Nanu-Edu in WINI
Weizmann Institute Nano Initiative

Ron Blonder & Sidney Cohen

WINI (Weizmann Institute Nano-Initiative)

40 Research Groups from disciplines of

* Chemistry
* Physics
* Biology
* Mathematics
* Science education
* 230 Graduate Students and Post-doctoral fellows

Goals and Input of the Weizmann Team

* Expose high school teachers to modern research topics with emphasis on nanoscience
* Increase nanoliteracy of chemistry teachers
* increase chemistry teachers' nanoliteracy
* Make them passionate about nanoscience
* Enhance nano-expertise of advanced students and professionals

Achieved by:

1) Nanotechnology course for teachers
2) Developing online graduate courses in Scanning Probe Microscopy

Blonder, R. (2011). The story of nanomaterials in modern technology: An advanced course for chemistry teachers. *Journal of Chemical Education*, *88*(1), 49-52.

Instrumentation Topics for the Teaching Laboratory

edited by
Michelle Bushey
Department of Chemistry
Trinity University
San Antonio, TX 78212

Atomic Force Microscopy: Opening the Teaching Laboratory to the Nanoworld

by Ron Blonder*

Department of Science Teaching, Weizmann Institute of Science, Rehovot, 76100 Israel
*ron.blonder@weizmann.ac.il

by Ernesto Joselevich

Department of Materials and Interfaces, Weizmann Institute of Science, Rehovot, 76100 Israel

by Sidney R. Cohen

Chemical Research Support, Weizmann Institute of Science, Rehovot, 76100 Israel

Since the days of Democritus' atom and Avogadro's molecule, scientists have longed to observe these fundamental building blocks of nature. This dream came true in 1981 with the invention of the scanning tunneling microscope (STM) *(1, 2)* by IBM researchers Binnig, Rohrer, and Gerber, which allowed them to visualize individual atoms on a surface for the first time. This achievement had such profound implications in fundamental science that it earned them the Nobel Prize in physics in 1986 *(3)*. However, the use of STM is limited to electrically

angle from the very end of the cantilever. As the tip scans the surface, a feedback system raises and lowers the sample to keep a constant force between the tip and the surface. A plot of this upward and downward motion as function of the tip position on the sample surface provides a high-resolution image of the surface topography. This mode of operation is called "contact mode". Alternatively, the tip can vibrate rapidly up and down and tap the surface while scanning it. This mode, referred to as "tapping", "semicontact", or "dynamic" mode, is actually the most common

Blonder, R., Joselevich, E., & Cohen, S. R. (2010).
Atomic force microscopy: Opening the teaching laboratory to the nanoworld.
Journal of Chemical Education, *87*(12), 1290-1293.

Scanning Probe Microscopy - Principles, Theory, and Applications

Scanning Probe Microscopy - Laboratory Course

Scanning Probe Microscopy has revolutionized our view of materials and our power to investigate their fundamental properties.

This course will cover the fundamental physical principles behind the technique, considerations in the operation of the instrument, aspects of data acquisition and analysis, and applications. Subjects will largely be discussed through referral to current scientific literature.

Background Physical Effects
Principles of SPM Instrumental design and operation
Data Analysis and image processing
Applications

This course will provide training which should lead to a basic understanding of operation and image analysis.

Image Analysis
Force Curves
Basic Operation
Electrical measurements
Artifacts
Lithography