

## 2009 SURF Summer Seminars and Tours

May 26 First official work day and orientation for SURF Session I students

June 4 Kristen Markham, Esmaeel Paryavi, and Phil Sandborn  
University of Maryland College Park Students

### ***Engineers Without Borders – Building a Better World – One Community at a Time***

Speakers were officers within the University of Maryland, College Park's Engineers Without Borders chapter. Speakers met with and answered questions from the NIST SURF fellows and NIST staff following the symposium.



June 11 Bob Shull  
NIST Materials Science and Engineering Laboratory, Metallurgy Division

### ***Nanomagnetism – What is it? Why should we care?***

As has been found for many other properties, the magnetic character of materials possessing some material dimension in the nanometer regime can be quite different from that commonly associated with conventional macro-scaled materials. New magnetic phenomena, unusual property combinations, and both enhanced and diminished magnetic property values are just some of the changes observed. As a consequence, these materials are being investigated for their potential as the next generation soft ferromagnets in addition to their future as pioneered hard ferromagnets with vastly improved energy products. Why that is the case and why you should care was presented. In addition, the unique domain kinetics, the “Giant Magnetoresistance (GMR)” effects, and the “Enhanced Magnetocaloric Effects” of this class of material were also described. These nanostructured materials were one of the reasons for the excitement surrounding the “Nanotechnology Revolution” that has presently captured the imagination of the world.



June 18

Dave Wollman  
NIST Electronics and Electrical Engineering Laboratory, Quantum Electrical  
Metrology Division

***What's So Smart about the Smart Grid?***

By upgrading our existing electric power grid with two-way communications and advanced sensors, monitoring and control, the resulting Smart Grid will support increased use of renewable energy sources, allow more efficient and effective use of electricity, and reduce the potential for blackouts and power disturbances. In the Energy Independence and Security Act of 2007, NIST is charged with "primary responsibility to coordinate the development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems...". This talk helped to explain what makes the Smart Grid unique, and why this topic is of great interest in the U.S. and around the world. NIST's Smart Grid efforts were presented within the context of numerous challenges, including significant national visibility, bringing together multiple stakeholders with varying goals and objectives, and developing a standards roadmap to organize and accelerate standards development in the private sector to support and enable new Smart Grid technologies.



June 25

Tom Juliano  
Academic Programs Manager, American Society for Engineering Education

***Creating a Competitive Application for the NSF Graduate Research Fellowship Program***

Using the National Science Foundation Graduate Research Fellowship Program (NSF-GRFP) as the working example, this presentation introduced attendees to the program and ways they can be more competitive when applying. The strategy can be applied to other various award programs, graduate school applications, and employment positions.

The National Science Foundation Graduate Research Fellowship Program offers up to 3 years of graduate school support worth over \$120,000 to each awardee – this year 1,236 awards were offered. Benefits include a \$30,000 stipend, a \$10,500 annual cost of education allowance, a one time \$1,000 international travel allowance, and access to TeraGrid supercomputing facilities. U.S. citizens, nationals, and permanent residents at or near the beginning of their graduate study seeking research-based Master's and/or PhD degrees in NSF-supported science (including



social science and psychology) and engineering disciplines are eligible to apply. The NSF welcomes applications from all qualified students and strongly encourages women in engineering and computer science, under-represented minorities, and persons with disabilities to apply for this fellowship. For more information, please visit [www.nsfgrfp.org](http://www.nsfgrfp.org) or [www.nsf.gov/grfp](http://www.nsf.gov/grfp).

July 2

Brian Paegel  
Scripps Research Institute Florida

***Oceans and Archipelagos: Landscapes for Extracellular Darwinian Evolution***

Natural selection and the evolutionary adaptation of organisms to their environments are direct reflections of the Darwinian process of selection and imperfect reproduction at work on the molecular level. RNA and DNA, the informational molecules of modern biology, can be evolved directly using the tools of biochemistry to achieve selection, amplification, and mutation. These extracellular Darwinian systems enable systematic control over the entire evolutionary process, from population size, to selection pressure and mutagenesis. Over the past decades the molecular and physical sophistication of these experiments has blossomed. Reactions of simple replicating RNAs have expanded into multi-species experiments with RNAs competing to catalyze the key reaction of biological information transfer. And, the test tubes of conventional chemistry are yielding to computer controlled microchip reactors and microfluidic droplet generators that precisely create billions of microscopic islands, each populated with a single progenitor molecule. On the 200<sup>th</sup> anniversary of Charles Darwin's birth, we can now recreate in the laboratory the quintessential evolutionary experiment of the Galapagos finches entirely from molecules!\*



\* Beaks and feathers not included.

July 9

Bill Phillips, Nobel Laureate  
NIST Physics Laboratory, Atomic Physics Division

***Time, Einstein, and the Coldest Stuff in the Universe***

At the beginning of the 20<sup>th</sup> century Einstein changed the way we think about nature. At the beginning of the 21<sup>st</sup> century Einstein's thinking is shaping one of the key scientific and technological wonders of contemporary life: atomic clocks, the best timekeepers ever made. Such super-accurate clocks are essential to industry, commerce, and science; they are the heart of



the Global Positioning System (GPS), which guides cars, airplanes, and hikers to their destinations. Today, atomic clocks are still being improved, using atoms cooled to incredibly low temperatures. Atomic gases reach temperatures less than a billionth of a degree above Absolute Zero, without freezing. Such atoms are at the heart of Primary Clocks accurate to better than a second in 80 million years as well as both using and testing some of Einstein's strangest predictions. This was a lively, multimedia presentation, including experimental demonstrations and down-to-earth explanations about some of today's most exciting science.

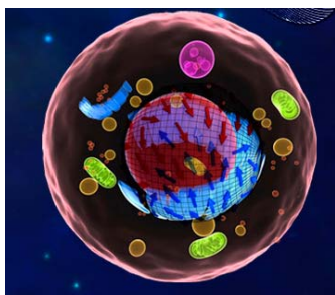
July 16

Rob Ivkov  
School of Medicine, Johns Hopkins University

Cindi Dennis  
NIST Materials Science and Engineering Laboratory, Metallurgy Division

### ***Treating Cancer with Magnets: Fact or Fiction?***

Magnetic nanoparticles are being developed for a wide range of biomedical applications. These range from diagnostic tests like DNA assays and clinical Magnetic Resonance Imaging (MRI) contrast agents to a variety of disease treatments through drug delivery and hyperthermia (artificial fever). MRI is a well-established technology with FDA approved commercial contrast agents to enhance the visibility of abnormal tissue. However, both drug delivery and hyperthermia are still in the early stages of development. Here we will focus on hyperthermia, as aspects of it also play a critical role in drug delivery applications.



Biologically, it is well-established that heat has a profound effect on cells and tissues. It has also been known, for about two thousand years, that heat can be an effective treatment for cancer. However, the question has long been how to deliver heat locally to cancer without overheating the normal tissue. This is where magnetic nanoparticles may provide an answer. Hyperthermia involves heating magnetic nanoparticles through exposure to an alternating magnetic field. This promises to be a successful method if there are enough particles in the tumor possessing a sufficiently high specific absorption rate (SAR) to deposit heat quickly while minimizing thermal damage to surrounding tissue.

However, there is a complex relationship between heat production, physiological methods for dispersing that heat, targeting of the nanoparticles, and RF radiation interactions with tissue, resulting in a not well understood system, either physically, chemically, and biologically. The various factors were discussed that play a role, both on the biology/physiology side as well as in the physics/chemistry. In addition, methods for characterization and quantification

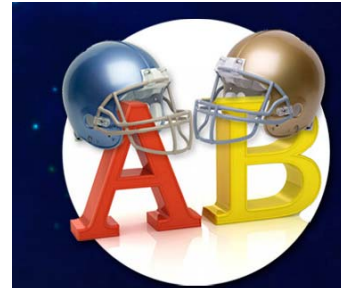
both *in vivo* (in live animals) and *in vitro* (in glass dishes) of these parameters were described. Finally, to illustrate the interplay between physiology and physics, recent studies were discussed about new magnetic nanoparticles, including their effectiveness.

July 23

Antonio Possolo  
NIST Information Technology Laboratory, Statistical Engineering Division

### ***Statistics – A Contact Sport***

The subject of “statistics” more often than not stirs memories of boring lectures, irrelevant textbooks, and impossible homework – just ask any student of nursing or anthropology (who, in most schools, must take at least one statistics course), about their encounters with statistics.



The funny thing about statistics is that it has made (and undergone) its most consequential advances in the hands of geneticists, chemists, geophysicists, and agronomists.

Then there is the probability part, which we all are familiar with because we know about odds in gambling, and chances of rain. Statistics courses usually dedicate a good deal of attention to probability. But do we ever get to figure out what relation there may be between familiarity with games of chance and the evaluation of risks in real life (of an earthquake or a hurricane, or of an accident at a nuclear power plant)?

This talk told several statistical tales that attempted to suggest that there is a lot more to statistics than has met the eye of many the suffering nurse or pained anthropologist; that probability is the language of statistics; that statistics is the art of dealing with vagueness and with interpersonal differences in decision situations; and that statistics is best practiced, and then makes a difference, when it involves collaborations between professional statisticians and scientists (geneticists, chemists, geophysicists, agronomists, etc.), jointly to advance knowledge – that is, when it is “played” as a “contact sport.”

August 4 Final presentations by SURF students moderated by invited guests.

August 4 Lunch: SURF Directors and special invited guests.

August 5 Final presentations by SURF students moderated by invited guests.

August 6 Final presentations by SURF students moderated by invited guests.

August 7 Last day for SURF students and farewell pizza party.

## 2009 SURF Summer Activities

It's difficult when you're in a new city and starting a new job. Many of the NIST Gaithersburg SURF students all find themselves in the same boat and thus forge bonds that may last a lifetime. A number of the students also come back for a couple years so they're more than willing to help the new students with the benefit of their experience. They work together AND play together. In fact, to make life easier NIST SURF Director Lisa Fronczek created a Facebook group just for the SURFers called "NIST SURF 2009 – Gaithersburg. In fact, two students found the site before she even finished creating it.

### SURF BBQ – NIST Picnic Grove



Burgermeister Cameron Miller at the grill (PL SURF Director)



Whether you call them perrito calientes or just plain old American hot dogs – Chris White in his chef's white (BFRL SURF Director) is grillin' them up

The SURF Directors' continued the tradition of welcoming the SURF students with a BBQ at the NIST Picnic Grove. The Directors' provide burgers/dogs, fruit, chips, and dessert. All the students needed to do -- show up and provide the entertainment with Frisbees, footballs, etc. This year the University of Maryland Materials Science Research and Engineering REU was touring NIST on the day of the BBQ and got to join the NIST SURFers for the goodies -- surely much better than that brown bag lunch they brought along. It also gave the two REUs a chance to compare notes. NIST is always a top tour spot for the UMD REU to tour during the summer.

### July 4<sup>th</sup> in the Nation's Capitol

Many of our 151 SURF students are out of the area and are given a chance to see the celebration that takes place in our Nation's Capitol. Take the "History Buffs" test of July 4<sup>th</sup> knowledge. 1) "Which of our Founding Fathers created the blueprint for our Fourth of July celebrations by suggesting that the day be celebrated with "bonfires and illuminations from one end of this continent to the other" by succeeding generations of Americans?" 2) On July 4, 1976, Americans all over the country celebrated our nation's 200th birthday. How many tons of fireworks were exploded in a magnificent display above the Washington Monument in Washington, DC — 5, 24 or 33? 1) John Adams ; 2) 33 tons!



## 2009 SURF T-Shirt Design



What better way to remember your summer at NIST than to design your very own souvenir T-shirt. Unlike the shirts you buy at an Orioles or Nationals games, these T-shirts are designed by a group of fellow SURFers. All the fashion conscious are seen sporting the latest design across the 578 acre NIST campus. It lets all those students at their home university know what they were doing during the summer!

## NIST Summer Institute for Middle School Science Teachers



The third NIST Summer Institute for Middle School Science Teachers was held from July 6 – 17, 2009. The workshop sponsored 16 middle school science teachers. The Summer Institute, a collaboration between NIST and local school districts, is an innovative combination of hands-on activities, lectures, tours, and visits with scientists in their laboratories. Designed to coordinate with the middle school curriculum, the teachers are provided with resources and instructional tools for teaching math and science, with an emphasis on measurement science used at NIST. Led entirely by NIST

scientists, the Summer Institute translates the cutting-edge research done in the laboratory to activities designed to be carried out in the classroom. Networking among the scientists and teachers provide long-term resources through the on-going relationships for the teachers and their students. Since the SURFers were working on interesting projects they were asked to help in the project. It's important for the SURFers to learn to explain what they are doing to others. This made them great examples for the teachers. It's a small world out there – maybe they got to connect with a science teacher from years ago – something I'm sure all the teachers would like to have happen in the future!



## Neighbor Helping Neighbor

The honor, spirit and resources of the American people comes forth with neighbors helping neighbors in need — during earthquakes, floods, fires, storms — and also for the deeply personal and often quiet disasters that require a gift of blood. Quietly, without fanfare, SURFers gave the gift of blood during the NIST blood drive.

## **Pentagon Tour**

The Pentagon is virtually a city in itself. Approximately 23,000 employees, both military and civilian, contribute to the planning and execution of the defense of our country.



The Pentagon tours program was established on May 17, 1976 to support the nation's Bicentennial Celebration. Initially, the program was to last through the 4th of July and then be disbanded; however, internal support and public demand were so great that the program has been continued ever since – with a few SURFers adding to those numbers.

## **Tour of University of Maryland College Park**

A few professors in the Physics Department of the University of Maryland College Park offered the students a tour through some of the labs (Condensed Matter, Atomic Molecular and Optical Physics), then invited them to a lunch to talk with some of the current grad students to ask questions about what grad school is really like.

## **Volunteers Wanted – Survey of Information Habits and Preferences of Millennial Scientists**

A previous SURF student who was hired in the Information Services Division at NIST extended a call to participate in a survey on their research habits. A total of 91 SURFers participated in the survey.

## **SURFers and Netflix**

An inexpensive way to spend a summer night with a bunch of friends – Netflix the latest comedy by Jim Carrey and you're on your way.

## **Baltimore National Aquarium**

The SURFers headed over to Baltimore to check out the Baltimore National Aquarium.

When the National Aquarium began taking shape on Pier 3 in the 1970s, Baltimore had never seen anything like it, and once it opened, the city's historic harbor would never be the same. In the same way, the extensive renovation of the National Aquarium in Washington, DC, opens up new opportunities for visitors to connect with nature in our nation's capital.



Together, the two National Aquarium locations have offered millions of visitors transforming experiences that inspire them to enjoy, respect, and protect the aquatic world. Action follows experiences that change our thinking. For some, seeing the Chesapeake Bay for the first time through a school field experience is a catalyst to do something. For others, getting face-to-face



with the Aquarium's amazing animals or attending a thought-provoking lecture will challenge ideas and change perspectives.

### Washington, DC Museums



How could you come to the Nation's Capital and not check out all the wonderful museums. They range from The Aircraft Museum, The Museum of Modern Art, International Spy Museum, Smithsonian National Air and Space Museum, National Museum-America History, National Museum-Natural History (I always like to check out the Hope Diamond), and the National Museum of Crime of Punishment (one that you might want to visit but never have your name associated with).



### *Annual Summer Horizons Program*



Tawny McManus, PROMISE Coordinator, UMBC, issued the annual invitation to the SURF students to attend the Summer Horizons program at the University of Maryland, Baltimore County (UMBC). Participants in Summer Horizons had an opportunity to: 1) learn about “Graduate School 101: The Road to Graduate School”, the graduate school application process, e.g., GRE, funding, applications; 2) meet with UMBC faculty, tour laboratories and talk with current graduate students about their experiences, motivations, and succeeding in graduate school, and 3) hear a thought provoking address from UMBC's President, Dr. Freeman Hrabowski. He is well-known for his speaking ability. (As an aside, one of the SURFers last year said she chose UMBC over several other big-name schools because she heard Dr. Hrabowski speak.) Breakfast refreshments and lunch was served, along with a dessert reception that accompanied the keynote address by President Hrabowski.

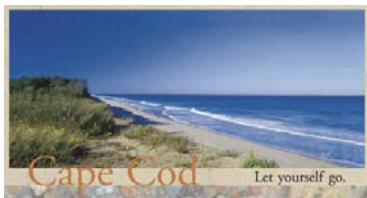
### **Trips – New York**



New York, New York, is everything they say  
And no other place that I'd rather be  
Where else can you do a half a million things  
All at a quarter to three (AM??)

Sounds like a trip tailor-made for a group of energetic SURFers.

## Trips – Cape Cod



“Let yourself go” -- sounds like something a group of SURFers might feel like doing after putting in a grueling week of research.

## GRE® – Graduate Record Examinations®

One of the SURF students organized a physics GRE study group to prepare for the test. The **Graduate Record Examinations® (GRE®) General Test** measures verbal reasoning, quantitative reasoning, and critical thinking and analytical writing skills. The **GRE® Subject Tests** gauge undergraduate achievement in 8 specific fields of study.

## Soccer and Volleyball



They may not have been wearing DC United soccer jerseys and had the trappings of 11 domestic and international champions dominating the NIST lobby, but the competition between the teams (Grumpy Gumbo, Ferocious Fondue, and Jam’n Jambalaya) was just as fierce, well maybe fierce isn’t the correct word – more like fun! In fact, some of the teams had matching shirts that they made that were pretty cool! They also played volleyball (probably not on the same scale as Misty May-Treanor and Kerri Walsh, who dominated both the AVP and FIVB beach volleyball tours and the 2008 Beijing Olympics) but I’m sure they had fun just the same.



## SURF Farewell Pizza Party

Every year the SURF Directors treat the students to a farewell pizza party. This year the SURF T-shirt committee made a few dollars profit selling NIST’s hottest fashion item – the SURF 2009 T-shirt. Luckily for their fellow SURFers, the T-shirt committee decided to treat everyone to Rita’s Ice in three yummy flavors – cherry, cotton candy, and a mystery flavor – pizza (54 of them!) and dessert, what’s not to love.



**See ya!**