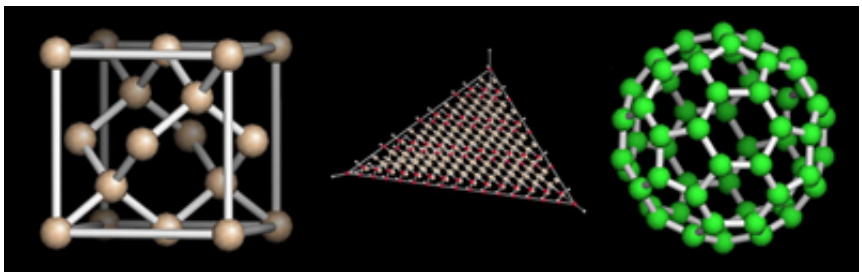
nanoHUB Resources for K-12



Resources for Grade School Students

Dragonfly TV
An on going series on PBS that ventures into modern day science, Dragonfly TV makes it easy for children from elementary school to middle school to understand. With games, experiments, and a message board where kids can ask their questions about science, kids will have fun and learn at the same time.

nanooze
Created for kids, nanooze is a place to hear about the latest exciting stuff in science and technology. *What kind of stuff?* Discoveries about the world that is too small to see and making tiny things. You will find interesting articles about recent discoveries and what it might mean for the future.

Purdue EPICS Team Animations for Children
This is a great starting point for kids to learn about nanotechnology. Travel with Martin and Laura into the nanoworld to understand just how small a nanometer is. Also, learn about nano-microscopes using Legos; find out how nanotechnology relates to seeing colors and more! Kids will enjoy these fun, animated presentations.

Resources for Middle School Students

NanoDays - NanoTrees: Making Paper Stronger than Steel, Robert Moon, Purdue University
Learn about how nanotechnology can allow you to make paper that is stronger than steel! Also learn about where extra-strong paper could be used, including the medical and construction industries.

Resources for High School Students

Mark Ratner Interview on Nanotechnology, Mark Ratner, Northwestern University
Dr. Mark Ratner talks about what the future holds for nano technology and where it is likely to head. Dr. Ratner relates nanotechnology to other sciences and the future role of modeling.

A Gentle Introduction to Nanotechnology and Nanoscience, Mark Ratner, Northwestern University
Dr. Mark A. Ratner gives a lecture about the basics and implications of nanotechnology. By starting with how big a nanometer is, Dr. Ratner begins to put nanotechnology into perspective and their potential. He gives a good overview and the path that nanotechnology will take.

Nanotubes and Nanowires: One-dimensional Materials, Tim Sands, Purdue University
Dr. Tim Sands speaks about nanotubes and nanowires explaining their applications and properties. Dr. Sands goes into further detail and explains what happens to their electronic properties, optical properties, mechanical properties, thermal properties, and chemical properties. High school students who are looking into nanostructures will benefit from his lecture.

Ecological Implications of Nanotechnology, Chad Jafvert, Purdue University
Prof. Jafvert discusses the ecological impact nanotechnology may have, especially the hydrological impact.

Solar Cells, Richard Schwartz, Purdue University Prof. Schwartz presents a basic view of how solar cells work and their evolutionary history.

Nano*High: Nanoscience for High School Students, Lawrence Berkeley National Lab
Nano*High is a series of general topic lectures by UC Berkeley professors and LBNL senior scientists conducting research from nanoscience to molecular medicine, and climate change to astrophysics.

Nanodays - Space—Lab on Chip Technology: The final frontier, Marshall Porterfield, Purdue University
Dr. Porterfield describes how nanotechnology can be used to construct lab-on-a-chip and life support systems to help astronauts survive in space.

Solar Fuel
MIT professor Jeffrey Grossman explains how an energy storage device that uses sunlight to create a “re-chargeable heat battery”.

Resources for High School Students (Advanced Study)

Nanomedicine – How Can Something so Small be so Huge for the Future of Healthcare?, James Leary, Purdue University
Dr. James Leary discusses the future on medicine and the impact nanotechnology will have on healthcare. This presentation was the keynote speech for the 2010 USA Biology Olympiad Finals.

Physics for Future Presidents, Jerry Woodall, Purdue University
Based on the book *Physics for Future Presidents* by Richard Muller, this course provides a liberal arts style education in physics that could be important for you to understand if you were

the president of the United States. This course is an opportunity for high school physics clubs to engage in similar discussions.

Crystal Viewer Tool
This tool can be used to visualize the nanostructure of different materials (Silicon, graphene, diamond, Buckyball, etc.). It is a helpful tool for material, electronics, and chemistry courses.

NanoDays - Artificial Photosynthesis with Biomimetic Nanomaterials: Self-Repairing Solar Cells, Jong Hyun Choi, Purdue University
Dr. Choi presents a more efficient form of solar energy involving self-repairing solar cells.

NanoDays - Metamaterials, Transformation Optics and Cloaking, Vladimir Shalaev, Purdue University
Learn about metamaterials and their futuristic applications in optics and invisibility cloaks.

Nanotechnology 101 Lecture Series
A collection of presentations targeted toward college undergraduate students but also maybe of interest to high school students in advanced studies.

Nanobiotechnology Resources for K-12
Additional nanoHUB.org resources focused on nanobiology.

Resources for Teachers

Thinking Small, Carl Batt, Cornell University
Dr. Carl Batt discusses the challenges of enhancing the public's understanding of nanotechnology and its ability to comprehend a scale of size over several orders of magnitude. Dr. Batt gives an overview of creating the traveling museum exhibit "Too Small to See," which has successfully faced the challenges of bringing nanoscale phenomena to the human-scale.

NCLT Seminar Series
A collection of presentations hosted by the National Center for Learning and Teaching in Nanoscale Science and Engineering (NCLT) that focus on teaching NSE at the K-12 level. These presentations explore teaching methodologies and the fundamentals of NSE.

DragonflyTV Nano – Using the Power of Television to Introduce Middle School Children to Nanotechnology
The producers of "Dragonfly TV" introduce their new season about nanotechnology. In these series, real kids do real research and experiments find out more about nanotechnology. Teachers can learn more at "Dragonfly TV"

K-12: Introduction to Quantum Wells
David Beck, Larry Gatz and Mark M. Budnik of Valparaiso University created a simple experiment for upper middle school and high school students that introduce the idea of quantum wells and tunneling. The only supplies needed are the students and movable desks.

Nanotechnology in Biology Louie Baca, Jr. and Eric Hagedorn
Teaching aid to help students understand nanomaterials.

The Scale of Things - Nanometers and More, Department of Energy (DOE)
Downloadable image developed by the Office of Science that depicts the scale of natural and manmade items.

Purdue EPICS Team Animations for Children
A collection of animated presentations on nanotechnology that were part of a museum exhibit developed for the Children's Museum. Topics covered include: picturing the size of a nanometer; the connection between nanotechnology and biology; scanning probe microscopes; molecular- and nano- manufacturing. Brought to you by the Lego Scanning Probe Microscope team, an EPICS project at Purdue University.

Quantum Computing Workshop for Teachers
A discussion of quantum advancements which are being developed and can change your life, such as: quantum computing and quantum cryptography. Includes a hands-on activity for Quantum Tic-Tac-Toe.

Resources for Parents

Mark Ratner Interview on Nanotechnology, see description above.

WALLA Lecture Series: Big Things from a Tiny World, Purdue University
A collection of lectures on various nano-related topics, from solar cells to ecological and societal implication

NanoDays 2011
Educational activities about nanoscale science and engineering for students in grades K-12