# Distribution Network Development (DND)

Robert J. Gordon
Senior Executive

# What is STEM Education?

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STEM =

**S**cience

**T**echnology

**E**ngineering

**M**athematics

***Cultivate widespread literacy in STEM education!***

# Global Demands, Local Challenges

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- The demand for STEM education and skills is global.
- Students around the world will have to meet common expectations.
- Yet, different countries and states face different challenges.

GOAL▸▸▸ **Balance LOCAL and GLOBAL Pressures.**

# Change the Equation - *CTEq*

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- ***CTEq*** was started by five Chief Operating Officers from some of the largest companies in the U.S. along with the Carnegie Corporation of NY.
- This is a non-profit, non-partisan CEO-led initiative to help solve America's innovation problem.
- CTEq is meant to answer the call of President Obama's Educate to "Innovate Campaign" to move the U.S. to the top of the Pack in Science and Math education over the next decade.
- CTEq will improve participation and performance of America's students in STEM education and,
- Mobilize the business community to improve the quality of STEM learning in the U.S.

# Role of CTEq

- Advocacy – build value to improve STEM policy objective.
- Provide research and guidance to member companies to improve investments in STEM education, how to use resources to make most impact.
- Developing rubric tool for analyzing, assessing STEM programs.
- STEM Design Principles: What makes a STEM program successful?
- Guide for best practices to strengthen employee engagement (Employee Engagement Committee).

# CTEq Goals

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- ***Great Teaching***

  Improve STEM teaching at all grade levels, with a larger and more diverse cadre of highly capable and inspirational STEM teachers.

- ***Inspired Learners***

  Inspire student appreciation and excitement for STEM programs and careers to increase success and achievement in school and opportunities for a collegiate education, especially among females and students of color.

- ***A Committed Nation***

  Achieve a sustained commitment to improving STEM education from business leaders, government officials, STEM educators and other stakeholders through innovation, communication, collaboration and data-based decision making.

# Hitachi & CTEq



- July 2010 <u>The origin of the relationship between Hitachi and CTEq</u>
  During a meeting between Presidential aide John Holdren and Hitachi Ltd. Chairman Kawamura, STEM education in the U.S. and Japan was discussed, and both acknowledged the importance of STEM education.
- April 2011 Hitachi becomes a member of CTEq
  One of two Japanese companies to become a member (Sony Pictures)

# Corporate Members

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1. A123 Systems
2. Accenture*
3. Activision Publishing
4. The Aerospace Corporation
5. Agilent Technologies
6. Alcoa
7. AMD Foundation
8. Amgen
9. Applied Materials
10. Archer Daniels Midland
11. AT & T
12. Aurora Flight Sciences
13. Autodesk
14. BAE Systems
15. Ball Aerospace & Technologies
16. Battelle
17. Baxter International
18. Bayer
19. Bechtel
20. Boeing
21. Cardinal Health
22. Carolina Biological
23. Caterpillar
24. Causecast
25. Celgene
26. Chevron
27. Cisco
28. Cognizant
29. Comcast
30. Corning
31. Dell
32. Deloitte
33. Dreamworks
34. Discovery Communications
35. Dow Chemical
36. DuPont
37. Eaton
38. E-line Media
39. Eli Lilly and Company
40. EMC2
41. Epic Games
42. Ernst & Young
43. ExxonMobil *
44. Facebook
45. Fluor
46. GE
47. GlaxoSmithKline
48. Google
49. Hitachi, Ltd
50. HP
51. Honeywell
52. IBM
53. Intel *
54. JP Morgan Chase
55. Knowledge Universe
56. Eastman Kodak *
57. LMI Aerospace
58. Lockheed Martin
59. McKinsey & Company
60. McKinstry
61. Medtronic
62. Merck
63. Microsoft
64. MITRE
65. Motorola
66. Nature Publishing Group
67. The Nielsen Company
68. Northrop Grumman
69. Oracle
70. PASCO Scientific
71. Prescription Solutions
72. PricewaterhouseCoopers
73. Procter & Gamble
74. Promethean
75. Qualcomm
76. RAND
77. Raytheon
78. Rockwell Collins
79. SAS
80. Sally Ride Science *
81. Samba Energy
82. Samsung
83. Schlumberger Limited
84. Sempra Energy
85. Siemens
86. SMART Tech
87. Sony Pictures
88. Space Systems / Loral
89. SpaceX
90. State Farm Insurance
91. Stellar Solutions
92. Symantec
93. Synopsys
94. Teradata
95. Texas Instruments
96. ThermoFisher Scientific
97. Time Warner Cable *
98. United Launch Alliance
99. United Space Alliance
100. United Technologies
101. Univision Communications
102. Verizon
103. Vernier Software & Technology
104. Viacom
105. Virgin Galactic
106. Wireless Generation
107. Xerox *

*** Founding/Board Member**

{CHANGE THE EQUATION™

# Why STEM Education

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## Facts & Figures

- **69%**: Share of U.S. students who graduated from high school with a regular diploma in four years (2006)
- **47%**: The share of black males who graduated from high school with a regular diploma in four years (2008)
- **43%**: Share of 2010 U.S. high school graduates who are ready for college-level math
- **29%**: Share of 2010 U.S. high school students who are ready for college-level science
- **25th out of 30**: The U.S. ranking in an international assessment of high schoolers' performance in math
- **3 million:** The projected shortage of workers with U.S. college degrees, associates or better, by 2018

# Obama Administration's STEM Initiative

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- November 2009, President Obama launches "Educate to Innovate" campaign for excellence in Science, Technology, Engineering & Math (STEM) education.
  - Nationwide effort to raise American students from the middle to the top of the pack in science and math
  - Five public-private partnerships to reach more than 10 million students over the next four years
  - $4.35 billion Race to the Top fund
  - Annual science fair at the White House
  - **Commitment by industry leaders to recruit corporate members to increase the scale, scope and impact of private-sector and philanthropic support for STEM**

- January 2011, President Obama declares the need for "Winning the Race to Educate Our Children" in his State of the Union Address.
  - Proposes in 2012 Budget for $100 million to prepare 100,000 STEM teachers over the next decade
  - Investments in K-12 and Undergraduate STEM education
  - Funding for 2,000 new Graduate Research Fellowships in 2012
  - Private-sector launch of Change the Equation, "a historic effort to scale up effective models for improving STEM education."

# Launch of Change the Equation

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*"Our success as a nation depends on strengthening America's role as the world's engine of discovery and innovation. I applaud **Change the Equation** for lending their resources, expertise, and their enthusiasm to the task of strengthening America's leadership in the 21st century by improving education in science, technology, engineering and math."*

President Obama, Sept. 16, 2010

# Why Nano Education?

- The NSF estimates that by the year 2015 there will be a need for **2 million workers** worldwide in the fields of nanoscience and nanotechnology.
  - An additional **5 million workers** will be needed in support areas for these fields
    - 0.8-0.9 million – US
    - 0.5-0.6 million – Japan
    - 0.3-0.4 million - EU
- By 2015, nanotechnology is expected to be a $2.0 trillion “industry”

# Weathering the Storm with STEM

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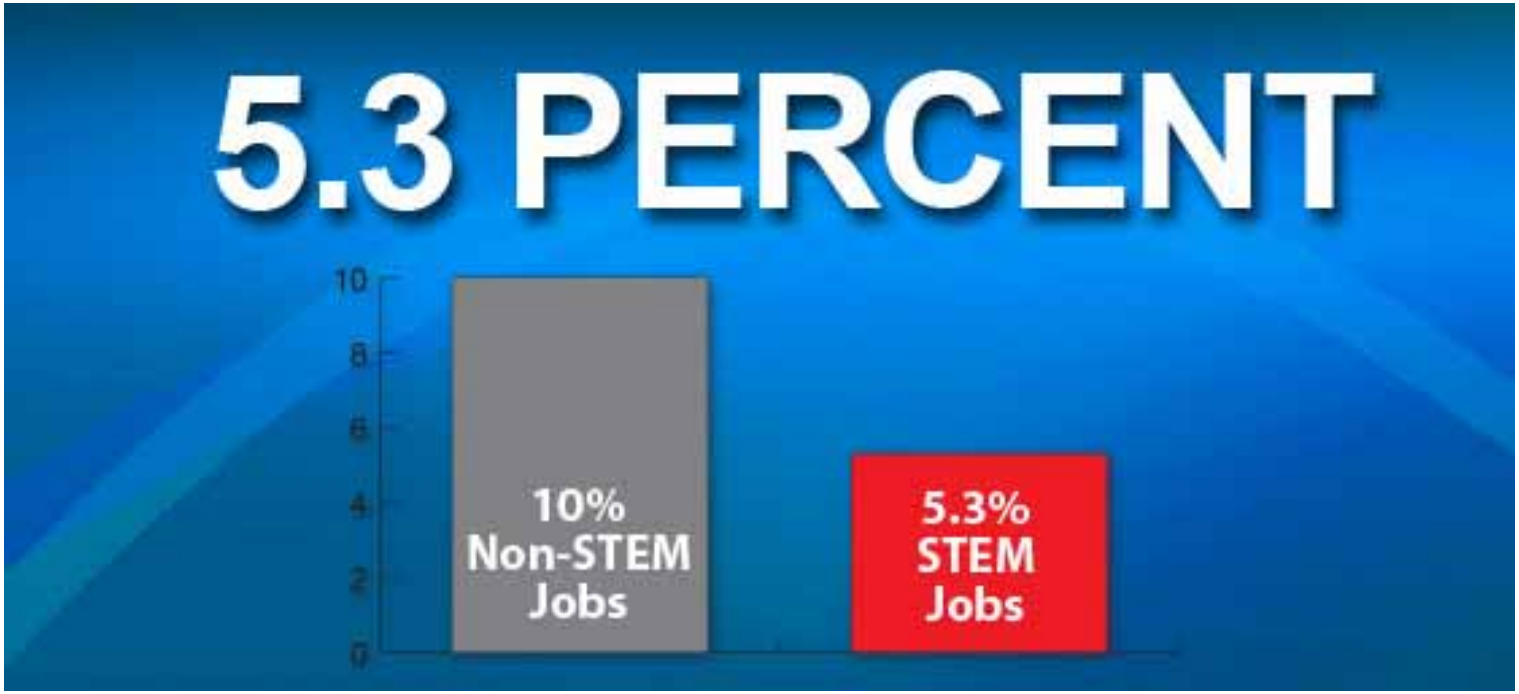


In 2010, U.S. unemployment in STEM was much lower than total unemployment.

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# The Workforce of the Future

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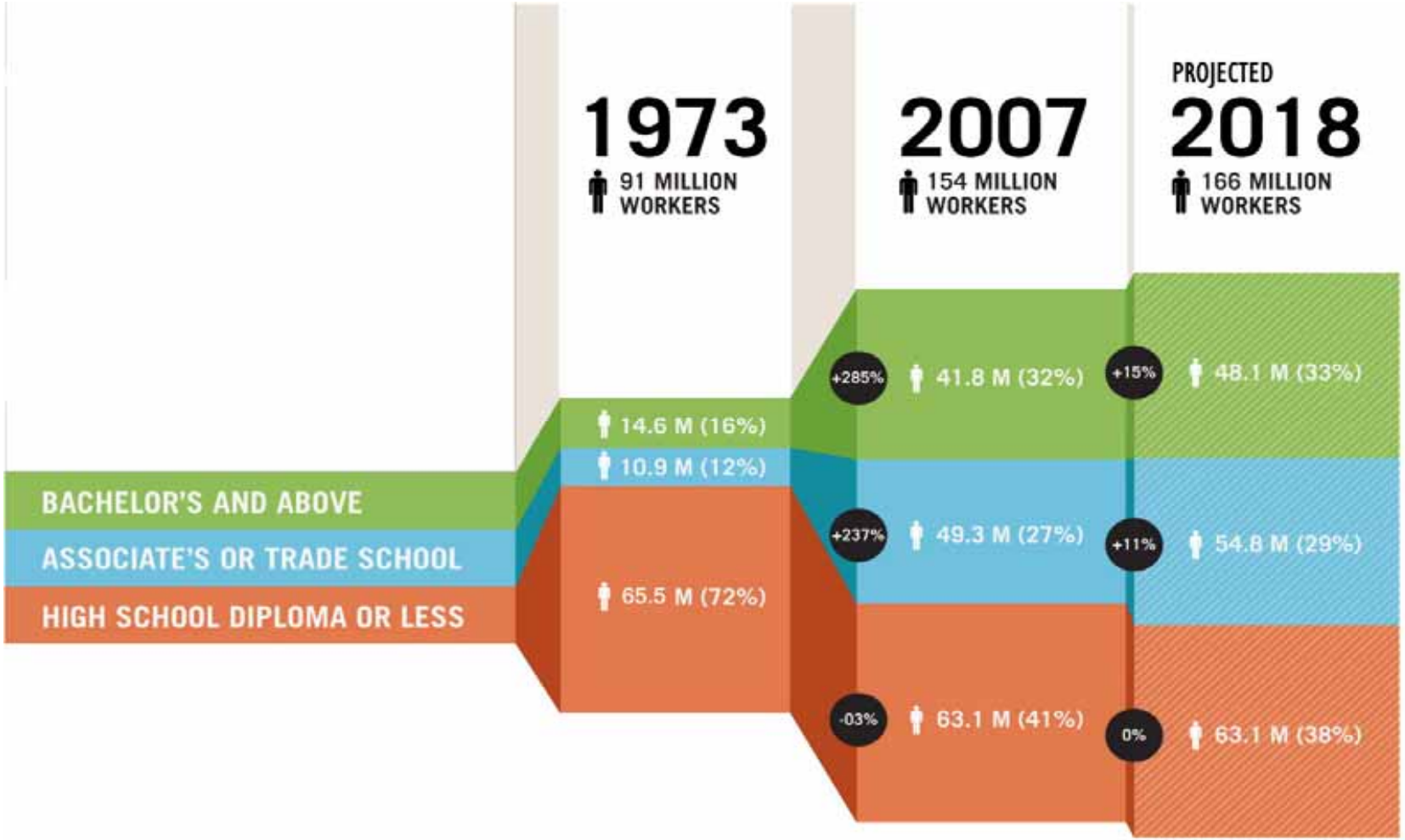


Source: Georgetown Center on Education &the Workforce, via GOOD Magazine, 2010

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# Growth in STEM Careers

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- 182,000 science and engineering workers in 1950; 5.5 million in 2007
- Annual growth rate of 6.2%, nearly 4 times the 1.6% growth rate for the total workforce
- Impending retirement of older workers may create even greater demand

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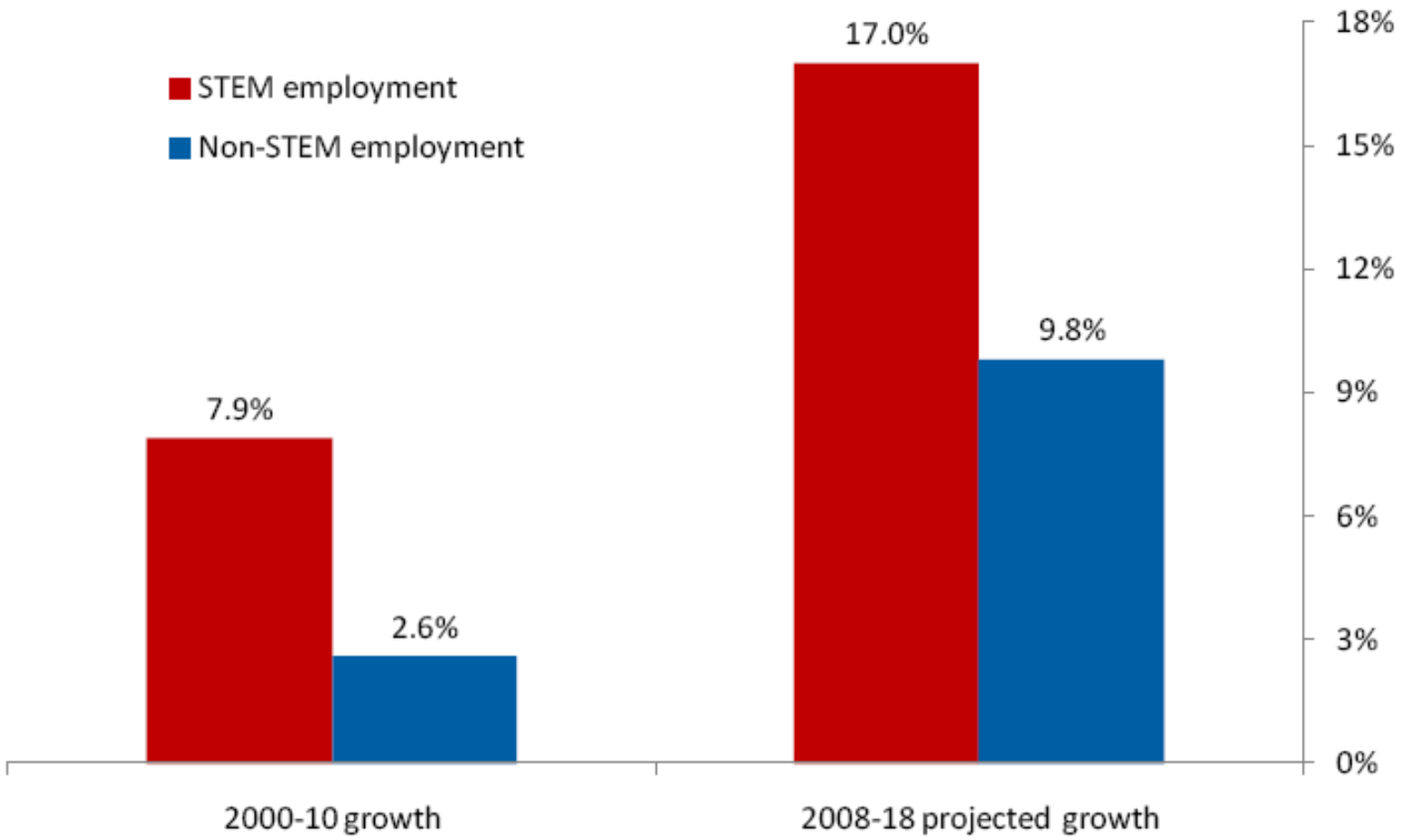
# Growth Will Accelerate




Source: ESA calculations using Current Population Survey public-use microdata and estimates from the Employment Projections Program of the Bureau of Labor Statistics.

# STEM Skills Pay Off at Every Level

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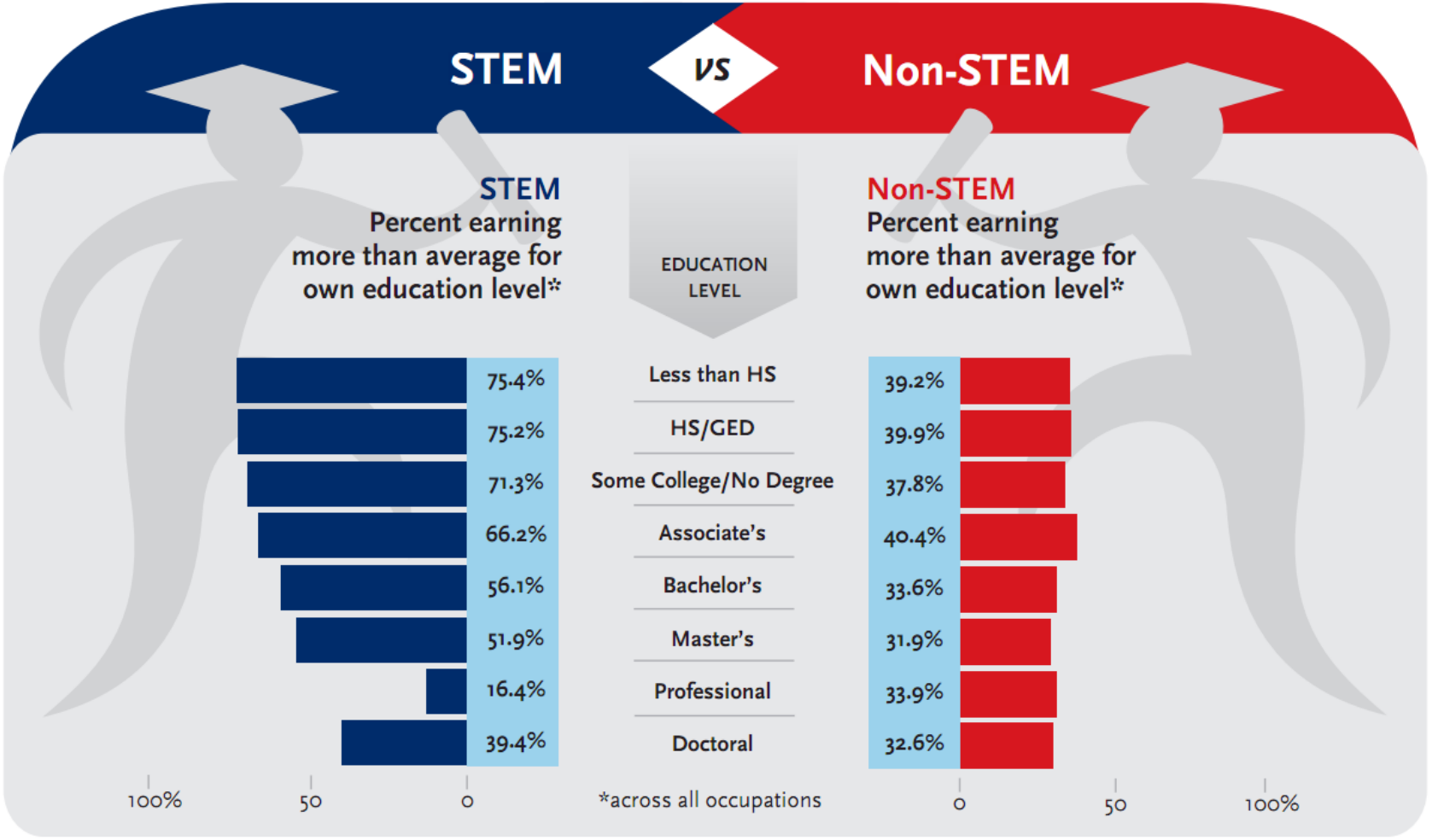


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# Power of Innovation

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Innovation is positively correlated to job growth:

- First-to-market advantage
  - Growth in exports leads to twice as many jobs as domestic sales
- Expansionary effect
  - Factory worker, advertiser, truck driver, salesperson and maintenance person all benefit from new inventions
- Higher productivity
  - Increased wages and lower prices

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# Half of U.S. Patents Awarded in Other Countries

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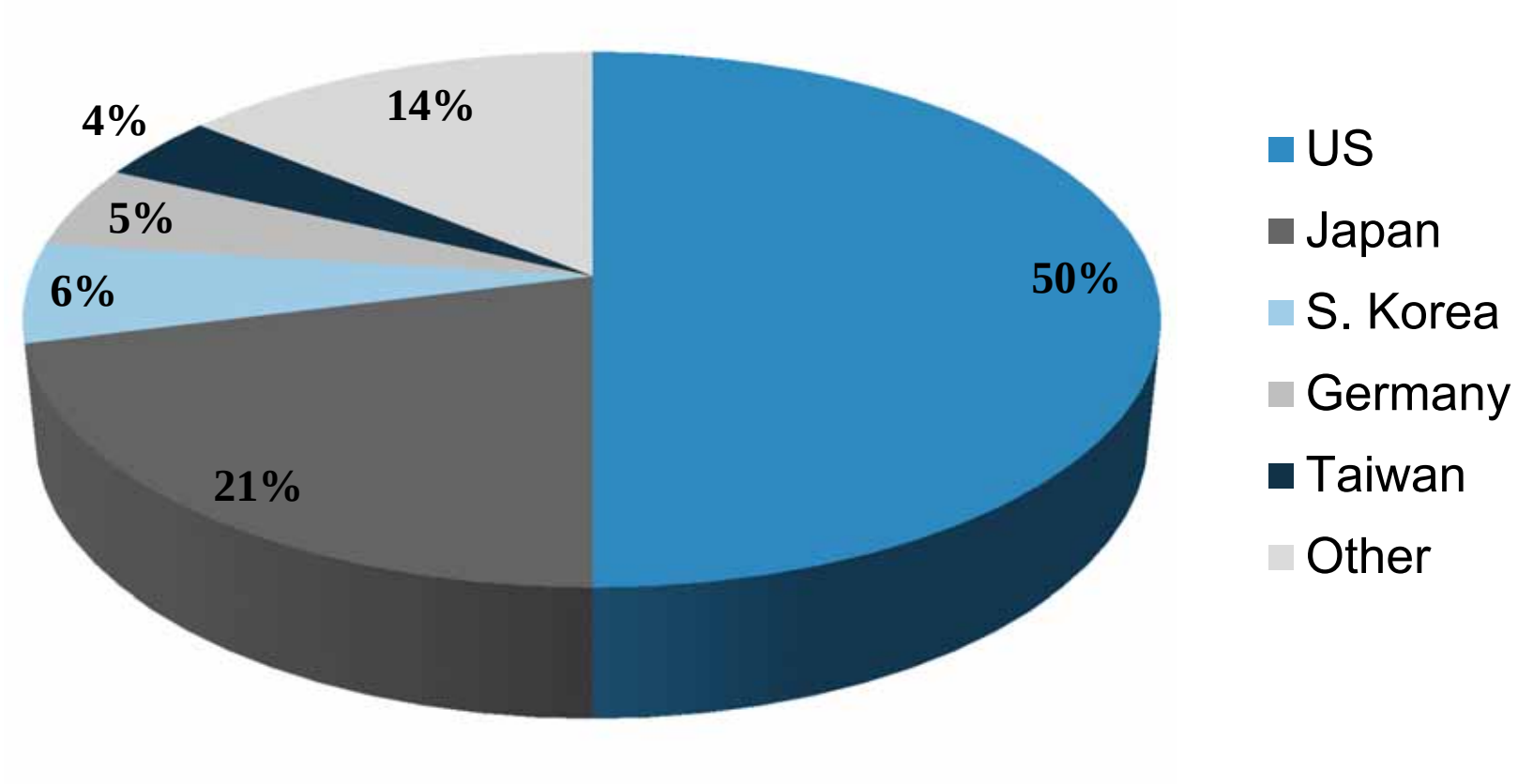


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# Math: Bringing Up the Rear


**17 developed nations** scored significantly ahead of us in 2009. Only **4 nations** scored significantly lower.

# Science: Falling Behind


**12 nations** scored significantly ahead of us, and **9** scored significantly lower

# Companies Play a Critical Role

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- They are at the nexus of global demands and local challenges.
- Companies can advocate for strong, consistent standards.
- More than ever, they can expose youth in their communities to exciting & challenging demands of the global economy.

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# Key Focus of CTEq

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1) Scalability
2) Sustainability
3) Emphasis on long term impact
4) Support of teachers in the STEM field
5) Encouragement of hands-on-learning
6) Address the needs of underrepresented groups: females, urban poor, “underrepresented people of color”

# Member Snapshots & Featured Programs

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Organizing program that contribute to the STEM education field:

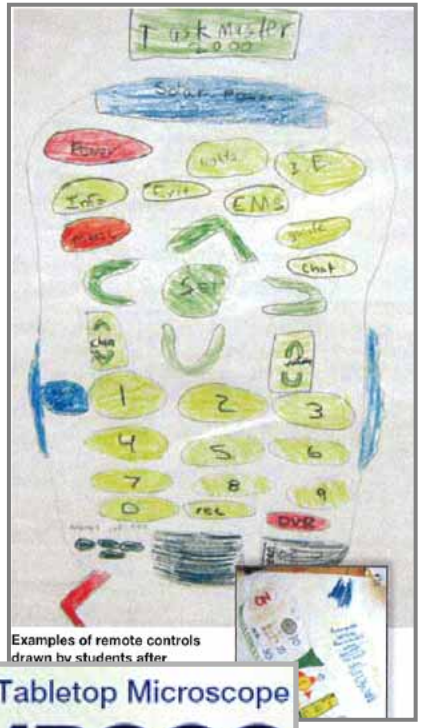
A. Snapshots
   - STEM Programs (organized programs, volunteer engagement, sponsorship)

B. Featured Programs
   - Independent evaluation of their effectiveness to improve STEM teaching and/or learning
   - Scalability

## Hitachi Celebrates Science

Southern CA CAC – Boys and Girls Club – California Science Center


## Universal Design




## Hitachi High-Technologies America (HTA)

TM3000 Tabletop Electron Microscope

# HTA Microscopy

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Desktop models available for loan to schools, universities, community colleges, tech institutes, science camps, etc.

HTA trains teachers on how to handle the machine, input samples and adjust magnification.


**Hitachi TM-3000**
*A Portable Scanning Electron Microscope*

# Why We Need Scanning Electron Microscopes?

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- Medicine
- Food Industry
- Materials Research
- Biology
- Geology
- Semiconductor Research
- Archaeology
- Aerospace Research
- Automotive Research
- Cosmetics
- Industrial
- Forensics
- Entomology
- Oceanography

# HTA Microscopy

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# HTA Microscopy

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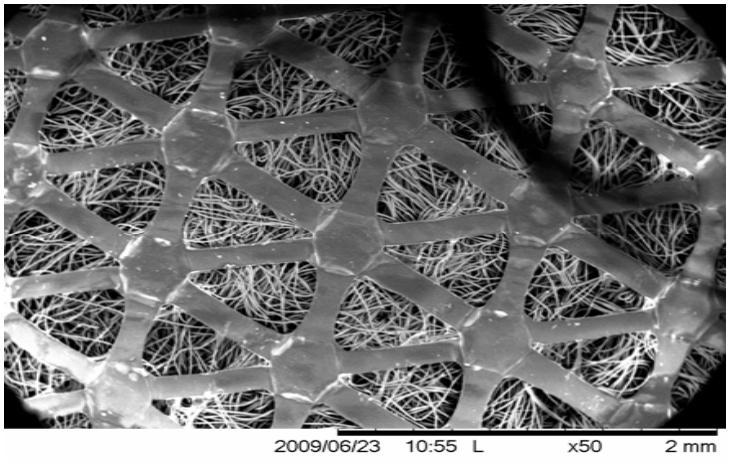
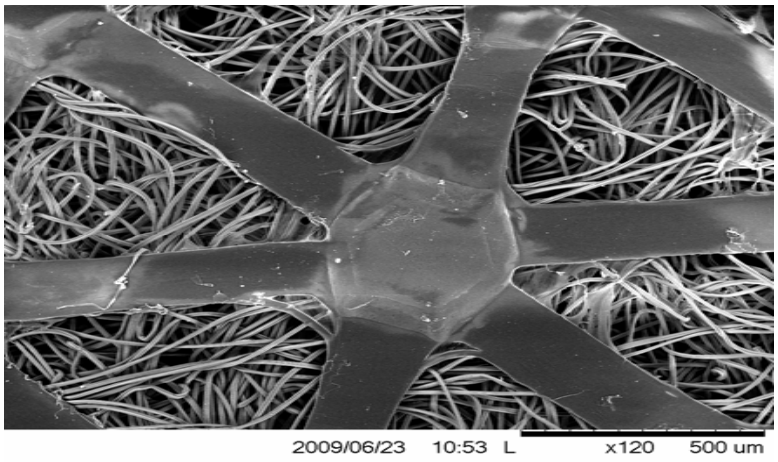
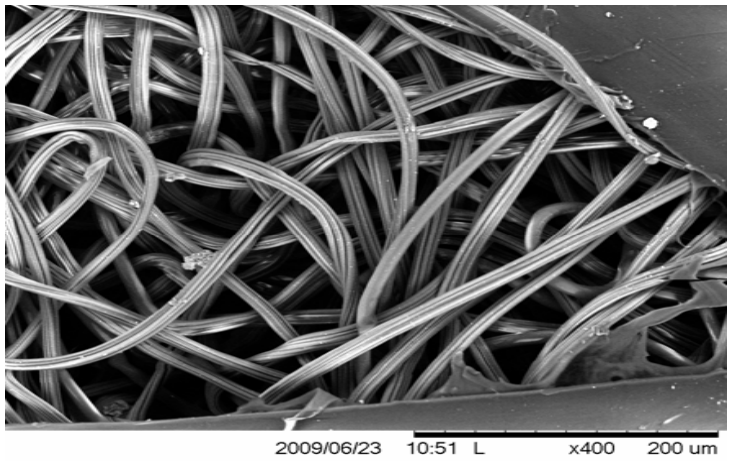
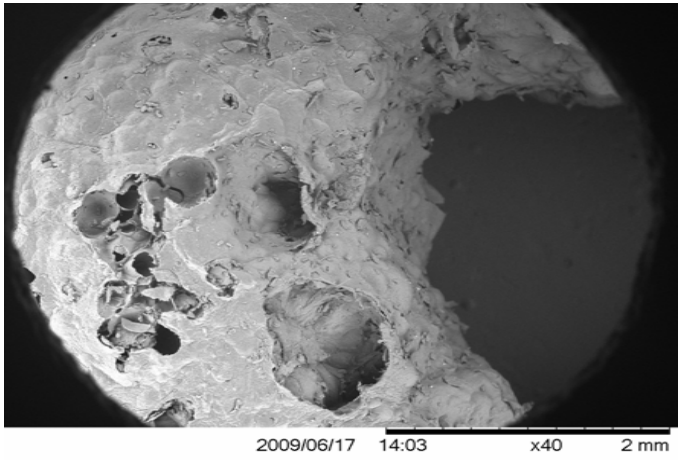
# Band-Aid

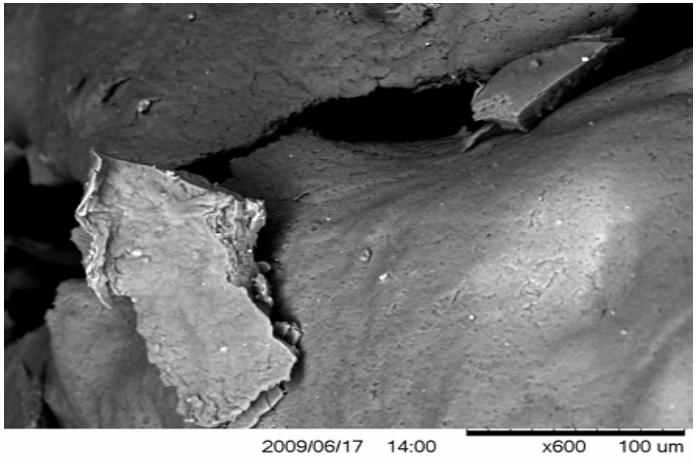


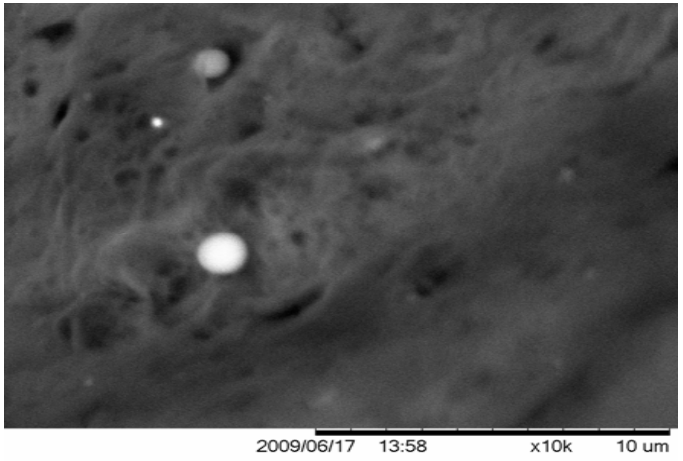



# Cheerio



# Eye shadow

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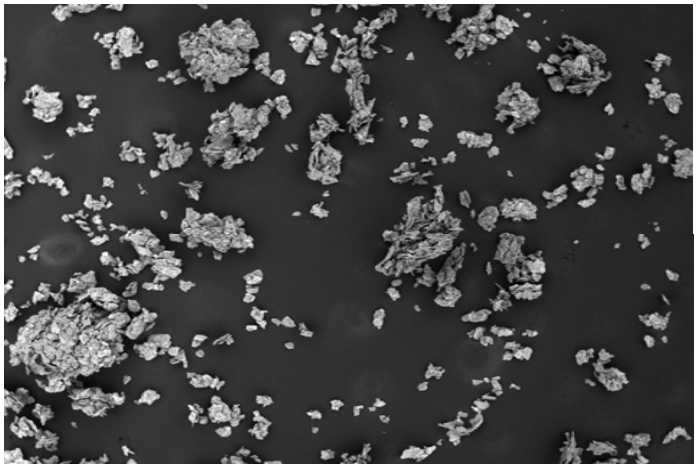

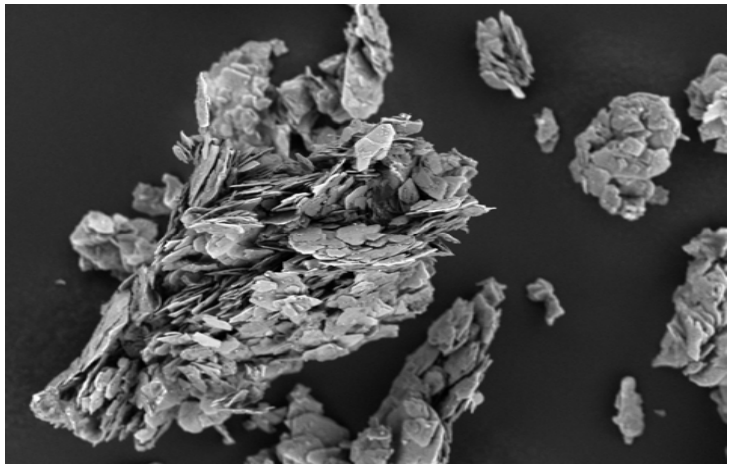

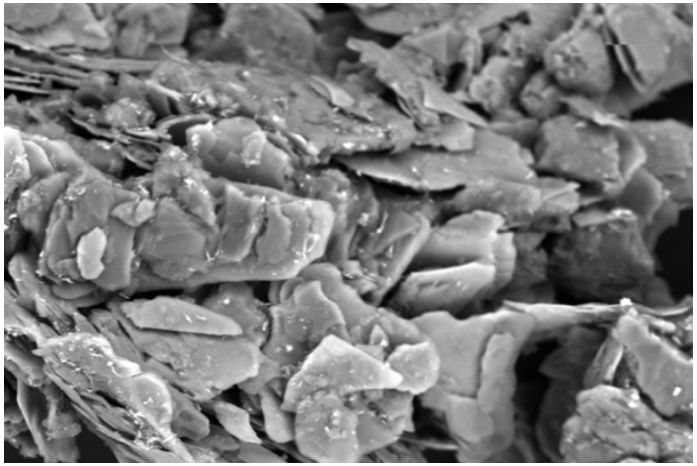

# Duke TIP Classroom

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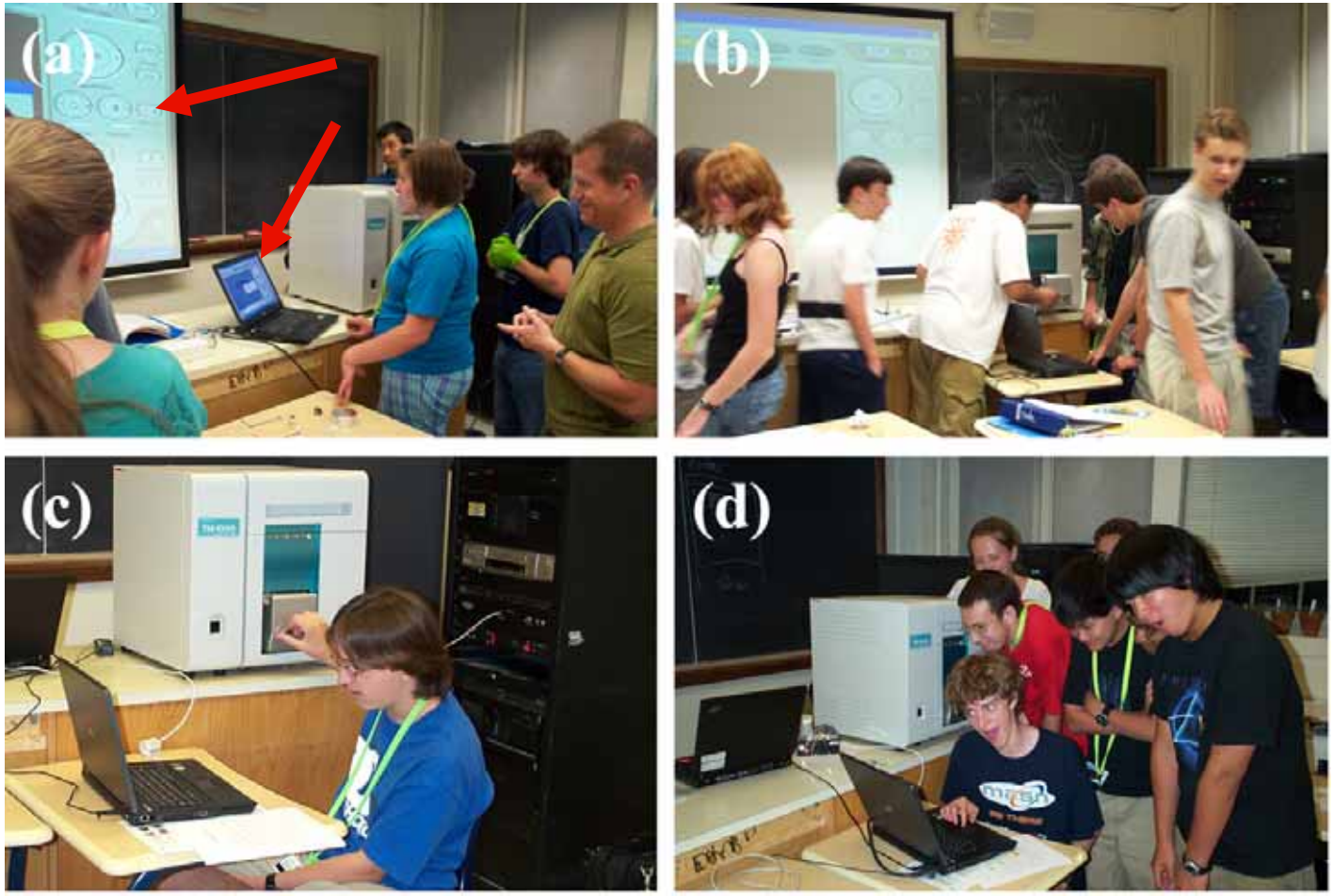
- LCD projector used to train entire class
- All students signed up for two 1/2hr SEM sessions
- Acquired 50x, 500x and 5000x of samples they chose



# 7 Steps of Science Inquiry

## 1) Choose a topic

general subject of inquiry

## 2) Develop a question

"If I make a change in X, what will happen to Y?"

## 3) Plan an investigation

think carefully about the sort of equipment and materials needed to investigate the research question

## 4) Predict an outcome

this is not a hypotheses

## 5) Experiment and observe

WRITE THINGS DOWN in lab notebook

## 6) Interpret results

tabulating, averaging, graphing


## 7) Communicate findings

poster, oral presentation

# Student SEM Power Point

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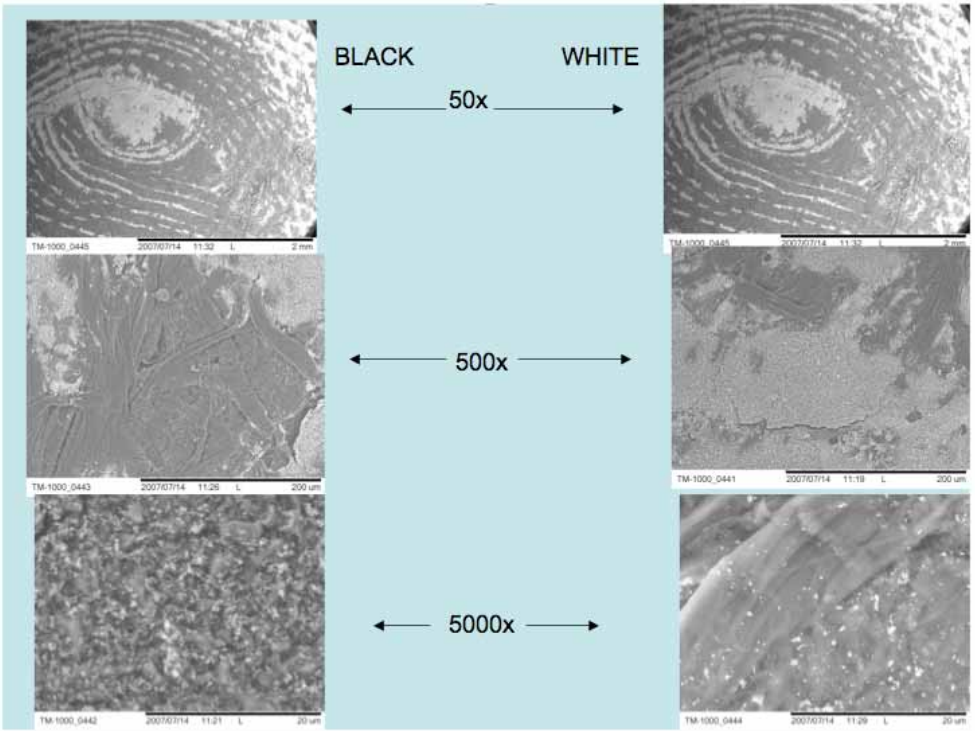
## Eye of George Washington

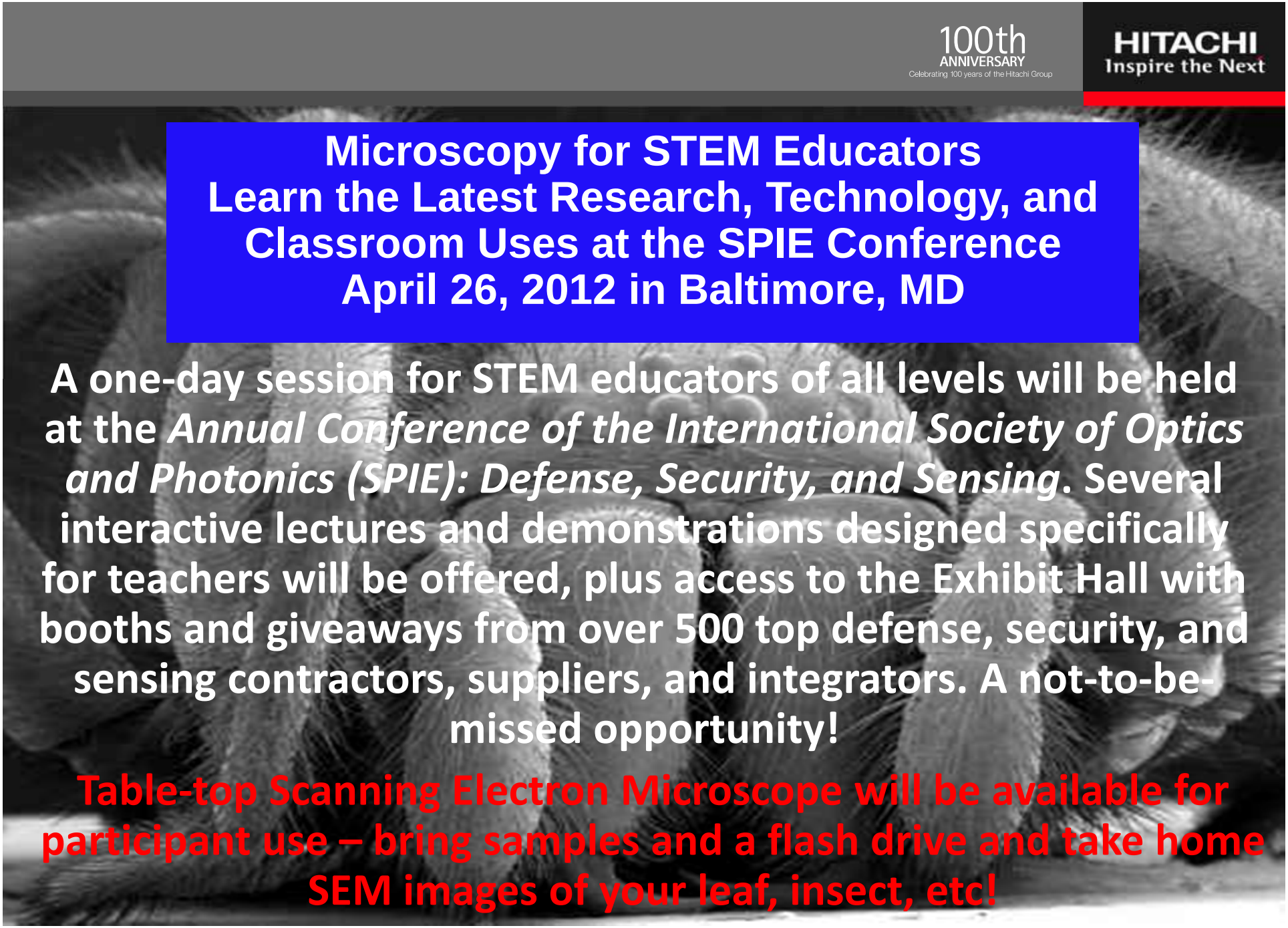




### Observations

- The bill is actually made from irregular fibers, which are probably organic in nature.
- The lines of ink used to draw the eagle's head on the back are between 100 and 150 µm wide.
- The ink seems to be made of small crystals only about 1 µm wide. The crystals stick to form stiff structures which can crack, in much the same way paint cracks.

### Conclusions

- Because the panning was done mechanically and not by computer, the sample moved the same distance no matter what the magnification. This made it extremely sensitive at 5000x but very slow to search for things at 25x.
- The scale bar made it much easier to determine distances. In an optical microscope, it is usually hard to make accurate measurements.



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# Microscopy for STEM Educators
# Learn the Latest Research, Technology, and Classroom Uses at the SPIE Conference
# April 26, 2012 in Baltimore, MD

**A one-day session for STEM educators of all levels will be held at the *Annual Conference of the International Society of Optics and Photonics (SPIE): Defense, Security, and Sensing*. Several interactive lectures and demonstrations designed specifically for teachers will be offered, plus access to the Exhibit Hall with booths and giveaways from over 500 top defense, security, and sensing contractors, suppliers, and integrators. A not-to-be-missed opportunity!**

**Table-top Scanning Electron Microscope will be available for participant use – bring samples and a flash drive and take home SEM images of your leaf, insect, etc!**

# Microscopy for STEM Educators

**Michael T. Postek**, National Institute of Standards and Technology (United States); **Mary Satterfield**, and National Institute of Standards and Technology (United States), and **Robert Gordon** Hitachi High Technologies (United States) and National Institute of Standards and Technology (United States)

The future of our nation hinges on our ability to prepare our next generation to be innovators in science, technology, engineering and math (STEM). Excitement for STEM begins in the earliest stages of our education process. Yet, today far too few of our students are prepared for the challenges ahead. The special session "Microscopy for STEM Educators" is a general interest forum with several notable invited speakers discussing their successful programs implementing microscopy in STEM education to foster student interest and excitement. A hands-on session with tabletop scanning electron microscopes will be held at the end of the presentations and the attendees are encouraged to bring samples of interest and operate the instruments. STEM educators will receive one-day reduced registration fees and will be able to visit the exposition where other microscopes may be on display.

**Special Session on Microscopy for STEM Educators**

**Introduction, Michael Postek, Mary Satterfield and Robert Gordon**

**Forensic practice in the field of protection of cultural heritage** *(Invited Paper)*, Marek Kotrly, Ivana Turkova, Institute of Criminalistics Prague (Czech Republic) [DS300-31]

**Science and art at the nanoscale** *(Invited Paper)*, Baratunde A. Cola, Georgia Institute of Technology (United States); Kelly Voss, Renee Gaither, Tucker High School (United States); Jamila Cola, Georgia Institute of Technology (United States) [DS300-32]

**The National Nanotechnology Infrastructure Network's Education and Outreach Programs: understanding size and scale and the tools of nano** *(Invited Paper)*, Nancy Healy, Georgia Institute of Technology (United States) [DS300-33]

10:00 am: **Integrating research and advanced microscopy into the high school curriculum**, Craig Queenan, Alyssa Calabro, David Becker, Bergen County Technical Schools (United States) [DS300-34]

**Coffee Break**

**Special Hands-on Session on Microscopy for STEM Educators**
Thurs. 11:00 am to 12:30 pm

Table-top scanning electron microscopes will be available during this hands-on session and experts will be available to answer questions. The attendees are invited to bring samples of interest and to operate the instruments. Attendees should also bring a memory stick to obtain scanning electron microscope images. Other scanning electron microscopes including laboratory instruments may be found on the exhibition floor. Attendees are encouraged to visit these instruments, as well.

Thursday December 8, 2011

# 'Awesome' high-tech microscope on loan

## ■ Walkersville science students get sharper look at life

BY MARGARITA RAYCHEVA
STAFF WRITER

Walkersville High School students did not have to wait until Christmas to play with a new toy.

Thanks to one parent's generosity, students at the school have been given a rare chance to work with a $85,000 scanning electron microscope, which is at least 30 times more powerful than any microscope available in the county public schools.

Unlike most microscopes used in the school system, which show images in two dimensions and zoom in about 400 times, the electron microscope shows images in three dimensions and has the capacity to magnify them up to 30,000 times.

That means that a student can use the microscope not only to examine a spider's leg, but also on the tiny hairs that grow from the hairs on the spider's leg, said Walkersville senior Joey Williams.

"It is awesome!" said the 17-year-old, who has been spending hours with the microscope since it arrived last Monday. Joey, who hopes to study biology and environmental science at Salisbury University next year, has used the microscope to examine and take photos of many things, from the structure of mold on old bread crumbs to the stomata, or the breathing organs, of leaves.

"This is the best opportunity for us," said Joey, who was so excited about the microscope that he came to school on a Saturday.

Traditional microscopes use visible light to illuminate and magnify

See MICROSCOPE, Page A-12

BILL RYAN/THE GAZETTE

Walkersville High School senior Taylor Hudak places a feather in an electron microscope during science class on Tuesday.

ZETTE Thursday, December 8, 2011 wt

## MICROSCOPE

Continued from Page A-1

objects. An electron microscope uses electrons instead of regular light, which allows them to focus and zoom onto much smaller objects than optical microscopes.

Scanning microscopes are typically too expensive to be used and maintained at schools, said Walkersville High School science teacher Scott McIntosh, who teaches environmental science and biology.

McIntosh borrowed the microscope from a parent, Larry Cessna, who is also the technical support supervisor for nanotechnology at Hitachi High Technologies America, a global company that has a division based in Gaithersburg.

Cessna contacted the school and offered to bring in the microscope as part of Change the Equation, a nationwide educational organization, which is governed by business leaders in the private sector and aims to encourage more students to explore careers in science, technology, engineering and math, McIntosh said.

Before coming to Walkersville High School, the $85,000 microscope had been on loan at the Trinity School of Frederick, a private school for students in kindergarten through grade eight.

The microscope arrived at Walkersville High on Nov. 28 and will be available to students until Friday, McIntosh said.

"I never dreamed we'll be able to do this," McIntosh said. "To me this is like playing with a mythical creature. It's like riding a unicorn."

Resembling a large desktop computer, the microscope has been installed in one of Walkersville High's science classrooms, where students have been using it to view, photograph and catalogue various objects, including pieces of fiber, fingernails, tiny insects, feathers, mold and lichens, McIntosh said.

The electron microscope requires students to place the objects in a vacuum chamber and projects the images on a computer screen, where they can be easily photographed and catalogued.

The best part about that is that students have been able to use the microscope to see in reality and large scale everything that they have been learning about in the classroom and from their textbooks, McIntosh said.

"This is something that has been in the kids' hands all the time. That is the basis of exploration," said McIntosh who hopes that he would be able to borrow the microscope again in the future.

Abbey Burnett, a junior who takes McIntosh's Advanced Placement environmental science class, was also fascinated with the microscope.

"This is nothing like science class," she said on Tuesday as she used the microscope to examine the tiny fibers that make up a shred of paper. "It kind of makes life look really cool."

BILL RYAN/THE GAZETTE

Walkersville High School junior Abby Burnett and senior Matt Guyton look at a mosquito with an electron microscope during science class on Tuesday.

# HTA Educational Outreach Program Flyer

100th ANNIVERSARY
Celebrating 100 years of the Hitachi Group

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## HITACHI HIGH TECHNOLOGIES AMERICA (HTA)

### EDUCATIONAL OUTREACH PROGRAM

**Model TM-3000 Table Top Scanning Electron Microscope**

### ANALYZE

Model TM-3000 Table Top Scanning Electron Microscope used for imaging and analysis of materials and biological specimens.

### PORTABLE

Instrumentation is portable; therefore can be moved easily in and out of educational institutions.

### SIMPLE

No special environment or electrical conditions – Standard 110V outlet is required.

### SUPPORT

HTA certified and trained personnel assist educators with set-up, training and sample analysis.

### SET UP

Ideal set-up is for 1-2 week period with first day half hour set-up and 1-2 hour training session. Product is removed within one hour when educator is finished.

### RESPONSIBILITY

Educators will be responsible for the instrument that is left at any institution.

Robert J. Gordon | Hitachi High Technologies America, Inc. | phone 925-218-2817 | email robert.gordon@hitachi-hta.com

# STEM Outreach Activities

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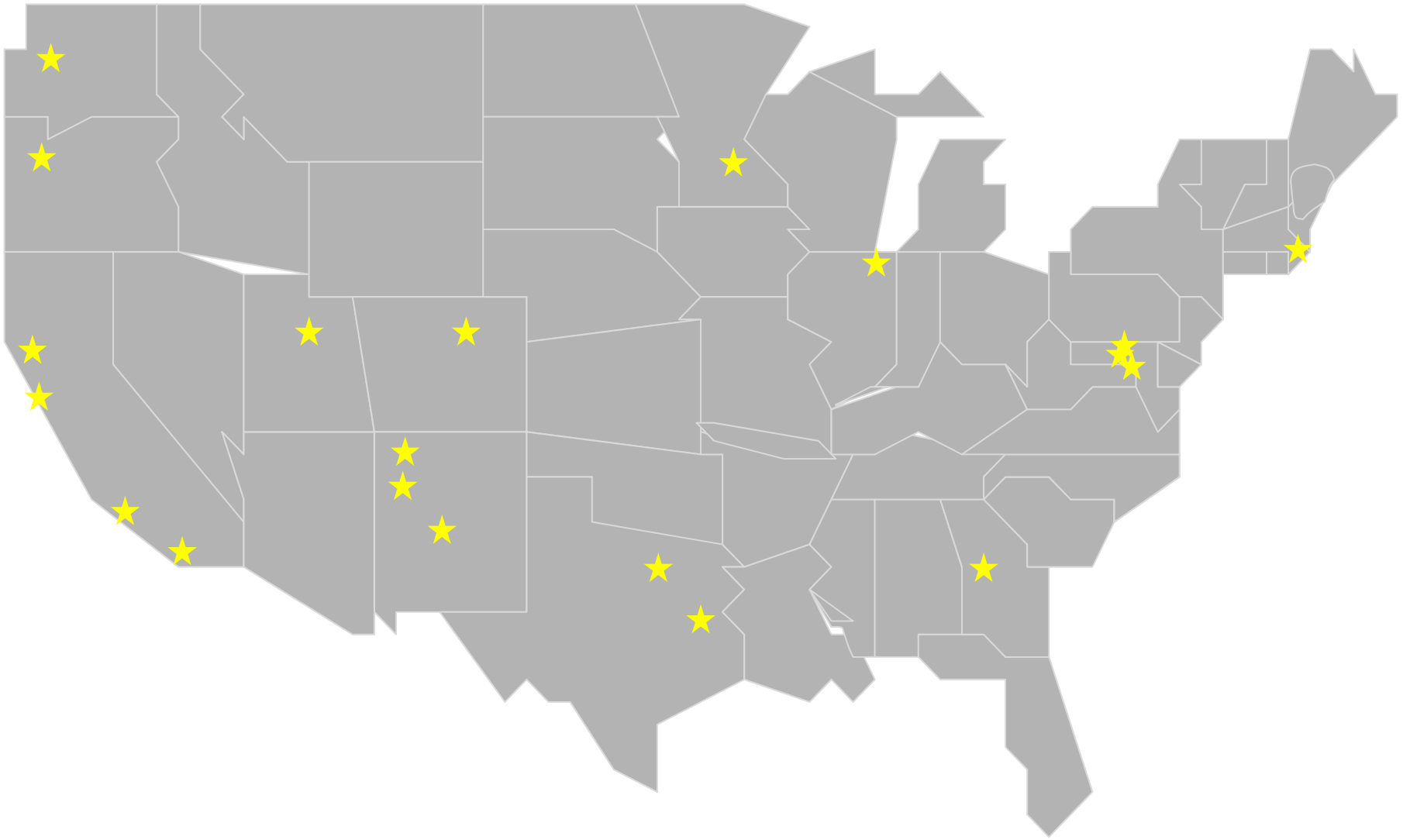
*September 2011 - February 2012*



# National Science Teachers Association - Indianapolis 3/28-31

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# National Science Teachers Association - Indianapolis 3/28-31

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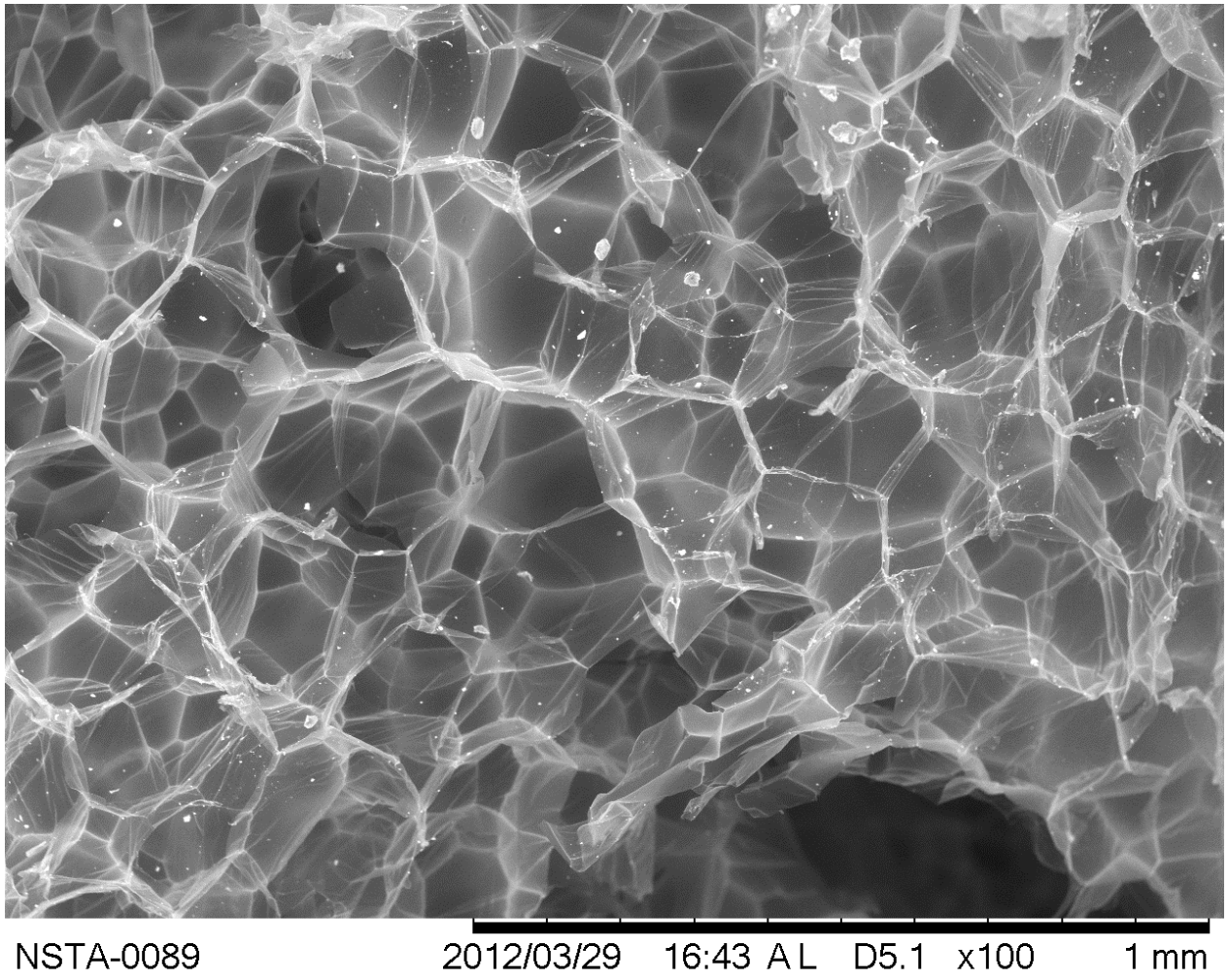
Winner: Mrs. Cheryl Thomasson - Murray County Schools, Chatsworth, GA




Cheryl Thomasson

# HTA Educational Website

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- The purpose of this microsite is to create a platform to promote HTA's participation in U.S. STEM initiatives and HTA's specific education programs.
- Working title for the microsite: "HTA Educates" as it illustrates the overall purpose and mission for the microsite.
- This educational program focuses on electron microscopy, specifically HTA's Table Top SEM Model TM-3000. The three primary facts of the program include:
  1) Provide an overview of HTA's STEM initiative and outreach program
  2) Highlight the electron microscopy program and future program
  3) Support educators with available teaching tools and resources.
- This microsite will be VOID of any commercial activities for our products and will provide a link to our HTA product website.
- Targeting June, 2012 release to market!

# Summary

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- Hitachi High Technologies America (HTA) will continue our STEM Education Program throughout 2012 with and emphasis on Nanoscience and Nano Materials.
- Program will also incorporate other Hitachi Group companies' support and interaction.
- HTA will continue our collaboration and partnership with Change the Equation (CTEq), National Nanotechnology Infrastructure Network (NNIN), and educators throughout the U.S. market.
- At HTA, employee-led Community Action Committees (CACs) are charged with assessing the needs and assets in their communities and developing strategies to respond on behalf of their Hitachi Group companies. This program seeks to improve the quality of life in communities where Hitachi employees live and work. "This program" supports two of our key focus areas which are Education and Youth Development.

***They are our responsibility.***
***Let's educate the youth of America and return the U.S. to a leading Innovator globally.***