

FALL 2011

MAUREEN PALMER, Editor/Public Affairs Manager



Team USA 2011 (From left to right) Charles H. Du, University of Chicago Laboratory Schools, Chicago, IL; Rebecca Shi, West Windsor-Plainsboro High School South, West Windsor, NJ; Chelsea Voss, Cupertino High School, Cupertino, CA; Shulin Ye, Texas Academy of Mathematics and Science, Denton, TX

4 Gold Medals, #1 Team in the World, and #1 Individual Score in the World!

USA Biology Olympiad and the International Biology Olympiad

Team USA 2011 returned from the prestigious International Biology Olympiad (IBO) in Taiwan with 4 Gold Medals, named #1 Team in the World, and a team member garnered the top Individual Score in the World. Rebecca Shi (West Windsor, NJ), Charles Du (Chicago, IL), Chelsea Voss (Cupertino, CA), and Shulin Ye (Denton, TX) honored this nation. For the first time, a female U.S. team member, Rebecca Shi, placed first in the world in individual score at the renowned science competition.

The four high school scholars competed in practical assessments and theory examinations against students from 58 nations. Team USA excelled in the practical assessment of hands-on laboratory skills inclusive of dissection, ecological investigation, and protein and DNA analyses.

"The Center is proud of the success of Team USA 2011 members and their ability to honor the United States with their outstanding academic performance in the global competition," said Joann DiGennaro, President of the Center for Excellence in Education. "This is a remarkable achievement for U.S. academics."

Team USA 2011 adds to the victorious record of success for the USA Biology Olympiad. Every U.S. team member has medaled in the international competition since 2003, bringing home twenty-seven gold, seven silver and two bronze medals.

Team USA 2011 was accompanied by Coaches Kathy Frame, Director of USA Biology Olympiad and Special Projects at the Center for Excellence in Education, and Dr. Scott Mills, Animal and Sciences Professor at Purdue University. Korean Air provided travel for the U.S. delegation.

Supporters of the USA Biology Olympiad include Amedisys, Biogen Idec Foundation, Bio-Rad, Genentech, Korean Air, LabCorp, National Association of Biology Teachers, Northern Virginia Electric Cooperative, Pearson, Purdue University, Psychemedics Corporation, Texas Instruments, Vanguard Research, Inc., and Ward's Natural Science. ♦

Physics Taught Before Biology???

It has been said that physics explains the fundamental mechanisms of other sciences and creates new research opportunities in biology, chemistry and mathematics. Physics has a profound impact on the advances of new technologies that have come from theoretical breakthroughs.

A topic of conversation among stakeholders in education is whether physics should be taught in high school before other sciences. The Center posed this question to physicists.



Dr. J. Michael McQuade is Senior Vice President, Science and Technology, for United Technologies Corporation. His responsibilities include overseeing

UTC Power and UTC's Research Center and providing strategic oversight and guidance for research and development activities throughout the corporation. Dr. McQuade earned his Ph. D., M.S., and B.S. degrees in physics from Carnegie Mellon University. He is a member of CEE's Board of Trustees.



Dr. Douglas E. Himberger is Senior Vice President and Director of Security, Energy, and the Environment, National Opinion Research Center

(NORC) at the University of Chicago. He is responsible for new business in the area of security and is responsible for expanding the organization's current portfolio of work in the areas of energy and the environment. Dr. Himberger earned a B.S. degree in Physics from Nebraska Wesleyan University, and M.S. and Ph.D. degrees in physics from Georgetown University. He is a member of CEE's Board of Trustees.



Dr. Jennifer Hoffman is an Associate Professor at Harvard in the Department of Physics. Her research is about scanning probe microscopy of correlated

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Spotlight on CEE Board of Trustees



Congresswoman Susan Davis

Congresswoman Susan Davis, Representative for California's 53rd Congressional District, currently serving her 6th term, recently joined the Center for Excellence in Education's Board of Trustees. Congresswoman Davis is known for legislating as a bipartisan consensus-builder in education, health care, election reform, military families and veterans' support.

"I will look forward to working with my distinguished colleagues and the Center to reach this nation's goal of taking students and teachers to the next level of educational achievement for this country's competitive leadership," said Congresswoman Davis.



Arvind Parthasarathi

It is CEE's pleasure to have Arvind Parthasarathi, RSI'90, as trustee on CEE's Board. He is Senior

Vice President and General Manager at Informatica Corporation (Nasdaq: INFA), responsible for defining, delivering, marketing and managing the company's master data management and identity resolution solutions.

Prior to joining Informatica, Mr. Parthasarathi was Director of Product Management at i2 Technologies where he managed the radio frequency identification (RFID), product information

management, supply chain integration, and supply chain event management product lines. He began his career in Product Management at Oracle Corporation.

Mr. Parthasarathi received his master's degree in computer science from the Massachusetts Institute of Technology (MIT) and a bachelor's degree in computer science from the Indian Institute of Technology.



Ron Hohaus

The Center welcomes Ron Hohaus, RSI'85, to its Board of Trustees. He is the Chief Financial Officer for

Summit Entertainment, responsible for financial operations, human resources, information technology and investor relations. He played a key role in raising over \$1 billion in equity and debt financing to position Summit Entertainment as a worldwide production and distribution studio. Before his Summit days, Mr. Hohaus was at Marvel Studios.

Mr. Hohaus received his MBA in Finance and Decision Processes from the Wharton School of Business. He graduated with a Bachelor of Arts degree with honors from the University of Virginia as an Echols Scholar. His Interdisciplinary major was concentrated in Computer Science, Philosophy, U.S. Government and Economics. ♦

CEE Sponsors Financing Start-Ups Panel

Research Science Institute Alumni gathered at the Massachusetts Institute of Technology (MIT) Stata Center for a discussion on Planning and Financing Start-Up businesses. The late spring event included a stellar panel:

- Dr. Tom Leighton – Co-Founder/Chief Scientist at Akamai Technologies, Inc.
- Marc Horowitz – Engineer at Facebook; RSI '87
- Matt DeBergalis – Chairman and Founder of ActBlue; RSI '94

Alumni learned first hand about how to take an idea to patent and how to strategize for taking the idea to market.

Panelists agreed that you cannot have a start-up and control every aspect of it. They emphasized the need to have people with business experience to handle the day-to-day administration to position the business for growth. Each suggested sticking to what you know best to accentuate the business and then hiring really good people to support your goals. All emphasized that the bottom line is you might have really great ideas, but not know enough about "business" to attract investors. ♦

Left to right: Matt DeBergalis, RSI '94, Marc Horowitz RSI '87, and Dr. Tom Leighton, Co-Founder, of Akamai Technologies, Inc.



McDonnell Lauds Launch of Center for Excellence in Education's National Lab Skills Initiative in Virginia

Governor Bob McDonnell of Virginia announced the expansion of the Center for Excellence in Education's National Lab Skills Initiative (NLSI) in the Commonwealth at a bill signing in Richmond to help increase college degree attainment in Virginia. The expansion of NLSI supports the goal of Governor McDonnell's Commission on Higher Education Reform, Innovation and Investment and the 'Top Jobs' legislation to better align higher education and business leaders in increasing degree access for jobs of the future.

Governor McDonnell reported to several hundred guests that the National Lab Skills Initiative will:

- Provide a clearinghouse of content rich programming to urban and rural underserved teachers
- Host "Share-a-thons" to work with Virginia teachers to share and develop lab activities that are cost effective, replicable, scalable, and may involve public/private partnerships in Abingdon, Manassas, Richmond and Hampton

- Disseminate cost-effective lab activities developed by teachers for teachers in Virginia.

The Governor thanked the Center's Virginia partners on NLSI which include George Mason University, ExxonMobil, Micron Foundation, Southwest Virginia Higher Education Center, Systemic Solutions at Northern Virginia Community College the Virginia Space Grant Consortium and others. ♦

RSI 2011 - Hosted Seventy-Seven Top Achieving Scholars at MIT



Research Science Institute 2011 faculty and students



Daniel Pollack, voted "Rickoid of the Year" by his peers with Joann DiGennaro, President of CEE.

This year marks the 28th annual Research Science Institute (RSI) hosted at the Massachusetts Institute of Technology (MIT). Sponsoring 47 top-achieving U.S. scholars, including three Department of Defense Education Activity (DoDEA) students, and 30 scholars from other nations, RSI continued to demonstrate excellence and rigor. Represented countries were Australia, Bulgaria, China, Greece, Israel, Lebanon, Qatar, Saudi Arabia, Singapore, Spain and Sweden.

RSI is offered cost free to top-achieving high school students in science and mathematics with private and public financial donations. International students are supported by their respective nations, organizations or companies in their country. The highly revered RSI program allows young scholars to experience the world of graduate level research to propel them to new levels of achievement and academic success.

The RSI Selection Committee, comprised of distinguished STEM professionals, met in McLean, Virginia in late February of 2011 to select students chosen on the basis of academic merit, demonstrated leadership, and scientific achievement. Selection also was based on standardized test scores, high school grades, essay submissions, teacher recommendations, and demonstrated potential to become future leaders in STEM.

At the Massachusetts Institute of Technology (MIT), scholars participate in college-level classes. Mentors are scientists and researchers at MIT, Harvard University, Northeastern University, Boston College, Boston University, and corporations in the Boston-Cambridge corridor.

The Center's RSI program remains rich in tradition. Scholars experience a rigorous academic schedule including professional lectures, research design, oral and written communication skills, evening guest lecture series, and individualized research projects.

RSI 2011 was led by Dr. Andrew Charman, RSI '86 alumnus and Lecturer in the Department of Physics at University of California Berkeley. RSI scholars were taught by:

- Dr. Steven Leeb of the Massachusetts Institute of Technology - Engineering

"Science, like democracy, is not built on hopes of human perfection but on an acknowledgement of human fallibility."

~ Benjamin Franklin

- Dr. Forrest Michael, RSI '90 of the University of Washington - Chemistry
- Mr. Lance Rhoades of the University of Washington - Humanities
- Ms. Rebekah Rogers, RSI '01 of Harvard University - Biology
- Dr. Christopher Skinner, RSI '88 of Princeton University - Math
- Dr. Sam Waldman, RSI '94 of the Massachusetts Institute of Technology - Physics

RSI scholars were also treated to the highly acclaimed RSI Distinguished Lecture Series featuring prominent STEM representatives and Nobel Laureates. The session also inaugurated a much requested economic component to the curriculum.

At the conclusion of the RSI program, Rickoids demonstrated their work through academic papers and offered their findings to their peers and a panel of judges. Commended for top written papers were Anni Cai (Singapore), Amy Chyao (Texas), Peter Lu (Illinois), Todor Markov (Bulgaria), and Debra Van Egeren (Michigan). Celebrated for oral presentations were Sam Backwell (Australia), Anni Cai (Singapore), Sitan Chen (Georgia), Hadass Inbar (Israel), and Matthew Rauen (Pennsylvania). The title "Rickoid of the Year" went to Daniel Pollack (New York). He was selected by his fellow classmates for individual scholarship and RSI community participation. ♦

Anni Cai of Singapore received top written paper and top oral presentation awards for her research, "Determining the amino acids involved in inhibition of PDE4B by structurally-diverse compounds."



"Western Civilization was transformed by two great movements: the economic changes which we sum up as the rise of capitalism, and the changes in knowledge which we sum up as the scientific movement."

~ George Norman Clark

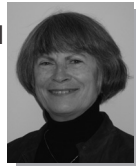
CEE's National Lab Skills Initiative

For over three decades, the Center for Excellence in Education (CEE) has been at the forefront of advancing science, technology, engineering and math (STEM) education. CEE has adhered to its legacy of pioneering programs to nurture young scholars and to assure this nation's competitive future. CEE announces the National Lab Skills Initiative to assure a future talented and diverse U.S. workforce in STEM. Through teachers, NLSI will support secondary school students' readiness for the STEM workforce of the future.

NLSI offers high school biology teachers and students, especially at urban and rural schools, a clearinghouse containing an online compilation of laboratory programs including models for the classroom, after school, summer, and virtual and/or year-round learning experiences in selected states. NLSI also publishes laboratory activities online which are hands-on or virtual, cost-effective, replicable, scalable, and containing an assessment component and potential public/private partnerships.

CEE rolled out the National Lab Skills Initiative in Virginia in July and will inaugurate the Initiative in Indiana before taking it nationwide to Illinois, California, Texas, Alabama, Connecticut, Massachusetts, Mississippi, Montana, New Jersey, South Carolina, and then moving on to other U.S. states.

Charles Farmer, National Lab Skills Initiative Manager, is leading this Initiative. He brings to CEE his senior management experience in the private sector, along with expertise in administering large scale organizational roll outs. Kathy Frame, Director of CEE's USA Biology Olympiad and Special Programs, will co-lead the Share-a-thons in all targeted states and will continue her outreach efforts to teachers.



NLSI provides an online Clearinghouse, which gives a listing of scientific resources and programs for educators in targeted states, allowing them more effective tools to engage their students. Teachers can use the Clearinghouse to supplement their classroom activities and to identify additional enrichment programs for their students.



Teachers of the National Lab Skills Initiative Share-a-thon, held at the Southwest Virginia Higher Education Center in Abingdon, Virginia.

NLSI also will host Share-a-thons which are professional development sessions in targeted states at which approximately twenty-five teachers per session will meet to present laboratory activities. Share-a-thons are the central component of NLSI and will allow teachers to present lab activities that they have developed. NLSI will then work with teachers to prepare their laboratory activities for online publication on the Science Education Resource Center (SERC) website at Carleton College.

Rather than bringing teachers to one central location for professional development, NLSI brings these experiences to the regions of urban and rural teachers in these states. CEE schedules the Share-a-thons in collaboration with the needs of partnering organizations in targeted states to serve diverse communities.

CEE will inaugurate the NLSI Share-a-thons in the cities of Abingdon, Manassas, Norfolk and Richmond, Virginia in 2011. The Center's Virginia NLSI partners include George Mason University, ExxonMobil, Micron Foundation, Southwest Virginia Higher Education Center, Systemic Solutions at Northern Virginia Community College and the Virginia Space Grant Consortium.

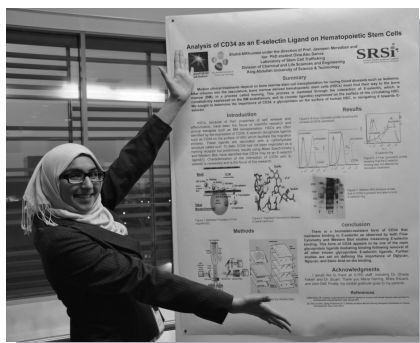
The Indiana State Museum-Center for Science and Culture, 21st Century Scholars, Purdue University, Purdue University Science Express and Purdue University Science Outreach Office are partnering with CEE in Indiana. The Center plans Share-a-thons in the cities of Indianapolis, Gary, Logansport and West Lafayette, Indiana.

"The NLSI clearinghouse, combined with teacher Share-a-thons, are critical to ensuring effective laboratory skill instruction," said Charles Farmer, Manager of the National Lab Skills Initiative. "NLSI is designed to integrate effective science pedagogy and professional development strategies. By providing teachers with laboratory skill tools and training, they in turn will prepare students for postsecondary education studies whereby they become this nation's future STEM professionals."

The Center's National Lab Skills Initiative will serve a minimum of 87,500 students by the end of 2012 through Share-a-thons, and even more through the National Lab Skills Initiative's Clearinghouse. ♦

"The progress of science offers to increase the comforts, enlarge the understanding, and improve the morality of mankind."

~ Thomas Jefferson



S-RSI participant celebrates her completed research at the poster session presentation for VIP's and guests at KAUST.



S-RSI student using state-of-the-art equipment at KAUST.

Inauguration – Saudi Research Science Institute (S-RSI)

The inauguration of the Saudi Research Science Institute (S-RSI) took place this summer at King Abdullah University of Science and Technology (KAUST). Saudi Aramco, KAUST and Mawhiba are partners with the Center for Excellence in Education for the S-RSI program.

The Saudi Research Science Institute is the first science, technology, engineering and mathematics (STEM) summer program for high school students in Saudi Arabia to include top-achieving math and science females. The Co-Directors of S-RSI were Dr. William T. Stuart and Dr. Ghadah O. Fakieh. Dr. Stuart previously directed CEE's first Research Science Institute (RSI) and inaugurated the Center's USA Biology Olympiad (USABO).

Twenty-five students participated in S-RSI. Candidacy was assessed on intellectual merit and leadership potential in science, technology, engineering and mathematics by a selection committee consisting of educators, scientists, KAUST and RSI staff.

S-RSI students mastered each step of the research process from literature review to the design, execution and analysis of an original experiment. The student projects led to the submission of a scientific paper and a plenary session where they reported their findings.

Students of S-RSI are now, part of the RSI Alumni network that will continue throughout their academic and professional careers. In fact, S-RSI students participated in a Skype chat with RSI students at MIT this summer. They will be encouraged to stay in contact with each other through social, academic and professional activities. ♦

Where Are They Now?

- Jud Bowman, RSI '98, is the Founder & CEO of Appia and former Co-Founder & CTO of Motricity (Nasdaq: MOTR).
- Dr. Jeremy Buhler, RSI'91, is Associate Professor at Washington University in St. Louis, Missouri, serving as interim Department Chair for Computer Science and Engineering. Dr. Buhler has secondary appointments in the Departments of Biology and Genetics.
- Dr. Sara Goldhaber-Fiebert, RSI'92, is a faculty member at the Stanford Medical School.
- Dr. Eric Rains, RSI'86, is a Professor of Mathematics at California Institute of Technology.
- Jonathan Kemp, RSI'91, is a Science Operations Specialist at the Gemini Observatory in Hilo, Hawaii.
- Scott Duke Kominers, RSI '04 is a Postdoctoral Research Scholar at the Milton Friedman Institute for Research in Economics at the University of Chicago.
- Shishir Mehrotra, RSI '95, is the Director of Product Management at Google, responsible for YouTube Product Management.
- Dr. Rinaa Punglia, RSI'89, is Assistant Professor of Radiation Oncology, Harvard Medical School. She also is a member of the Department of Radiation Oncology at Dana-Farber Cancer Institute and Brigham and Women's Hospital, Boston, MA.
- Dr. Oliver Rando, RSI'90, is Associate Professor of Biochemistry and Molecular Pharmacology at the University of Massachusetts Medical School.
- David Schairer, RSI '89, is the Chief Technology Officer and co-founder of Trapit. He is responsible for steering the company's technology strategy and leading the engineering organization in the development and delivery of all Trapit products, services and infrastructure.
- Dr. Prasanna (Sonny) Tambe, RSI'91, is Assistant Professor of Information, Operations and Management Sciences of the Leonard N. Stern School of Business at NYU.

"A man never mounts so high as when he knows not where he is going."

~ Oliver Cromwell

USA Biology Olympiad

The USA Biology Olympiad (USABO), in collaboration with Purdue University, was held June 5th through June 17th on Purdue's campus. Twelve male and eight female students were chosen from nearly 10,500 students for their scores on the USABO open and semifinal exams.

The USABO, a progressive academic competition, starts with an Open Exam administered nationwide to interested high school students at participating schools. The Open Exam is a 50-minute/ 50-multiple choice question exam designed to identify the top 10% of biology students in the nation. The next round, the Semifinal Exam, is a two-hour multiple choice and short answer exam that continues to heavily focus on application-based inquiry. From the Semifinal Exam, the top 20 students in the nation are invited to join USABO faculty at the National Finals training session at Purdue to compete for U.S. medals and the four places on Team USA to represent the United States at the International Biology Olympiad (IBO).

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Research Science Initiative in India

This summer marked the second year for the Research Science Initiative in Chennai, India. The intensive four-week program was held at the Indian Institute of Technology Madras (IITM) in collaboration with the PSBB Millennium Group of Schools and the Center for Excellence in Education. All secondary schools in Chennai were invited to nominate outstanding math and science students for the program, of which 30 young scholars were chosen.

The program took place from May 4th - June 10th. At the closing ceremony, Joann DiGennaro, CEE's President, gave the keynote address and presented awards with Dr. (Mrs.) Y.G. Parthasarathy, Dean and Director of the PSBB Group of schools.

The Research Science Initiative in India offered a plethora of activities apart from academic lectures by eminent scholars in the fields of math, computer science, physics, chemistry, biology, biotech-

nology and other scientific fields. Professors from IITM, The Institute of Mathematical Sciences, Chennai Mathematical Institute, Anna University and Sastra University (Thanjavur) taught various topics ranging from Scaling in Physics to Probability in Math.

RSI India scholars visited Shanmugam Precision Forging (SPF) and were shown how high precision instruments were used and maintained. The RSI group went to BHEL, Trichy, one of the top 10 providers of electrical equipment to the world. Students toured the labs of Sastra University and The Hindu Printing Press. The RSI India scholars also attended the Ramanujan Mathematical Institute at Kumbakonam. They also visited the labs at IITM, Anna University, M.S. Swaminathan Research Foundation and Saint-Gobain Glass India, Ltd.



Joann DiGennaro, President of CEE, presenting a Research Science Initiative India 2011 Certificate to an alumna.

RSI India 2011 alumni have the opportunity to network with USA-RSI, China, Bulgaria and Saudi Arabia scholars through an active alumni network. They are now part of a tight community of approximately 2,000 alumni around the world. This networking component is underwritten by the Caterpillar Foundation. ♦

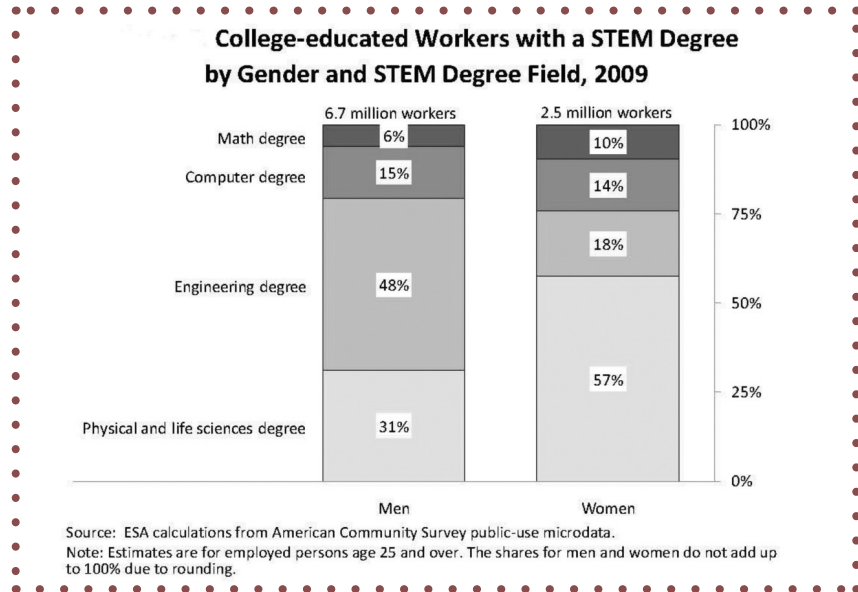
USA Biology Olympiad (from page 5)

The twenty National Finalists were welcomed by France A. Cordova, President of Purdue University. She acknowledged her love of science, highlighted her role as the youngest person and first woman to hold the position of NASA Chief Scientist, and encouraged their pursuit and study of biology.

During their two weeks at Purdue, the finalists participated in intensive theoretical and practical tutorials with experts in the fields of cellular biology, microbiology, biotechnology, plant anatomy and physiology, animal anatomy and physiology, ethology, genetics and evolution, ecology, and biosystematics. The students also toured research laboratories in Discovery Park and elsewhere on campus.

At the USA Biology Olympiad Closing Ceremony, the Center for Excellence in Education and Purdue University named the four top-scoring students from the practical and theoretical exams. These students, known as Team USA, went onto win 4 gold medals at the 22nd IBO held in Taipei. ♦

The USA Biology Olympiad 2011 National Finalists on the "Boilermaker Special" at Purdue University



Senators Begich, Graham and Lieberman along with Congressmen Dold and Hultgren Address CEE Congressional Luncheon Attendees



Left to right: Joann DiGennaro, CEE President, Senator Lindsey Graham (SC), Emily Webb, Special Assistant for Education Office of Governor Bob McDonnell of Virginia, Gerard Robinson, Virginia Secretary of Education, and Ted Hack, Director of Government Relations, General Dynamics



J. Douglas Koelmay, Vice President of Community Relations, SAIC, makes welcoming remarks at luncheon.



Senator Mark Begich (AK) and Matthew Kilgore, RSI '10

The Hart Senate Office Building was the setting for the annual spring CEE Congressional Luncheon sponsored by SAIC for Supporters and Friends of the Center. The event celebrated the success of CEE's educational programs that assist the world's greatest young minds to pursue careers in science, technology, engineering, and mathematics (STEM).

The premier Research Science Institute (RSI), offered in partnership with the Massachusetts Institute of Technology (MIT), and the renowned USA Biology Olympiad (USABO), collaboratively sponsored with Purdue University, were proudly recognized at this event. CEE shined the spotlight on its newest program, the National Lab Skills Initiative (NLSI), to be rolled out in Virginia and Indiana before its inauguration nationwide. The National Lab Skills Initiative for urban and rural teachers is to assure a future talented and diverse U.S. workforce in STEM.

Joann DiGennaro, President of CEE, stated, "CEE has a 28-year record of achievement and will remain at the forefront of identifying and mentoring young scholars who will be the innovators and leaders of the U.S. in STEM. Now the Center will assist teachers too."

Senators Joseph Lieberman (CT) and Lindsey Graham (SC), CEE Honorary Board Members, addressed the Center's Congressional Luncheon attendees. Senator Mark Begich (AK), along with

Congressmen Randy Hultgren (IL) and Robert Dold (IL), also provided comments. Each emphasized how good education is the foundation to assure this nation's future. Senator Graham stated, "Great scientific minds come from U.S. schools, and it is a good investment to create a sound future full of possibilities."

In reflecting on CEE's earlier days, Senator Lieberman stated, "The Center for Excellence in Education is Admiral Rickover's Legacy. CEE has good programs and ideas and could not get where it is today without the support of its sponsors. His legacy will live on, thanks to all of you."

Mrs. Britta Kilgore, mother of RSI Alumnus Matthew Kilgore, addressed the audience and discussed how her son does not believe in any limitations from his disability of spinal muscular atrophy. Matthew Kilgore RSI '10 and Dr. Shamik Das RSI '94 spoke of the uniqueness of the Research Science Institute, laboratory research, lasting friendships with fellow classmates, fond memories, accomplishments, and future goals. Dr. Das was recognized by scientists this past spring for his breakthrough of developing a nanotech computer. ♦



Left to right: Dr. Shamit Das, RSI '94, The MITRE Corporation, receives Congratulations for his development of a nanotech computer processor from Senator Joseph Lieberman (CT) and Joann DiGennaro, CEE President.

RSI and USABO Alumni Accolades

- The Center congratulates Dr. Shamik Das RSI'94, Principal Engineer at The MITRE Corporation. He was recognized earlier this year for his breakthrough engineering of a nanotech computer processor.
- Congratulations to Mark Kantrowitz RSI'84 on his published work *Secrets to Winning a Scholarship*. This book provides insight to college students and their families about securing postsecondary funding and scholarships.
- CEE proudly congratulates Shiv Gaglani, RSI'05, Maria Elena De Obaldia, RSI'03, and Scott Kominers, RSI'04 on their book. *Success with Science: The Winners' Guide to High School Research*. It provides insight and information to encourage students and teachers to seek out lab-based experiences to enrich and strengthen their scientific acumen.
- CEE proudly recognizes Dr. Andrew Charman, RSI'86, is Director of the Research Science Institute 2011. He is

- a Lecturer in the Department of Physics at the University of California Berkeley.
- RSI'10 Alumni, Jao-Ke Chin-Lee, Alexander Gilbert, and Gabriel See have been named High School Inventors 2011 by *Popular Science Magazine*. Congratulations from CEE.
- RSI'10 Alumni, Lucy Chen and Andrew Das Sarma brought home silver medals from the International Physics Olympiad (IPO). Andrew's score ranked him as the second highest silver medalist. The Center takes pleasure in their success.
- Congratulations to Carey Tanner, RSI'97, on her new position as Senior Materials Engineer at InVisage in Menlo Park, CA.
- RSI'08 Alumnus, Sujay Tyle is a recipient of the \$100,000 award of the 20 Under 20 Thiel Fellows.
- The Center extends a round of congratulations to the following RSI'10 students that were named in the U.S. Presidential Scholars Program:
 - Kevin Hu*, Naperville Central High School in Naperville, Illinois
 - Christopher H. Cai, DuPont Manual Magnet High School in Louisville, Kentucky

- Rohit Agrawal, Wayzata High School in Plymouth, Minnesota
- Jan J. Gong, Garden City Senior High School in Garden City, New York
- Applause for Kay Aull, USABO'03 (Silver Medalist at the International Biology Olympiad) and USABO'04 (Gold Medalist at the International Biology Olympiad) Alumna for being featured in the Bio Hackers article in *Discover*.
- Kudos to Chelsea Voss, USABO'10 and '11 (2 Time Gold Medalist at the International Biology Olympiad) for making finalist category at the 2011 National Intel Talent Search.
- CEE congratulates Zach Frankel, USABO '07, who received a Rhodes Scholarship to Oxford to pursue a doctorate in Machine Learning.
- Congratulations to Alice Pang, USABO'08, President of the *Dartmouth Undergraduate Journal of Science (DUJS)*, the only official science publication on campus. *DUJS* was mentioned honorably by *Nature Magazine*. ♦

*An asterisk indicates a U.S. Presidential Scholar in the Arts.

Physics Taught Before Biology??? (from page 1)

electron systems with a focus on scanning tunneling microscopy of novel superconductors. Dr. Hoffman received her Ph.D. and M.A. in physics from the University of California. She received her B.A. from Harvard University and graduated magna cum laude with Highest Honors in physics. She is a RSI'94 alumna.



Dr. John Dell is Director, Modern physics and Optics Lab, at Thomas Jefferson High School for Science and Technology in Alexandria, Virginia.

Dr. Dell received his B.A. at Hampshire College, and a Master of Science and a Ph.D. from the University of Maryland. Dr. Dell served as the Research Science Institute (RSI) Director in 2002, and he helped to inaugurate CEE's Saudi Research Science Institute (S-RSI) in 2011.

Question: An important movement among educators is that of teaching high school physics before biology. Why would you support or not support this change?

Dr. J. Michael McQuade

As a broad foundation science, physics provides a grounding in observation, the basic scientific method and, importantly, an introduction to the role of mathematics as the basic

tool to codify the observed and hypothesized world. The emerging realization that these two pedagogic underpinnings – observational and mathematical methods – can be approached at multiple levels, depending on the maturity of the student, drives the physics first movement. Younger learners have a rich set of options and experiences to experiment, record and analyze with basic algebra and geometry, while building their competence to approach later disciplines – chemistry, biology, calculus-based physics - with a then more broadly developed set of skills.

A second driver for the move to delay biology is the fundamental transformation of what we now teach in the biology classroom. The last twenty years have seen biology move from being an observation-based, classification and phenomenological curriculum, to a highly technical experimental and theoretical physio- and chemico-biological science. This argues for a deeper background in physics and chemistry to allow a full appreciation for the fundamental processes being explored and taught in a modern molecular biology curriculum.

Dr. Jennifer Hoffman

From a scientific standpoint, it is a very good idea to move physics before biology. I can't think of a single physics'

concept which relies on knowledge of biology. But I can think of many biological concepts which rely on physical concepts. For example, thermal expansion and contraction, and buoyancy are important concepts to understand why the water in a lake turns over every fall and spring, oxygenating the water and allowing more life. Viscosity is important for understanding many of the fluid processes in cells and in the human body. Electromagnetic forces are important for understanding neuron function.

The main problem with moving physics before biology is math: the more math that the students know, the more rigorous the physics course can be. Since students are building on their math knowledge progressively throughout high school, there is an argument that a better physics course can be taught later in high school.

But I don't agree with the math argument. One should be able to teach a good physics course which emphasizes conceptual understanding. Most students walk into a physics course with so many crazy misconceptions. (For example, Prof. Eric Mazur has shown that most students

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Physics Taught Before Biology??? (from page 8)

Dr. Jennifer Hoffman (cont'd)

seem to believe that as long as an object is moving, there must be some force on that object in the direction of motion. It is believed that an object shot into the air has some upward force on it, as long as it is going up, then the upward force somehow "runs out" at some point, or gravity "takes over", so the object falls. (In fact, there is no upward force after the initial launch, and gravity is a constant downward force throughout the motion.) The first physics course could focus on a very conceptual understanding and try to undo all these crazy misconceptions. It would be great for the students' overall scientific reasoning ability to get the students thinking hard, and applying logic to physical scenarios, even if there is little math involved.

Furthermore, I think that much math can actually be taught better in a physical context. Many students have trouble with abstract math, but might do better if the math has physical context. Who wants to integrate just to find the volume of a sphere? It is more interesting to integrate to find out how far an accelerating object (e.g. a thrown baseball) will travel in a given time.

Dr. John Dell

The answer very much depends on what you mean by physics. The depth of treatment that is possible depends very much on the level of mathematical preparation of the students and what topics in physics are to be covered. The point here is that the OUTPUT of physical modeling of systems can be understood by students who understand high school algebra and geometry. In most high schools this would not generally be the case until the 3rd year. Alternatively, one could accelerate or build in a math component to a freshman course – which would require the creation of an integrated course in physics and math.

Dr. Douglas Himberger

I have a personal response on this question – I indeed took my high school physics class before biology, and had to move heaven and earth to get approval to do so! I'd like to say that I had great insight as to the reasons and logic behind this move, but that isn't true. I did, however, have a knowledgeable and supportive junior high school teacher who encouraged me to do this. In the end, I believe it made all the difference.

The points made about math were entirely true in my case – my physics teacher gave me additional help and support as the class progressed to fill in my gaps. Additionally, that physics teacher believed in what was then a non-traditional curriculum – emphasizing many of the points made by Drs. McQuade and Hoffman. This extra support and tailored experience from teachers and the school can't necessarily be expected on a regular basis – and could prove troublesome when scalability is considered.

That said, presenting physics to students first could open us to thinking more specifically about concepts, and could transform other science education – and even education writ large.

Question: Why do you think it is important to have students take physics courses in high school and at the university level?

Dr. J. Michael McQuade

Physics is a foundational science, and a comprehensive course of study provides the broad experimental, observational, analytical and mathematical tools necessary to pursue most effectively all other science and engineering courses of study.

Dr. Jennifer Hoffman

Physics is excellent for overall reasoning ability. If physics is taught at a conceptual level (instead of "plug and chug" into given formulas), it really forces students to practice thinking.

At the college level, a physics course for non-physics majors should emphasize real world skills like how to read a graph, how to interpret the statistical significance of a public news claim, etc. Students should understand conservation of energy and laws of thermodynamics in order to realize that using hydrogen fuel isn't going to magically solve our energy problems. It's just going to shift the pollution problem from one physical location (the streets) to another (the coal mines, or wherever the energy is originally extracted from the natural environment). Furthermore, there will be additional energy lost during the additional conversion step from some other form of energy to hydrogen energy; due to the laws of thermodynamics (entropy always increases, useful energy is always lost to heat during any conversion process).

Dr. John Dell

All of modern science and technology is based on manipulation of fundamen-

tal physical structures. The point is that machines or devices that perform in predictable ways are typically the results of applications of fundamental physical principles. These devices and machines provide the functional instrumental basis of other sciences.

Dr. Douglas Himberger

The "scientific method" is key to thinking critically – and though that paradigm can be taught in any and all of the sciences (biology, chemistry, and physics, to be sure), I believe physics approaches this in a way that is broadest in its application. Nearly every topic of current societal concern – energy, environment, security, and others – can often be addressed, quantified, and even analyzed through careful application of the techniques that are taught in high school physics, and elaborated (with greater rigor and underlying math) in college.

Question: What do you think are the exciting areas in physics for meeting future challenges in health, national security, environment, and energy?

Dr. J. Michael McQuade

Basic energy sciences – thermodynamics, fluid mechanics, transport phenomena and combustion - are critical to attacking our most urgent global challenge of how to create a world in which energy is secure and available while mitigating the historical and projected impacts of global warming and climate change. This is health, national security, environment, and energy all wrapped up into one.

Dr. Jennifer Hoffman

Energy storage (materials science of batteries, etc.) Energy transmission (superconductivity, etc.)

Dr. Douglas Himberger

Nanotechnologies, communication technologies, high-energy technologies – the list is endless, and every element exciting. All those areas mentioned by the others have their place on this list of fields of physics meeting our challenges ... and all offer promising advances. However, even more exciting are those that have yet to emerge. Who could have foreseen the role of semiconductors on our society and economy just a few decades ago? Who could have foreseen the impact that wireless communication would have on every aspect of our lives? Similar emerging fields in physics will have similar impact ... the exciting part will be seeing those developments spring from our young physicists! ♦

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The Center for Excellence in Education (CEE) nurtures careers of excellence and leadership in science, technology, engineering, and math (STEM) for academically talented high school and college students and encourages collaborations between and among leaders in the global community. Founded in 1983 by the late Admiral H.G. Rickover and Joann DiGennaro, President of the Center for Excellence in Education, the Center's programs help keep the United States competitive in science and technology. CEE challenges young scholars and assists them on a long-term basis to become the creators, inventors, scientists, and leaders of the 21st century.

As a private non-profit organization, CEE is not subject to federal and

state mandates or political pressures. All CEE programs are open to students and teachers regardless of race, color, creed, or economic background; the only criterion is academic excellence. CEE sponsors the Research Science Institute, the USA Biology Olympiad and the National Lab Skills Initiative.

To date, CEE has received funds from the U.S. Department of State, the U.S. Agency for International Development, the National Science Foundation, the United States Information Agency, the National Endowment for the Humanities, the National Security Agency, the Bureau of Indian Affairs, the Department of Agriculture, the Department of Energy, and the Department of Defense. Private individuals and corporations, however, provide most of CEE's funding. ♦