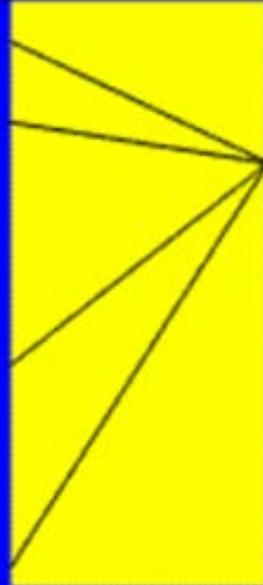




UNIVERSITY of NEW HAMPSHIRE

Space Science



**S**cience &  
**M**athematics  
**A**chievement  
through  
**R**esearch  
**T**raining

Nanotechnology  
Biotechnology

Marine & Environmental Science

**PROJECT SMART**

*From 1992-2011 - A Timeline*

UNIVERSITY OF NEW HAMPSHIRE

VICE PRESIDENT FOR ACADEMIC AFFAIRS  
DURHAM, NEW HAMPSHIRE 03824-3547  
(603) 862-3290

June 13, 1991

TO: Participants in Project SMART Discussions and Drafts  
FROM: *Walter Eggers*  
Walter Eggers, Vice President for Academic Affairs

I am happy to report that the Governor is enthusiastic about our proposal and plans to provide \$250,000 in State funding for five years. When we get final confirmation, I will call the group together again so that we can begin to refine and implement the plan. President Nitzschke asked me to convey his gratitude for a job well done.

In a related development, we will send members of the group to a planning conference at NSF to get information about major state-wide funding for science and mathematics education. We will have a report on this subject when we meet again.

We have shown the Governor how effectively this institution can respond to the needs of the State, and in the process, we have elicited a new kind of direct support from his office. The students and teachers we serve will be the chief beneficiaries of Project SMART, but your good work also enhances the University in the public view. Bravo!

\1

cc: President Nitzschke

**Let's  
Begin**

# Project SMART evolves

- 1992-2002 Four modules – Biotechnology, Environmental Science, Marine and Aquatic Science, Space Science
- 2003 – Marine and Environmental Science emerges from the Environmental Science & Marine and Aquatic Science
- 2004 – Four UNH credits for INCO430 added with tuition waiver from the university
- 2006 – Nanotechnology added to Biotechnology

## **Geographic distribution of students –**

- 1992 – 85 schools from 70+ towns in NH
- 1995 – Opened to New England
- 2006 – Weekend program offered and the program opened to national participants
- 2008 – Limited to students from inner-city New York area and some local
- 2009 – Opened to international students – students have come from Pakistan, Korea, Greece, Turkey, and India – Also, the first group of students from Alaska joined the program



*One hundred of New Hampshire's top high school students recently arrived at UNH to participate in a new summer institute, Project SMART (Science and Mathematics Achievement through Research Training). A collaborative effort of many departments, the institute is being lead by professors Subhash Minocha, plant biology; Barry Rock, complex systems; Alan Baker, botany; Roy Torbert, space science; David Meeker, mathematics; and Joan Ferrini-Mundy, mathematics.*

*In the photo above, Minocha, left, Project SMART director, talks with student Kristen Stephens and her parents, Mary Helen and Bob Stephens, at opening ceremonies July 6.*

*(Photo by Sharon Keeler)*

**In Brief**

**High school pupils study math, science at UNH**

Students live in residence hall are receiving a stipend to cover summer institute's full cost. Project SMART runs through 31.

DURHAM — Several area high school students are studying advanced math and science at the University of New Hampshire this summer in a new program called Project Science and Mathematics Achievement through Research Training (SMART).

Students are each studying in one of four areas including biotechnology, freshwater and marine science, environmental science and space science.

They were selected based on their grades in science and math, recommendations from teachers and a brief essay describing their interest in the program.

Elizabeth Dell of Durham and Tamara Oliver of Exeter are studying biotechnology.

Joonu-Noel Andrews of Dover, Christopher Hilton of Durham, Kyle Krouse of Madbury, Justin Quimby of Dover, Patrick Russell of Durham, and Amy Swift of Dover, are studying space science.

These students are among 100 high schoolers from throughout the state selected to participate in the program.

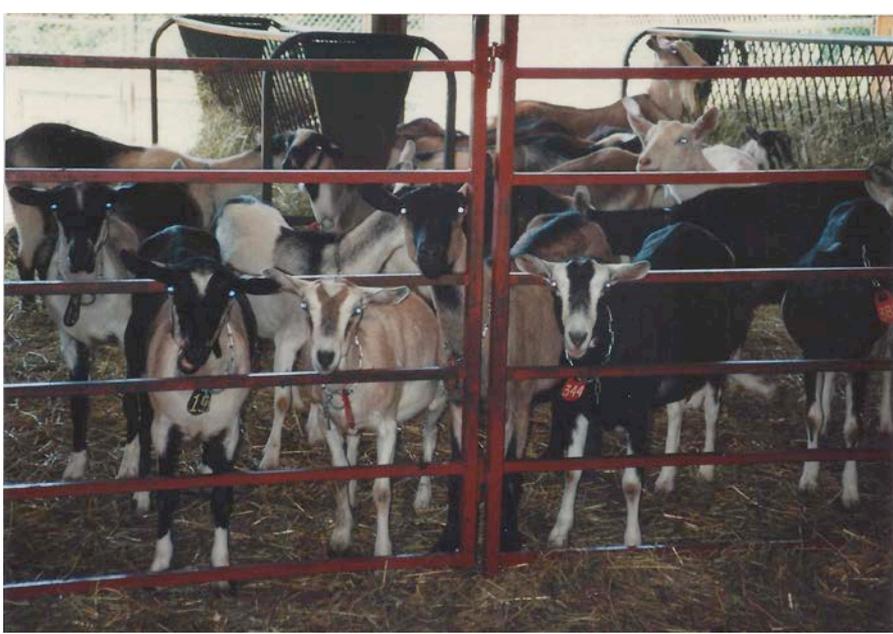
The students taking part in Project SMART are studying advanced topics in science, math and computers through lectures, demonstrations, field trips and hands-on lab work.

They are learning about research from UNH faculty and graduate students.

**The opening year was great – the opening ceremonies were attended by the Vice President for Academic Affairs Walter Eggers, several administrators, some trustees, parents of the students, several invited high school teachers, and UNH faculty. It was almost a full house at the Johnson Theater, with 100 young enthusiastic students and over 300 guests.**

# Highlights

- We started with over 400 applications from over a 100 NH schools, selected 100 students to participate in four modules – Biotechnology, Freshwater and Marine Science, Environmental Science and Space Science. The participants represented over 75 schools from 65 towns
- They studied science, mathematics, were introduced to the best computers in the state (a novelty then), talked about social, ethical, legal, environmental, economic and political implications of the recent advances in science
- They studied in the class room, in the fields, up in the mountains and on water
- They interacted with each others, made friends with each others and with the faculty at UNH
- They went home with memories that would last a life time



While the Biotechnology group visited the Tufts University School of Veterinary Medicine , N. Grafton, MA to meet the ‘million dollar goats’, genetically engineered to produce the human anti blood clotting protein (Plasminogen Activator),.....



And the Environmental Science students were in the field studying the forests and the climate.....



*Project SMART students studying freshwater and marine biology recently traveled to Barbadoes Pond in Dover to conduct research on crayfish populations. Keith Pearson of Chester, photo at left, holds up a crayfish taken from the traps. In the photo at right, Jim Haney, professor of zoology, talks with students about the methods used to tag the tiny creatures. Project SMART continues through this month, and is designed to encourage science studies among today's high school students. They, in turn, can well become the science researchers of tomorrow. (Photos by Sharon Keeler)*

The Marine and Aquatic Science students were in the ponds and lakes catching crayfish and studying the plankton.....

**So, where were the future Space scientists?**



## They were talking to a real space traveler!

*Rick Searfoss, center, a NASA astronaut, recently came to UNH to speak to students involved in the Project SMART Summer Institute. With Searfoss are, left, Barrett Rock, associate professor of natural resources and coordinator of the Project SMART environmental science sessions, and Subhash Minocha, professor of plant biology who heads the Project SMART biotechnology program. (Sharon Keeler photo)*

*Campus Journal July 23, 1992*

They came back from the space to teach participants in Project SMART-

**Rick Searfoss is a UNH graduate - confirm this**

Rick Searfoss has led many different teams to the space. He commanded the most complex science research space mission ever, the STS-90 Neurolab flight on Columbia, with unparalleled mission success. He also piloted two other space flights, including a joint Russian-American mission to the Mir space station.

<http://www.eaglestalent.com/Rick-Searfoss?source=Bing>

1993

## Classroom of the '90s

# Going Beyond Book Science

## High School Students Try Hands-On Problem-Solving at UNH

URHAM — From phyton and satellites, to acid and genetically engineered s, high school students atting a summer institute at the versity of New Hampshire are hing there's more to science what they read in their textks.

ty of New Hampshire's top school students have given three weeks of their summer tion to go back to school. The ents, who have interests in n and science, are participat in UNH's Project SMART ence and Mathematics levement through Research ing), a program which aims ducate and challenge them nd their high school curricu-, while acquainting them n the environment and rces of the university as a e for higher education and rech.

roject SMART is a course ut scientific thinking and oblem-solving, says director hash Minocha, UNH profes- of plant biology. "Students at ven grade level often learn 80 ent of their science knowle- e from a single textbook," he s. "The process of science hing involves recitation, test- and discussion of tests, all ed upon the textbook materi- Project SMART takes students y from that mode of instruc-."

he institute is an intensive, ds-on experience where stu- ts not only learn what the



UNH News Bureau

UNH GRADUATE student Becky Gamble, left, of Newmarket, and high school student Emily Hodgson of Manchester squeeze eggs from a female lamprey into a dish during a laboratory experiment at UNH's Project SMART summer institute. Hodgson and several other high school students are learning about the lamprey, a primitive eel-like fish whose lineage extends bck 500 million years, as part of a class on biotechnology.

current trends in various sciences are, but also gain historical and philosophical perspectives for understanding social and ethical issues raised by recent scientific development.

In Minocha's biotechnology program, for example, participants gain experience in the techniques of cell culture, cloning, DNA isolation and gene ma-

nipulation. Recent controversies such as those concerning genetic engineering, surrogate motherhood and biological warfare are also covered.

Other activities of the institute include ecology studies at the Isles of Shoals, environmental assessment activities on Mount Washington, reproductive re-

search on lamprey fish, and field trips to Tufts University School of Veterinary Medicine and New England Biolabs.

Project SMART is a collaborative effort which brings together the expertise of several UNH departments and faculty members, and the experience of many graduate students. Participants choose between three areas of study: biotechnology, headed by Minocha; environmental science, headed by Barrett Rock, associate professor of natural resources; and marine and freshwater biology, headed by Alan Baker, associate professor of plant biology.

According to Minocha, it is hoped that, given the opportunity to explore careers in science and mathematics, many of these students will continue their education in these disciplines at the pre-college and college levels.

Most importantly, however, Minocha hopes the institute will help students to become scientifically literate citizens.

"When rockets and astronauts are sent to explore space, when the ozone layer is destroyed, when the water systems are polluted or new drugs and technologies are developed to diagnose and treat new and old diseases, it is not scientists alone who are involved; it is the public at large that must support such adventures," he says. "To participate in decision-making, we must understand the concepts and techniques of science."

In 1993, Rebecca, Ben and Kimberly, and Sheri, Keri and Zachary, along with Eric, Sofia and Josephine came with 50 others to have another successful year of Project SMART at UNH. Some still captured the plankton, others discovered that large animals (like sheep) could be cloned. The Space Science program was not offered this year.

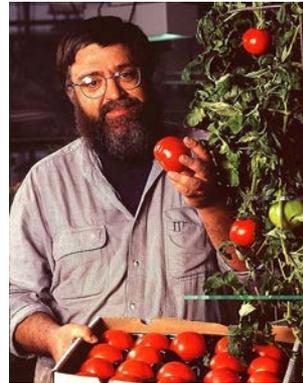


The program continued in 1994 again with about 60 students, all from New Hampshire

1995 – Project SMART Opens its  
doors to New England



Students from around the New England region learning biotechnology. Plant Biotechnology with the Flavr Savr tomato (one that will not rot for several weeks) being introduced into the market created the big news and an interesting topic of discussion.



# 1996-1998

The program funding became reduced and the program started charging a fee for boarding and lodging, but continued with students coming from as far away as Maryland; mostly still came from the New England region.



**Project SMART Summer Institute**  
**June 28 - July 22, 1999**

2000



Project SMART swings into the Y2K with strong support of the administration (but with reduced funding), and looking forward to increase diversity of participants

### **PROJECT SMART**

*Subhash Minocha, professor of plant biology and director of Project SMART, takes a moment in the closing ceremonies July 28 to thank the faculty who devote their time and energy to making the program a success. Behind him are Provost David Hiley, CEPS dean Art Greenberg, and COLSA dean Andy Rosenberg. This year, more than 50 high school students participated in the month-long program, which exposes them to research methodology and professional scientists.*

*(Photo: Michelle Gregoire)*



**Project SMART Summer Institute**  
(Science and Mathematics Achievement Through Research Training)  
July 5 - 28, 2000  
University of New Hampshire

This is the year that visits to the Tufts Veterinary facility were stopped due to private ownership by Genzyme – Lonza Biologics filled the gap with visits to their facility in Portsmouth which produced human proteins in large scale cell cultures.



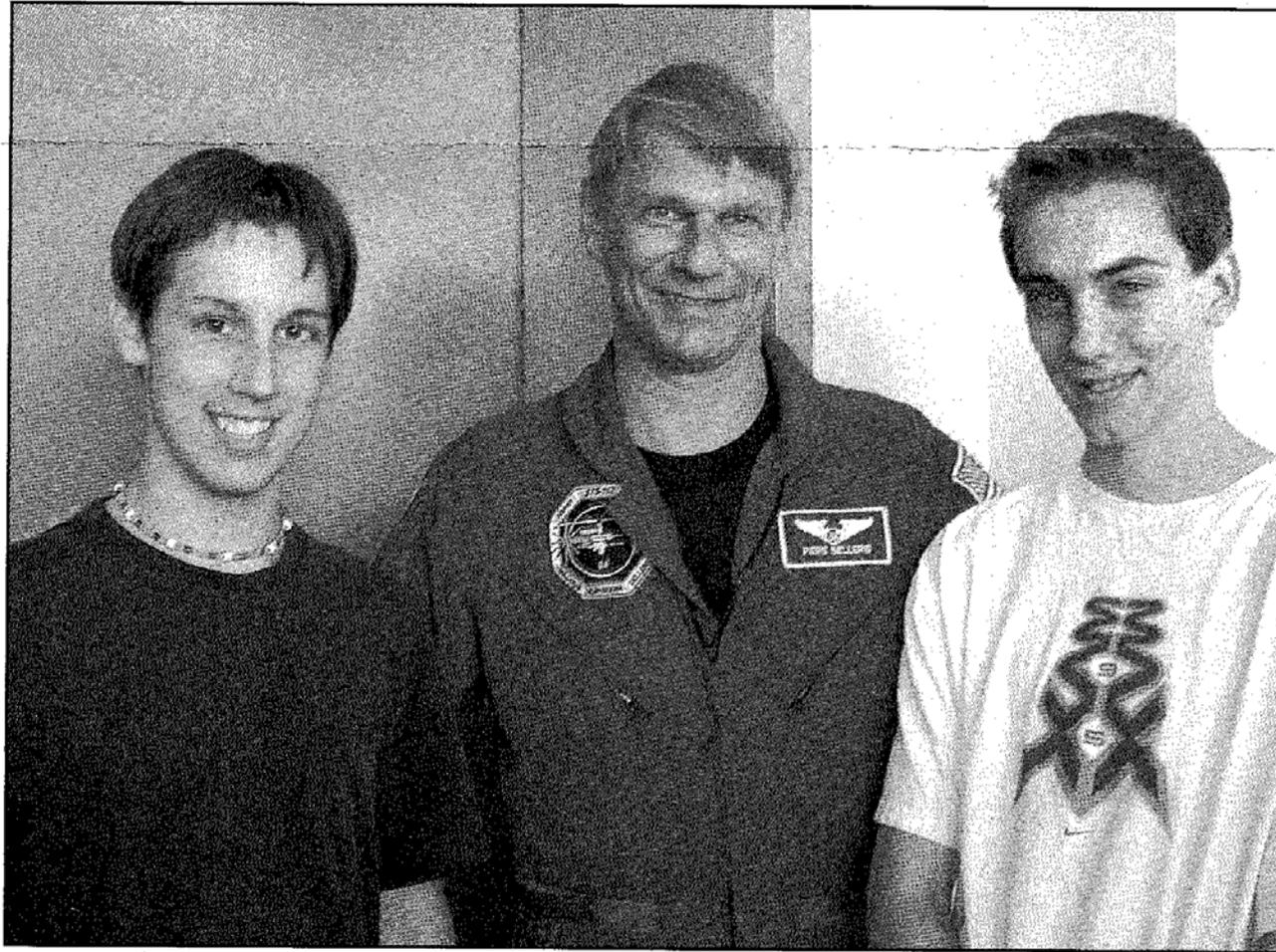
# Project SMART Summer Institute

(Science And Mathematics Achievement Through Research Training)

July 1 - 26, 2002

University of New Hampshire

## *The sky's the limit*



*Shuttle Astronaut Piers Sellers recently visited UNH's Institute for the Study of Earth, Oceans, and Space. Here he spends a few moments with two Project Smart students, Oliver Salmon (left) and Ryan Haley (right). (Kristi Donahue/ EOS)*

Project SMART-2003 Space Science students had a chance to talk to Piers Sellers, a space shuttle astronaut: [STS-112 Atlantis \(October 7 - 18, 2002\)](#); [STS-121 — Space Shuttle Discovery — \(4–17 July 2006\)](#); [STS-132 — Space Shuttle Atlantis — \(14–26 May 2010\)](#)

*Campus Journal July 11, 2003*



# Project SMART Summer Institute

(Science And Mathematics Achievement Through Research Training)

June 23 - July 18, 2003

University of New Hampshire

# 2003-2005

**The program continued with little change in style but with big revolutionary advances in biotechnology field, major discussions in climate change, and the excitement of repeat visions of space through the space shuttle and the space station**

**The New England Biolabs facility moved to Ipswich, MA; an impressive grandiose set up – our association with them continued with them through full day visits**



Kathy (E)

Stacy (E) ✓

Amy (E) ?



Jen (E) ✓

Stephanie (E) ✓

Jared (E) ✓



Katie (E) ✓

Suzanne (E) ✓



Neelani (E) ?

Vanessa (E) ✓

?



Katelyn (B) ✓

Megan (B) ✓

Ben (B) ✓



Bethany (B) ✓

Tenaya (B) ✓

Rohan (B) ✓



Danene (B) ✓

Chiara (Key-ara) (B) ✓

Shaun (B) ✓



Kerin (B) ✓

Jon (B) ✓

Norman (B) ✓

**Do you recognize any one of them? – The class of 2003**



A wonderful segway into the college life – A Project SMART 2005 student at the New England Biolabs testing out the Segway transporter. Everyone had a chance to try it out.

2008



In July 2008, UNH Project SMART partnered with Harlem Children Society students to bring a group of 28 inner-city high school students to UNH. Students doing plant cloning DNA cloning, bacterial genetic engineering and discussing implications of these techniques

[http://photo.unh.edu/Clients/harlem\\_childrens\\_society/index\\_2.html](http://photo.unh.edu/Clients/harlem_childrens_society/index_2.html)



Students from Harlem Children Society in the Biotechnology lab studying chromosomes  
They said “they couldn’t sleep here in NH dorms, because...” ..”it was too damn quiet”

Students attending the program in 2008 were connected live around the world from NH to New York to the African continent to share their experience in learning science



2009



Nanotechnology students work at levels unseen - 2009



UNIVERSITY OF NEW HAMPSHIRE

## How Can Nanomedicine Help Cancer Treatment?

Somyi Hur  
Concord Senior High School

**Introduction**

The medical application of nanotechnology began with Dr. Richard E. Smalley's interest in another potential of nanotechnology. Dr. Smalley was a chemist at Rice University, Texas, once he became interested in another potential application of nanotechnology, he referred to a new discipline known as nanomedicine. Nanomedicine is treating and preventing disease with the use of novel molecular technique. It is very useful to treat the specific organs or cells, because we can use this to enter nuclei to repair damaged genes. Nanomedicine is very helpful to operate inside the body, it will emerge in the future.

**What is nanomedicine?**

- Nanomedicine is an application of nanotechnology to the prevention and treatment of disease in the human body.
- Nanomedicine can define as monitoring, repair, construction and control of human biological systems at the molecular level, using engineered nanodevices and nanostructures.

**What changes nanomedicine made?**

- Evolving of the nanomedicine has the potential to dramatically change medical science.
- It covers areas of human body such as nanoparticle drug delivery.

**What are the possible benefits we can get from nanomedicine?**

- Nanomedicine will eliminate all medical pain and suffering of all common diseases of the 20<sup>th</sup> centural.
- Nanomedicine will allow the extension of human capabilities, especially the mental abilities.
- Nanostructured data storage device measuring about 6,000 Micron cubic area and the size of it is smaller than a typical neuron. If we implant this nanostructure to somewhere in human brain, it will allow extremely rapid access.

**Treat cancer with nanomedicine**

- 1) Surgeons inject the nanoparticles of cadmium selenide (a.k.a. quantum dots) into human body.
  - Nanoparticles of cadmium selenide glow when they exposed to ultraviolet light.
- 2) Nanoparticles of cadmium selenide glow when they exposed to ultraviolet light.
- 3) Surgeons use these nanoparticles as a guide for more accurate work on tumor removal.

**Conclusion**

The medical application of nanotechnology is giving huge benefits to us. By using nanomedicine, we can eliminate the pain and suffering of diseases and it also helps us to do better operate inside. Since nanomedicine has discovered, we have been able to...

Art gallery of nanobot, by CONEYL JAY (Picture above)

Dr. Richard E. Smalley, a chemist of Rice University (Picture left)



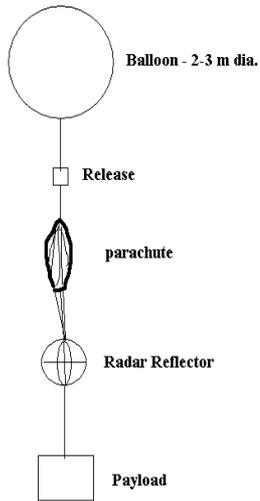
This image was captured by a video camera flown by high school students as part of the 2009 UNH Project SMART program, Space Science Module. The students were supervised by Lou Broad, a local high school teacher working in the program. They integrated the payload that included GPS and telemetry along with a radiation experiment and flew the payload under a weather balloon to 96,000 feet over the state of New Hampshire. Total flight, including the descent, was about 2 hours.



Students from Alaska and Greece join the program in 2009 adding a new dimension to diversity in the program – The exchange of ideas goes way beyond learning science

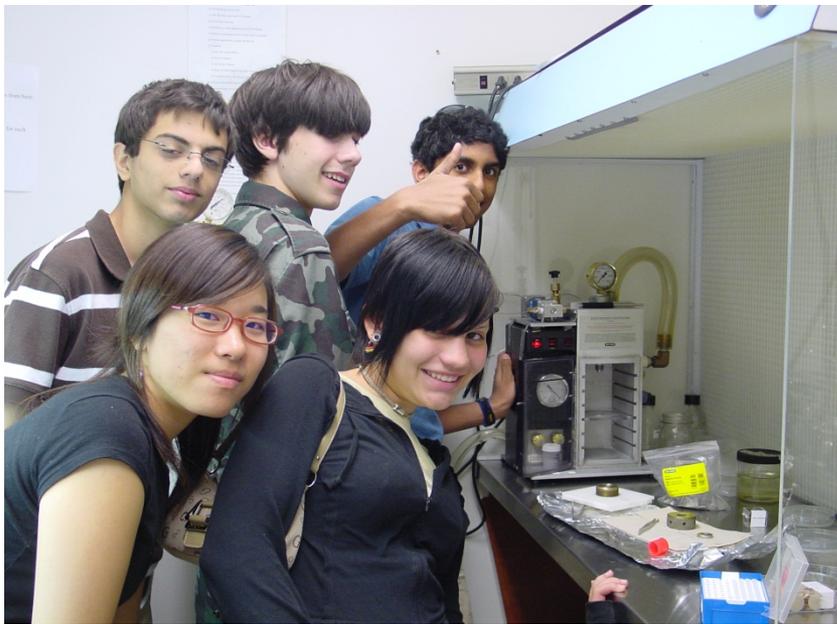
2010

<http://esp.sr.unh.edu/smart/smartpix/P1010132.MOV> Open link to see Rocket test



- **2010-launching a balloon**
- DURHAM, N.H. – A handful of high school students made history of a sort recently when the one-of-a-kind reentry vehicle they built out of pink Styrofoam and corrugated cardboard fell back to Earth without aid of a parachute following a 15-minute balloon ride up to 100,000 feet – the edge of outer space. The dish-shaped reentry vehicle – one meter in diameter and weighing under two kilograms, the Federal Aviation Administration limit – carried a payload of a miniscule Geiger counter, two temperature sensors, and two video cameras about the size of a pack of gum. During the flight the students obtained real-time measurements of changing levels of cosmic rays and atmospheric temperatures. The balloon burst (under pressure) at 100,000 feet, in the blackness of outer space. **The balloon system uses amateur (HAM) radio and GPS for tracking and control. All flight parameters meet the FAA regulations (FAR 101).**

[http://www.eos.unh.edu/newsimage/smart\\_balloon\\_lg.jpg](http://www.eos.unh.edu/newsimage/smart_balloon_lg.jpg)



While the Space science students were flying their balloon; the Marine and Environmental Science students were exploring the White Mountains looking for clues to measure the impact of climate change



UNITED STATES SENATE  
WASHINGTON, D. C. 20510

JUDD GREGG  
NEW HAMPSHIRE

July 30, 2010

Senator Judd Gregg,  
whose initiative as  
Governor of New  
Hampshire gave birth  
to Project SMART  
Summer Institute sent  
his greetings on the  
upcoming 20<sup>th</sup>  
anniversary of Project  
SMART

Prof. Subhash Minocha  
Professor of Plant Biology and Genetics  
105 Rudman Hall  
46 College Road  
Durham, NH 03824

Dear Prof. Minocha:

Please pass along my congratulations to each of the students participating in Project SMART. It is deeply satisfying to know a program started while I was Governor of New Hampshire continues to not just teach students about science and mathematics but to inspire them to excel in those fields. I want to thank the administrators and professors at UNH who have been leading this initiative during the last twenty years. Their commitment to the young people from New Hampshire and across the country is impressive and has reinforced the University's reputation as a center for academic innovation and distinction.

I am especially pleased to extend special recognition to the students. Their acceptance into Project SMART shows they already had a strong understanding of math and science. Their completion of the program's requirements demonstrates they are uniquely motivated to experience all the benefits it offers. As they move ahead with their education, I know this initiative will help open more exciting opportunities for them. Once again, congratulations and best wishes.

Sincerely,



Judd Gregg  
U.S. Senator

2011

# M&E

They were doing it then (1992) and are doing it now  
M&E students on their field trip to one of the local lakes  
collecting samples to analyze the planktons<sup>1</sup>

PICTURE MISSING WILL COME SOON

**1.Plankton** (singular **plankter**) are any drifting [organisms](#) ([animals](#), [plants](#), [archaea](#), or [bacteria](#)) that inhabit the [pelagic zone](#)\* of [oceans](#), [seas](#), or bodies of [fresh water](#).

\*Any water in a [sea](#) or [lake](#)\*\* that is not close to the bottom or near to the shore can be said to be in the **pelagic zone**. The word *pelagic* comes from the [Greek](#) πέλαγος or *pélagos*,

\*\*A **lake** is a body of relatively still fresh or salt water of considerable size, localized in a [basin](#), that is surrounded by land apart from a river, stream, or other form of moving water that serves to feed or drain the lake.

1, \*, \*\* <http://en.wikipedia.org/wiki>



# NEWS RELEASE

U.S. Forest Service, Northern Research Station

Contact: Jane Hodgins, 651-649-5281

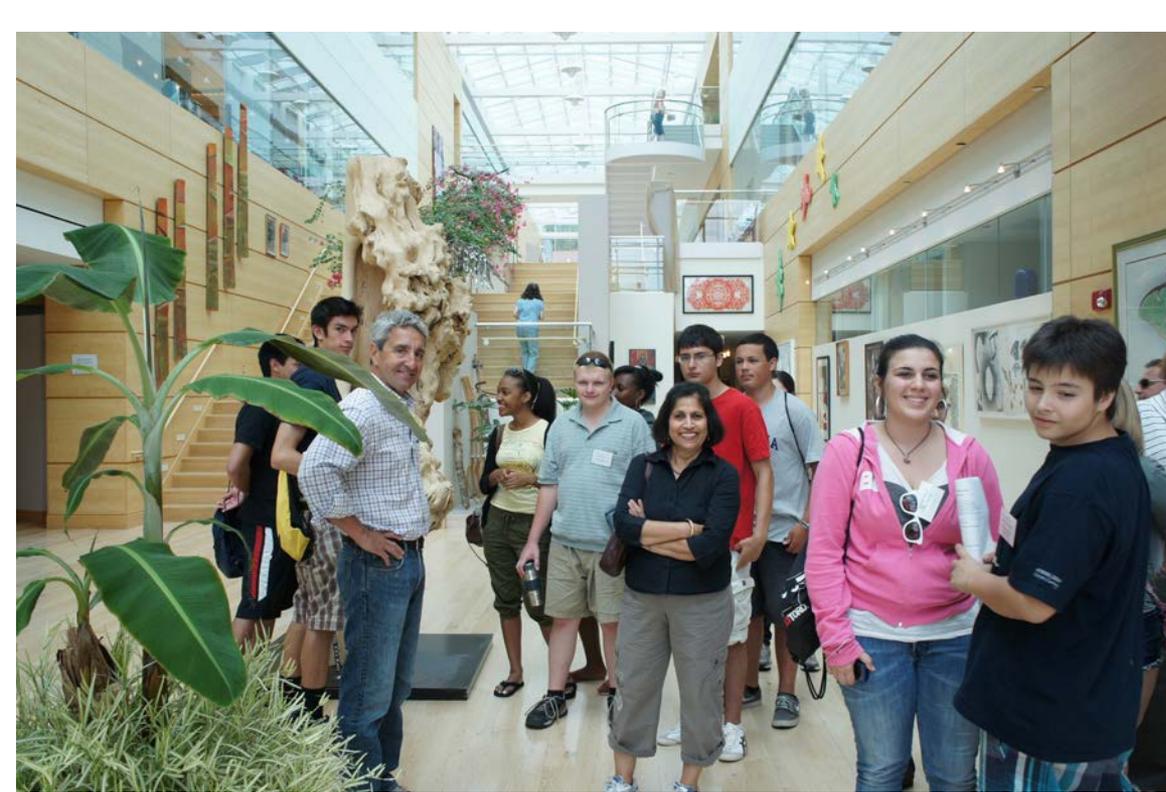
## **“Project SMART Summer Institute” Receives Funding to Introduce Rural and Urban Youth to Environmental and Forestry Sciences**

**Newtown Square, PA, April 5, 2011** – The U.S. Forest Service announced Monday that Project SMART Summer Institute - 2011 has been awarded \$30,000 in More Kids in the Woods funding to support environmental and forestry education and mentoring. The 4-week program provides young people more opportunities to experience the great outdoors, learn about nature, and build a lasting commitment to conservation and land stewardship.

“The value of expanding our programs for children must not be underestimated,” said U.S. Forest Service Chief Tom Tidwell. “Young people are tomorrow’s stewards of our public lands, and we have a duty to help them develop a lasting connection and passion for conservation of America’s great outdoors.”

While one group tries to scale the altitudes of >2 miles into space with a balloon (Space science-2010 – balloon article), and the other attempts to get into the depths of our mind and the level of atoms and molecules (the biotechnology and nanotechnology - poster on mind changing hormones and nanotubes); the third group searches for answers to problems on earth – the water and the climate (posters –pictures of M&E).





He's still there, we are still coming..21 years at NEB with Richard Grandoni who has kept in touch with Project SMART for the entire 21 years of the program

and the Lady from New York is still there too!



- **Partnerships**

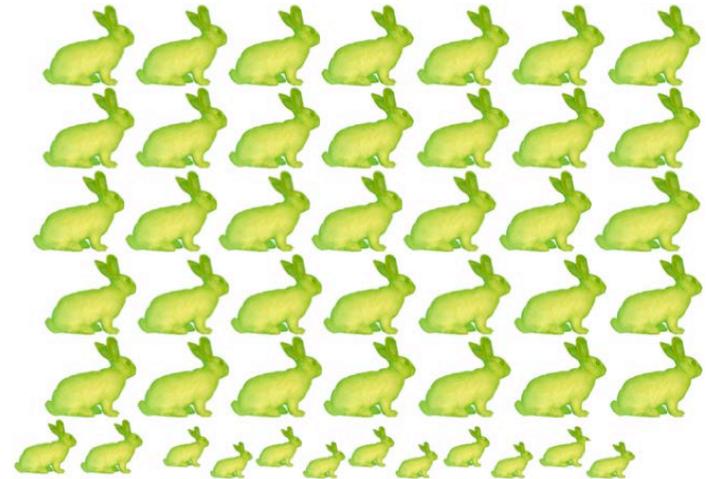
- New England Biolabs, Peabody MA and Ipswich, MA ([www.neb.com](http://www.neb.com))
- Integrated DNA Technology, Des Moines, IA (<http://www.idtdna.com/site>)
- Rural Alaska Honors Institute, University of Alaska, Fairbanks, AK  
(<http://www.uaf.edu/rahi/>)
- Summer Search Organization supports students to attend Project SMART  
([www.summersearch.org](http://www.summersearch.org))
- Harlem Children Society, New York (<http://www.harlemchildrensociety.org/>)
- NH EPSCoR (UNH) <http://www.epscor.unh.edu/>
- Liberty Mutual Foundation - <http://www.libertymutualgroup.com>



To Clone a Human: How, Why and For Whom?



FROM **In Vitro Fertilization**  
TO  
Cloning, Stem cells, Chimaeras and  
Designer babies



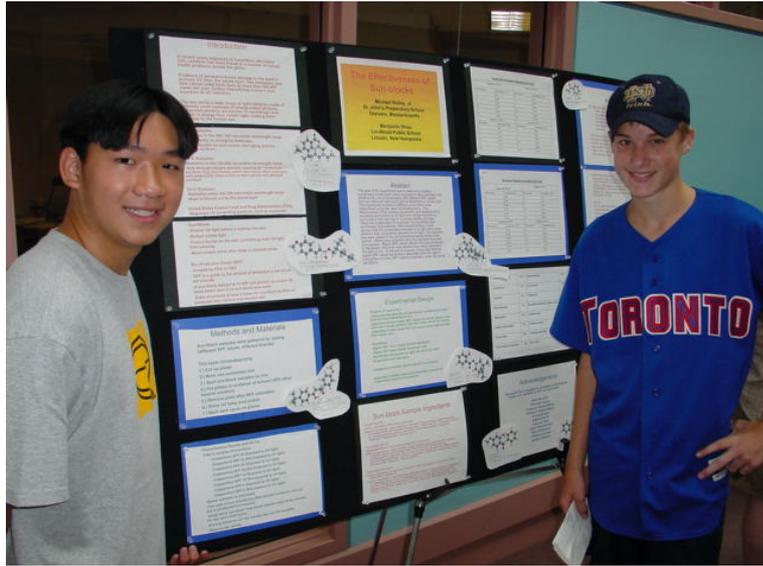
They clone plants and learn about cloning animals/humans – even chimaeras



Some found an evening to visit the Minocha home



On the final day of the program, everyone presents a scientific poster at a three-hour long session, which is attended by more than 200 students, faculty, teachers, parents and UNH administrators. Students take pride in preparing and presenting their posters.



## Nanotechnology in Food Production

UNIVERSITY OF NEW HAMPSHIRE  
Jessie Bleiler  
Masconnet Regional High School, Buxford, MA

After the wariness of the public over genetically altered foods, scientists are thinking twice about how to introduce foods produced or made using nanotechnology. The public is nervous about consuming anything that they don't know a lot about, and food altered using nanotechnology is still a fairly new idea. Many types of altered foods are not yet legal, because scientists do not know a lot about what nanoparticles can do to negatively affect your health.

In our supermarkets now, a large portion of foods are genetically engineered. In a few years from now, who knows how many food products will be altered using nanotechnology? As of now, much of the public is not aware of which foods are genetically modified. How will we know which foods contain nanoparticles?

### Packaging

A possible use of nanotechnology in the future is using nanoparticles to coat the packaging of food products. With this technology, there would be no expiration dates, but the package would change color as the food gets older. The nanoparticles can sniff out the gases which are given off by deteriorating food, and trigger a color change in the labels. The label is also able to tell you when a product is ripe. This type of product is not yet sold in the US, but it is possible that it will be in the near future. Already, this type of product is being manufactured in Europe.

Other German scientists have begun looking to create temperature and time sensitive packaging. These "Oxy-T" time-temperature indicators tell you about the freshness of food. These are not yet being produced in America, but are being produced in Europe.

Other nanoparticles have been used to quite some time in the storage of food. The particles are embedded with plastic, and they help to kill bacteria in storage containers.

Although nanotechnology is still a fairly new science, there are already many applications to the food industry.

### Storage

Some companies are developing new technology for storage of foods. Plastic storage bins are being imbedded with silver nanoparticles to kill any bacteria from whatever was previously in the storage container. This lowers the health risk from bacteria.

Some scientists have experimented with using encapsulation, or adding nano-droplets of water inside each emulsion. This keeps the ice cream as body as a normal ice cream, but with reduced fat. This is not yet officially on the market in the US, but has been done in other countries.

### Creating Healthier Foods

New research also suggests that nanotechnology can be used to produce healthier food with the same quantities as the original food. For example, many foods contain emulsions, or tiny droplets of fat coated with proteins. One way to make food less fattening is to cross link the proteins, and strengthen the protein coat. This delays the breakdown of the emulsion used to reach the small intestine. The sudden burst of fats makes the body feel full, because the body thinks that it has had a high fat diet. A question many are asking about this new technique is whether a person can fool their body by eating food that is slow digesting. Will they still eat the same amount as before, or will they realize that they are not hungry? (Davies, 2010)

Another way to make food less fattening using nanotechnology is when about half of the fat content in emulsion based food is used. In many typical "frit" foods, about half of the fat is replaced with water. Using nanotechnology, the extra water can be hidden in each drop of fat. This way, less of the fat is used, but the low fat version can taste the same as the regular food. This technique is currently being tested in foods like margarine and ice cream to create a tastier low fat version. (Davies, 2010)

The food industry is also looking at using the encapsulating technique to put vitamins, minerals, and omega 3 fatty acids in foods to make them healthier. This will not negatively affect the taste of the food since the particles are so small, but it will help people receive the necessary vitamins. (<http://www.understandingfoods.com/food.html>)

Nanoparticles have special properties that other food products don't have, which scientists are trying to develop in order to make foods healthier. For example, a couple of years ago scientists attempted to make nano salt. They made salt that was the size of micrometers, because it had the best surface area to mass ratio. This enabled the taste buds to taste a saltier taste with the same amount of salt as a larger piece. With this type of technology, we can use a smaller amount of usable nutrition, but still have food taste the same. (Davies, 2010).

### Controversy

Although food altered using nanotechnology could be very helpful, there is not much support for nano-food products. Many people are wary of technology that they don't understand, especially since they are not able to see nanoparticles. There is also fear because nanoparticles have not yet been proven to be harmless. There is no way to know if we would be prone to serious side effects. For example, some of the particles are so small that some scientists are worried about possible health effects. It is feared that the particles from the food, which are not dangerous in their larger form, are more dangerous in the nano size. For example, there is some fear that the nanoparticles can go through the intestine, and make their way into the bloodstream.

**References**

Science News, "The Smart Food Revolution" <http://www.sciencenews.org>, July 11, 2010

\*Food and Nanotechnology, "Food and Nanotechnology: Food" <http://www.foodandnanotechnology.com>, July 11, 2010

USA Today, "Food's New Nanotechnology: Benefits, Concerns" <http://www.usatoday.com>, July 11, 2010

http://www.biology.com/food/nanotechnology.html

Posters  
then  
(above -  
2003) and  
posters now

## Magnetospheric Entropy

By: Dimitris Tsaras, Danielle Jacques, Yaseong Go, Jimmy Raeder PhD., and Matthew Gilson

**Abstract**

The THEMIS mission began in 2007 with the placement of five satellites in different orbits around the earth. These are still being used today for data collection on plasma in the Earth's magnetosphere. Some of this data was used to ask the question, Why is the entropy of the Magnetosphere higher than that of the solar wind and other regions. Why is the entropy of the Magnetosphere higher than that of the solar wind and other regions. Why is the entropy of the Magnetosphere higher than that of the solar wind and other regions. Why is the entropy of the Magnetosphere higher than that of the solar wind and other regions.

**Background on the THEMIS Project**

The creation of the THEMIS project had specific goals in mind when they launched the satellites. They pass through four phases a year: three months each. They are the daytime phase (the sun, the dark phase (the sun is on the south pole), the satellite phase (the sun is on the north pole), and the dawn phase (the sun is on the dawn phase). The satellites are used to collect data on the magnetosphere and as a result, the data being transmitted is currently being used to determine why the entropy levels are higher on the magnetosphere than the other regions. The five satellites transmit the density of particles, the temperature, and the strength of the primary magnetic field of the area. These can be used to calculate the entropy (lower at a defined area) of the area in which the satellite is located. Through the use of computer software and an application created by one of the researchers, these data points are collected and organized into plots. In a portion of this magnetosphere, density, efficiency becomes a key factor.

**What was accomplished**

This portion of the THEMIS project consisted of two sections. There were graphs from the five satellites of one stage to take the three months. These graphs were used to analyze the data and to compare the satellite watch main regions (Magnetosphere, Magnetopause, and Solar Wind). These graphs were used to show the velocity of the magnetosphere's strength (B), temperature (T), the density (n), and the strength of the magnetic field of the charged particles. The part was to calculate and compare with the average temperature and density every 10 minutes for the five satellites and one stage.

**Conclusion**

The data collected at THEMIS in combination with the data from other years and phases should lead to more observations about the magnetosphere. This led to the conclusion that the solar wind had higher entropy than the magnetosphere, but lower entropy than the magnetopause.

**Acknowledgments**

The data collection team would not have been able to accomplish anything if not for many people in the lab. Matt Gilson was an incredible help in his explanation of the project and its associated with the graphing software, which he created in the programming language, Python. Thank you also to Dr. Steve Go, who assisted in explaining entropy when the team was unable to understand the concept, and ending another question from a couple of teenagers on various topics. Dr. Jimmy Raeder, was head of the project, and thanks to him for allowing two high school aged people to take part in the project and for explaining entropy yet again. Scott Goebel and Lou Broad require thanks for providing access of the every year when the students were able to observe many experiments, as well as for the physics lessons in the morning. They were very caring and useful. Finally, to Sarah Bleiler and Dr. Chuck Smith, require thanks for allowing the opportunities of Project SMART. To mentioned parents and many others who helped to provide this opportunity, thank you.

**In Closing**

The rest of me, Matt Gilson, does want to understand the world of physics. He understood that the greatest question may never be asked. This was the final reason why. As a student of physics, the student who is engaged in each concept, Physics do not, however, have the answer of the internal part.

**Where does one go from here?**

The data collected at THEMIS in combination with the data from other years and phases should lead to more observations about the magnetosphere. This led to the conclusion that the solar wind had higher entropy than the magnetosphere, but lower entropy than the magnetopause.

**Equations:**

$$S = P$$

$$P = \rho v^3$$

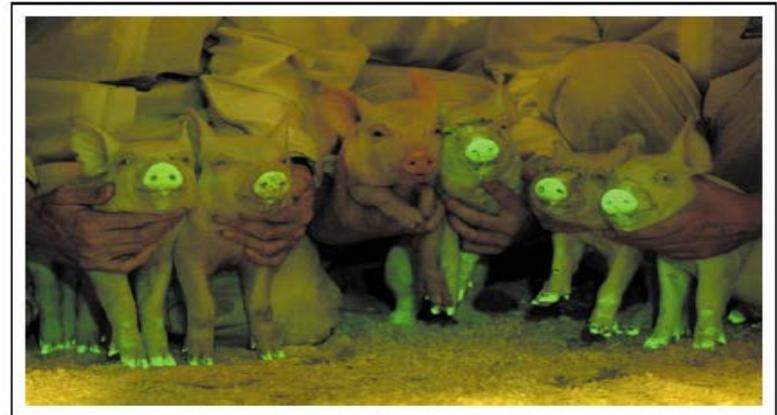
$$v = \frac{1}{\mu_0} \frac{1}{r^2}$$

$$dS = \frac{1}{T} dQ$$

$$P = nkT$$

$$P = \rho v^3$$

They turned blue then (1998) and glow now:  
Genetically engineered bacteria produced by  
Biotechnology students



**Figure 1.** Transgenic pigs generated using an equine infectious anaemia virus-based lentiviral vector carrying the reporter gene encoding green fluorescent protein. Image courtesy of the Roslin Institute.



**A happy bunch saying goodbye! Project SMART - 2011** SMART  
While they look happy as they finish their program; they are indeed sad to leave this place –  
BUT they'll come again next year – a new group to make new friendships with UNH.

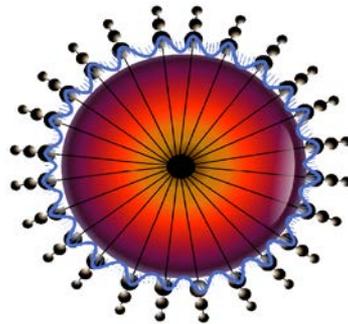
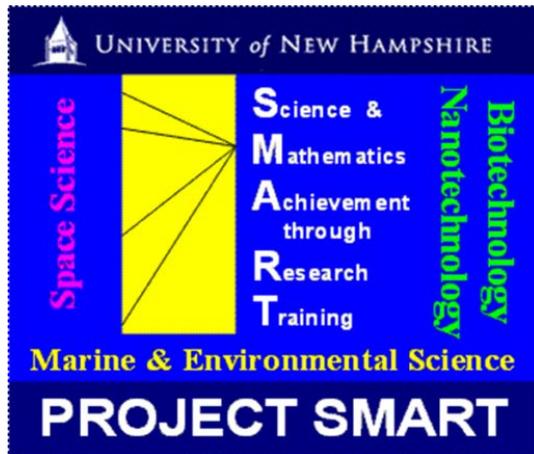


.....But tears were visible in the eyes of many –  
Must we leave?

# Sponsors



UNIVERSITY of NEW HAMPSHIRE



**Harlem Children Society**

*"The Purpose of Souls is to Assist Each Other"*

[www.harlemchildrensociety.org](http://www.harlemchildrensociety.org)



College of Life Sciences and Agriculture

College of Engineering and Physical Sci.

UNH Provost's office

NH Space Grant Consortium

Office of Multicultural Student Affairs

NH Agricultural Expt. Station

UNH Office of Admissions

The Vice Provost for Diversity

NSF Career Awards to faculty

McNair Grad. Opportunity Prgm.

***THANK YOU FOR  
TRAVELING WITH US!***

*For more travels, please visit: [www.smart.unh.edu](http://www.smart.unh.edu)*