STEM RAYS began with funding from the National Science Foundation and later was expanded through funding from the Massachusetts Department of Higher Education STEM Pipeline Program.

In its fifth year a smaller version of the project will be funded through an NSF no-cost extension. The program teams faculty at UMass, Smith College and GCC with teachers in the Pioneer Valley to provide authentic science research opportunities to students in an afterschool setting.

While we have both evaluated and conducted education research on the project for all four years, the simple question put to the students during their June science conference gave us new insight into the impact we have had on their everyday lives, view of the world, and future goals. Beyond the majority of responses similar to the one above, another student had this to say, "if you work hard you can accomplish anything. When I first started I had no idea what engineering was, now I want to get my masters degree in engineering". Others responded more specifically, "(I learned) how to set up experiments, the club really made me want to do more experiments at my own house".



STEM ED PI's and staff have presented the results of the evaluation effort for STEM RAYS at a variety of conferences over the past few years, including NARST (National Association for Research in Science Teaching), MEES (Massachusetts Environmental Education Society), NEEEA (New England Environmental Education Alliance), and a special conference sponsored by NSF on Research Academies for Young Scientists. More recently, our program was asked to submit a white paper for the NSF sponsored, ITEST convening for Out of School Time Science. In preparation for this presentation we analyzed the data we collect each year on the content learned by students who participate in our program. Pre and Post-tests were administered to students with the following results:

	Nature of Science			Content		
	Pre	Post	%Change	Pre	Post	%Change
Bird studies	75.0%	85.0%	10.0%	53.4%	64.9%	11.4%
Engineering	53.0%	56.0%	3.0%	44.5%	54.3%	9.8%
Sustainability	58.0%	65.0%	7.0%	79.3%	88.1%	8.8%

These test scores show significant gains in content knowledge over the year, most especially in the Bird and Engineering groups. The Nature of Science portion of the test asked students to reflect on what science research is and how it is implemented. Students also gained expertise in this over the course of the year.

We also regularly survey and interview our participating teachers to learn how the program has influenced their view of science and their teaching practice.

STEM IPY

POLAR CONNECTIONS INSTITUTE 2010

BY HOLLY HARGRAVES

This summer, for the third and final year, STEM Ed hosted a one-week institute for teachers to study the Polar Regions and climate change in association with the International Polar Year (IPY). Supported by the National Science Foundation and the Climate System Research Center (CSRC) at UMass Amherst, IPY STEM Polar Connections was an initiative to integrate activities associated with the International Polar Year into the middle and high school curriculum. This curriculum development and professional development program was held at UMass Amherst from July 12th to July 16th.

Thirty-three educators from 13 different states were participants, coming from the states of Arizona, California, Florida, Illinois, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Texas, and Washington State. Thirteen participants were from Massachusetts. Participants living outside the commuting distance stayed in the North Residential Housing area on campus. A \$350 stipend was offered to participants along with opportunity for reduced credit costs or free professional development points. This year the Institute was at the newly constructed Integrated Sciences Building, directly across the street from Hasbrouck Labs.

Led by STEM Ed Director Morton Sternheim, and Professor Julie Brigham-Grette, an internationally known geologist, the institute's staff also included climatologist Dr. Ray Bradley, retired high school teachers Rob Snyder and Holly Hargravess, Project Manager and science educator, Marie Silver; and doctoral student Beth Caissie. A combination of lecture, discussion, and a variety of hands-on activities during the week was packed with opportunities for learning and curriculum development (see accompanying article by Prof. Julie Brigham-Grette).



Teachers provided overwhelmingly positive feedback about this institute and expressed appreciation to the staff for the well organized and interesting material, including an impressive amount of material put online on the Institute's website, <http://umassk12.net/ipy> ■



IPY 2010 PARTICIPANTS listing on pg. 11

PARTICIPANTS' COMMENTS

"I feel we have been armed with materials to take to middle school and high school classes, but also to the college level and even to train other science teachers in our individual regions."

"It is invigorating and heart-warming to be with teachers who are so obviously caring, intelligent, and creative. It's great to be a part of this class"

"The lectures were great and the willingness of the presenters to field questions, comments, and discussion as we went on was very helpful."

POLAR CONNECTIONS INSTITUTE

The Legacy Beyond Our Doors

BY JULIE BRIGHAM-GRETTE, GEOSCIENCES

Summer 2010 marked the third and final year of our STEM Polar Connections Institute funded by the National Science Foundation. All endings mark new beginnings, however, as our efforts seed creative approaches in classrooms across the country.

For one jam-packed week each summer since 2008, we have hosted a science-teacher education program for 30 teachers under the auspices of the International Polar Year 2007-2009. The primary objective of the program was to provide expertise and develop teaching practices and curriculum to better integrate knowledge of the Polar regions with scientific principles being taught at the middle school and high school level. While this year's program attracted teachers from 6 states, over three years the program hosted 90 teachers from all corners of the country. A few of these teachers came as new-found "polar junkies" having been involved in high latitude field experiences offered either through the NSF Polar TREC Program or other programs offered by federal agencies. Their enthusiasm and field stories helped to spread polar fever to most participants by week's end.

Lectures, videos, and curriculum shared during the STEM institutes grew over the life of the program, building on the success of what worked in year one and the recommendations and enthusiasm of our participants. Topics ranged from modern climatology and Earth system feedbacks to the history of polar exploration and contemporary environmental challenges. Because of our paleoclimate expertise, we also targeted what could be learned about the carbon cycle and from Greenland and Antarctic ice core records.

With large population centers perched on our coasts, we also discussed the issues of local and global sea level rise as increasing global temperatures provoke thermal expansion of surface ocean and escalating levels of ice sheet melt. Who could forget the brightly colored paint trays we used to simulate rapid shoreline transgression with only a small rise in sea level. Equally amusing were brine rejection experiments designed to understand processes related to the development of sea ice, that later led to some hilarious fun perfecting plastic tub simulations of oceanic thermohaline circulation.

With large population centers perched on our coasts, we also discussed the issues of local and global sea level rise as increasing global temperatures provoke thermal expansion of surface ocean and escalating levels of ice sheet melt.

Over the three years of the program external speakers enhanced the content and variety of our courses. John Pickle (Concord Academy and formerly of Museum of Science in Boston) developed exercises for analyzing remote sensing data and images with computer applications during summer 2008. In 2009 we added more Antarctic content with guest Robin Bell (Lamont-Doherty, Columbia) who shared her research and discovery of the Gaburtsev Mountains underlying the East Antarctic Ice Sheet. In both 2009 and 2010 Craig Nicolson (UMass-Amherst) introduced us to the science of tracking the migration patterns of whales and caribou in northern Alaska. And Lisa Wexler (UMass-Amherst) presented us with memorable self-made videos documenting the lives of Inuit teenagers from Northwest Alaska, providing new subject matter concerning contemporary Arctic communities. This year the teachers also heard from Fred Calabretta (Mystic Seaport Museum) about the life and career of George Comer (1858-1937), a whaling captain/photographer who was famous for his superb knowledge of Hudson Bay and the Inuit inhabitants of the surrounding coastlines.

The STEM Polar Institute program was my first immersion into communicating polar science at the K-12 grade level and it's been one of the more gratifying educational experiences of my career. What could be more fun than sharing science and research while developing new ways to communicate traditional ideas? Yet knowledge in this program easily flowed in all directions and I am certain that I learned much more from these dedicated teachers and my colleagues than they learned from me! Their inquisitive questions and perspectives helped me to question my own approaches and taught me to think more linearly about how to develop content and learning outcomes.

I was also proud of the team effort of my colleagues in this adventure as we persisted in seeking the best combination of content and schedule while optimizing the individual talents of the group. Equally exciting and gratifying for all of us was hearing about the varied dissemination projects that continue long after the summer institute is over.

Would I do it again? Yes, in a heartbeat. ■

ARE YOU CLIMATE LITERATE?

BY JAY LOUIBRIS, 6TH GRADE TEACHER, NORTHFIELD ELEMENTARY

Are you interested in going to San Diego during February school vacation to attend a conference on climate literacy?

I thought about my answer for all of 15 seconds and agreed! As a public elementary school teacher in rural Franklin County, opportunities like this happen as often as the school budget being overfunded.

The American Association for the Advancement of Science Annual meeting was being held in San Diego, California and they were sponsoring a two-day conference entitled, "Promoting Climate Literacy through Informal Science" before the meeting, February 17-18, 2010.

The goals of this conference were to bring together educators working in informal science environments to focus on climate literacy and to provide opportunities for informal science educators to interact on the topic of climate change with scientists and science media.

Day One of the conference was hosted by the Birch Aquarium, part of the world-renowned Scripps Institution of Oceanography in La Jolla. Day Two was held at the San Diego Convention Center, site of the AAAS Annual Meeting. The convention center is located along the bustling waterfront in downtown San Diego.

As a public elementary school teacher in rural Franklin County, opportunities like this happen as often as the school budget being overfunded.

I was asked to attend by STEM Ed Director Mort Sternheim because I have directed two afterschool science clubs for the past four years at Northfield Elementary School. These science clubs are part of the NSF funded STEM RAYS program, a joint venture between UMass and Greenfield Community College faculty.

For the previous two years, the focus of my clubs had been Sustainability and Climate Change.

The first day of the conference at Scripps was a series of panel discussions on current climate change research, understanding and communicating with public audiences, and framing climate change for public audiences. The panelists were a varied group of experts from universities, government agencies, and research centers. The time flew by! Some of the information presented was what I had already known or



Susan Reyes and Jay Loubris

suspected, but much of what I learned was that climate change was a more serious problem than I had thought and that positive change must happen now since there is such a lag time between our actions/inactions and reducing global warming.

The other noteworthy panel discussion was around data presented by Leah Christian from the Pew Research Center. Surveys show that a large percentage (35% or greater in most cases) of the American people do not understand the basics about global warming, fossil fuels, and climate. Our lunchtime break allowed us to visit the Birch Aquarium and view the new exhibit: Feeling the Heat: The Climate Challenge. The exhibit was designed for elementary age students and I thought it did that well. There were interactive elements and "bells and whistles" to hold student's attention, while presenting information logically without causing alarm or panic.

The highlight of the second day for me was having lunch at a table that included Richard Somerville, a professor at Scripps and a leading authority on climate change. The lunchtime discussion centered on how to counter the disinformation being spread by various groups about climate change and also whether the chicken we were eating needed more seasoning. Dr. Somerville gave the opening remarks of the conference and I took some comfort in his guarded optimism that all is not necessarily "doom and gloom" for the earth's future, despite what current science seems to be telling us. The conference ended with breakout sessions that allowed participants to discuss ideas that were presented to improve climate literacy as well as to share what they are doing in their own work.

Was the conference worthwhile? Certainly. Was it depressing at times? Yes. I left the conference thinking that I accept the challenge of trying to instill change and hope in my students and my community. I have to. ■

THE FAR REACH OF THE CLIMATE LITERACY CONFERENCE

BY SUSAN REYES, SCIENCE EDUCATOR, NESEA

In February 2010, I joined a UMASS group representing the STEM RAYS program in attending a Climate Literacy Conference sponsored by the American Association for the Advancement of Science (AAAS.org). STEM RAYS (umassk12.net/rays/) is a theme based after school science and engineering club led by teachers and mentored by scientists and engineers in our local community. Children engage in a constructivist process that includes authentic scientific research and/or the engineering design process. Others in our group were principal investigators, Mort Sternheim and Alan Feldman, as well as fellow teacher Jay Loubris.

For two days, we listened to an intensive series of presentations from climate scientists, pollsters and others committed to understanding and fostering climate literacy. One key theme I gleaned from the conference was that there is a lot of misinformation and there are many misconceptions about climate science and climate change. Politics and personal philosophies combined with a lack of understanding of the nature of science contribute to the problem, and there also have been some powerful media forces working to sway peoples' opinion.

Shortly before the conference, I heard a commentator on mainstream television proclaim that global warming was a hoax and the unusual snowstorm in the mid-Atlantic states ("Snowmageddon") this year was the proof! Some basic understanding of climate vs. weather would help the audience evaluate this. The good news is that most Americans are eager to learn more about the topic, and at the Climate Literacy Conference, AAAS provided a great many educational leaders with a wealth of new understanding to bring to their home communities.

Politics and personal philosophies combined with a lack of understanding of the nature of science contribute to the problem, and there also have been some powerful media forces working to sway peoples' opinion.

Personally, I find the many inevitable and potential consequences of global warming to be somewhat discouraging, and often debate when it is developmentally appropriate to bring it up with kids and just how to go about it.

Fortunately, my current work as a science educator at the Northeast Sustainable Energy Association (www.nesea.org) involves development of curriculum and presentation of teacher workshops on sustainable energy topics, and this offers teachers and their kids something positive: solutions and personal actions to take that can reduce greenhouse gas emissions. After my work with the STEM IPY institute last summer, a year with STEM RAYS on Climate Change and the Climate Literacy conference, I have added a new section to several of my presentations that I offer throughout the Northeast: "Why renewables?" Here I address climate change and also some of the other costs of burning fossil fuels for energy, and this helps create a rationale for considering alternative energy sources and relative costs and benefits.

For me, one of the most exciting aspects of my travel to San Diego was discovering that I had a cousin there who is just as enthusiastic about empowering youth with scientific knowledge and a sense of environmental stewardship as I am. We have been in contact regularly since then, discussing potential activities and field trips for a two-week science camp he's planning for high-achieving Latino high school students from the US and South and Central America. The planned focus is on climate change and renewable energy, with the requirement of a relevant service project to extend the reach to each students' community at home.

For climate change information from real scientists, go to realclimate.org/ ■

TESTING THE SCHOOLS

BY MORT STERNHEIM

The Massachusetts Comprehensive Assessments System, better known as MCAS, has many supporters and critics. There is merit to much of what both groups have to say. Thanks to the tests and the related curriculum standards, there has been an improvement in student achievement levels and a better alignment of the curricula across schools and grade levels. There also has been sometimes an undue stress on what is tested – mostly math and English – to the detriment of science and social studies, especially at the elementary level. This makes little sense to me, since students can build math and language skills while exploring these subjects. And in some schools, art, music, physical education, etc., have disappeared, making school even less engaging for children who are not inclined toward academics.

A related issue is the use of test scores to assess teacher and schools in an overly simplistic fashion. They have been judged by whether appropriate numbers of their students have received passing test scores, and to what extent these numbers have improved from year to year. In some cases, individual teachers have been fired, or entire schools or districts shut down or turned over to new management.

One weakness in this use of test scores is that teachers and schools are held accountable for every child in their classrooms, no matter how long that child has been there. In some communities, only a small fraction of the children come and go; while this does somewhat weaken the interpretation of the test scores, it is not a large effect. However, in areas with high student mobility, it makes the use of the tests to assess the schools meaningless unless the turnover is taken into account. A district should not be held accountable for the achievement levels of newly arriving students who have not spent substantial time in that district.

Two recent publications put this issue into perspective. An article in the Springfield Republican (*Homeless student population growing*, March 20, 2010) reported that a very large number of area students are homeless, living in motels or other temporary housing. The student who lives in a one room motel unit which serves as the family's kitchen, living room, and bedrooms faces huge challenges. The article notes, *in terms of academics, homeless students are twice as likely as those from stable housing to quit school, and they are less likely to score well on standardize tests, studies show.... To help students adjust, area school systems are offering a growing array of support ser-vices, from nutrition, health and trauma counseling to after-school MCAS tutoring.* Homeless students come and go, and account at times for up to 10% of the Holyoke enrollment, and almost as large a fraction in Springfield.

The second publication is a detailed Mobility Report produced by the Holyoke School District and posted on its web site (http://www.hps.holyoke.ma.us/pdf/mobility%20report/mobility_report.pdf). It compares the achievements of mobile students – those who had been in the district less than five years – with stable students who had attended Holyoke schools for at least five years. Mobile students are about 40% of the total, not counting those who have changed schools within the district.

The differences in MCAS scores are striking; the difference in the proportion scoring at the proficient level is as high as 40%. The stable cohort outperformed the mobile group in every grade and subcategory, including Special Education, Limited English Proficiency, and Hispanic students, and generally did quite well. The report concludes with this observation:

The findings of this study reveal that there is a significant discrepancy in performance when you compare students who are stable with those who are transient. The discrepancy transcends already established subgroup performances that have been

Is it ... equitable and fair to label a school district underperforming whose stable population is performing on par with the state? If one can argue that it isn't, then we need to find better ways to hold communities accountable when they are challenged with significant mobility issues.

historically lower than the norm. When you disaggregate the mobility data and the stable data is left to stand alone, we found that by tenth grade most students performed at or above the State Composite Performance Index (CPI) in both ELA and math. Is it truly equitable and fair to label a school district underperforming whose stable population is performing on par with the state? If one can argue that it isn't, then we need to find better ways to hold communities accountable when they are challenged with significant mobility issues. ■

NOYCE SCHOLARS: WHERE ARE THEY NOW?

BY MARIE SILVER

For a five-year period (2004-2009) the STEM Ed Institute provided scholarships to UMass students interested in becoming STEM teachers under the NSF funded Robert E. Noyce program. Under the UMass STEM Bridges for Noyce Scholars Program, students who were entering their junior year of an undergraduate math or science degree or post graduate students obtaining a masters degree in science or math education could apply for up to \$20,000 per year towards the cost of their education. In exchange for receiving the scholarship, students agreed to teach in a “high needs” school district for 2 or more years (based on the number of years they were funded). High needs districts are defined as:

- 1) having at least one school in which 50 percent or more of the enrolled students are eligible for participation in the free and reduced price lunch program,
- 2) It has at least one school in which academic classroom teachers are teaching out of their trained subject area, or
- 3) It has at least one school whose teacher attrition rate has been 15 percent or more over the last three school years.

Although the scholarship funding has ended, we are still in touch with all of our scholars.

Although the scholarship funding has ended, we are still in touch with all of our scholars. Each fall we send out a contact form asking where they are teaching and how their job is going. We get some interesting answers. While a small handful of students have yet to graduate, more than 39 have gone on to find teaching jobs here in the state and beyond.

Three of our scholars left Massachusetts to teach in New York, Connecticut and Indiana. A few headed east to the Boston area or to the west to North Adams. But by far the largest group, 31 of our scholars, stayed right here in the Pioneer Valley working in high needs schools. They teach high school science (16) and Middle School Science (6). Some teach high school or middle school math (11) and one scholar currently is teaching remedial science courses in a Massachusetts Juvenile Detention Center. The greatest number of teaching positions held by former scholars is in high schools with 21 teachers, while the remaining teach in middle schools or in sixth grade at elementary schools. Our scholars teach at Athol-Royalston High School, Easthampton High School, Springfield Central High School, Malden High School, and Great Falls Middle School to name a few. Many have stayed in the same schools after completing their scholarship requirements, finding the work challenging and rewarding.

The responses received concerning their experiences has been interesting. One scholar who has been teaching for three years now commented: “Working in a high need district truly puts modern day society and the role of being a teacher into perspective. I have found that being an educator is a continuous learning experience, whether it be academically, socially, or culturally.”

And another, new to teaching in 2009, said, “The program focused me on finding a job that can really make a difference in our extended community, namely, by working in a high need district. My skills can be applied to a subgroup that doesn’t just need teachers, but needs teachers empathetic to their circumstances that are uninfluenced by the weight of excess financial burden and its compromising effect on job selection.” ■

*One scholar who has been teaching for three years now commented:
“Working in a high need district truly puts modern day society and the role of being a teacher into perspective.
I have found that being an educator is a continuous learning experience, whether it be academically, socially, or culturally.”*

The UMass Center for Hierarchical Manufacturing (CHM) is a large NSF funded nanotechnology center. The CHM's mission is to be a leading research and education center for the development of manufacturing processes for nanomaterials. As you may know, nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. A nanometer is a billionth of an inch, or about 100,000 times smaller than the width of a human hair.

The education and training of the next generation of scientists and engineers is a vital activity in the Center. The CHM strives to provide high-quality training geared towards innovation and an enhanced base of nanomanufacturing capabilities, as well as educational materials and opportunities designed to reach K12 students, community college and four-year college undergraduates, graduate students and the public. It has a very comprehensive program tailored to the needs of these diverse audiences.

One component of this program is the production of web-based multimedia modules on specific nanotechnology related topics. They feature videos and animations and are designed to be adaptable to various student levels. Some are introductory in nature, while others are intended to teach specific laboratory skills.

Thirty middle and high school teachers attend the annual Nanotechnology Summer Institute offered in cooperation with the STEM Education Institute. Since these teachers typically have more than 100 students, a large number of students are introduced to nanotechnology. The fifth institute will be held July 11 to July 15, 2011. Many presentations and hands-on materials have been created or adapted for this program, and they are available online at www.umassk12.net/nano. Academic year half day workshops at UMass and presentations at regional and national science education conferences reach additional teachers.

... nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. A nanometer is a billionth of an inch, or about 100,000 times smaller than the width of a human hair.

The projected need for nanotechnology workers is large, and it includes technicians as well as engineers and scientists. Springfield Technology Community College prepares technicians for many high-tech fields, and is piloting materials developed for this audience in its electronics engineering program. This activity is one of several in a network of national community colleges in nanotechnology education.

At UMass there are new or revised courses for undergraduates and graduates in Physics, Chemistry, Chemical Engineering, Electrical and Chemical Engineering, and Mechanical and Industrial Engineering. Each summer several undergraduate students have the opportunity to work full time as part of a research team and also work on honors theses during the school year.. The CHM ensures that students at Mount Holyoke College and at Rio Piedras in Puerto Rico have similar opportunities to conduct research on their own campuses. An NSF funded Integrative Graduate Education and Research Traineeship Program (IGERT) grants supports nanotechnology graduate students in several departments. The IGERT program includes a seminar series on nanotechnology entrepreneurship to broaden their education. ■

2010 NANOTECHNOLOGY INSTITUTE PARTICIPANTS

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Bruce Ennis, Charlestown, RI, Physics
Anita Finn, Waban, MA, Math
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Nina Rooks Cast, Hope Valley, RI, Chemistry, Biology
Robert Sawczuk, New Haven, CT, Physics
Laura Schofield, Newburyport, MA, Geology, Astronomy
Deirdre Scott, Northampton, MA, Physics, Technology, Eng.
Maria Scudere, Belchertown, MA, Biology
Stacey Sebert, Ravena, NY, Physics, Chem., Earth Sci
Anthony Shroud, Easthampton, MA, Chemistry
Richard Slesinski, Huntington, NY, Conceptual Sci., Physics
Lynne Stopen, Orange, MA, Earth Science, Chemistry
Sharri Tyas, Mansfield, MA, Biology, Physics
Robert Weir, Southampton, MA, Chemistry
Joanne Zema, Parma Heights, OH, General Science ■

Michael Benjamin, Roger Bacon H.S., OH,
Chemistry, Global Science
Jack Czajkowski, Elms College, MA, Science
Bryna Diamond, Franklin County Tech. H.S., MA, Math
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Susan Duncan, Hopkins Academy, MA, Science, Math., Tech.
Alex Eilers, Pink Palace Family of Museums, TN, All Science
Teresa Gable, Seneca Falls M.S., NY, Life Sci., Advanced
Science
Dave Grant, Ocean Institute, NJ, Env. Science., Biology
Robert Harris, Hartford H.S., NH, Bio, Physical Science
Dave Hruskoci, Shrewsbury H.S., MA, Earth Science,
Enviro Sci, Astro
Kelda Hutson, Warren Township H.S., IL, Earth,
Enviro Science, Geo
James Johnson, Children's Cntr for Treatment and Ed., PA,
Misc Sci
Octavio Lerma, Raymond Telles Acad., TX, Physics, Biology,
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Lise LeTellier, Holyoke Catholic H.S., MA, Enviro Science.
Jay Loubris, Northfield Elementary, MA, Science
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STEM RAYS *After Four Years* continued from page 3



Responses have mirrored those of the students, the experience has been positive, teacher turnover is extremely small and they report positive gains in science research skills, understanding of the nature of science and impact on their classroom teaching.

This year the STEM RAYS program will include a smaller cohort of teachers and students. Nine veteran teachers will work with a Geosciences graduate student at UMass and former faculty at GCC, Beth Caissie and GCC faculty and co-PI Brian Adams researching Climate Change and Sustainability.

STEM RAYS Teachers on page 13

SCIENCE & ENGINEERING SATURDAY SEMINARS

- SEMINARS ARE DESIGNED FOR SCIENCE TEACHERS; NEW TEACHERS ARE ESPECIALLY WELCOME
- FIVE SATURDAY EACH TERM FROM 8:30 A.M. - 1:00 P.M. AT UMASS AMHERST, LEDERLE GRAD TOWERS 1033.
 - EDUCATIONAL MATERIALS, REFRESHMENTS, PARKING, PDP'S INCLUDED
 - ADVANCE REGISTRATION IS REQUIRED; CAPACITY IS LIMITED
 - COST \$30 PER SESSION, \$120 FOR ALL FIVE SESSIONS
 - 4 PDP'S PER HALF DAY SESSION; OPTION FOR 3 GRAD CREDITS (\$345)

AT REDUCED COST WITH EXTRA WORK

Sept. 11 **INVASIVE PLANT SPECIES: COMING TO AN ECO-SYSTEM NEAR YOU!**

Robin Harrington, Turners Falls HS.

Sept. 25 **ACTIVE AND PASSIVE SOLAR ENERGY FUNDAMENTALS**

Peter Talmage, Greenfield Community College

Oct. 2 **NANOTECHNOLOGY**

Mark Tuominen, Physics

OCT. 16 **TRAFFIC ENGINEERING AND THE EVERYDAY WORLD**

Mike Knodler, Civil and Environmental Engineering.

OCT. 30 **BACKYARD BIOFUELS: UNDERSTANDING THE GENOMIC POTENTIAL OF THE Q MICROBE**

Integrated Sciences Building

Jeff Blanchard and Amy Biddle, Microbiology

NOV. 13 **WEATHER CANCELLATION MAKEUP DATE IF NEEDED.**

Dec. 4 **RECALL FOR THOSE REGISTERED FOR GRADUATE CREDIT.**

HASBROUCK LAB

UPCOMING (TENTATIVE)

JAN. 22 **WORKING WITH THE ENGINEERING DESIGN PROCESS:**

Thomas Gralinski, Smith College.

FEB. 5 **LEGO® MINDSTORMS® MEETS SCIENCE CLASS.**

Paula Brault, Math, Pioneer Valley RHS

FEB. 12 **COLLOIDS, EMULSIONS AND FOAMS**

Anthony Dinsmore, Physics

MARCH 5 **MAPPING NEST SUCCESS IN MIGRATORY BIRDS**

Dan Bisaccio, Brown University

MARCH 26 **STEM DIGITAL IMAGES IN THE SCIENCE CLASSROOM**

STEM Digital Staff

ONLINE SEMINAR REGISTRATION AND PAYMENT:

www.umassk12.net/sess/register.html. Required for everyone whether or not they are registering for graduate credit. ■

TUESDAY SEMINARS

STEM SEMINARS ARE HELD AT 4PM ON THE FIRST
AND THIRD TUESDAYS OF EACH MONTH

DURING THE ACADEMIC YEAR IN HASBROUCK 138.

EVERYONE IS WELCOME; NO RESERVATIONS ARE NEEDED, AND THERE IS NO CHARGE.

PARKING IS AVAILABLE IN THE CAMPUS CENTER GARAGE.

SEPT. 21 **SPACE, TIME, AND COMPLEXITY: THINKING AND LEARNING ABOUT THE EARTH AND CLIMATE**

Neil Stillings Hampshire College Dean, School of
Cognitive Sciences

OCT. 5 **REASONING ABOUT CAUSAL COMPLEXITY: CLIMATE CHANGE AND OTHER COMPLEX PROBLEMS**

Tina Grotzer Harvard Graduate School of Education

OCT. 19 **ARE WE BEGINNING TO SEE THE LIGHT? A LOOK AT THE PUBLIC'S PERSPECTIVE ON ENERGY, THE ENVIRONMENT, SCIENTISTS AND SCIENCE EDUCATION**

Jean Johnson Executive Vice President, Public
Agenda

NOV. 2 **THE UNDERMINING OF AUTHENTIC SCIENCE EDUCATION THROUGH EXCESSIVE RELIANCE ON STANDARDIZED TESTS**

Jonathan King Molecular Biology, Massachusetts
Institute of Technology

NOVEMBER 16 **COMMUNICATING CLIMATE CHANGE ON TELEVISION**

Evan Hadingham Senior Science editor NOVA/WGBH

DECEMBER 7 **WHERE DO WE STAND ON GLOBAL WARMING?**

Raymond S. Bradley Climate System Research Center
Department of Geosciences, University of Massachusetts,
Amherst

MARCH 15 **NEW STATEWIDE STEM PLAN**

David Cedrone, Mass Dept of Higher Education

APRIL 5 **NUTRITION ONLINE PROGRAM**

Patsy Beffa-Negrini, UMass Department of Public Health

APRIL 19 **RESEARCH RESULTS ON THE IMPACT OF AFTERSCHOOL ON IN-CLASS LEARNING**

Karyl Resnick, Afterschool Programs, Massachusetts
Department of Education ■

2009-2010 STEM RAYS TEACHERS

continued from article on page 11

Ken MacDonald, Northampton JFK Middle School
Jay Loubris, Northfield Elementary
Susan Reyes, Shutesbury Elementary
Chris Wings, Swift River School
Anne Bussler, Conway Grammar and Whately
Elementary
Susan Fisher, Pioneer Valley Regional Middle School
Wayne Kermenski, Mohawk Trail Regional Middle
School
Jennifer Welborn, Amherst Regional Middle School
Steve Chapman, Erving Elementary
Dwight Beebe, Rowe Elementary
Helen Kittredge, Sunderland Elementary
Becky Gutierrez, Greenfield Middle School
Jacqui Goodman, Buckland Shelburne Elementary
Jamey Bidwell, Amherst Regional Middle School
Kim Hughes, Colrain Center School ■

2011 SUMMER INSTITUTES FOR STEM TEACHERS

- At UMass Amherst
- Funded by the National Science Foundation
- Middle and High School Science, Math, and Technology Teachers
- Stipends, materials, parking, some meals
- Housing (new air conditioned dorms) for those outside the commuting radius
- 3 graduate credits available at reduced cost; free PDP's
- Applications due April 1; late applications accepted if space is available

JUNE 27-JULY 1 STEM Digital

See page 1 for information and www.umassk12.net/digital for applications

JULY 11-15: NANOTECHNOLOGY:

See page 2 for information and www.umassk12.net/nano for applications ■

SEEING THE DIGITAL LIGHT

continued from front page

During each of the following school years, the staff will continue working online with the teachers on approximately six more projects spread over the fall and spring semesters. The 2013 institute will be entirely online, with a 6 week summer course which will become part of an online M.Ed. program.

Curriculum materials will reflect Pellegrino's "Construct-Centered Design" (CCD) model in which assessment is an integral part of their design and use. An essential component will be the feedback from five teachers and their students who will serve as "alpha testers" before the first institute as well as input from participating teachers. Connections with curriculum standards and careers will be highlighted.

As usual in STEM Ed programs, teacher incentives will include stipends, food and housing as needed, and funds for materials. They will receive free "Professional Development Points" needed for continuing licensure, or optional reduced-cost graduate credits. The project will encourage applications from teams with STEM teachers and computer teachers or coordinators in order to strengthen the impact of the program in the school.

STEM DIGITAL will enable teachers and their students to use digital images and image analysis software for qualitative and quantitative analysis, engaging students, improving their in-depth understanding of fundamental science and technology, and ultimately increasing their interest in STEM and information technology careers. It will add to our knowledge of important environmental processes related to the movement of arsenic compounds in the environment and the dissolution of natural organic matter. It will also allow us to compare the efficacy of the in-person and online professional development programs.

The first summer institute will be held June 27-July 1, 2011.

See www.umassk12.net/digital for details. ■

STEM Ed

Newsletter of the
STEM Ed Institute



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