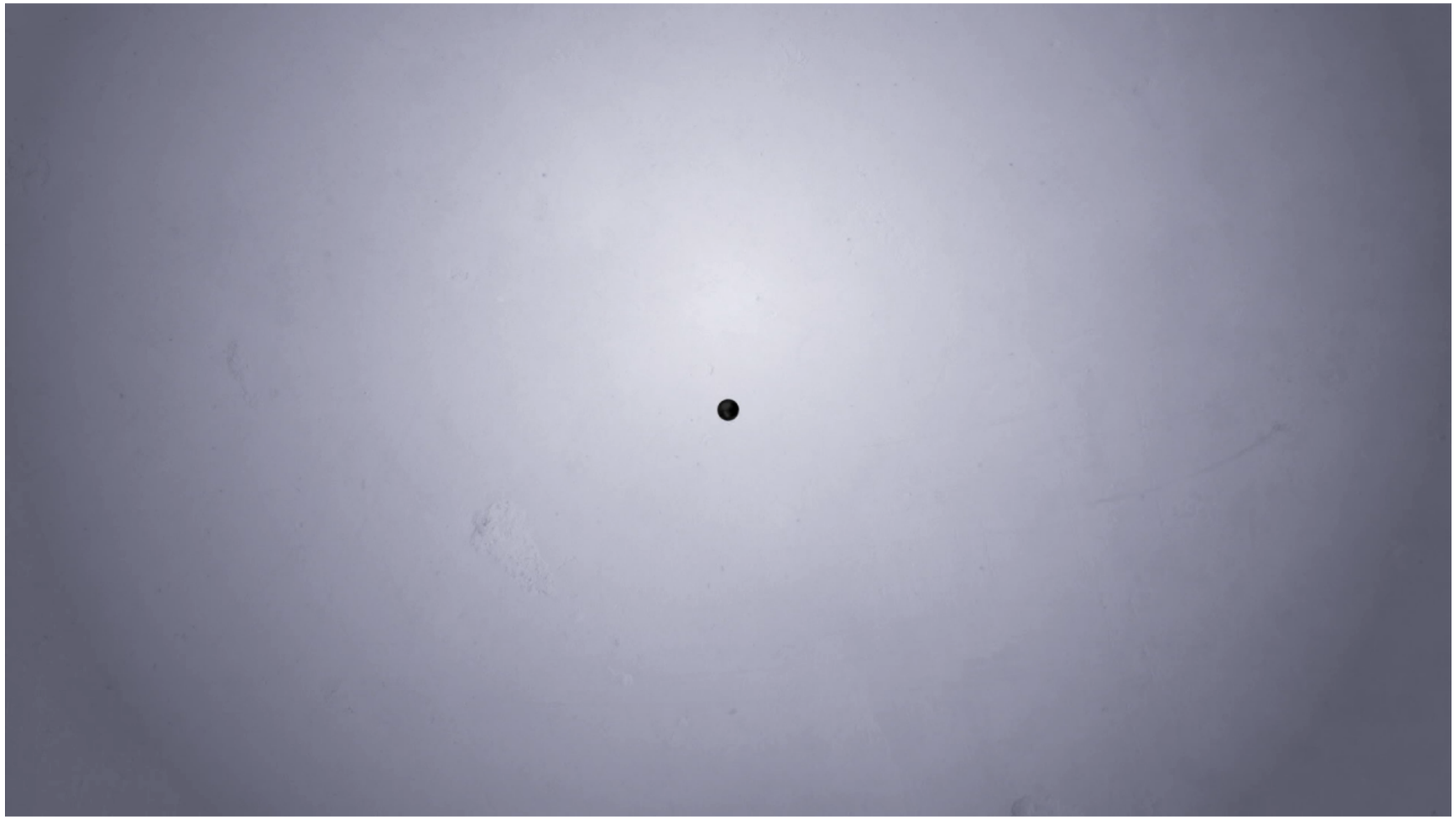
Nanotechnology
“Teaching Tiny”

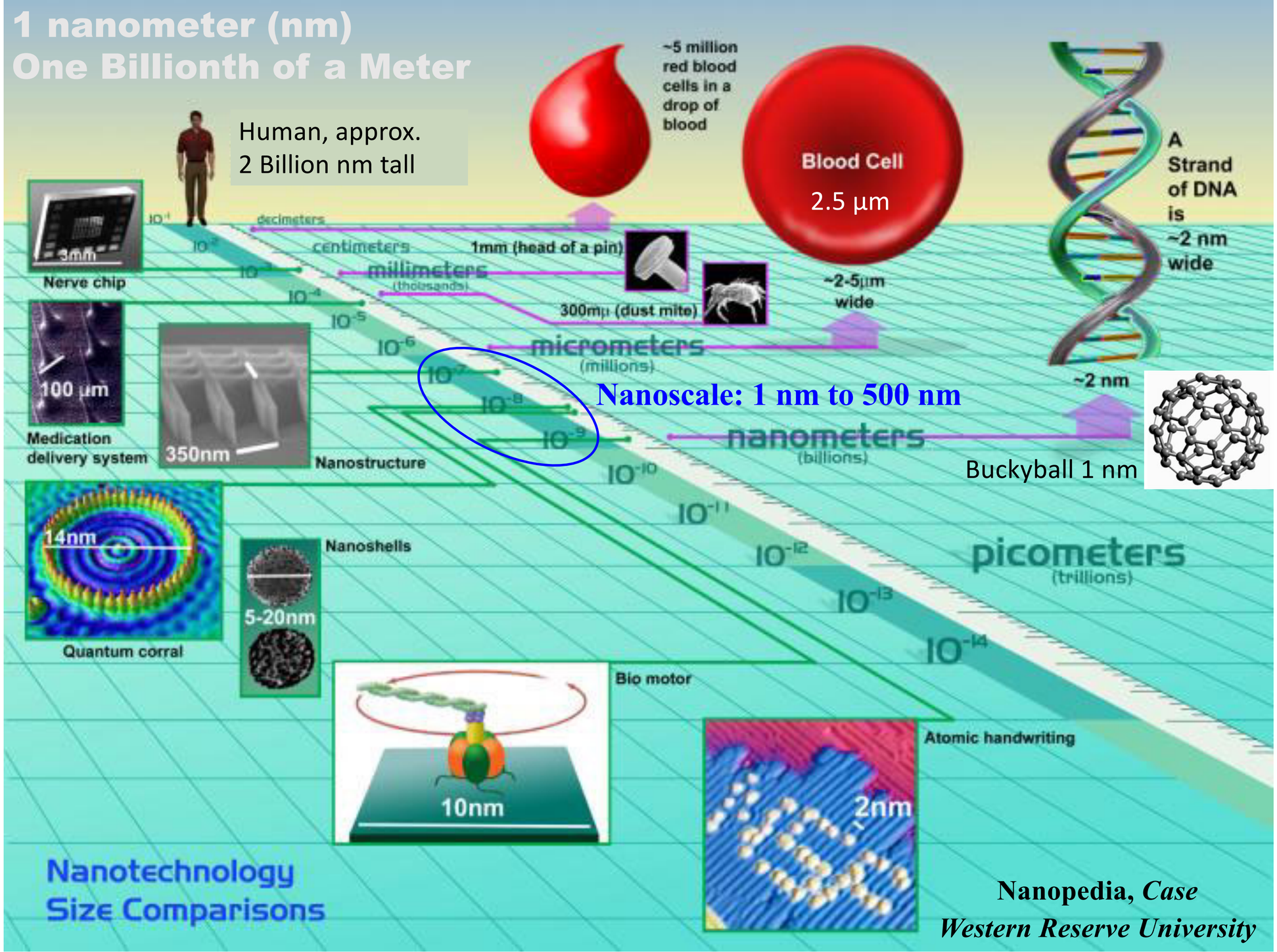
- *Presenters: Larry Browning, Terese Janovec and Steve Wignall*
- Nebraska Center for Materials and Nanoscience

Intro to Nanotechnology

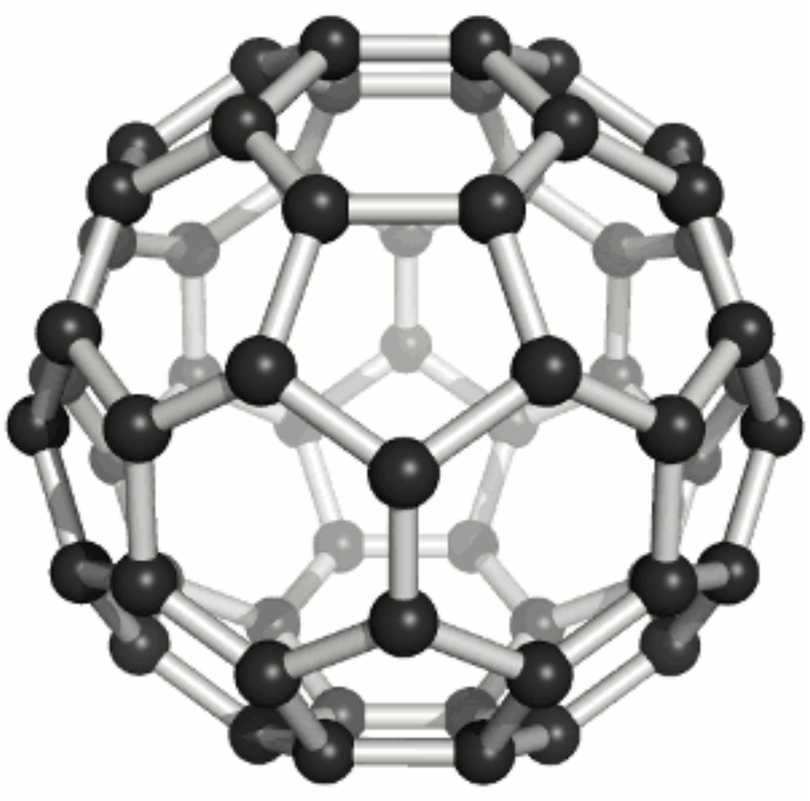


Materials and Nanoscience

Some of the following concepts will be an introduction of Nanotechnology and examined through the final activities with the Nano-Kits.


1 nanometer (nm)
One Billionth of a Meter
Human, approx.
2 Billion nm tall
~5 million red blood cells in a drop of blood
Blood Cell
2.5 µm
A Strand of DNA is ~2 nm wide
~2-5µm wide
~2 nm
1mm (head of a pin)
300mµ (dust mite)
decimeters
centimeters
millimeters
(thousands)
micrometers
(millions)
nanometers
(billions)
picometers
(trillions)
Nanoscale: 1 nm to 500 nm
Buckyball 1 nm
3mm
Nerve chip
100 µm
Medication delivery system
350nm
Nanostructure
14nm
Quantum corral
5-20nm
Nanoshells
10nm
Bio motor
2nm
Atomic handwriting
Nanotechnology
Size Comparisons
Nanopedia, Case
Western Reserve University

How Big is a Nanometer?



Carbon Nanoparticle about 1 nm across

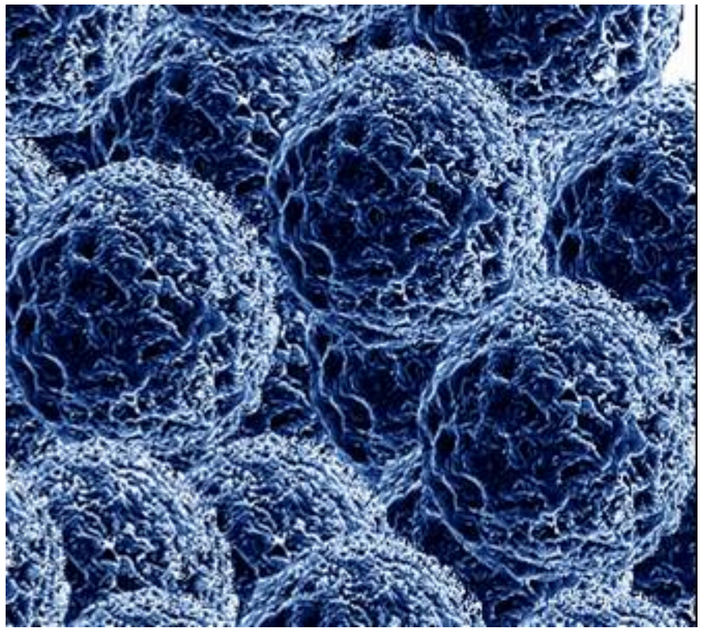
Also Called:

C-60, Fullerene, Buckyball

http://www.unl.edu/ncmn/outreach-edu-nanocamp-2013

Nano Socks!

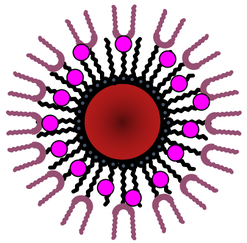
- Silver Nanoparticles **19 nm across have antimicrobial properties.**

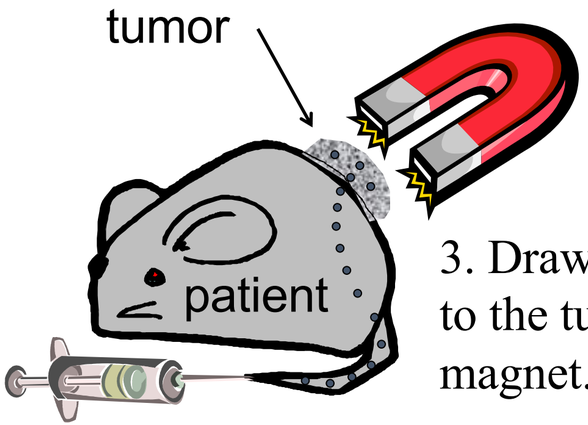


- **They make ArcticShield™ Socks** odor and fungus resistant

nanobits… Hyperthermal Therapy

1. Coat magnetic nanoparticles with biocompatible molecules.





2. Inject nanoparticles into the patient.

3. Draw nanoparticles to the tumor with a magnet.

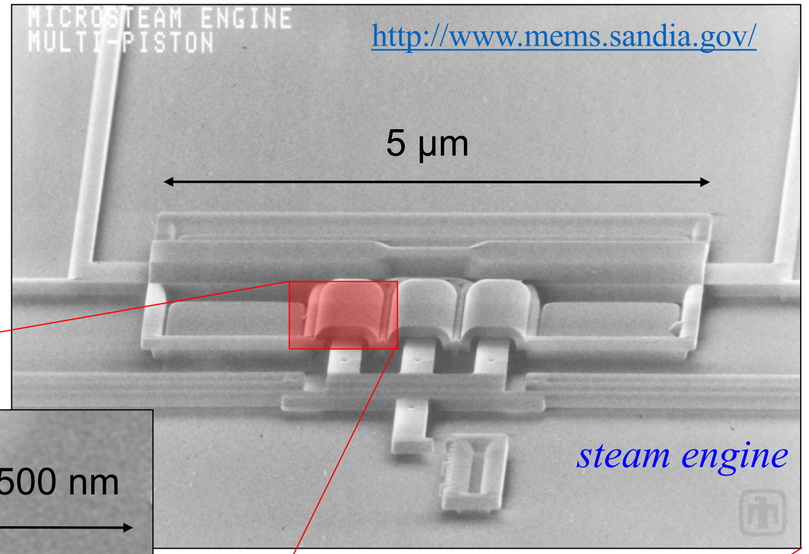
4. Heat nanoparticles with radio waves.

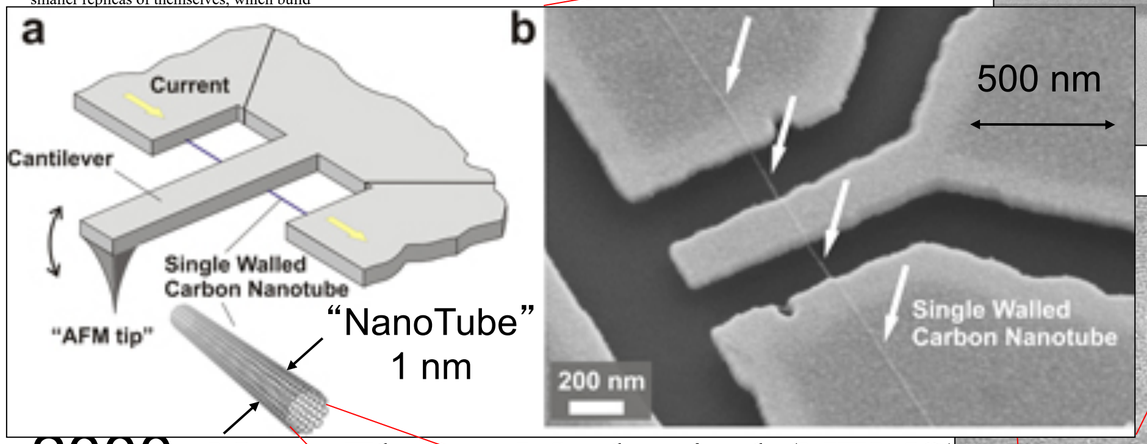
5. Melt your tumor away.

Prof. Diandra Leslie-Pelecky, ***UNL Department of Physics and Astronomy***

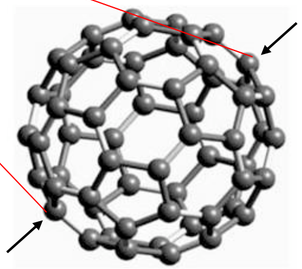
NanoTechnology

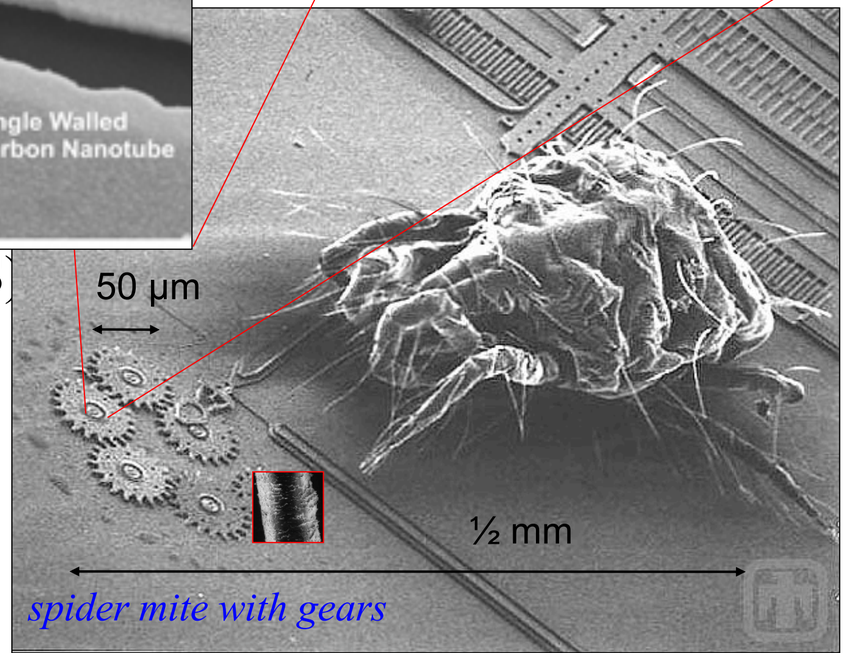
1959: Richard Feynman kicks off the nanotechnology era with his provocative lecture “There’s Room at the Bottom”, a scheme for building machines, which build smaller replicas of themselves, which build
smaller replicas of themselves, which build
smaller replicas of themselves, which build
smaller replicas of themselves, which build





2000: Nano-Electro-Mechanical (NEMS) devices.



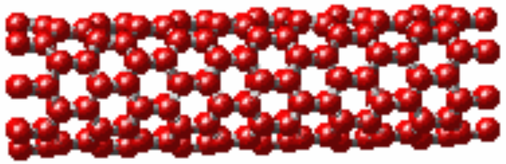


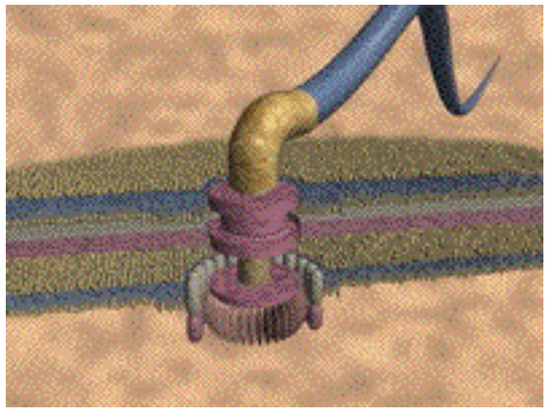
Nanoscience Research at the University of Nebraska

Voelte-Keegan Nanoscience Research Center

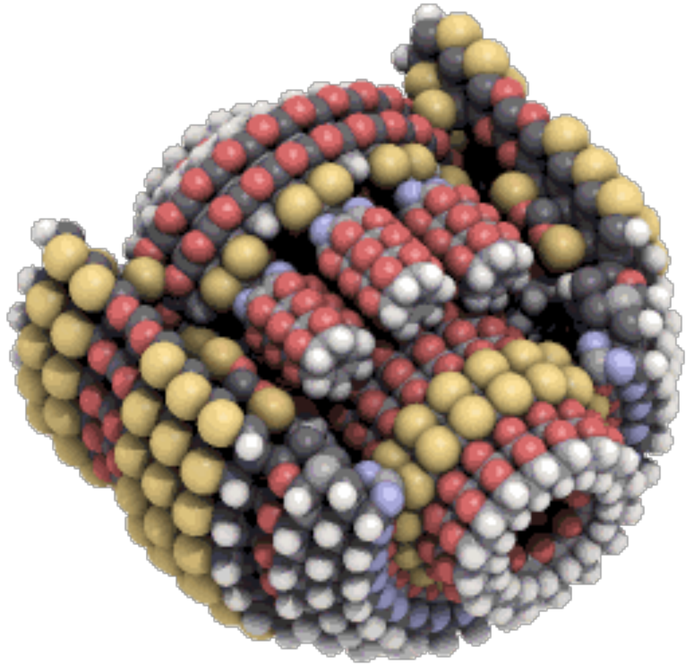
http://research.unl.edu/research_videos/

NanoMotors

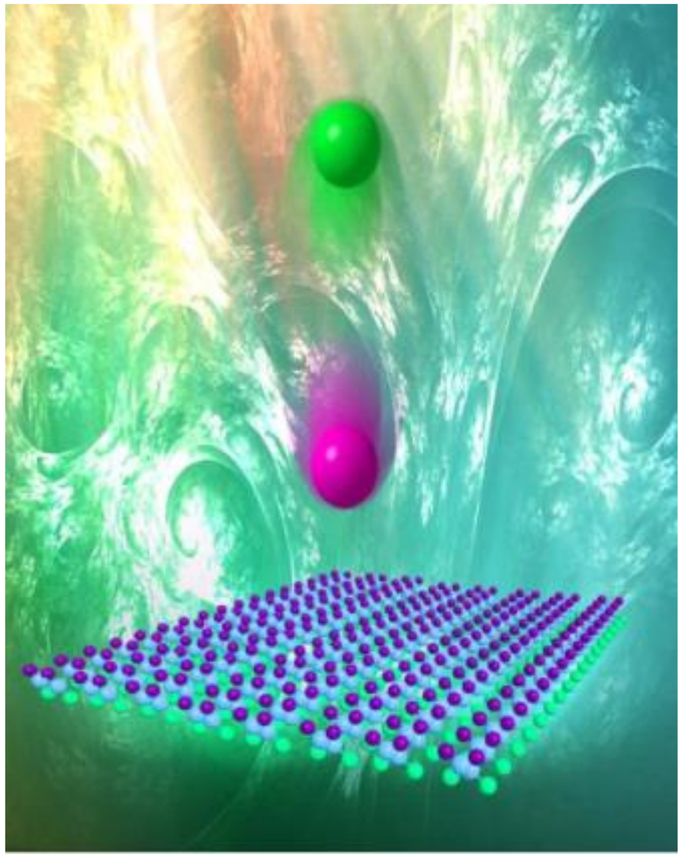




Carbon Nanotube about 1 nm across



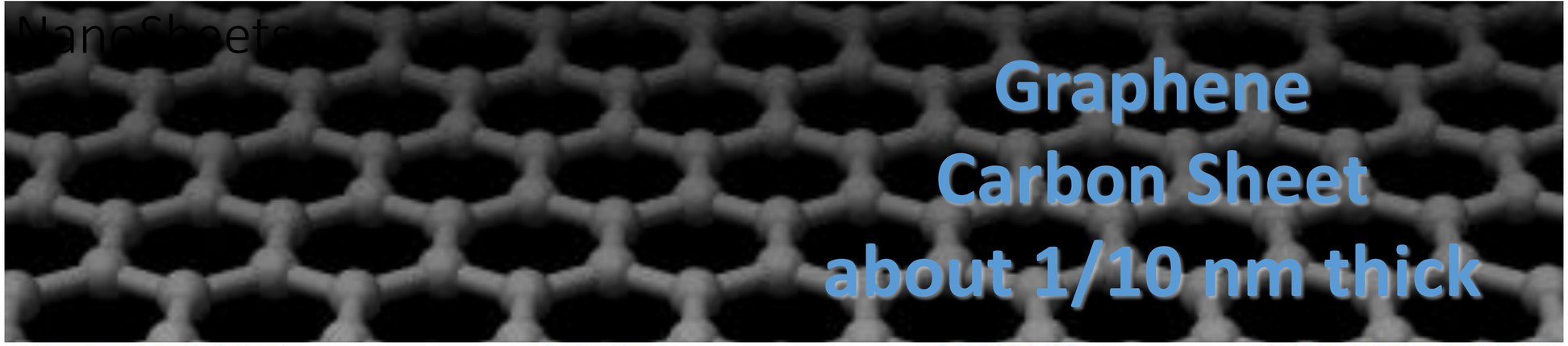
Nanoscience Research at the University of Nebraska



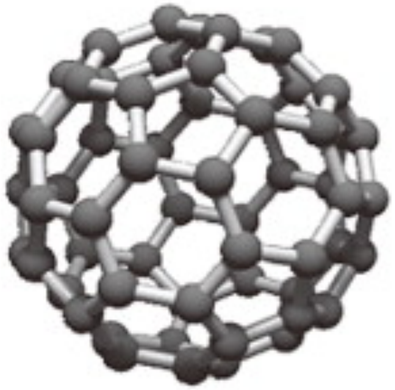
Polymer SolarCells

http://research.unl.edu/research_videos/

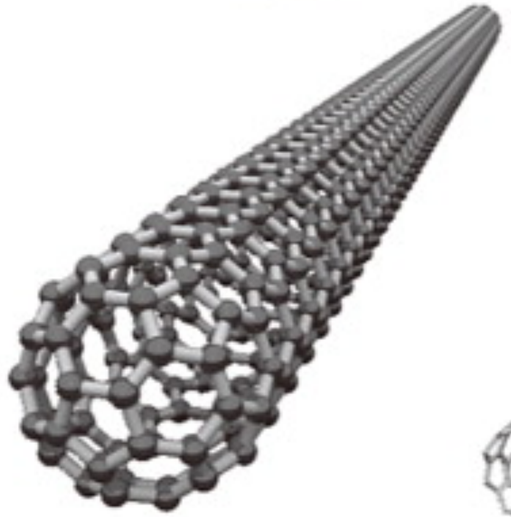
NanoSheets



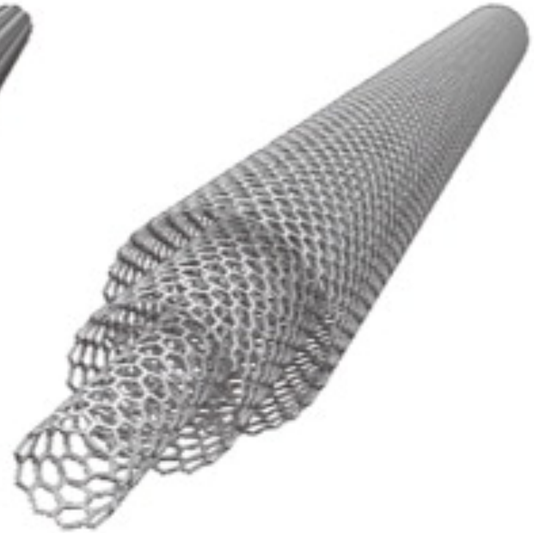
Fullerene (C_{60})



SWCNT

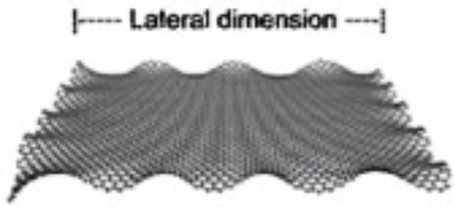


MWCNT

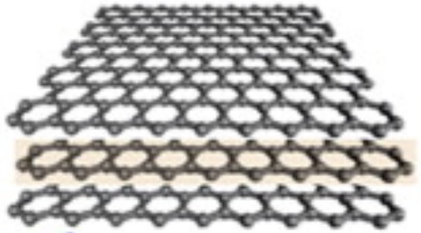


Carbon nanohorn

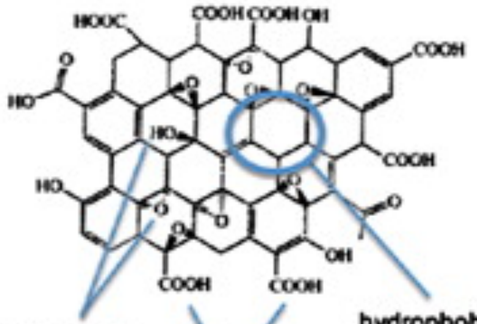
Graphene



Few-layer graphene

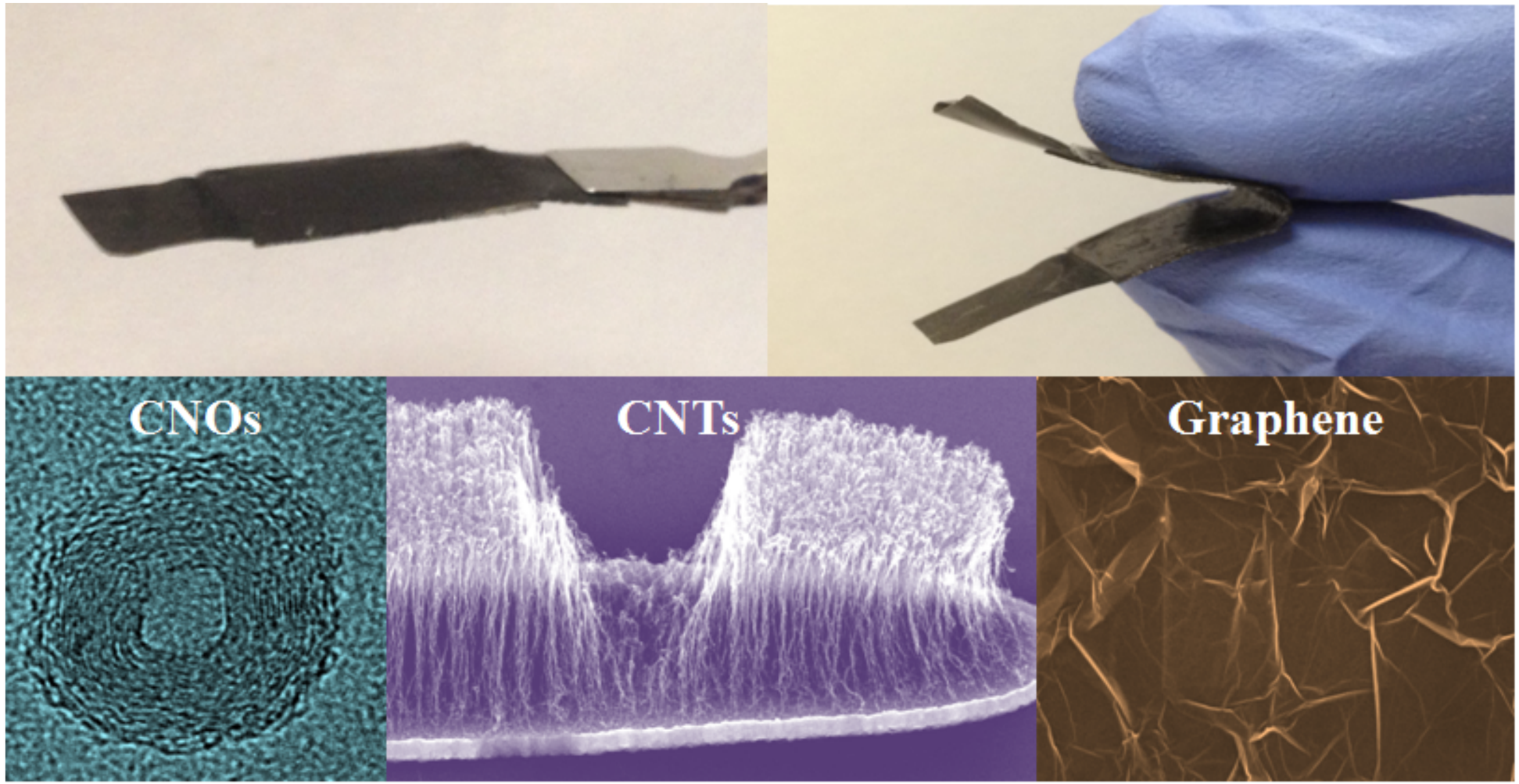


Graphene oxide



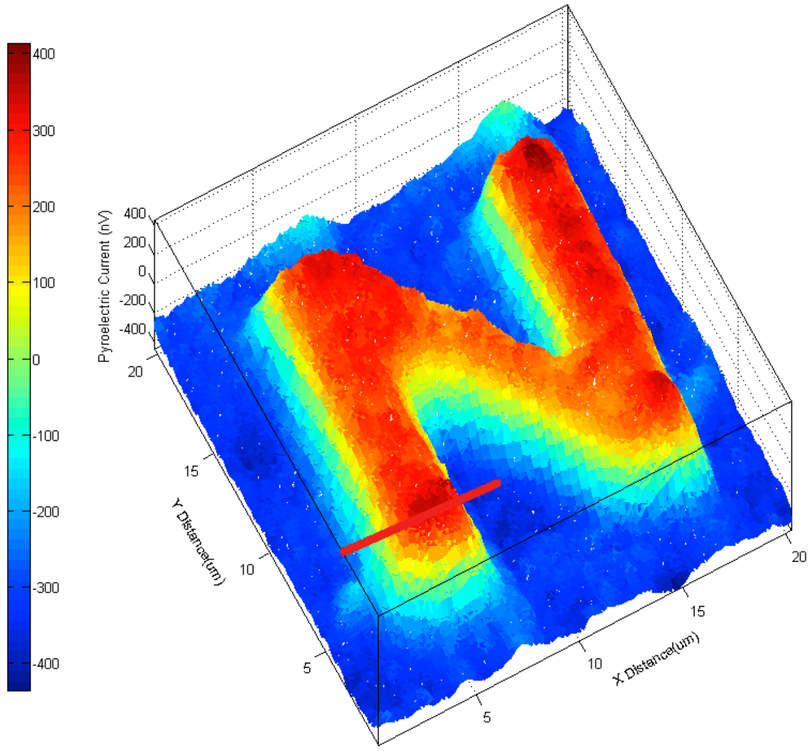
hydrophobic

Nanoscience Research at the University of Nebraska



http://research.unl.edu/research_videos/

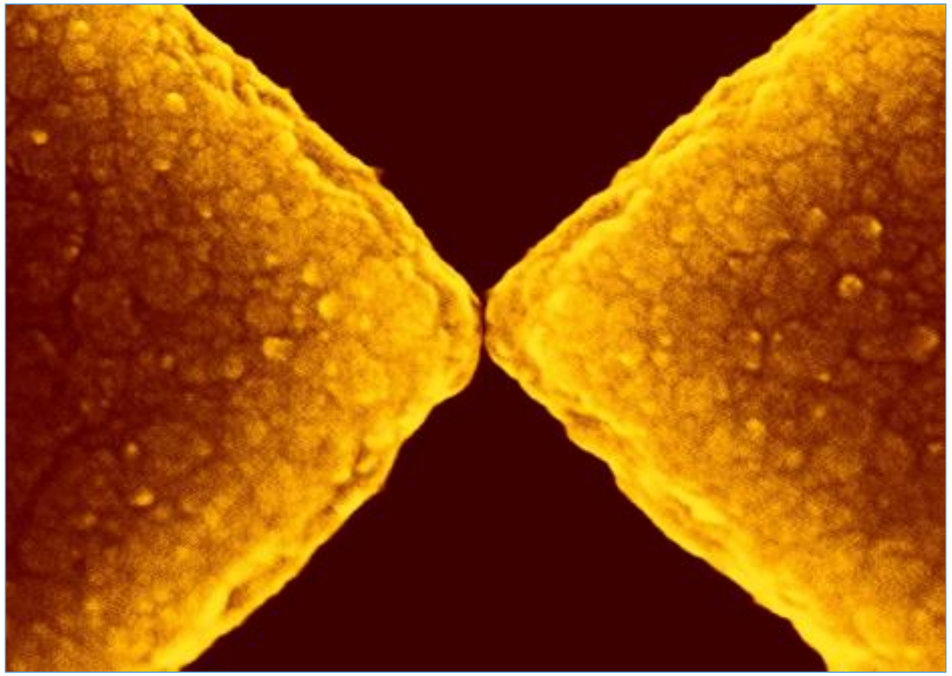
Nanoscience Research at the University of Nebraska



NanoPhysics Microscopes

http://research.unl.edu/research_videos/

Nanoscience Research at the University of Nebraska



Synthetic Bone Replacement

http://www.unl.edu/ncmn/videos.shtml

Teacher Resources

Educational Outreach Teacher Resources

NCMN provides numerous educational events throughout the year to engage student audiences in nanoscale science, technology, and engineering. A variety of methods and tools are used to increase the understanding of participants about science which are available below.

Nano/STEM Digital kits contain hands-on activities, programs, digital downloads complete with resources on getting started, posters, lesson plans, supply lists, marketing materials, training, multimedia files, and more.

Kits can be adapted for different ages, contain reuseable hands-on activities, and cost a nominal fee of $50 per kit. Some Nano/STEM kits are available for order by schools and other non-profits at http://ncmn.unl.edu/kit-order-form. We will invoice and ship kits within a few weeks.

NanoCamp Powerpoints and other Media Resources help support lessons about a variety of topics.

Kits for Purchase

Ordering: Visit http://ncmn.unl.edu/kit-order-form to purchase one or more kits for your school (non-profit required for order). We will invoice and ship kits within a few weeks.

Exploring Materials–Thin Films

Exploring Materials–Graphene

Exploring Products–Nano Sand (State Standards)

Exploring Products–Liquid Crystal Displays (State Standards)

Exploring Properties–Invisibility (State Standards)

Exploring Materials–Memory Metal (State Standards)

Exploring Materials–Ferrofluid (State Standards)

Exploring Materials–Oobleck

Exploring Size–Measure Yourself

Rain Project

Remotely Accessible Instruments for Nanotechnology

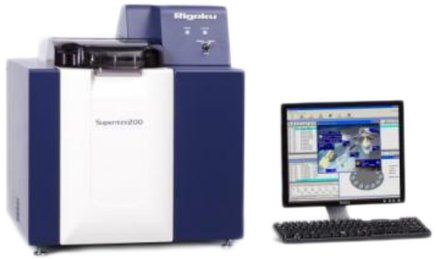

NORTH SEATTLE COLLEGE
One of the Seattle Colleges
Salt Lake Community College
Northcentral TECHNICAL COLLEGE
Oakton Community College
SUNY ECC
ERIE COMMUNITY COLLEGE
STATE UNIVERSITY of NEW YORK
IOWA
CABOCES
Stanford University
SUNY POLYTECHNIC INSTITUTE
RAIN Sites across the United States
Nano4me.org
PASADENA CITY COLLEGE
PennState
ASU Arizona State University
COPPIN STATE UNIVERSITY
THE UNIVERSITY of NEW MEXICO
Georgia Tech
ForsythTech
University of Nebraska Lincoln
UTSA
THE RESEARCH TRIANGLE PARK

X-ray fluorescence (XRF)

Remote Accessibility:

Nebraska Nanoscale Facility - (Rigaku Supermini200 X)

X-ray fluorescence (XRF) is the emission of characteristic "secondary" (or fluorescent) X-rays from a material that has been excited by bombarding with high-energy X-rays or gamma rays. The phenomenon is widely used for elemental analysis and chemical analysis, particularly in the investigation of metals, glass, ceramics and building materials, and for research in geochemistry, forensic science, archaeology and art objects such as paintings and murals.



RAIN Outreach

Nebraska Nanoscale Facility and 4H Summer Partnership

Nebraska Nanoscale Facility (NNF), in partnership with the University of Nebraska Extension Office and 4-H program provided remote analysis services through RAIN to youth in Omaha this summer. Fourteen schools and various programs throughout Omaha participated in the Engineering with Nano Power experience. Students were introduced to how specialized nano equipment can be used to analyze environmental materials and new products being developed in our society. Using the XRF a variety of materials were examined and their compositions discussed in the classroom after utilizing the remote technical capabilities of the XRF. Youth were able to connect and relate with a real nanoscientist using the RAIN platform. A variety of questions helped students engage with the remote session such as: *Why is analyzing samples important? What can you do with the info? What does this analysis tell us and how do you become a nanoscientist*?

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Over 190 students, 4th-8th grade, were able to experience the RAIN sessions, about 45% were females and 70% from underrepresented groups. We believe the RAIN sessions with enthusiastic teachers and scientists working together can have a positive impact on STEM identity formation and career orientation for youth!

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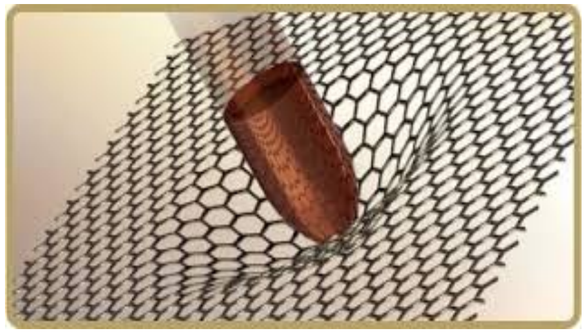
Thank you.
Any Questions?

Lets look at some of the Activities!

Activities

Graphene, Ferrofluids and Memory Metal



Graphene

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Ferrofluids

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Memory Metal

Thank you!
Any Questions?