

Exploration In Nanotechnology

What: Students in Ballston Spa have the opportunity to explore topics on the cutting edge of science and technology with the addition of our Exploration in Nanotechnology course (September 2008)

Teachers: Michael Potter - Technology and Nanotechnology Teacher
John Balet – Biology and Nanotechnology Teacher

Professional Development for Staff: Both Mr. Potter and Mr. Balet attended the Nanotechnology Curriculum Development Summer 2008 Institute sponsored by Rensselaer Polytechnic Institute, WSEHE BOCES and the Workforce Consortium for Emerging Technologies (WCET).

Who Can Take the Course: The course is open to all sophomores, juniors and seniors. The course can be used to meet the graduation requirement of a third year of science (since it is aligned to the standards) or as an additional science elective.

Course Structure: The students have been divided into two sections. During the first few weeks of the course both sections are studying an Introduction to Nano module. During the next 13 weeks one section studies nano topics from the perspective of the engineering sciences and the second section from the perspective of the biological sciences. After 13 weeks the sections switch to cover the topics that they have not yet covered. During the last few weeks both sections cover the topics of Nano Economics, Ethics, and Career Paths as well as completing culminating projects.

Collaboration: Students had the opportunity to attend NanoCareer Day at the University of Albany College of Nanoscale Science and Engineering during the fall.

Why: The Exploration in Nanotechnology course was developed as result of student interest and identified workforce needs. The region is abuzz with news about companies such as Global Foundries, IBM, Sematech, GE Global Research, and Superpower. HVCC, RPI, Union College and the College of Nanoscale and Engineering at The University at Albany are expanding research and development into this area, making this topic even more important for our high school graduates.

What's Next: We are continuing to look at ways to incorporate the emerging and converging technologies into our curriculum. In the fall of 2009 we will again be offering the Exploration in Nanotechnology course and will also be introducing a course in Nanoeconomics. In the Nanoeconomics course students will be able to analyze the impact of nanotechnology on the economic growth and development of Tech Valley. Our General Chemistry teacher is currently working on ways to incorporate Nanotechnology into that curriculum as well. We are continuing to expand our collaboration with area colleges and businesses to prepare our students to work in the jobs that we envision coming to this area.

Exploration of Nanotechnology Course Syllabus

Unit 1 Introduction to Nano (Both Sections) - Weeks 1-7

- Branches of Nanoscience
- Measurements
 - Metric units
 - Surface Area to Volume ratio
- Instruments and Tools of Scientists
 - TEM & SEM
 - Atomic Force Microscope
 - Scanning Probe Microscope

Technology Focused Curriculum (One section either Weeks 8-20 or Weeks 21-33)

- Unit 2 Material Science
 - Properties of materials at different sizes
 - Growing Nanotubes and their properties
- Unit 3 Energy Applications
 - Solar & Hydrogen Fuel cells
- Unit 4 Chip Building & Lithography
 - History of the Chip and Wafer Making Process
 - Clean room dynamics
 - Lithography
- Unit 5 Digital Electronics & Robotics
- Unit 6 Statistics and Process Control

Biology Focused Curriculum (One section either Weeks 8-20 or Weeks 21-33)

- Unit 7 - Nano Photonics & Particle Properties
- Unit 8 - Properties & Applications of Nano
 - Consumer & Commercial Grade Fabric Applications
 - Consumer Products
- Unit 9 - Genetic Engineering and Nanomedicine
 - Nanoparticles (Nanoshells, bucky balls, quantum dots, dendrimers, etc)
- Unit 10 - DNA Microarray
 - Construction of Microarrays
 - Application of Microarrays
- Unit 11- Lab-on-a Chip & Biosensors
 - Disease detectors
 - Homeland Security
- Unit 12 - LED & OLED
 - Energy efficient lighting and energy transfer

Unit 13 – Economic and Ethical Implications of Nanotechnology (both sessions for 7 weeks)

- Exploration to Nanotechnology re-cap
- Nano Economics
- Ethics
- Education and Career Path research and discussion
- Service Learning Poster Session on nanoproducts and the impact of nanotechnology