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NSDL/NSTA Web Seminar:
Knowing Nano: New Video, Web, and
Print from DragonflyTV



Wednesday, November 11, 2009

Resources from this web seminar are listed at:

<http://www.diigo.com/list/nsdlworkshops/web-seminar-nano>



Today's NSDL Expert



Lisa Regalla,
Science Editor, DragonflyTV



<http://nsdl.org>



Overview of Presentation



- Nano 101
- Approaches to teaching nano
- Resources from DragonflyTV: Real Kids, Real Science
- Additional resources sprinkled throughout!



<http://nsdl.org>



The Nano Revolution is Born



Richard Feynman
1959



<http://nsdl.org>



Poll Question:



The prefix nano means...

- A. One thousandth
- B. One millionth
- C. One billionth
- D. One trillionth



centi	one hundredth	0.01	10^{-2}
milli	one thousandth	0.001	10^{-3}
micro	one millionth	0.000001	10^{-6}
nano	one billionth	0.000000001	10^{-9}
pico	one trillionth	0.0000000000001	10^{-12}
femto	one quadrillionth	0.0000000000000001	10^{-15}

Macroscale



~1.5 m



~1 cm

Microscale



~100 μm

~100,000 nm



~7 μm

~7000 nm

Nanoscale

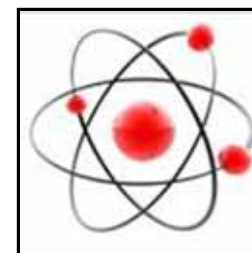


~100 nm



~2 nm

Atomic scale



~0.2 nm



Nanotechnology:



control of matter on a scale of
approximately 1 - 100 nanometers

atom by atom...

molecule by molecule...



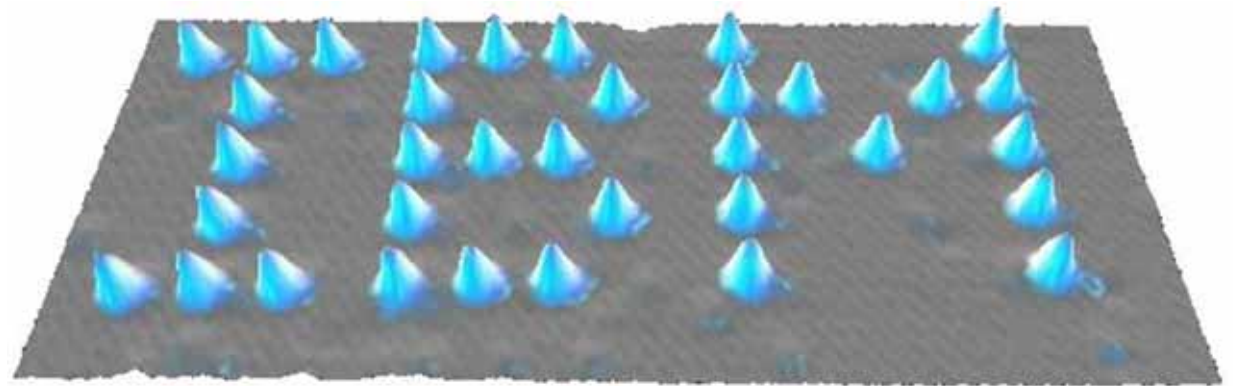
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**Don
Eigler**

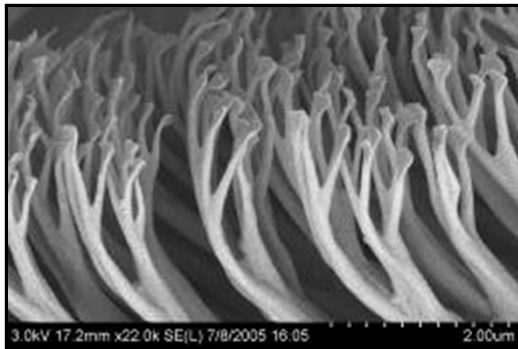
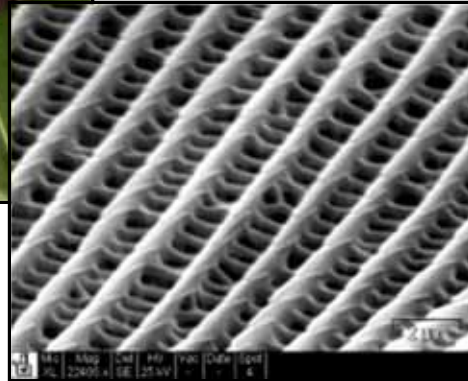
1989



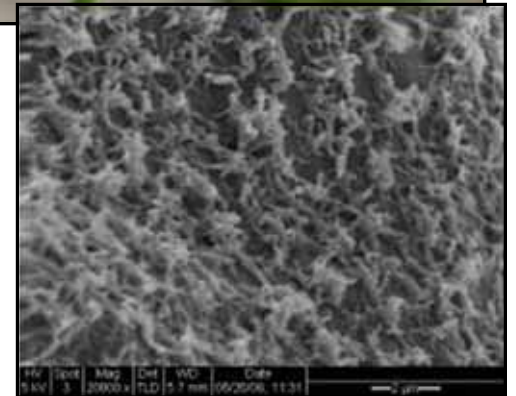
Nano in Nature



Asylum Research



Prof. Kellar Autumn, Lewis
& Clark College



Stanford Nano-
characterization Laboratory



<http://nsdl.org>



Nanoscientists are working on all of the following EXCEPT:
Stamp your answer.



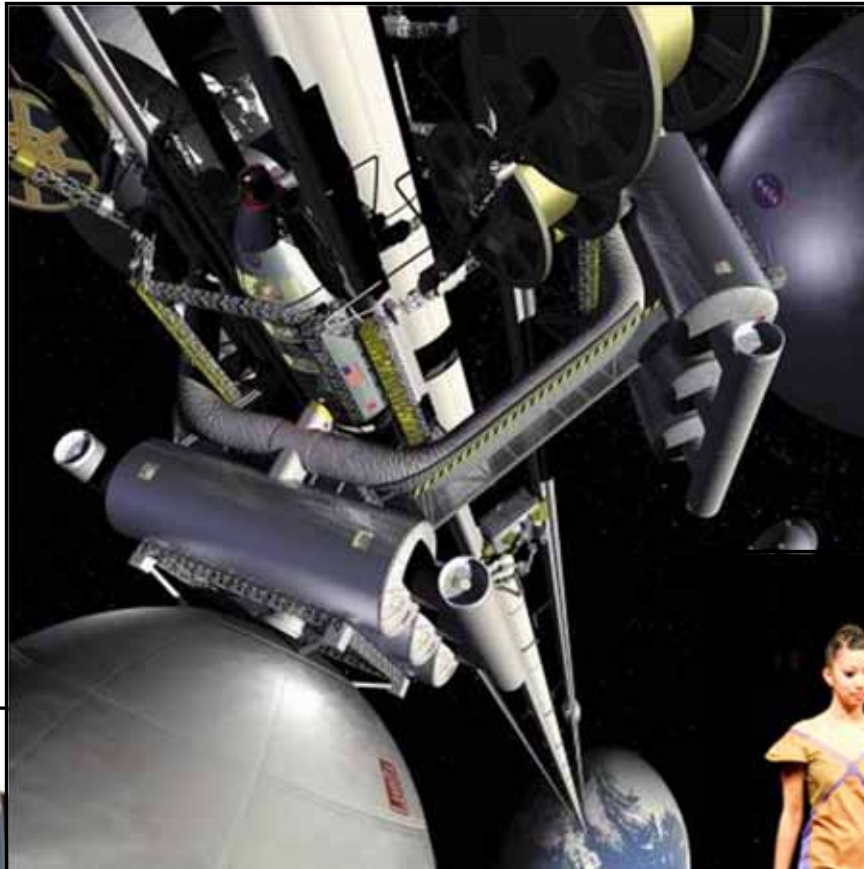
Invisibility cloak	Time Machine
Color changing clothes	Roll up TV screens



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In Development...

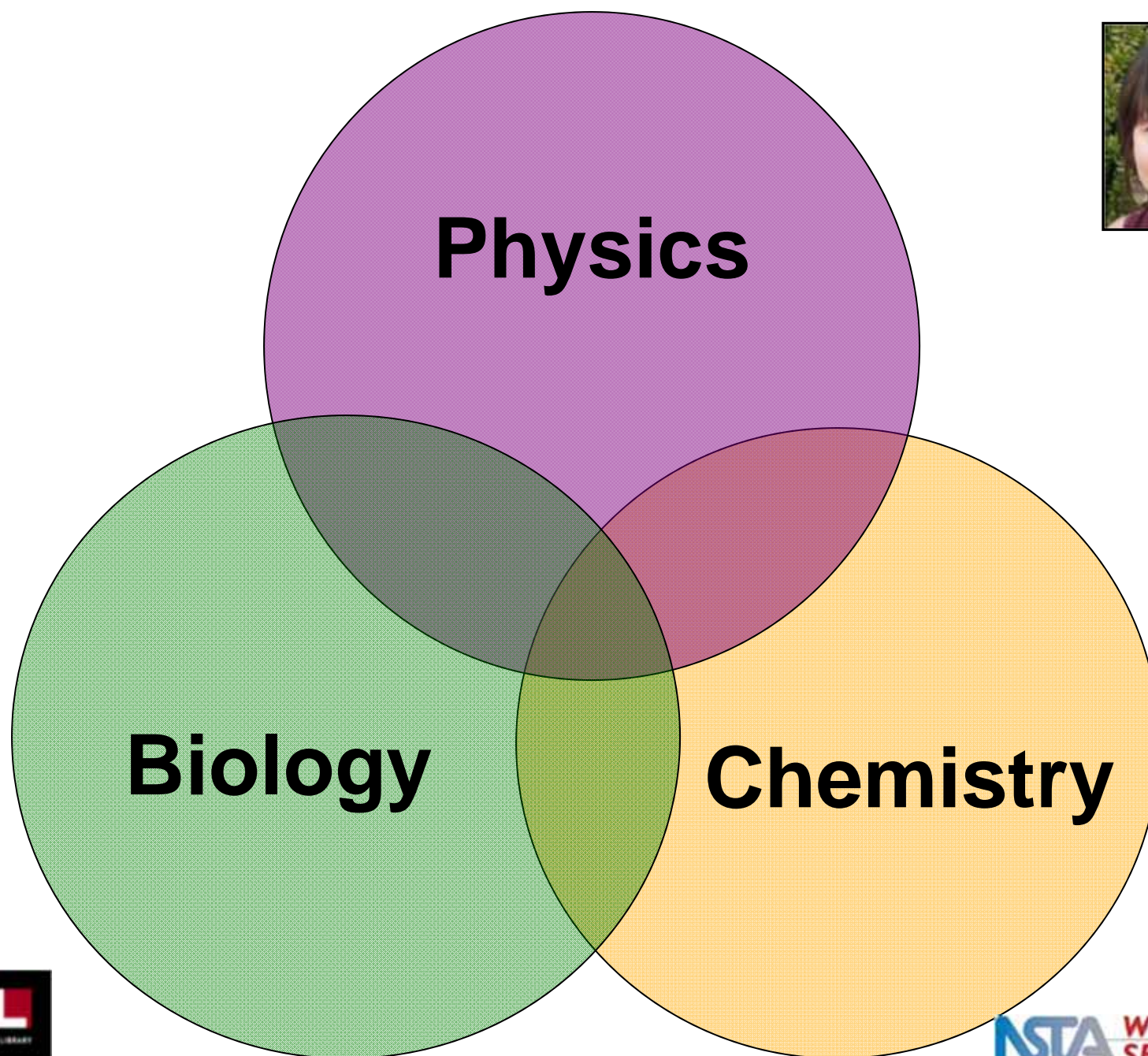




Physics

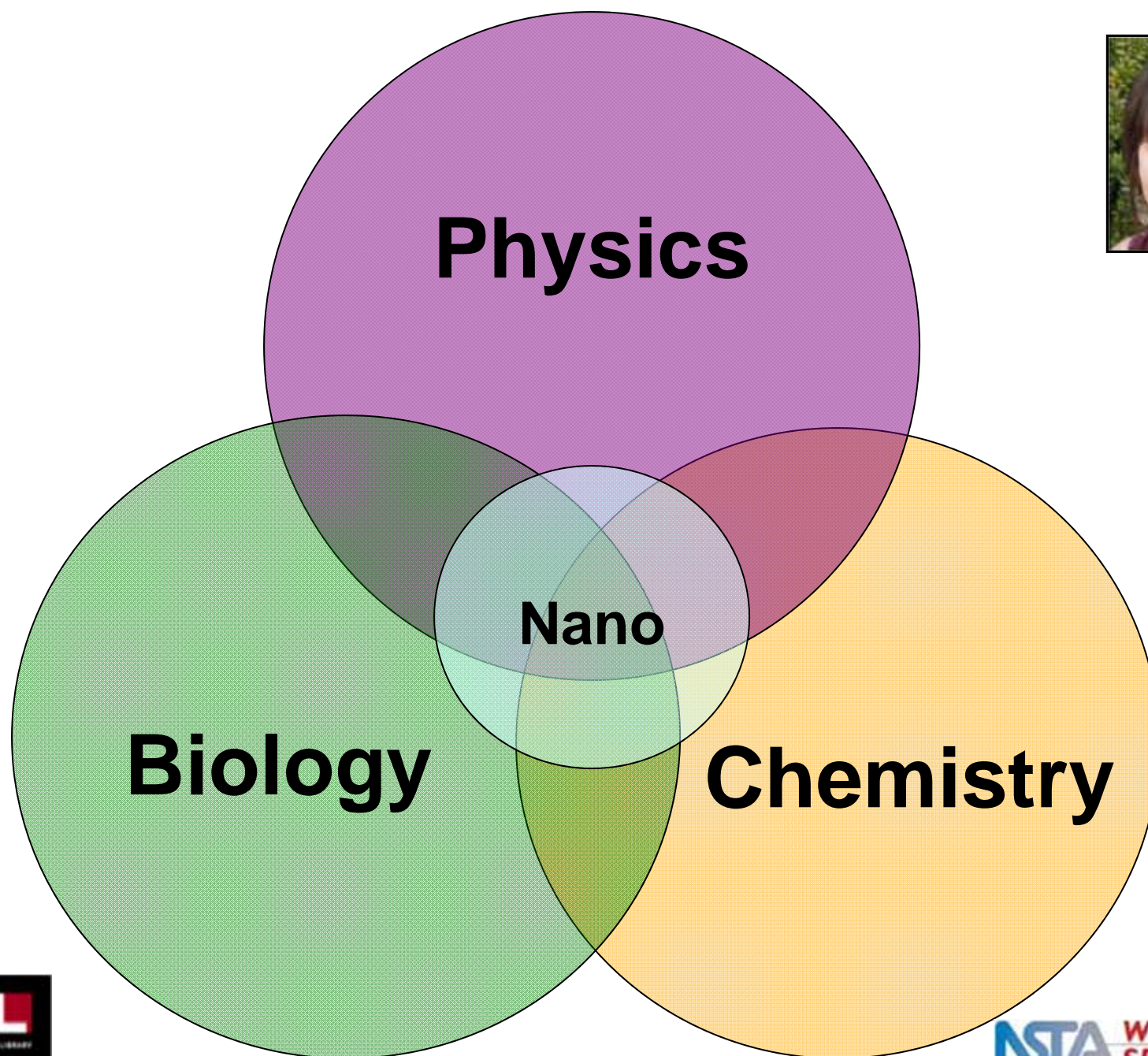
Biology

Chemistry



<http://nsdl.org>





<http://nsdl.org>



The Big Ideas of Nanoscience

Stevens, S., Sutherland, L., Schank, P., Krajcik, F. (Feb. 2007)

- Size and scale
- Structure of Matter
- Size dependent properties
- Dominant forces
- Self assembly
- Tools
- Models
- Technology and Society



Other Great Resources



nanoed.org *National Center for Learning and Teaching at Northwestern University*

- Field test

nnin.org/nnin_edu.html *Nanooze (elementary) and much much more!*

- Lessons for middle and high school (some developed by Research Experience for Teachers (RET) Program)

6 Episodes on Nanotechnology



- Short, inquiry-based videos cover the big ideas
- Activities you can do with your students
- Features scientists and scientific tools used in nanoscience



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EPISODES

Games

Nanobots

Do It

Nanojector

Quiz

What round object is one billionth of the Earth's diameter?

☐ a marble

☐ the Roman Colosseum

☐ the moon

ANSWER

Where's Nano?

We're Regina, Linda, Harrison, Jared, Kasey, and Rendi, and we just took for a science camp reunion at the Morehead Planetarium and Science Center in Chapel Hill, NC. We visited the "Zoom In" exhibit and were surprised to learn that even mud (yuck!) has something to do with the nanoscale. Our question: What other examples of nanoscale science and technology can we find in our everyday lives?

What did we do?

We broke up into two teams and set out on a nano scavenger hunt. We did some research and found examples of nanotechnology everywhere from the sporting goods store to a botanical


pbskids.org/dragonflytv/nano



Educator's Guide

- 7 Steps of Inquiry
- Ice Breaker Activity
- Inquiry Investigation
- Aligned to National Science and Math Standards

Applications: Activity 1 Self-Assembly





Get It Together

We're Keeli and Connor and we love the great outdoors. While practicing setting up our tents for a camping trip, we noticed that some tents take forever to put together but others seem to come together all on their own!

Our question:
How can some things come together all by themselves?

We headed to Children's Museum of Houston where we learned about self-assembly, a type of bottom up manufacturing in which molecules assemble themselves into complex patterns. Snowflakes are a great example of self-assembly! Then we visited Rice University to see firsthand how nanoscientists are using self-assembly to make tiny capsules that could be used to deliver drugs or clean up oil spills. Even fancy chefs are using self-assembly these days to trap tasty food ingredients! We needed to see this for ourselves and so we went home to self-assemble ice cream toppings.










Nano Matters

One of the major barriers preventing nanotechnology applications from becoming mainstream is in manufacturing. Scientists are getting quite skilled at manipulating things atom by atom, but this approach results in the production of a single device. If we want to produce many items that look and function exactly the same, we need to come up with new "assembly lines." Manufacturing at the nanoscale is a whole new ballgame and self-assembly is one way scientists are getting the job done.

pbskids.org/dragonflytv





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Based on evaluation results, which television program format(s) do you think were most effective in communicating concepts?



Stamp your answer(s) in the boxes

Kids doing onscreen activities	Kids talking to adult scientists
Host explanations	Use of models



<http://nsdl.org>

Evaluated by Barbara Flagg,
Multimedia Research




Show 1: Size and Scale



What's Nano?

How big is one billion and how small is one nanometer?



 Museum of Science

Harvard University

Where's Nano?

What examples of nanoscale science and technology can we find in our everyday lives?



UNC
MOREHEAD PLANETARIUM
AND SCIENCE CENTER



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Consumer Products



nanotechproject.org/inventories/consumer/



<http://nsdl.org>



Poll Question:



Which round object is about one billionth of the earth's diameter?

- A. marble
- B. beachball
- C. Roman Coliseum
- D. moon




Show 2: Structure of Matter



Hockey Sticks

How do carbon nanotube hockey sticks compare to wood and composite sticks?



 Museum of Science

Harvard University

Butterfly Wings

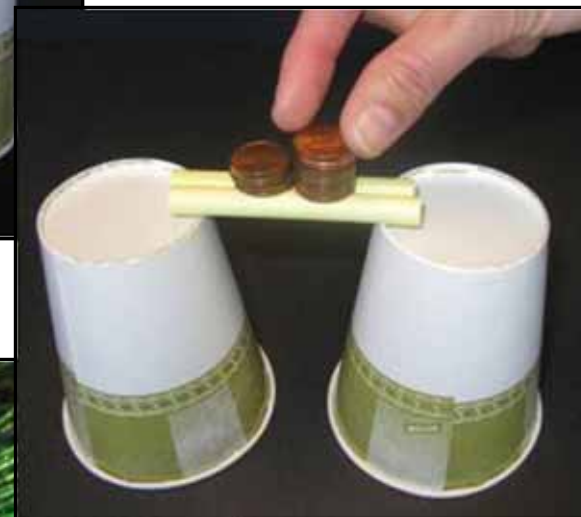
Why do some butterflies change color when you look at them from different angles?




MUSEUM
of LIFE +
SCIENCE

Duke
UNIVERSITY

Activities



<http://nsdl.org>



Other Great Resources

Informal



mrsec.wisc.edu/Edetc

- videos, lesson plans and more!
- all audiences, intermediate, advanced

nisenet.org *"Take it, hack it" catalog*

- classroom activities
- cart demonstrations
- facilitated activity



<http://nsdl.org>





Some old stained
glass gets its
color from
nanoparticles of
what?

Stamp your answer(s)

metals	
berries	
clays	



<http://nsdl.org>



Show 3: Small is Different



Surface Area

How does surface area affect how things react?



Stained Glass

How can gold look red and silver look yellow?



mrsec.wisc.edu/Edetc

Show 4: Forces at the Nanoscale

Gecko Feet

Which lizards are the best climbers?



LHS LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Berkeley
UNIVERSITY OF CALIFORNIA

Nasturtium Leaves

Why does water bead up on some leaves and not others?



expl **atorium**[®]
the museum of science,
art and human perception

STANFORD
UNIVERSITY

Great Resources - High School



mcrel.org/nanoleap *Evaluated by teachers*

- “Investigation Static Forces in Nature: The Mystery of the Gecko”
- “Nanoscale Materials and Their Properties”

nanosense.org *Aligned to standards*

- Size Matters
- Clear Sunscreen
- Clean Energy
- Fine Filters



Prof. Kellar Autumn, Lewis
& Clark College



<http://nsdl.org>



Scientists are trying to mimic the nanostructures of lotus leaves to create self-cleaning what?
Stamp your answer(s)



Teeth	Windows	Dishes	Clothes



<http://nsdl.org>



Show 5: Applications



Self Assembly

How can some things assemble all by themselves?



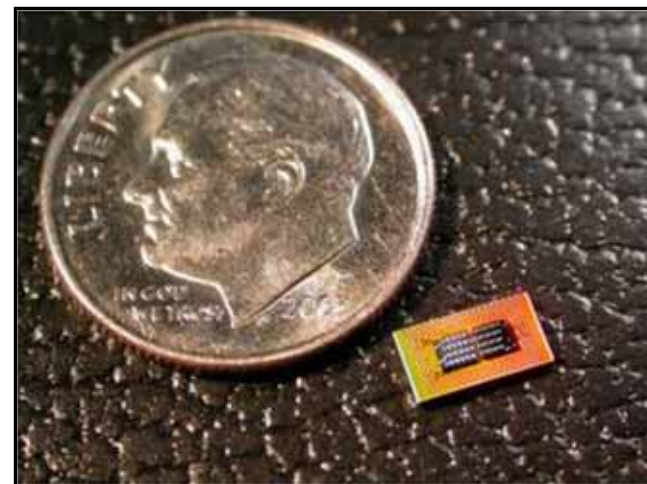
Bone Regrowth

What's the best nanomixture to make the strongest bone repair?



Brown University

Hopes for Future



<http://nsdl.org>



Show 6: Nanotechnology and Society

Water Clean-up

Can nanoiron clean up pollution in soil and prevent it from getting into drinking water?



THE FRANKLIN

PENN STATE

Nanosilver

Does any nanosilver leak out of socks when they are washed?



Cornell University

What Kids Think About Nano



<http://nsdl.org>





What societal issues are you concerned about surrounding nanoscale science and engineering?

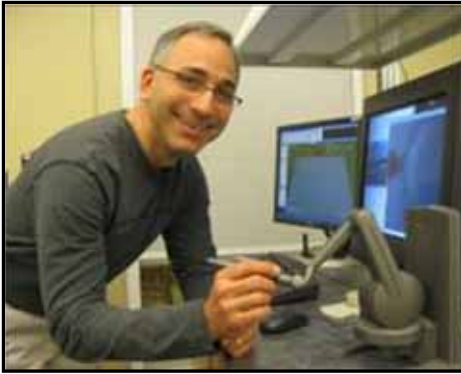
Write your responses in the chat



<http://nsdl.org>



Scientist Profiles



Rich Superfine
Cilia scientist

*Univ. of North Carolina
at Chapel Hill*



Jason Guerrero
Nanocar engineer

Rice Univ.



Lesley Hamming
Glue-ologist

Northwestern Univ.



Tejal Desai
Bioengineer

*Univ. of California, San
Francisco*



Christy Haynes
Nano safety scientist

Univ. of Minnesota



Anil Netravali
Skateboard Scientist

Cornell Univ.

Other Great Resources



nanozone.org *Lawrence Hall of Science*



<http://nsdl.org>

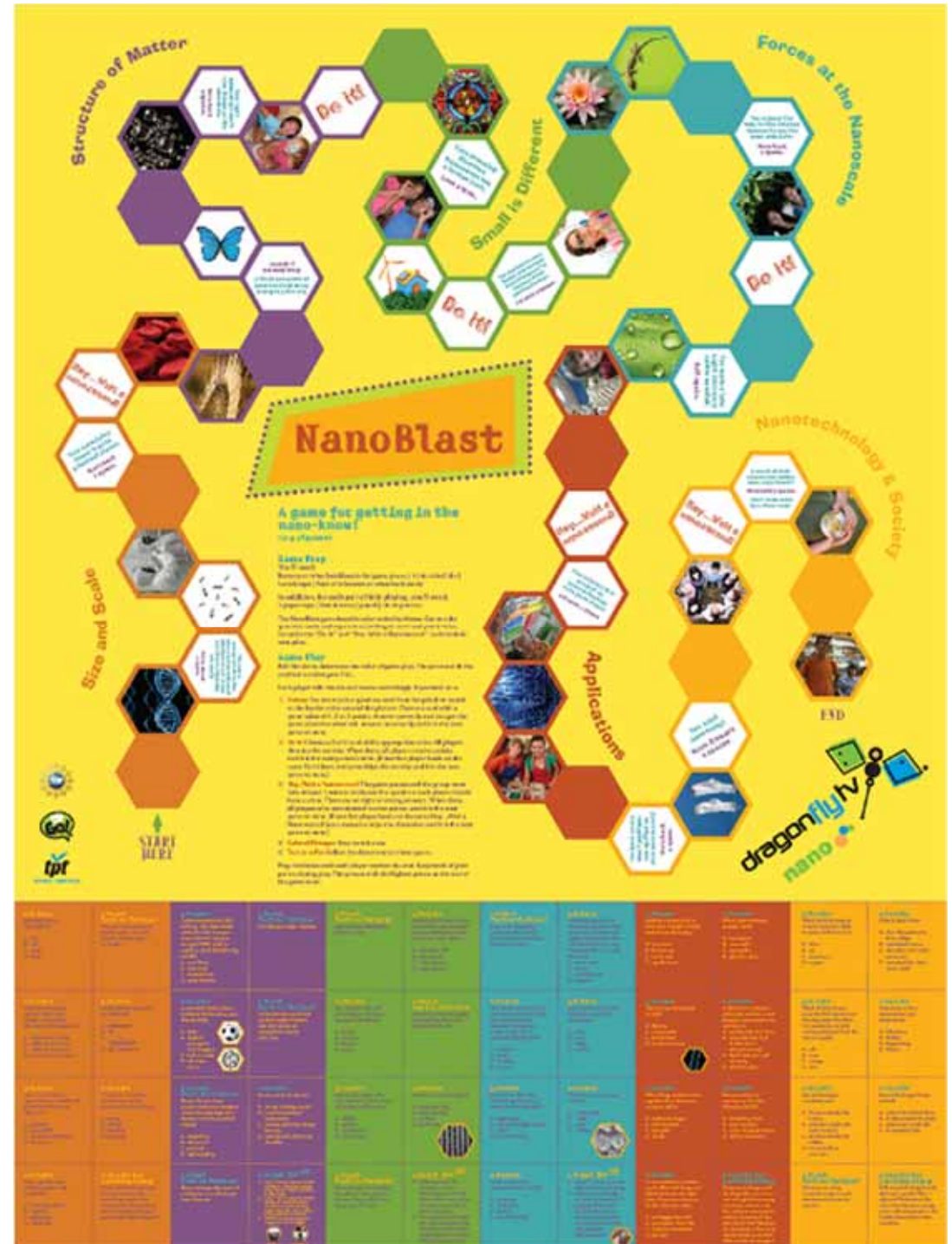




NSTA insert

Dec. 2008

Science Scope



Poll Question:



Which nano-invention
actually exists?

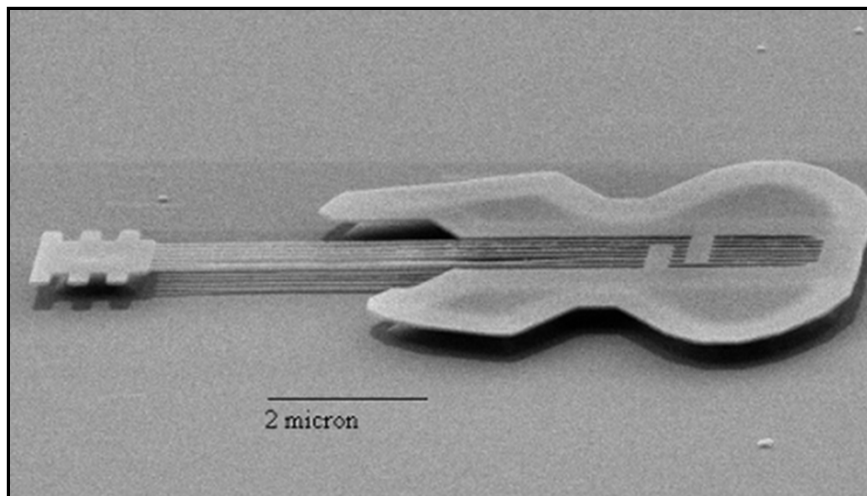
- A. nanoguitar
- B. nanoradio
- C. nanotoilet
- D. all of the above



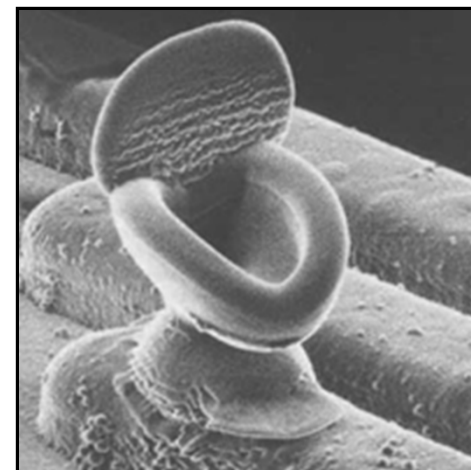
<http://nsdl.org>



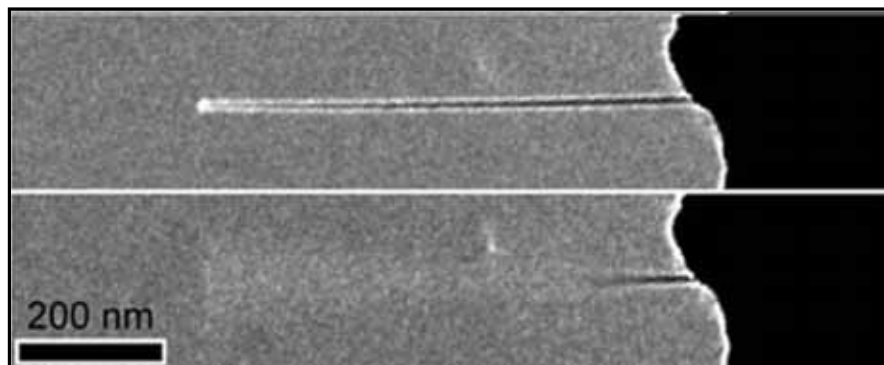
All of the Above!



Cornell University



SII Nanotechnology Inc.



Lawrence Berkeley National Laboratory and U.C. Berkeley



<http://nsdl.org>





Lisa Regalla
lregalla@tpt.org

**THANK
YOU!**



<http://nsdl.org>



Resources from this web seminar are listed at:

<http://www.diigo.com/list/nsdlworkshops/web-seminar-nano>

Learn about new tools and resources, discuss issues related to science education, find out about ways to enhance your teaching at:

<http://expertvoices.nsdl.org/learningdigitalK12>



<http://nsdl.org>



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Multimedia Overview

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Flash Player Required

Free Learning Resources

[Solar System: A Look at the](#)



<http://learningcenter.nsta.org>



<http://www.elluminate.com>

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