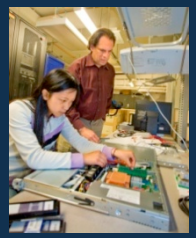
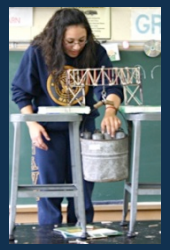




DOE-WDTS Outreach Opportunities

Kirk A. Janowiak

Albert Einstein Distinguished Educator Fellow

Office of Workforce Development

for Teachers and Scientists

(WDTS)

June 9, 2010

A Summary so far...

- ✓ Make an effort at outreach to a diverse & dynamic audience
- ✓ Use the resources you have and know
  - ✓ Play to your strengths
  - ✓ Be a real person
  - ✓ Remember why **You** got into a STEM field. It's fun!
- ✓ Use relevant & engaging activities or events
- ✓ Communicate Better - The World Has Changed

Today's Presentation...

- Review DOE Mission & Goals
- Show WDTS structure & programming
- Explore the need
- Offer you opportunities and roles to play

A Balancing

ALTRUISM & Self Needs

IDEALS & Practicalities

A Blending

Passion & OPPORTUNITY

DOE PRIORITIES & GOALS

- **Priority: Science and Discovery**
  - Invest in science to achieve transformational discoveries
  - Organize and focus on breakthrough science
  - Develop and nurture science and engineering talent
  - Coordinate DOE work across the department, across the government, and globally
- **Priority: Change the landscape of energy demand and supply**
  - Drive energy efficiency to decrease energy use in homes, industry and transportation
  - Develop and deploy clean, safe, low carbon energy supplies
  - Enhance DOE's application areas through collaboration with its strengths in Science
- **Priority: Climate Change: Position U.S. to lead on climate change policy, technology, and science**
  - Provide science and technology inputs needed for global climate negotiations
  - Develop and deploy technology solutions domestically and globally
  - Advance climate science to better understand the human impact on the global environment

DOE PRIORITIES & GOALS

- **Priority: Economic Prosperity—Create millions of green jobs and increase competitiveness**
  - Reduce energy demand and deploy cost-effective low-carbon clean energy technologies at scale
  - Promote the development of an efficient, “smart” electricity transmission and distribution network.
  - Enable responsible domestic production of oil and natural gas
  - Create a green workforce

- **Priority: National Security and Legacy: Maintain nuclear deterrent and prevent proliferation**
  - Strengthen non-proliferation and arms control activities
  - Ensure that the U.S. weapons stockpile remains safe, secure, and reliable without nuclear testing.
  - Complete legacy environmental clean-up

DOE STRATEGIC THEMES

SCIENTIFIC DISCOVERY AND INNOVATION

Mission: Discovering the Solutions to Power & Secure America's Future

Strengthening U.S. scientific discovery, economic competitiveness, & improving quality of life through innovations in science and technology

Energy Security

Promoting America's energy security through reliable, clean, and affordable energy

Environmental Quality

Protecting the environment by providing a responsible resolution to the environmental legacy of nuclear weapons production

National Security

Ensuring America's nuclear security

Management Excellence

Enabling the mission through sound management

A Scientific Workforce For Our Nation's Future

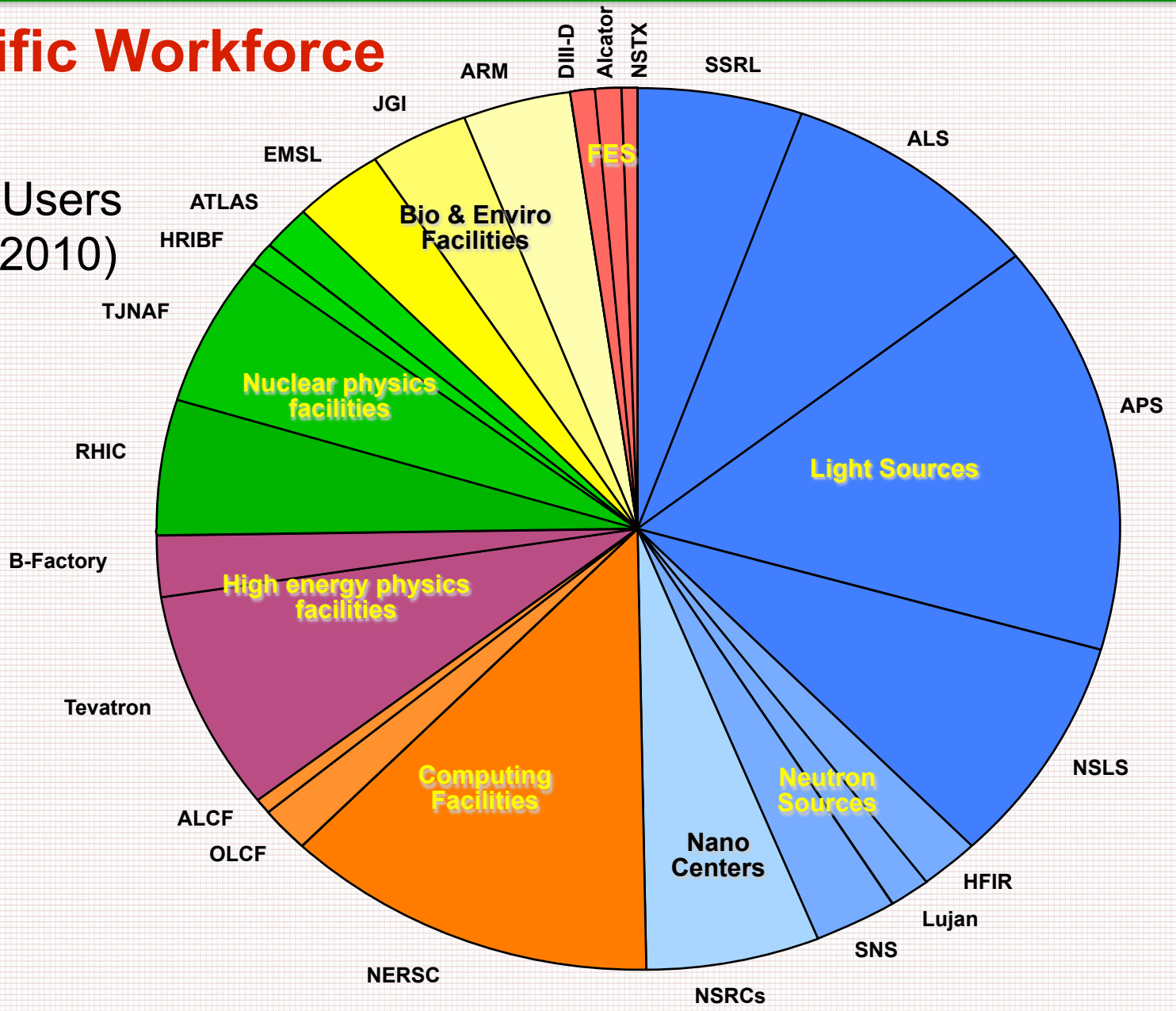
DOE has played an important role in training America's scientists and engineers for more than 60 years, making historic contributions to U.S. scientific preeminence.

In FY 2009, the DOE:

- ✦ Supports about 23,700 Ph.D.s, graduate students, undergraduates and technical staff at the DOE national laboratories; an increase of 2,600 over FY 2008
- ✦ Supports over 21,000 individual researchers from universities, national laboratories, and industry to use the Office of Science's world-leading suite of scientific user facilities this year; an increase of 1,000 over FY 2008 and projected to be 24,000 in FY 2010
- ✦ Supports over 12,500 individuals at universities through Office of Science grant programs
- ✦ Supports at least 10,000 industrial scientists and engineers working on technology deployment and development

DOE Scientific Workforce

Distribution of Users by Facility (FY2010)



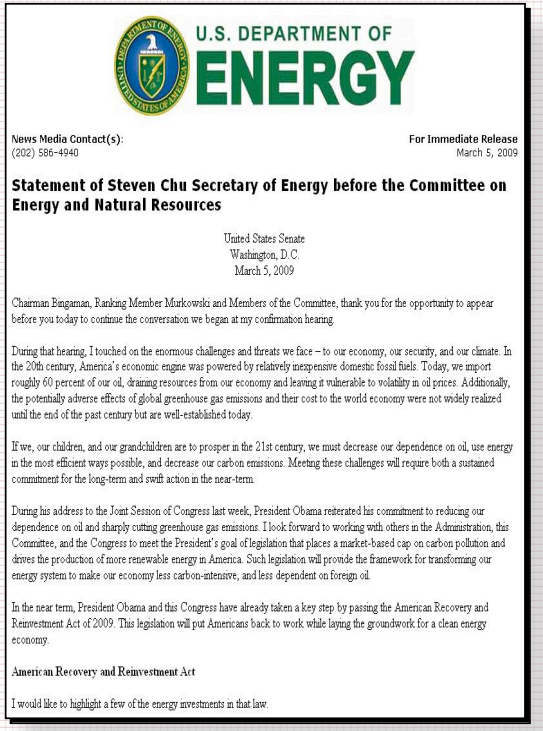
Science Research Integration

***Developing Science and Engineering Talent*:**

"One of the key recommendations was to step up efforts to educate the next generation of scientists and engineers. The FY 2010 budget supports graduate fellowship programs that will train students in energy-related fields. I will also seek to build on DOE's existing research strengths by attracting and retaining the most talented scientists."

Broader, More Effective Collaboration:

"DOE also needs to foster better research collaboration, both internally and externally. My goal is nothing less than to build research networks within the Department, across the government, throughout the nation, and around the globe. We'll better integrate national lab, university, and industry research."



U.S. DEPARTMENT OF ENERGY

News Media Contact(s):
(202) 586-4940

For Immediate Release
March 5, 2009

Statement of Steven Chu Secretary of Energy before the Committee on Energy and Natural Resources

United States Senate
Washington, D.C.
March 5, 2009

Chairman Bingaman, Ranking Member Murkowski and Members of the Committee, thank you for the opportunity to appear before you today to continue the conversation we began at my confirmation hearing.

During that hearing, I touched on the enormous challenges and threats we face – to our economy, our security, and our climate. In the 20th century, America's economic engine was powered by relatively inexpensive domestic fossil fuels. Today, we import roughly 60 percent of our oil, draining resources from our economy and leaving it vulnerable to volatility in oil prices. Additionally, the potentially adverse effects of global greenhouse gas emissions and their cost to the world economy were not widely realized until the end of the past century but are well-established today.

If we, our children, and our grandchildren are to prosper in the 21st century, we must decrease our dependence on oil, use energy in the most efficient ways possible, and decrease our carbon emissions. Meeting these challenges will require both a sustained commitment for the long-term and swift action in the near-term.

During his address to the Joint Session of Congress last week, President Obama reiterated his commitment to reducing our dependence on oil and sharply cutting greenhouse gas emissions. I look forward to working with others in the Administration, this Committee, and the Congress to meet the President's goal of legislation that places a market-based cap on carbon pollution and drives the production of more renewable energy in America. Such legislation will provide the framework for transforming our energy system to make our economy less carbon-intensive, and less dependent on foreign oil.

In the near term, President Obama and this Congress have already taken a key step by passing the American Recovery and Reinvestment Act of 2009. This legislation will put Americans back to work while laying the groundwork for a clean energy economy.

American Recovery and Reinvestment Act

I would like to highlight a few of the energy investments in that law.

http://www.energy.gov/news2009/6964.htm

Pipeline Approach

Kindergarten through Post Docs
- "Life long learners"
- "K through grey"

Integrated Highly Leveraged Partnerships
- Sustainability
- Long-term thinking

DOE Technical Workforce

Headquarters National Laboratories
100,000 Contract employees
15,000 Federal employees

Extended DOE Technical Workforce
Technical workers in industries, University and College related to DOE mission areas

National Technical Workforce
7.4 million workers in STEM-related fields

Undergraduate and Graduate STEM Students
500,000 U.S. University students studying STEM Fields

Middle School and High School Students
Approximately 25,000,000 students

U.S. STEM Workforce

What Does the Workforce Look Like?

Workforce Evaluation & Analysis is Difficult

- *OLD* data
- Incomplete, even non-existent data
- Inconsistent data
- Different or overlapping categorizations for the same job
- Data ignores multidisciplinary jobs

What We DO Know; What We CAN Say:

- ✦ Current workforce is aging out
- ✦ Current workforce is less adaptable to change
- ✦ We need to add more STEM students & workers to the "pipeline"
- ✦ Our Students need better skills in basic science & research – no matter what careers they chose!

- STEM enrollment and retention data is notoriously slippery.
- Decadal trending has been reported as declining, but it is not that simple
- The most recent report (using data from 2008) shows an upward tick for STEM Graduate Students

[NSF 10-320 June 2010]

InfoBrief SRS

Science Resources Statistics

National Science Foundation
Directorate for Social, Behavioral, and Economic Sciences

NSF 10-320
June 2010

Jump in Fall 2008 Enrollments of First-Time, Full-Time S&E Graduate Students

by Susan T. Hill[1] and Peter Einaudi[2]

Enrollments of first-time, full-time graduate students in science and engineering (S&E) programs reached a record 108,819 in 2008, representing 20.6% of all graduate enrollments in these fields. The increase, 7.8% over fall 2007, was the largest 1-year increase in the last 10 years (table 1). For the first time since 2003, first-time enrollment in engineering fields grew faster among U.S. citizens and permanent residents than among foreign students with temporary visas (table 2).

Overall, the class of new full-time graduate students entering S&E fields in fall 2008 was the largest since 1973, when the National Science Foundation (NSF) began to collect these data. These findings are from the fall 2008 Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS), cosponsored by the National Science Foundation (NSF) and the National Institutes of Health (NIH).

Graduate Student Enrollment in S&E

Among S&E fields, total graduate student enrollment (full-time and part-time) reached 529,275 in 2008, an increase of 2.5% from 2007 to 2008. Enrollment in the selected health fields included in the GSS fell by 1.1% over the same period (table 1). The remainder of this report primarily highlights data for S&E fields. Further analysis of GSS data on graduate enrollment in selected health fields can be obtained from the NIH.[3]

Enrollment Status

Growth in graduate S&E enrollment from 2007 to 2008 largely reflected full-time enrollment, which increased by 12,018, or 91.9% of the total growth in S&E enrollment (table 1).[4] Rapid growth in enrollment of first-time graduate students accounted for nearly two-thirds of this increase.

The number of students entering graduate S&E programs for the first time has been increasing for the last 10 years, with the exception of a 1-year decline from 2003 to 2004 (figure 1).[5] A key component of this growth has been the variation in first-time enrollment by citizenship. From 2001 to 2003, growth was driven by increasing enrollment among U.S. citizens and permanent residents. The 2003–04 decline was driven by decreasing foreign enrollment. First-time enrollment among students with temporary visas dropped 19% from 2001 to 2004 but has rebounded strongly since then. Recent record-breaking gains reflect increasing first-time enrollment among U.S. citizens and permanent residents and foreign students on temporary visas.

From 2007 to 2008, first-time, full-time enrollment grew more rapidly among foreign students (11.0%) than among U.S. citizens and permanent resident students (5.9%). Among foreign students, first-time, full-time enrollment increased 13.4% in science fields overall and 15.8% in the selected health fields (table 2).

Information and data from the Division of Science Resources Statistics are available on the web at http://www.nsf.gov/statistics/.
To request a printed copy of this report go to http://www.nsf.gov/publications/orderpub.jsp or call (703) 292-PUBS (7827).
For NSF's Telephonic Device for the Deaf, dial toll-free (800) 281-8749 or (703) 292-5090.

What About Green Jobs for the new Green Economy?

There are relatively few **Green** jobs ready to be filled today & contradictory reports of the effect of job growth in this area. This segment is predicted to grow, but the crystal ball is somewhat dim.

National Commission on Energy Policy's:

Task Force on America's Future Energy Jobs

Photo from National Council on Energy Policy's
TASK FORCE ON AMERICA'S FUTURE ENERGY JOBS

Of the 120,000 to 160,000 electric power workers who will be eligible for retirement or leave the industry for other reasons by 2013, industry surveys suggest 58,200 will be skilled craft workers and another 11,200 will be engineers.

A *lack of standardized* skill sets and curricula for some of the skilled crafts within the electric power sector presents a significant challenge for students, community colleges, and employers.

Status of 'Green Job/Career Prep'?

- K-12 vocational education programs are lagging behind the times
- Community Colleges are agile and catching up
- Undergraduate programming seems to locked into the past
- Graduate & Post-Doc training is tied to traditional disciplines
- Professional Science Master programs are emerging:
  - Ex: Advanced Energy and Fuels Management Professional Masters (Southern Illinois University, Carbondale)
  - 150+ universities offering a PSM
  - Industry driven degrees

DOE-WDTS Programs for Educational Outreach & Workforce Development

- Science Undergraduate Laboratory Internship (SULI)
- Community College Institute (CCI)
- Pre-Service Teacher (PST)
- Faculty and Student Teams (FaST)
- Science Graduate Fellowship
- Academies Creating Teacher Scientists (DOE-ACTS)

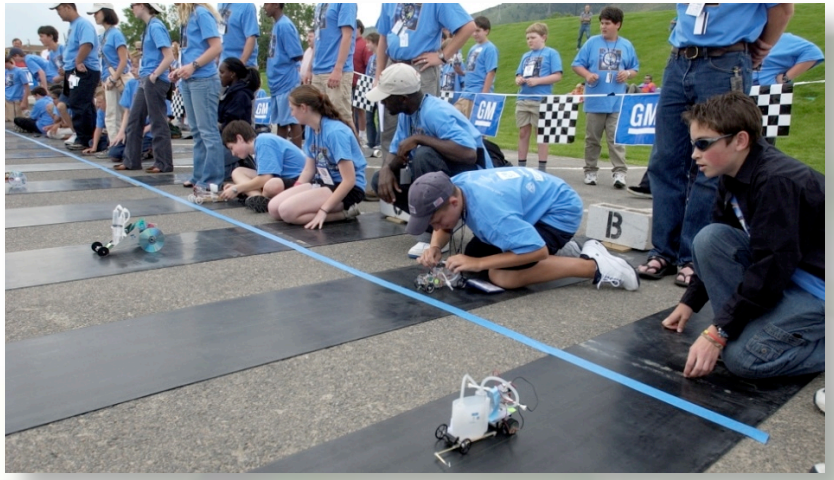
ScienceEducation.gov

A one-stop web portal for K-16 teachers, students, & parents.

The portal includes vetted & tested educational materials available from US Govt. science mission agencies.

- Leverages Web 2.0 capabilities:
  - "membership" & communities
  - tagging (by agency AND member)
  - ratings
- Currently in Beta with official launch in August 2010 (in time for the new school year)
- Current participating agencies include
  - DOE
  - NIH
  - NASA
  - NOAA
  - USDA
  - USGS
  - More on the way...

National Science Bowl®



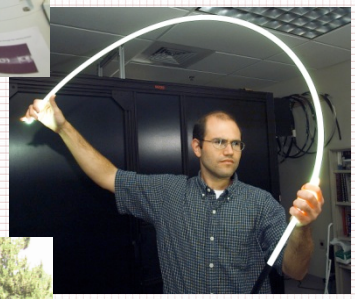
- High School now in its 20th year
- Middle School started in 2000
- Encourage students to study math & science

Regional events

- Hosted by DOE sites, colleges & universities, utilities, other educational institutions
- Hundreds of volunteers
- More than 16,000 high school students
- More than 5000 middle school students

Undergraduate Laboratory Internships (SULI, CCI, PST)

- Goal is to encourage students to pursue STEM careers through research internships at DOE national laboratories
- Origins are with the AEC
- **FY2010 ~740 Participants**



Undergraduate Programs (SULI, CCI, PST)

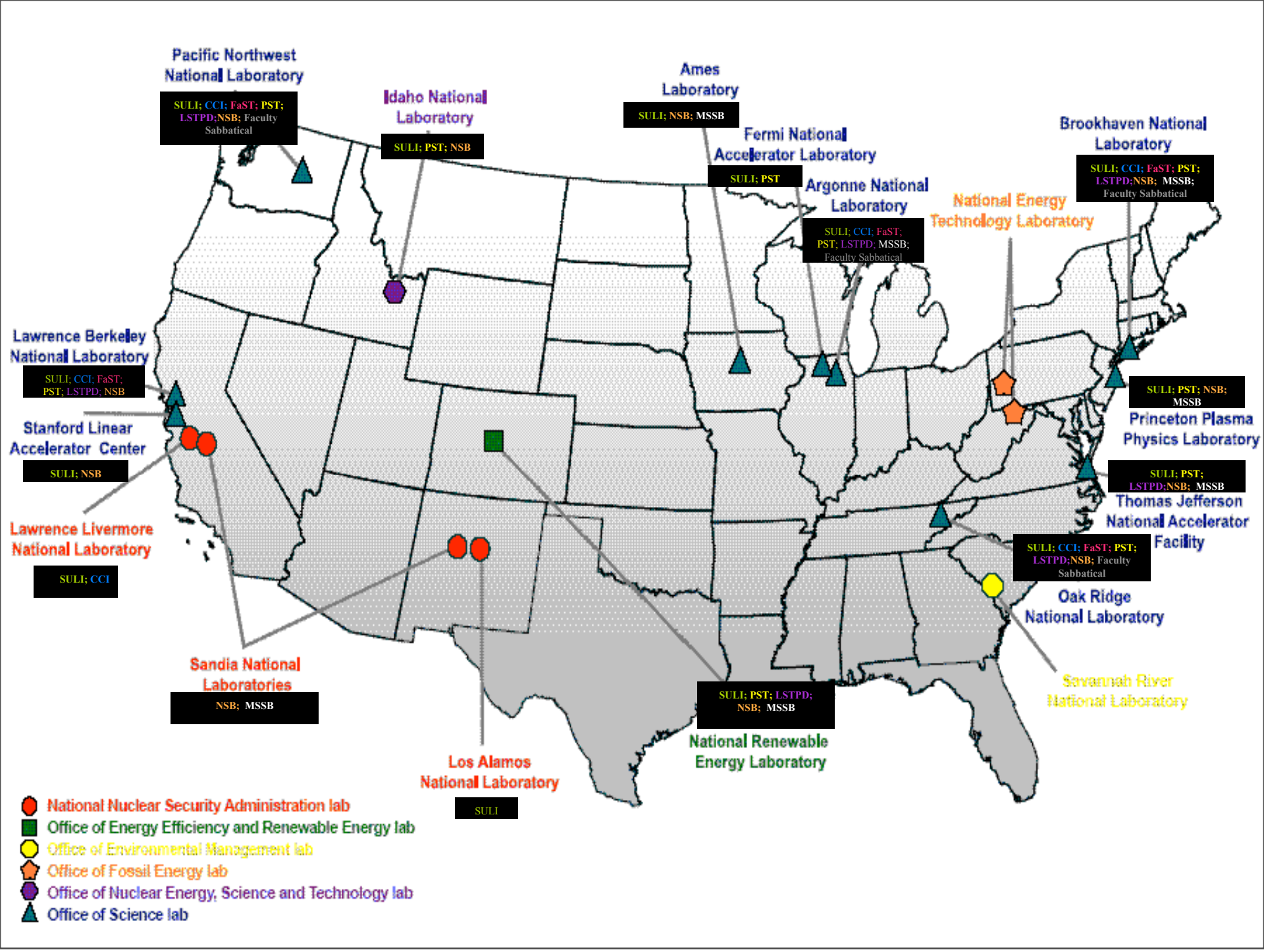
- Student support
  - Weekly stipend
  - Travel reimbursement
  - Housing allowance

- Student Deliverables
  - Abstract describing research experience published in the *Journal of Undergraduate Research*
  - Paper and/or poster presentation summarizing research efforts
  - Education Artifact such as a lesson plan or unit plan (PST only)

- Extensions
  - Participants are eligible to enter WDTS' Science & Engineering Research Challenge (SERCh) poster presentation competition
  - Participants' papers can be nominated for publication in the *Journal of Undergraduate Research*

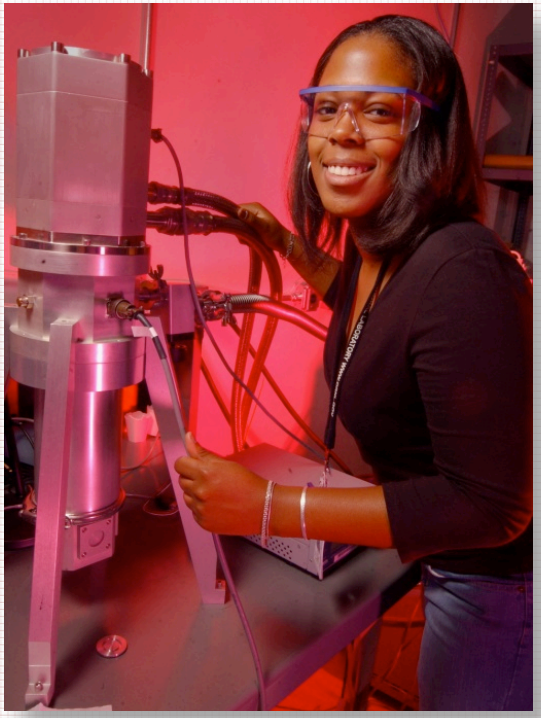
Undergraduate Research Internship Programs: Student Application

- Student Application (Summer term)
  - Online national application
  - Applications for summer internships open on October 1
  - National Laboratories begin selecting students February 1 through April 1
  - Describe academic preparedness
  - Outline career goals
  - Provide 2 letters of reference
  - Select up to 3 desired areas of research
  - Select preferred laboratory setting (1st and 2nd choice)


Pacific Northwest National Laboratory
SULI; CCI; FaST; PST; LSTPD;NSB; Faculty Sabbatical
Idaho National Laboratory
SULI; PST; NSB
Ames Laboratory
SULI; NSB; MSSB
Fermi National Accelerator Laboratory
SULI; PST
Argonne National Laboratory
SULI; CCI; FaST; PST; LSTPD; MSSB; Faculty Sabbatical
National Energy Technology Laboratory
Brookhaven National Laboratory
SULI; CCI; FaST; PST; LSTPD;NSB; MSSB; Faculty Sabbatical
Lawrence Berkeley National Laboratory
SULI; CCI; FaST; PST; LSTPD; NSB
Stanford Linear Accelerator Center
SULI; NSB
Lawrence Livermore National Laboratory
SULI; CCI
SULI; PST; NSB; MSSB
Princeton Plasma Physics Laboratory
SULI; PST; LSTPD;NSB; MSSB
Thomas Jefferson National Accelerator Facility
SULI; CCI; FaST; PST; LSTPD;NSB; Faculty Sabbatical
Oak Ridge National Laboratory
Sandia National Laboratories
NSB; MSSB
Savannah River National Laboratory
SULI; PST; LSTPD; NSB; MSSB
National Renewable Energy Laboratory
Los Alamos National Laboratory
SULI
National Nuclear Security Administration lab
Office of Energy Efficiency and Renewable Energy lab
Office of Environmental Management lab
Office of Fossil Energy lab
Office of Nuclear Energy, Science and Technology lab
Office of Science lab

Science Undergraduate Laboratory Internships (SULI)

- Students are placed with mentor scientists and engineers at DOE National Labs for 10 weeks in the summer or 16 weeks during a fall or spring semester.
- ~ 650 students each year



Success Stories

NATIONAL IMPACT SERIES

DOE National Laboratories Train the Scientist of Tomorrow

Stacy W. Kish, (202) 586-5278
October 28, 2009

Science Internships Provide Young Scientists Opportunities to Conduct Research at National Laboratories

As September transitions to October, school students across the country are settling into another academic year. Inevitably someone raises the question – What did you do this summer? For hundreds of undergraduate students, the answer is: "I worked at one of the preeminent national labs in the United States."

This past summer 301 students nationwide slipped on lab coats and joined the scientists at 13 of the 17 Department of Energy (DOE) National Laboratories as part of the DOE Office of Science (SC) flagship Science Undergraduate Laboratory Internship program (SULI).

The SULI program has been in effect since the inception of DOE's predecessor agencies. Although the program has gone by many different names, it has supported tens of thousands of undergraduate students with science internships over the past 60 years.

SULI interns come from a variety of educational backgrounds, spanning computer science, Earth and environmental science, marine science, physics, life science, physical science, and mathematics.

Nakita Horrell, an environmental engineering student at Utah State University, was interested in nuclear energy and began surfing the DOE website to learn about the field. "I was curious about employment opportunities with the Department of Energy so I checked into the SULI program. I thought it might be a good way to get my foot in the door."

"The internship program is competitive," said Sue Ellen Walbridge, program manager of Workforce Development for Teachers and Scientists (WDTS) that administers the SULI program, "The office received more than 2,300 applications in 2009."

Every year, the education department of each National Laboratory sifts through the applications and evaluates the applicant pool based on their academic coursework, recommendations, scientific interests, and compatibility with the research programs at the facilities.

Horrell and her SULI contemporaries began a ten week program in mid-June. The students collaborated with scientist mentors on cutting-edge research projects.

"I worked with my mentor Dawn Wellman, at Pacific Northwest National Laboratory (PNNL) in Richland Wash." said Horrell. "With my project, we wanted to quantify the dissolution rate of iron phosphate glass, which could provide an alternate way to store nuclear waste."

Marie Galante, a physics major at Albion College, participated as a SULI intern at the National Renewable Energy Laboratory in Golden, Colorado. with an eye on working eventually in the emerging green industry. Galante's project examined ways to improve the top layer of a solar cell.

Marie Galante is a physics major at Albion College and a participant of the 2009 SULI program.

Image Credit: National Renewable Energy Laboratory

National Impact 9-2009

U.S. DEPARTMENT OF ENERGY Office of Science

the latest from Gettysburg College

For employers, from the Center for Career Development
November 2003

An Example of Collaborative Success!

A student and a professor collaborated on a poster presentation at September's annual meeting of the Economic History Association in Nashville, Tenn. The presentation, "Pithole: a Tragedy of Dynamic Inefficiency," traced the rise and fall of an oil boomtown in western Pennsylvania. It stemmed from a senior thesis by Steven Fisher '03. He began the project in Prof. Brooks Kaiser's fall 2002 microeconomics seminar on energy and electricity markets.

Fisher's work - which included learning linear programming and visiting the Pithole area to gather data - earned him the economics department's award for best honors thesis. Fisher and Kaiser analyzed how changes in property rights might have altered Pithole's fate. An oil field was discovered there in 1864, creating a city of 15,000 almost overnight. But the black gold ran dry in only two years, transforming the booming burg into a ghost town of which few traces remain today.

Fisher and Kaiser found that individual well owners had no incentive to limit pumping, even though that would have kept demand high and driven prices up. "They had to pump it as fast as they could, because if you didn't take it, someone else would," Kaiser said.

A monopoly could have changed everything. According to Kaiser and Fisher's research and mathematical modeling, ownership of all the wells by a monopolist would have increased profits by stretching production over 15 years. The lack of competition would have left the monopolist free to look to the long term, Kaiser said. She and Fisher also looked at state ownership, under which social costs and benefits would have been factored into business decisions. They found that the result would have been a smaller increase in profits and an oil field lifetime of 10 years.

Fisher and Kaiser now plan to refine the presentation into a paper for a scholarly journal. "It's perfect for a professional paper for the same reason it's perfect for a senior thesis," Kaiser said. "It uses economic theory to show the cost to society of the wrong property-rights structure." *Information courtesy of Gettysburg College Public Relations*

Sophomore Conducts Research for Department of Energy

Tanya Ostapenko of Allentown, a sophomore at Gettysburg College, was awarded the Department of Energy's Summer Undergraduate Laboratory Internship (SULI). The program, designed to help future generations of physicists gain practical experience in a laboratory environment, places students in paid internships in science and engineering at any of several Department of Energy facilities.

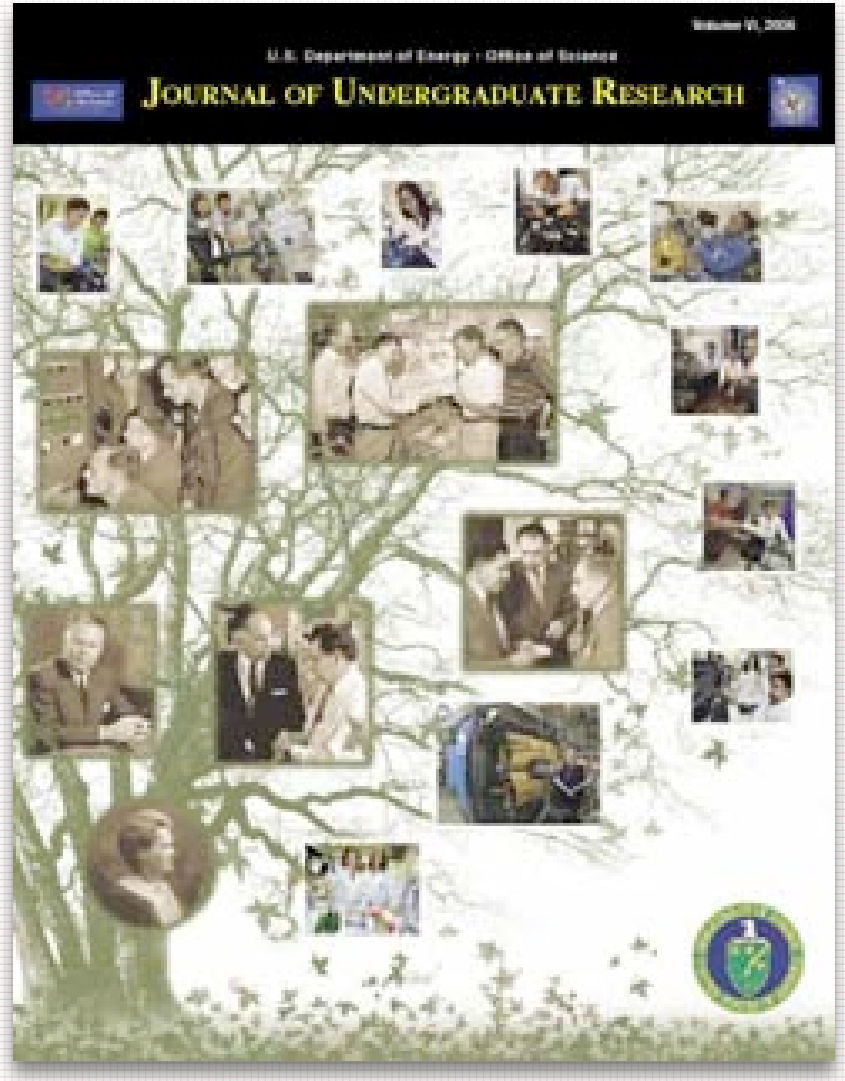
A mathematics and physics double major at Gettysburg, Ostapenko spent the summer conducting research at Thomas Jefferson National Accelerator Facility, or Jefferson Lab, in Newport News, Va. Jefferson Lab probes the nucleus of the atom to learn more about the quark structure of matter, giving scientists a unique and unprecedented probe to study quarks, the particles that make up protons and neutrons in the atom's nucleus.

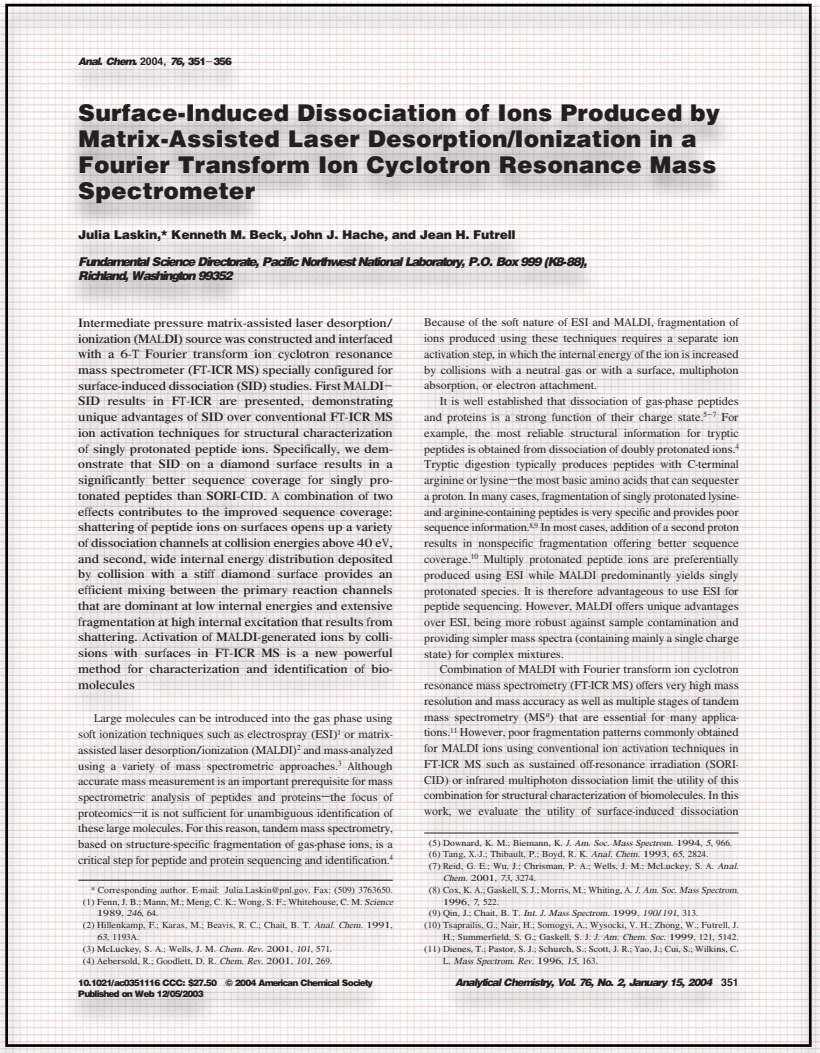
Ostapenko conducted research in the area of pion decay. Pions decay into electrons, positrons and gamma rays via electromagnetic interactions. Experiments involving scattering of particles from pion decay contain a number of uncertainties that can lead to unexpected results. Ostapenko is finding, from a list of possible outside interactions and wild cards, the possible deviation under each circumstance. "I'm giving them their margin for error," she explains. *Information courtesy of Gettysburg College Public Relations*

If you would like to get connected with talented students such as the ones featured above, contact the Center for Career Development at 717-337-6616 or career@gettysburg.edu. We can assist you with your internship and employment recruitment needs."

Enjoy the upcoming holiday season!

Success Stories





Anal. Chem. 2004, *76*, 351−356

Surface-Induced Dissociation of Ions Produced by Matrix-Assisted Laser Desorption/Ionization in a Fourier Transform Ion Cyclotron Resonance Mass Spectrometer

Julia Laskin,* Kenneth M. Beck, John J. Hache, and Jean H. Futrell

Fundamental Science Directorate, Pacific Northwest National Laboratory, P.O. Box 999 (K8-88), Richland, Washington 99352

Intermediate pressure matrix-assisted laser desorption/ionization (MALDI) source was constructed and interfaced with a 6-T Fourier transform ion cyclotron resonance mass spectrometer (FT-ICR MS) specially configured for surface-induced dissociation (SID) studies. First MALDI−SID results in FT-ICR are presented, demonstrating unique advantages of SID over conventional FT-ICR MS ion activation techniques for structural characterization of singly protonated peptide ions. Specifically, we demonstrate that SID on a diamond surface results in a significantly better sequence coverage for singly protonated peptides than SORI-CID. A combination of two effects contributes to the improved sequence coverage: shattering of peptide ions on surfaces opens up a variety of dissociation channels at collision energies above 40 eV, and second, wide internal energy distribution deposited by collision with a stiff diamond surface provides an efficient mixing between the primary reaction channels that are dominant at low internal energies and extensive fragmentation at high internal excitation that results from shattering. Activation of MALDI-generated ions by collisions with surfaces in FT-ICR MS is a new powerful method for characterization and identification of biomolecules

Large molecules can be introduced into the gas phase using soft ionization techniques such as electrospray (ESI)[1] or matrix-assisted laser desorption/ionization (MALDI)[2] and mass-analyzed using a variety of mass spectrometric approaches.[3] Although accurate mass measurement is an important prerequisite for mass spectrometric analysis of peptides and proteins—the focus of proteomics—it is not sufficient for unambiguous identification of these large molecules. For this reason, tandem mass spectrometry, based on structure-specific fragmentation of gas-phase ions, is a critical step for peptide and protein sequencing and identification.[4]

Because of the soft nature of ESI and MALDI, fragmentation of ions produced using these techniques requires a separate ion activation step, in which the internal energy of the ion is increased by collisions with a neutral gas or with a surface, multiphoton absorption, or electron attachment.

It is well established that dissociation of gas-phase peptides and proteins is a strong function of their charge state.[5−7] For example, the most reliable structural information for tryptic peptides is obtained from dissociation of doubly protonated ions.[4] Tryptic digestion typically produces peptides with C-terminal arginine or lysine—the most basic amino acids that can sequester a proton. In many cases, fragmentation of singly protonated lysine- and arginine-containing peptides is very specific and provides poor sequence information.[8,9] In most cases, addition of a second proton results in nonspecific fragmentation offering better sequence coverage.[10] Multiply protonated peptide ions are preferentially produced using ESI while MALDI predominantly yields singly protonated species. It is therefore advantageous to use ESI for peptide sequencing. However, MALDI offers unique advantages over ESI, being more robust against sample contamination and providing simpler mass spectra (containing mainly a single charge state) for complex mixtures.

Combination of MALDI with Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) offers very high mass resolution and mass accuracy as well as multiple stages of tandem mass spectrometry (MS^n) that are essential for many applications.[11] However, poor fragmentation patterns commonly obtained for MALDI ions using conventional ion activation techniques in FT-ICR MS such as sustained off-resonance irradiation (SORI-CID) or infrared multiphoton dissociation limit the utility of this combination for structural characterization of biomolecules. In this work, we evaluate the utility of surface-induced dissociation

* Corresponding author. E-mail: Julia.Laskin@pnl.gov. Fax: (509) 3763650.

(1) Fenn, J. B.; Mann, M.; Meng, C. K.; Wong, S. F.; Whitehouse, C. M. *Science* 1989, *246*, 64.
(2) Hillenkamp, F.; Karas, M.; Beavis, R. C.; Chait, B. T. *Anal. Chem.* 1991, *63*, 1193A.
(3) McLuckey, S. A.; Wells, J. M. *Chem. Rev.* 2001, *101*, 571.
(4) Aebersold, R.; Goodlett, D. R. *Chem. Rev.* 2001, *101*, 269.
(5) Downard, K. M.; Biemann, K. *J. Am. Soc. Mass Spectrom.* 1994, *5*, 966.
(6) Tang, X.J.; Thibault, P.; Boyd, R. K. *Anal. Chem.* 1993, *65*, 2824.
(7) Reid, G. E.; Wu, J.; Chrisman, P. A.; Wells, J. M.; McLuckey, S. A. *Anal. Chem.* 2001, *73*, 3274.
(8) Cox, K. A.; Gaskell, S. J.; Morris, M.; Whiting, A. *J. Am. Soc. Mass Spectrom.* 1996, *7*, 522.
(9) Qin, J.; Chait, B. T. *Int. J. Mass Spectrom.* 1999, *190/191*, 313.
(10) Tsaprailis, G.; Nair, H.; Somogyi, A.; Wysocki, V. H.; Zhong, W.; Futrell, J. H.; Summerfield, S. G.; Gaskell, S. J. *J. Am. Chem. Soc.* 1999, 121, 5142.
(11) Dienes, T.; Pastor, S. J.; Schurch, S.; Scott, J. R.; Yao, J.; Cui, S.; Wilkins, C. L. *Mass Spectrom. Rev.* 1996, *15*, 163.

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Undergraduate Program Impact: SULI Retention

- 50% of students whose initial educational goals ended with a BS, intend to pursue a graduate degree after completing a SULI experience.
- 23% of students who selected MS/MA as their intended terminal degree on the entry survey selected a higher-level graduate degree on the exit survey.

Community College Institute In Science and Technology (CCI)

Career training internship in all branches of science, mathematics, and engineering.

Community College students enter the scientific work force and expand career options

Award Winning Program for College Students

Semi-Finalist for Harvard Award "Innovations in American Government"

Recognized by the White House Initiative on Educational Excellence for Hispanic Americans as an exemplary program.

Pre-Service Teachers Internship (PST)

Don't just teach science, math, or technology: Do it!

- Goal is to enhance the nation's supply of proficient K-12 science, mathematics, and technology teachers
- 10-week summer research internship at 10 National laboratories
- Master Teacher
  - Organizes and presents enrichment activities
  - Works with the student's mentor & laboratory education staff
  - Assists students in transferring laboratory experience to classroom

Undergraduate Programs: Student Selection

- Selection by Laboratory (Summer term)
  - Each laboratory's educational staff can access applications that listed their location as the first choice by Feb. 1
  - Education staff and potential mentors review these applications and forward offers by March 1
  - On March 1, laboratory staff is provided access to applications that listed their location as their first or second choice
  - Applications are reviewed and offers are extended by April 1

Undergraduate Research Internships: Impact and Effectiveness

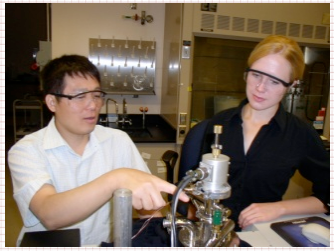
- WDTS undergraduate internship programs address all six of WDTS' Critical Indicators of Success, but are especially directed toward the Retention Indicator.
- WDTS' undergraduate programs address the need to direct more U. S. citizens into graduate study in science and engineering fields. The Retention Indicator measures the programs' effectiveness in achieving this goal.
- A second major goal of the undergraduate programs is to increase the content knowledge of students.

Faculty & Student Teams (FaST)

FY11: 70 Faculty

FY10: 60 Faculty

Goal: Link under-represented undergraduate faculty and students to the DOE research enterprise



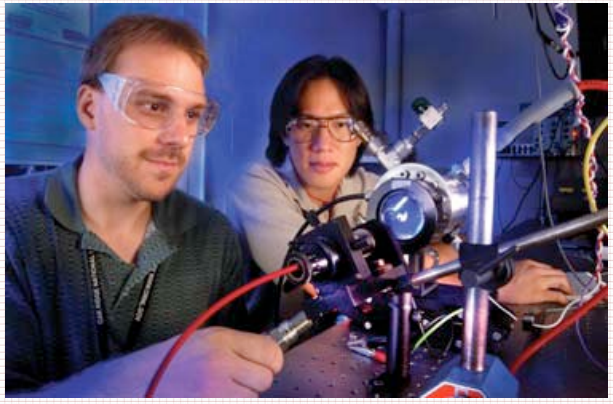
Program History/Considerations:

- Created in FY 2001 with 15 participants and 4 laboratories
- Laboratories recruit participants to meet their specific research needs
- Students are funded through WDTS undergraduate internship programs
- Evaluation is done on participant attitudes and progress; graduation is when they receive an independent grant

Faculty and Student Teams (FaST)

- The primary goal of the FaST program is to increase the Diversity of the STEM workforce by including institutions of higher learning that historically have not participated in the DOE/SC research effort.
  - FaST adds to the Diversity of the workforce by expanding opportunities for under-represented faculty to participate in DOE/SC research programs.
- FaST increases Content Knowledge by providing participants with skills and capabilities that increase their competitiveness in research.
- FaST increases Leverage by encouraging university/laboratory research partnerships and the development of proposals for follow-on funding.
- FaST is a highly Leveraged program with significant support from the National Science Foundation.

DOE SC Graduate Fellowship (SCGF)



Goal: A total of 400 Fellows in 3 cohorts, steady state

Program History/Considerations:

- Created in FY 2010; established 1st SC-wide graduate fellowships program
- FY10: $5M (plus $4.167 ARRA), 150 Fellows
- FY11: $15M (plus $4.167 ARRA), 310 Fellows in 2 cohorts
- Evaluation of Fellows attitudes and long-term career progress is part of program plan

The Nation's future STEM leaders are in this incredibly talented pool of young scientists, engineers, and mathematicians

DOE Academies Creating Teacher Scientists (DOE ACTS)

FY11: 270 participants in 3 cohorts

FY10: 230 in 2 cohorts

Goal: Create a cadre of educator leaders who can bring exciting DOE science to the classroom through DOE national laboratory research experiences and mentorship with master teachers and scientists

Program History/Considerations:

- Created in FY 2004; previous educator program was discontinued in 1996
- ACTS is closely aligned with DOE laboratory capabilities, Administration priorities, and current academic literature on STEM professional development and classroom learning
- Evaluation of educator career progress, creation of DOE-focused learning objects, and student achievement assessment are in process

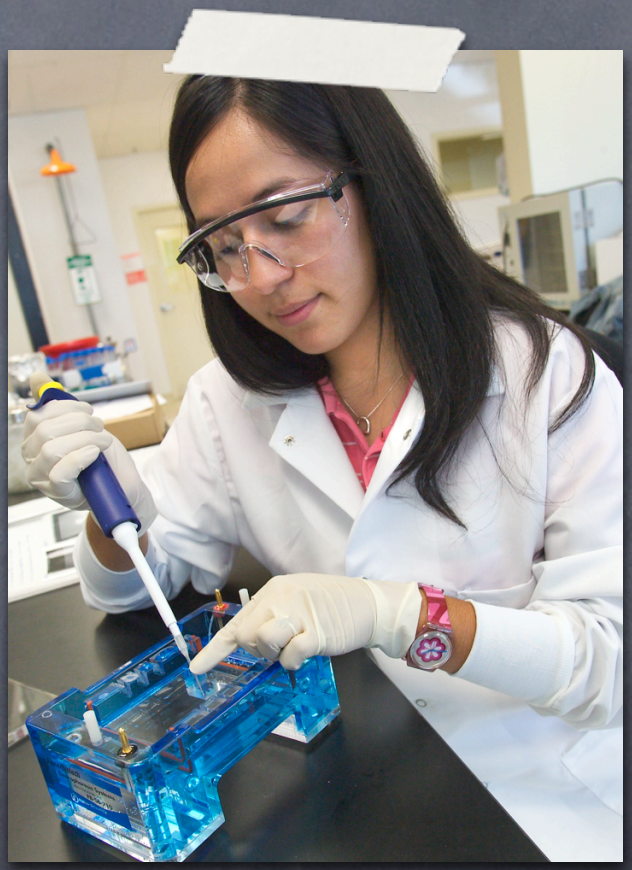
So...
What's in it for me
(or my institution?)

Advantages (The "Take")

- Free set of hands
- Eager, trainable, students
- Generally are independent workers with initiative

Caveat (The "Give")

- The first year for a Mentor is the most difficult.
- It takes effort to find a place for student interns and to integrate their work into the research effort on such a short time frame.
- But after that first one...



Other reasons You might consider

(more "Give")

- Who is going to replace you when you are gone?
- You can help prepare the next generation of creative inventors and innovators.
- You can play a direct role in placing & keeping the U.S. at the forefront of world-wide STEM endeavors.
- You can make a real difference in the lives of others.

Questions & Contact

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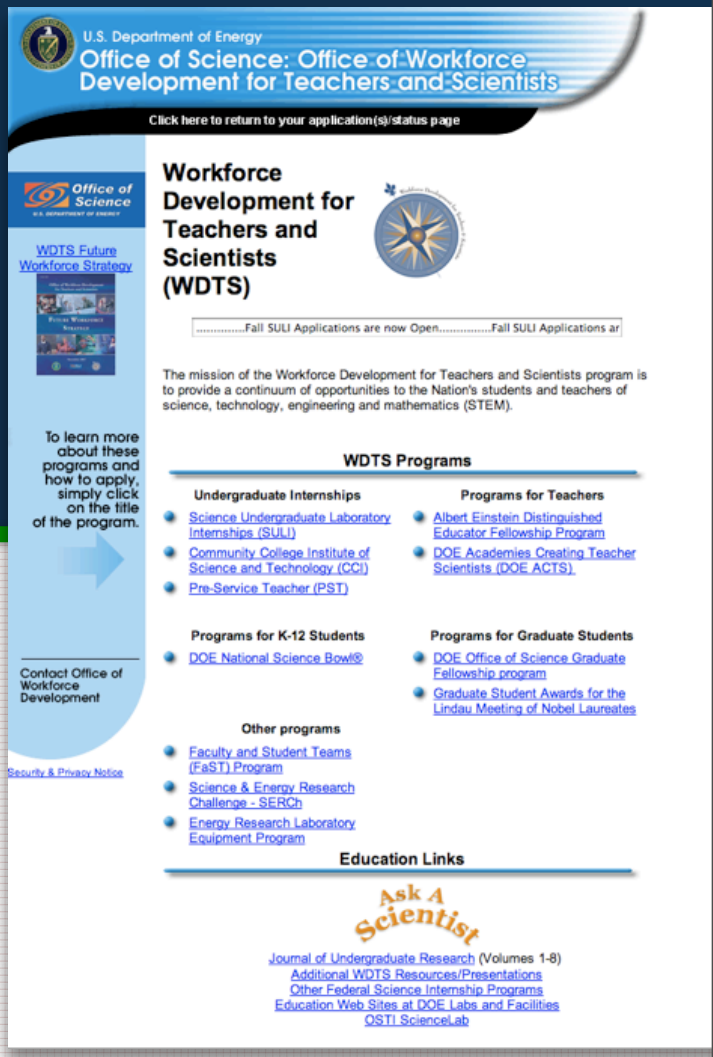

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