

THE FUTURE IS N.E.A.R.

NANOTECHNOLOGY EDUCATION AND RESEARCH
NORTH PENN HIGH SCHOOL ENGINEERING ACADEMY

October 26, 2005

INSIDE THIS ISSUE:

- Nanoworld** 1
- N.E.A.R. Funding** 1
- What is N.E.A.R.** 2
- Nanotech Goals?** 3
- Coming Up?** 3

CONTACT INFORMATION:

Mr. Michael A. Boyer
 North Penn High School
 1340 Valley Forge Road
 Lansdale, PA 19446

215.368.9800.460
 boyerma@npenn.org
 www.TheFutureIsNear.org

SPECIAL POINTS OF INTEREST:

Visit the nanotechnology research website:
www.thefutureisnear.org

At this website, you will find a link to the student research pages, program objectives and goals and many more exciting pieces of information related to the project and the research that the students are performing!

The North Penn Engineering Academy Enters the Nanoworld

Students in the North Penn High School Engineering Academy will be putting their research skills to the test this school year.

The students will be performing research at the nano-level by producing nanofibers which will be less than 300 nanometers in diameter.

For this activity, the students in the Senior Design course of

the Engineering Academy will study the emerging field of nanotechnology. To help prepare these students for the challenges that the senior design course will offer them, this unit has been developed to introduce them to the formal research process utilizing a relevant research topic.

For this activity, students will be grouped into teams of three; each having a specific

responsibility, such as, communications, safety, or proc-



Electrospinning Stations:
 These are the stations that the students will be utilizing for their research.

The Future is N.E.A.R. Project Receives Funding

Mr. Michael Boyer, a Technology Education and Engineering Academy teacher at North Penn High School, has been developing a unit for the introduction to nanotechnology research.

Mr. Boyer was introduced to nanotechnology at Drexel University with Dr. Frank Ko in the summer of 2003 as a participant of their National Science Foundation funded Research Experiences for Teachers program. He returned to Drexel for the next three years to continue the research process. As a result of his experiences at Drexel, he began to develop a nanotechnology research activity for his senior engineer-

ing academy students as a way to introduce them to the research process.

Mr. Boyer stated that two of the major hurdles in beginning the nanotechnology program at North Penn was finding the time to develop the curriculum and the funding necessary to acquire all of the equipment.

As for the first hurdle, Drexel University in Philadelphia, PA graciously accepted Mr. Boyer into their Research Experiences for Teachers (RET) program for a third year. He was able to utilize the time to develop the curriculum and test the electrospinning activities that his students are to perform. As for the second

hurdle, he was awarded three of five grants that he wrote this summer totaling \$12,000! The grants were awarded by the Toshiba America Foundation, Dominion Foundation, and the ING unsung heroes grant program.

Without the assistance of Drexel University and the generous funding from the foundations, the program would not have begun.

Mr. Boyer stated that he is greatly appreciative for the assistance he has received!

The next step is to look for further funding to expand the program and apply for the ability to begin a full year nanotechnology course within the engineering academy.

North Penn Enters the Nanoworld...continued

ess and materials.

One of their ultimate goals will be to use a process called electrospinning to create their own nanofibers that have an average diameter less than 300 nanometers. Each team will be given a specific polymer to research. They will need to find all of the chemical properties of the polymer, the MSDS (Material Safety

Data Sheet) for their polymer to identify how to store, measure, and blend the polymer into its solution. Engineering documentation, web-based proposal development, a study of the societal impacts of nanotechnology, properties of polymeric materials, chemistry and physics in the materials environment, and the use of high level instrumentation at Drexel Uni-

versity is all a part of the proposed activity. Applying the knowledge of nanoscience and nanotechnology to engineering education within the Engineering Academy at North Penn High School through the use of higher level mathematics, statistical analysis, physics (quantum vs. Newtonian), chemistry and formal research are the goals of The Future is N.E.A.R.

Through the rigorous research process, students will learn to analyze, quantify, and assess their data while at the same time they will prepare themselves for the rigors of college life and the world of work.

Please visit the website for further information.

www.thefutureisnear.org

Check out the link to the

What is the Future is NEAR?

One of the latest emerging technologies is Nanotechnology. Most work and research in this field is being performed at the university and corporate levels.

The main goal of The Future is N.E.A.R. project is to introduce the fundamentals of nanotechnology, research skills, and higher level thinking and application of knowledge to high school students while cultivating their interest in engineering, problem solving and life-long learning.

Organized approaches to true research can be such an educational tool. It is often a real eye-opener for one who has never endeavored into the unknown. It is an arena where failure is an

option...and often encouraged. Failure, in the right context and environment, with the right support and guidance can create character and desire. It is not the failure that matters, it is what was learned, applied and adapted from that failure that does. How often can an inventor or engineer state that their product was designed, prototyped and manufactured correctly on the first try without revision? Or state that their outcome was directly in line with their predictions from the beginning?

Much of the educational world today takes students through an activity where the outcome is known, expected, and prepared.

While there is merit to the approach, it is not enough to spark a true understanding of genuine problem solving. There becomes opportunities to skip steps to get to the end or to cheat to get an answer. Students find these methods rather easily and thus the activity has lost much of its student creativity and exploration.

In the research world, there is no room for cheating, for skipping steps, or saying, "I've seen this before and I know the answer." The students are left to create, solve, and try again. Their original goals are often abandoned for new ones as their research leads them to something deeper, stronger, and closer to the truth they are seeking!

This is the Future is N.E.A.R.!



Nanotechnology Program Goals

Global competition, the rapid advance of new and emerging technologies, and a shrinking national workforce make it imperative that our students are prepared now more than ever to succeed in today's world. Below are the goals of the nanotechnology program at North Penn High School:

1. Inform and educate students about nanotechnology, examples and applications, future work and general terminology.
2. Identify nanotechnology as a necessary program for improving student learning through research and preparing them to be competitive, productive members of society.
3. Discuss and study Materials Science as a field of engineering.
4. Discuss physics from the Newtonian vs. Quantum approach as it relates to the Nanotechnology field.
5. Research polymers and their chemical attributes.
6. Identify and research electrospinning as a method of producing nanofibers.
7. Learn about electrostatics and other electrical characteristics of the electrospinning process.
8. Design experiments from a given set of parameters.
9. Experiment with various ways to modify and improve the electrospinning process to produce aligned fibers.
10. Research, identify, and utilize the necessary tools, equipment, and procedures to create nanofibers of varying attributes. (Diameter, conductivity, morphology, etc.)
11. Utilize the Scanning Electron Microscope to quantify their results.
12. Understand how to organize collected data and properly display the results utilizing various software programs such as Excel, PowerPoint, Word, FrontPage.

What's Coming Up In The Nanotech Course?

With in the next week, the students will be designing their own experiments utilizing the electrospinning apparatus.

Students will be studying the parameters that affect the resulting fibers they will spin. They will study

effects of the weight percentage of the polymer solution, the angle of the syringe, voltage and distance effects, the whipping action of the jet, the type of metal used on the collection plate, and many other parameters.

The students are currently documenting all of their research in their team websites. The websites are currently under password protection until they are finalized.

To see more information about the teams' research and class activities, please visit the students' research website at the following address below:

Student Research Website
<http://nanoresearch.thefutureisnear.org>