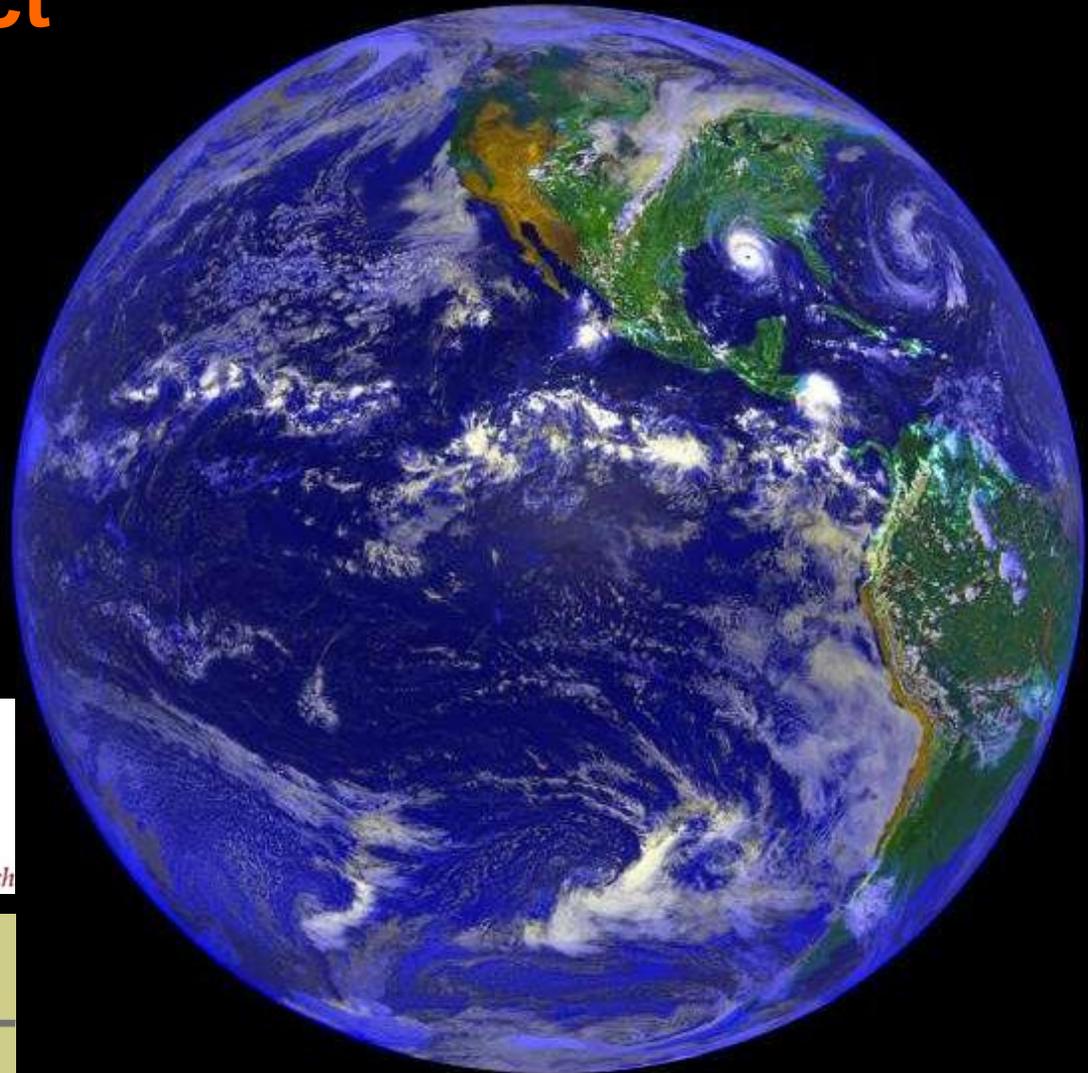
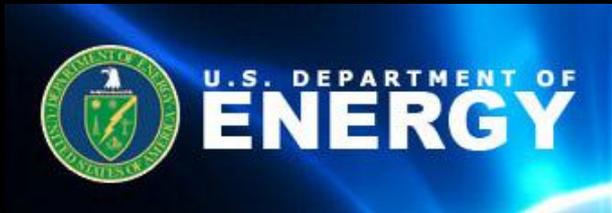


NSE's future is ultimately rooted in education: Towards the modern nano-education construct



A PERSONAL VIEW BY JAMES BURKE

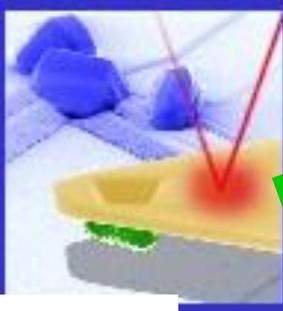
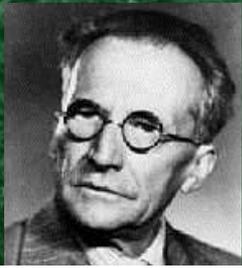
THE
SCIENCE

“You see what your knowledge tells you you are seeing. What you think the universe is, and how you react to that, in everything you do, depends on what you know. And when that knowledge changes, for you, the universe changes. And that is as true for the whole of society, as it is for the individual. We all are what we all know today. What we knew yesterday was different, and so were we.”

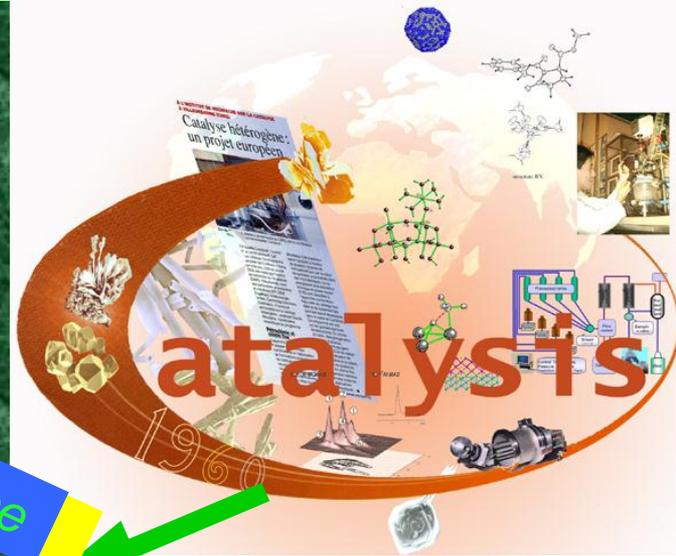
James Burke, British scientific historian, in 1978

A quote from Howard Gardner, the John H. and Elisabeth A. Hobbs Professor of Cognition and Education at the Harvard Graduate School of Education, in 2008:

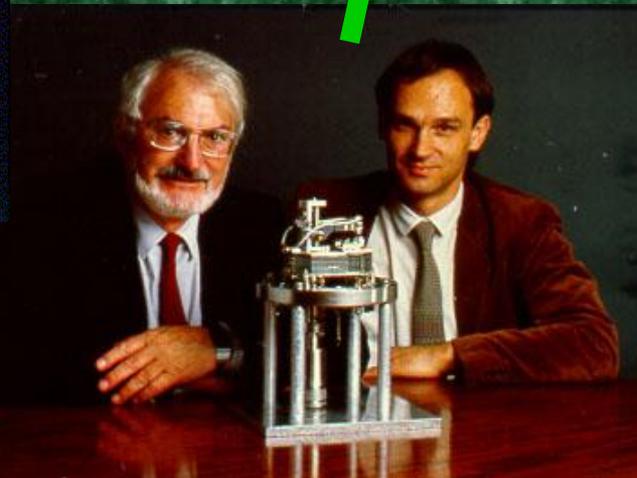
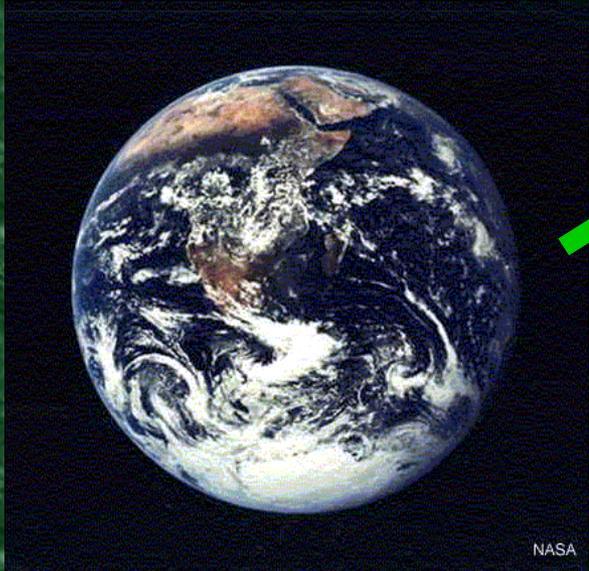
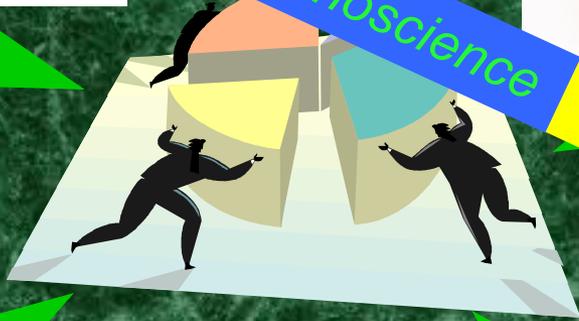
“In the 21st Century, the most valued mind will be the synthesizing mind: the mind that can survey a wide range of sources, decide what is most important and worth paying attention to, and then put that information together in a way that makes sense to itself, and ultimately, to others as well.”



$$-\frac{\hbar^2}{2m} \frac{\partial^2 \Psi(x,t)}{\partial x^2} + U(x)\Psi(x,t) = i\hbar \frac{\partial \Psi(x,t)}{\partial t}$$



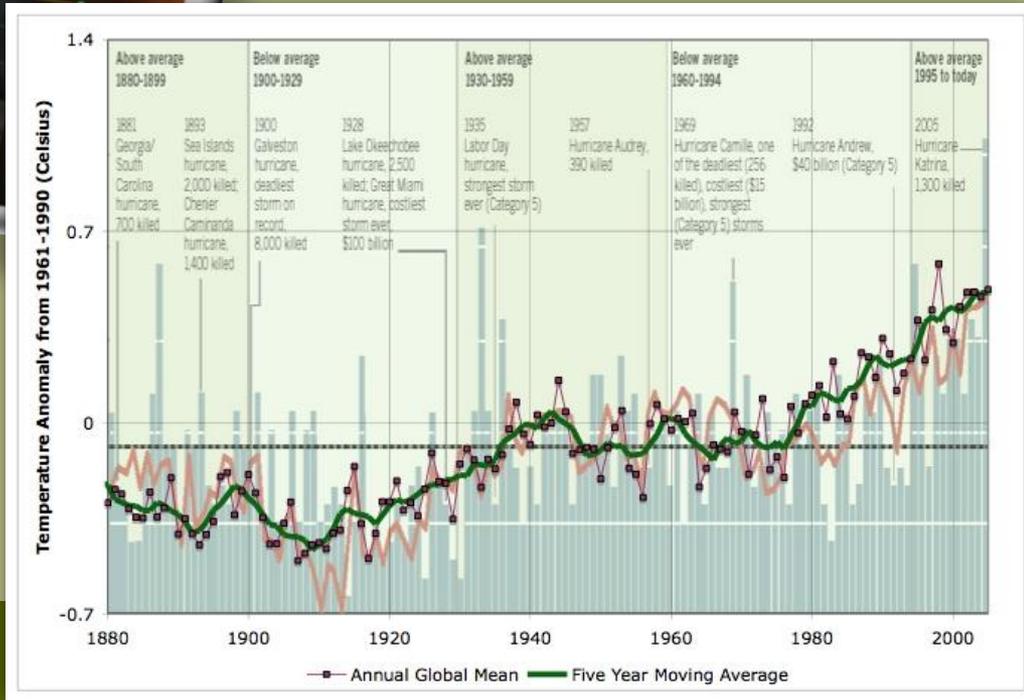
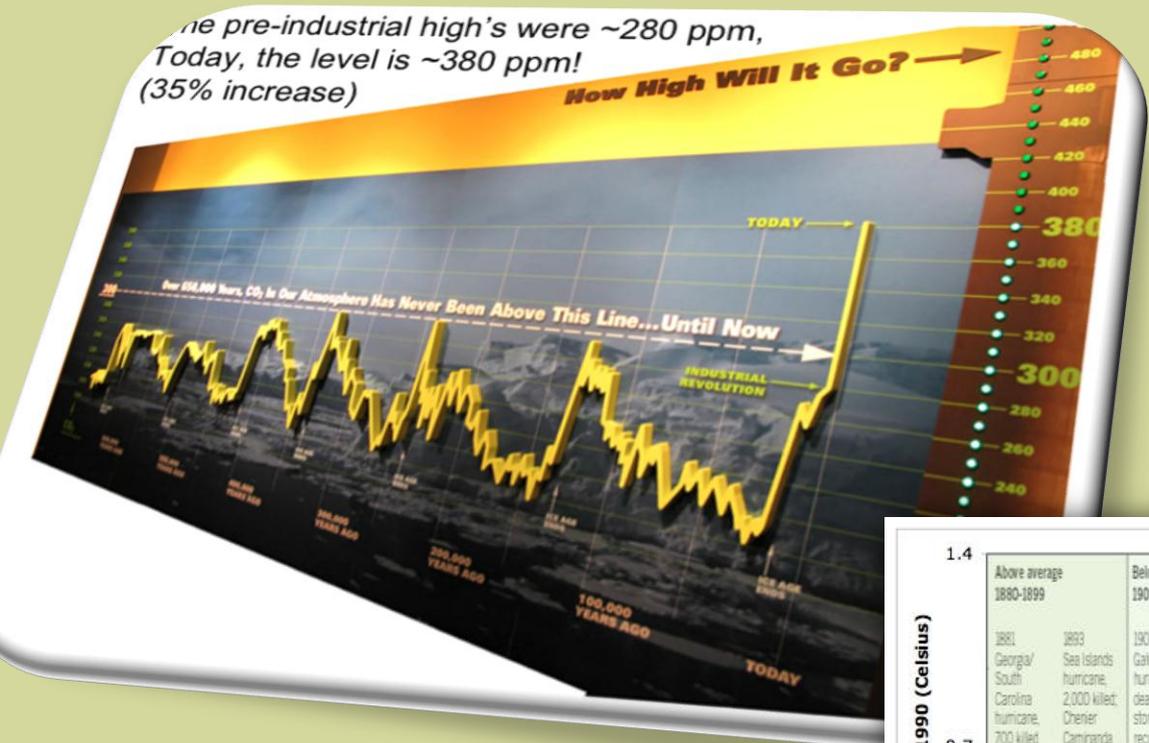
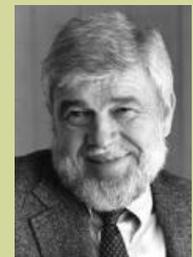
Nanoscience



“Give me half a tanker of iron and I’ll give you the next ice age.”

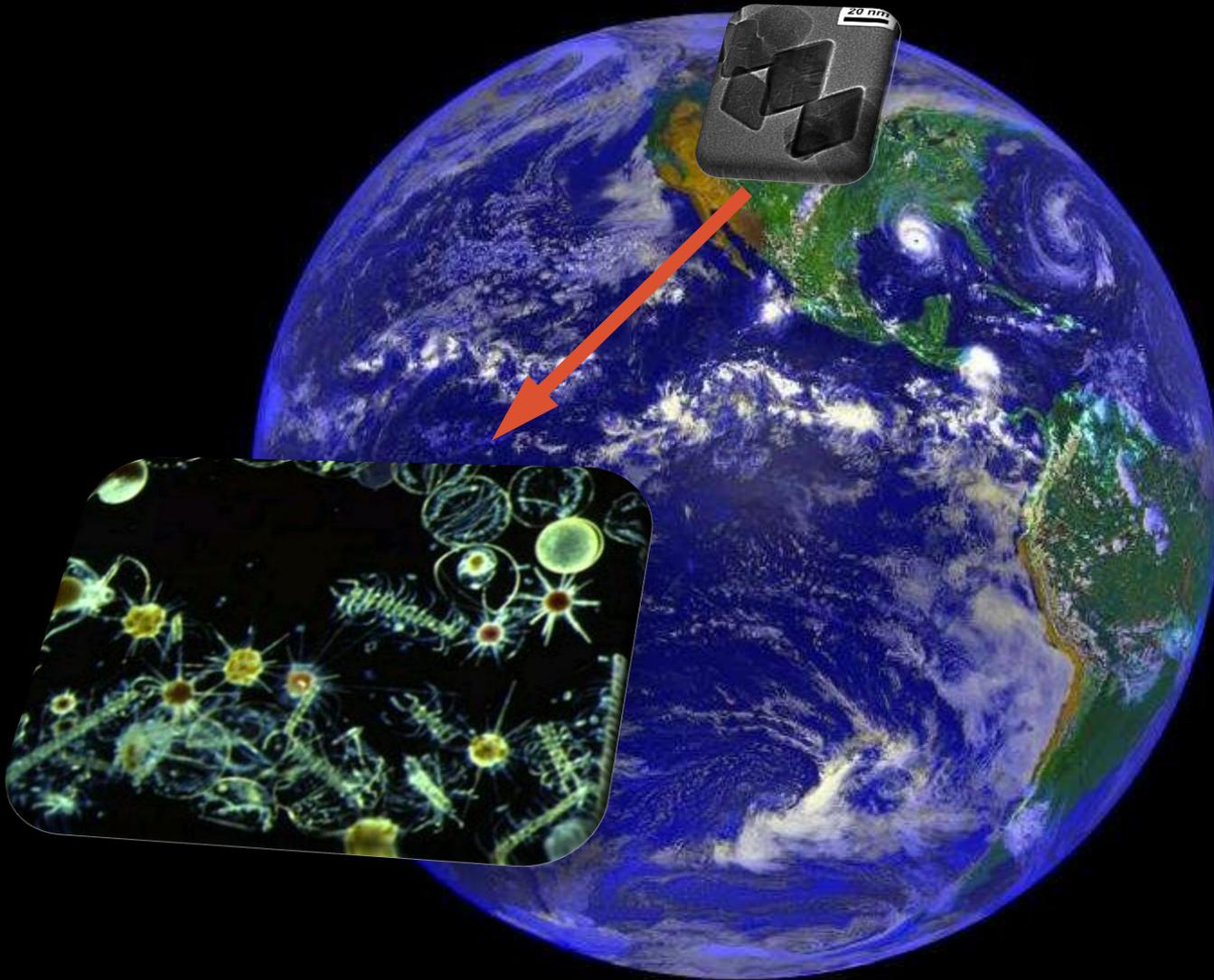
1988

John Martin, Director
Moss Landing Marine Labs



The great connection:

Iron biogeochemical cycling = key regulator of global temperature



Informs the remarkable chemical/physical FUNCTION that nanomaterials can have

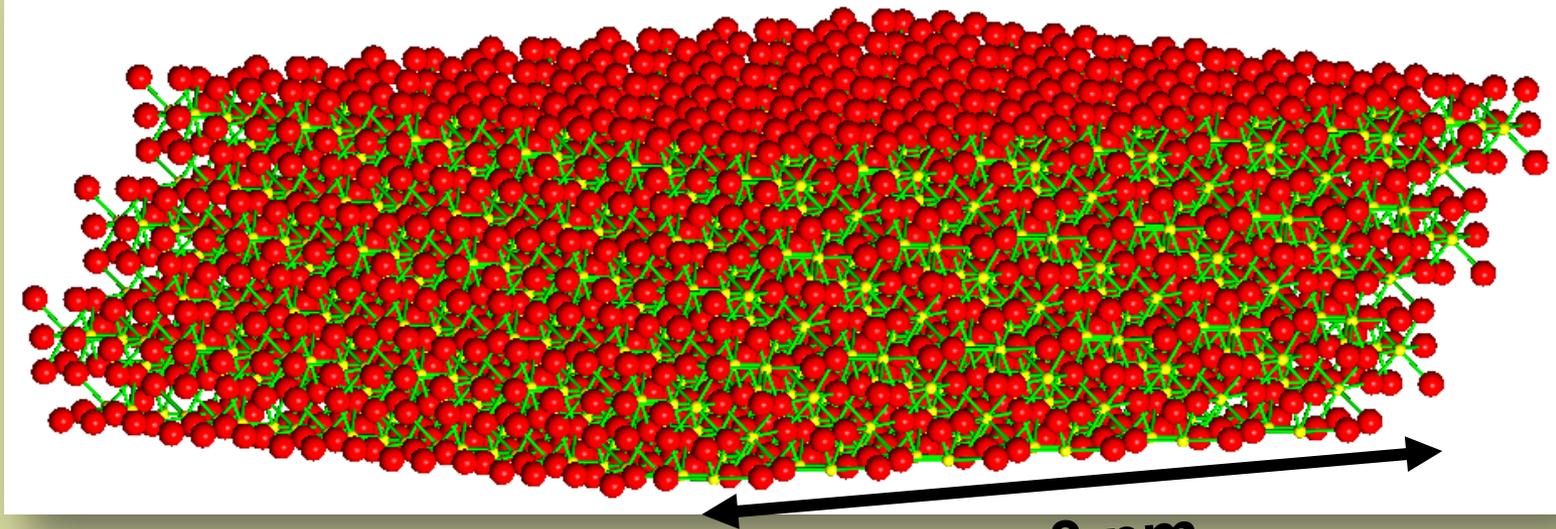
A road map for our journey through
dimensional and scientific *space*

PHYSICS
CHEMISTRY
BIOLOGY
MINERALOGY
ATMOSPHERY
OCEANOGRAPHY
GEOLOGY
MICROSPECTROS

The Bohr radius of an electron and hole in a semiconductor:

$$a_e = \frac{4\pi\epsilon_0\hbar^2}{m_e q^2} = 7.0\text{nm}^{hem}$$

$$a_h = \frac{4\pi\epsilon_0\hbar^2}{m_h q^2} = 3.8\text{nm}^{hem}$$



Fe₂O₃: nanohematite ≠ hematite

3 nm

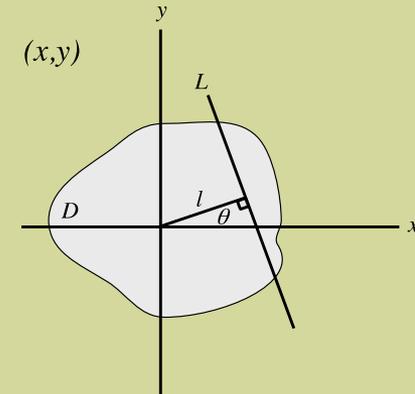
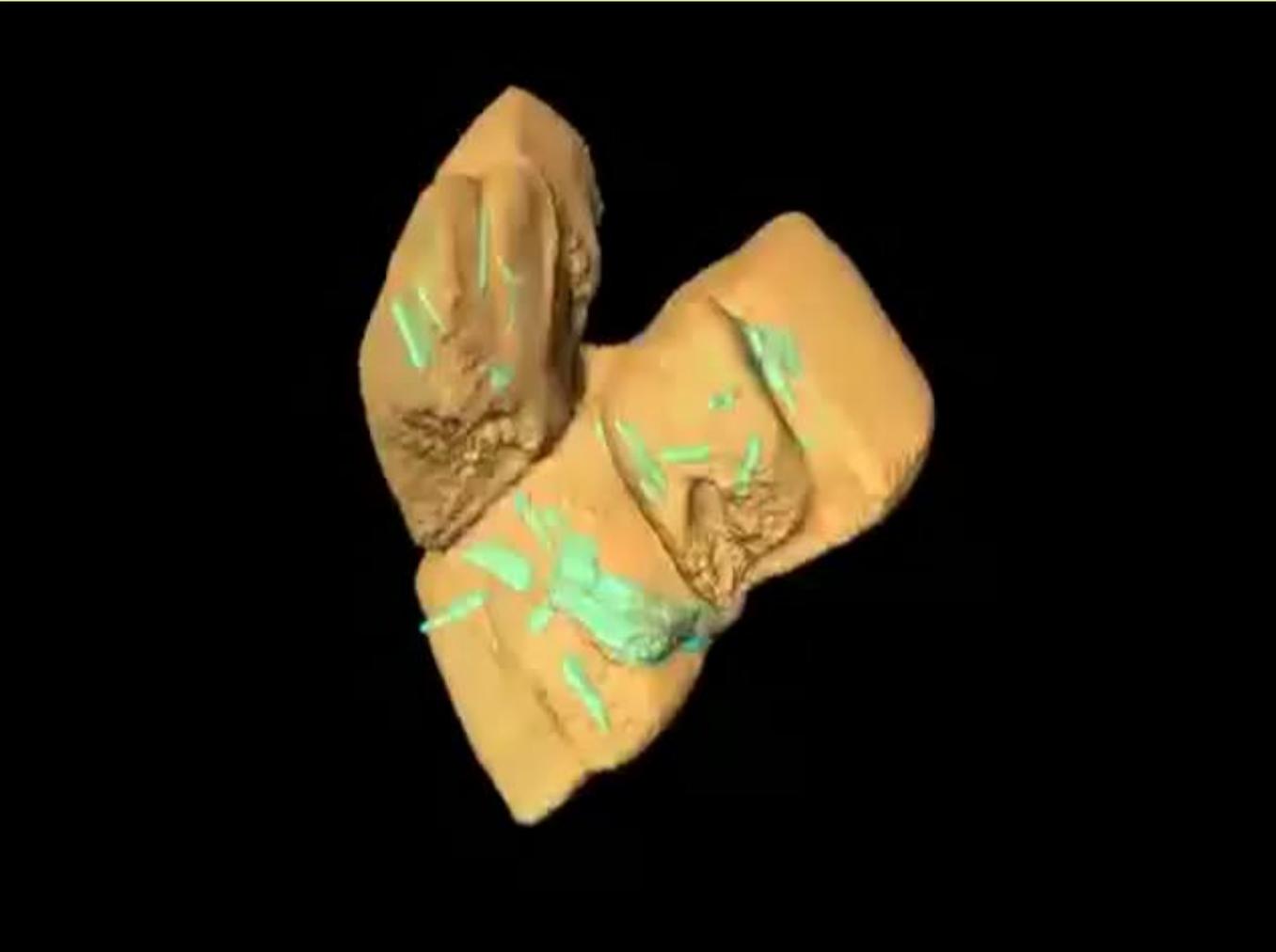
structure and electronic properties as *f* (size)

- bond length variation
- edges, steps, kinks
 - corrugation
 - order-disorder

- band gap (HUMO/LUMO shifts)
- surface and mid-gap DOS

***These property variations*
= reactivity changes as *f* (size)**

Nano-hematite, HAADF-STEM tomography, aggregate, 30 nm



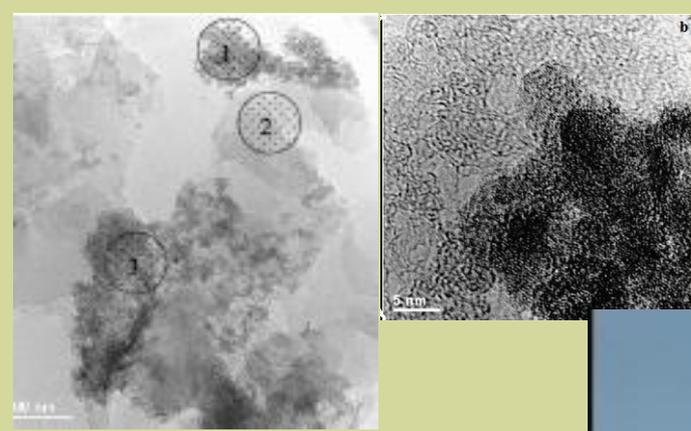
$$Rf = \int_L f(x, y) ds.$$

Radon J. (1917)
Leipzig Math.-Phys.

Echigo, Aruguete, Murayama, Hochella (in press) Am. Min.

Iron oxyhydr(oxide) from glacial meltwater

Raiswell et al. (2006) GCA



Video published June 1, 2012, by TempestZeta.



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Welcome to The EIGER Project at Virginia Tech!

Director

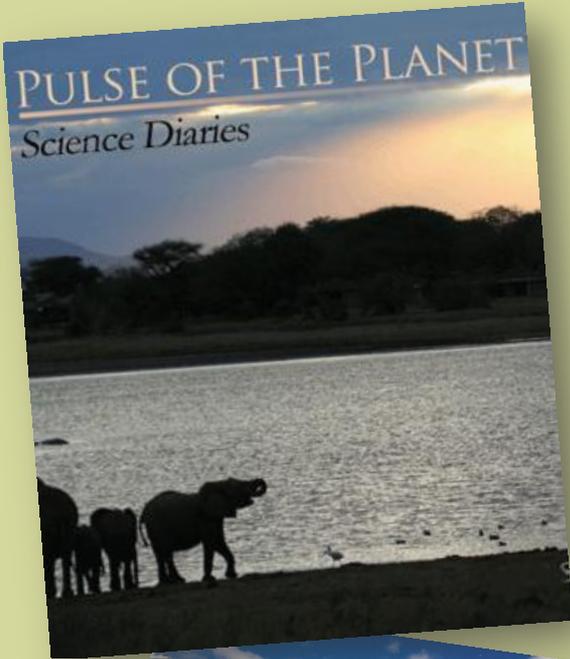
The EIGER Program at Virginia Tech, supported by NSF IGERT funding through 2010, focuses on graduate research in the areas of 1) interdisciplinary environmental interface science, as studied by physical scientists and engineers, and 2) human interfaces within interdisciplinary scientific and engineering teams, as studied by behavioral scientists. Ten departments in four colleges are involved in this project which will support 27 Ph.D.

NEWS AND EVENTS

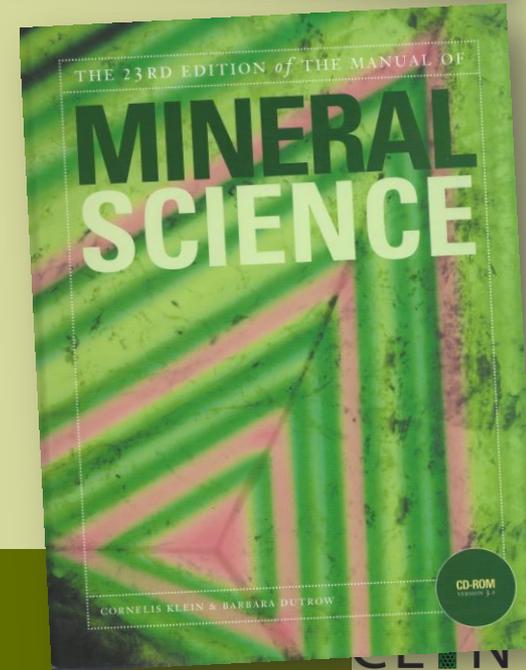
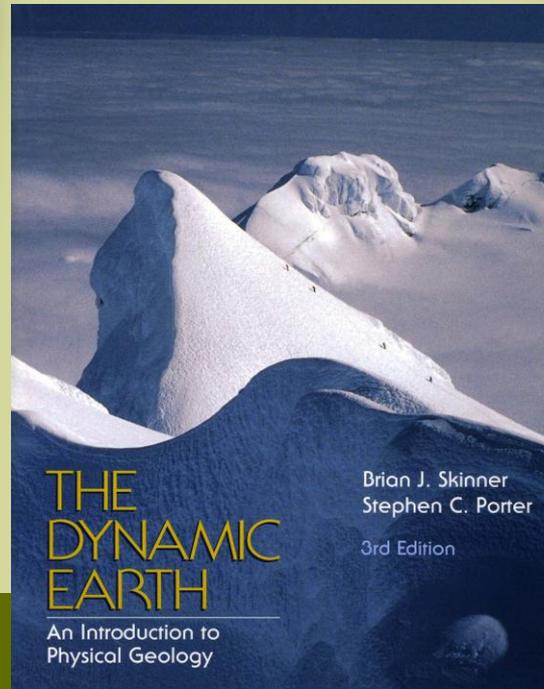
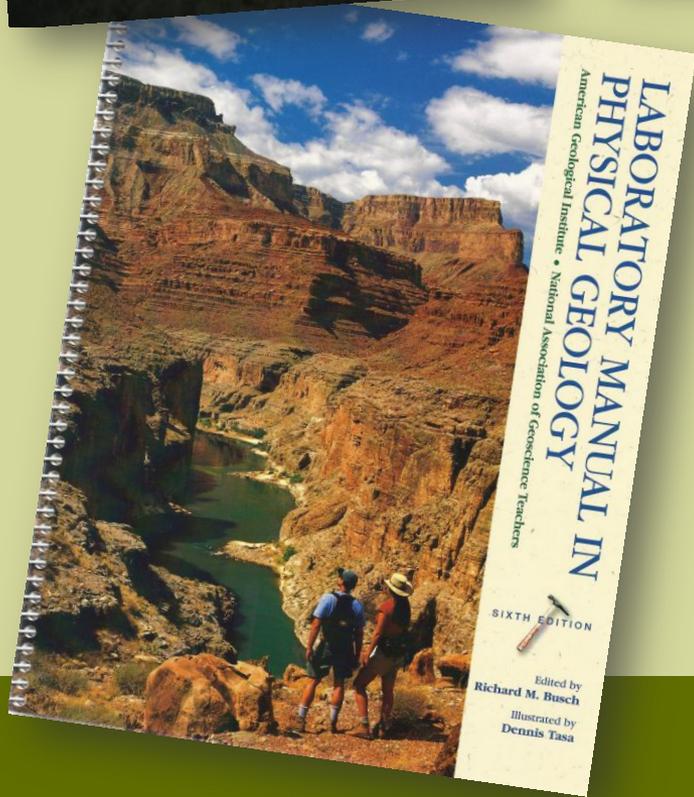
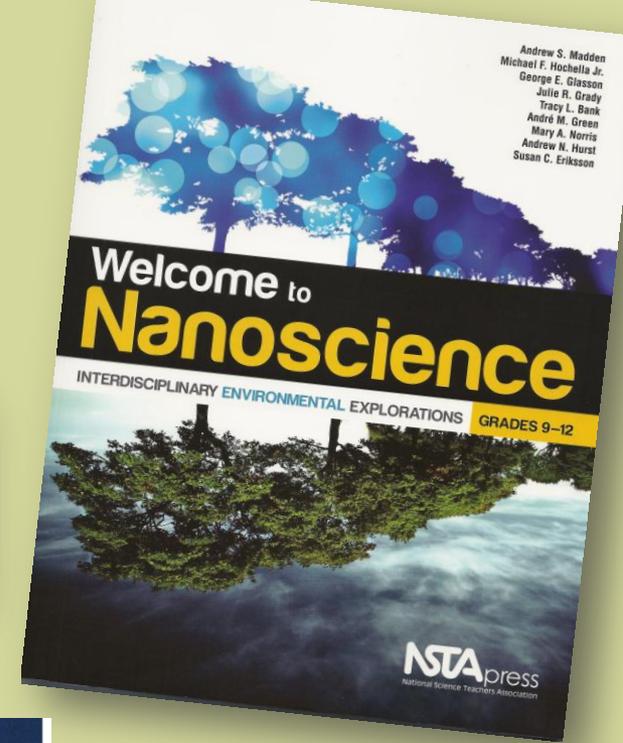


EIGER Fellow, TIFFANY ADAMS, has been awarded first place in the United States Society on Dams (USSD) 2010 Scholarship competition for her research on "The Stability of Levees with Deep Mixed Shear Walls."

The interdisciplinary nature of Tiffany's work, which concerns mitigating the consequences of levee failure through evacuation of the vulnerable



Connections: Education



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:: In the News

Current science news video from NBC Learn

STEM Students Must Be Taught to Fail

U.S. News & World Report

Failure will teach students to take the risks necessary for innovation.

Better Teacher-Candidate Mentoring Targeted

Education Week

To improve the student-teaching experience, teacher education programs are taking more care in picking and guiding "cooperating" teachers.

State Education Board to Revisit Decline in Science Education

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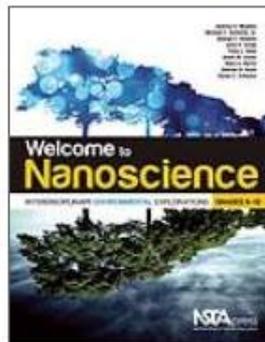
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ACTIONS

- Recommend to a friend
- Write a Review

Resource Detail: NSTA Press Book



Welcome to Nanoscience:
Interdisciplinary Environmental
Explorations, Grades 9–12

By: [Andrew S. Madden](#), [Michael F. Hochella Jr.](#), [George E. Glasson](#), [Julie R. Grady](#), [Tracy L. Bank](#), [André M. Green](#), [Mary A. Norris](#), [Andrew N. Hurst](#), and [Susan C. Eriksson](#)

\$20.76 - Member Price

\$25.95 - Nonmember Price

[Also see sets below](#)

Add to Cart

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Details

Type of Resource: NSTA Press Book ([also see downloadable pdf version of this book](#))
Publication Date: 6/1/2011
Pages: 171
Stock Number: PB296X
ISBN: 978-1-93613-732-9
Grade Level: High School

Description

Ideas For Use

Discussions

Additional Info

Contents

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Colleges and Departments

Students invent foods, shape future of food product development industry



The Sensory Evaluation Laboratory in the Food Science and Technology Building has become something of a second home to the 2012 Danisco team members, three graduate students from the Department of Food Science and Technology.

Nanoscience Curriculum Overview (2/4/11)

AP credits}

- Freshman English (6 credits)
- Foreign Language (6 credits, do not count towards degree)

Foundations:

Can take the form of an Integrated Science Curriculum (comparable number of credits) or well-rounded disciplinary training, e.g.:

- | | |
|-----------------------------------------------|------------|
| • General Chemistry CHEM 1055-1056 | 8 credits |
| • General Chemistry Majors Lab CHEM 1065-1066 | 2 credits |
| • Foundations of Physics PHYS 2305-2306 | 8 credits |
| • Calculus MATH 1205-1206 | 6 credits |
| • Cell and Molecular Biology BIOL 2104 | 3 credits |
| • Organic Chemistry CHEM 2535-2536 | 6 credits |
| • Sophomore MATH Sequence | 10 credits |

Total: 43 credits

CLE:

- | | |
|--------------------------------------------------|-----------|
| • Area 1: Writing and Discourse: | 6 credits |
| • Area 2: Ideas, Cultural Traditions, and Values | 6 credits |
| • Area 3: Society and Human Behavior | 6 credits |
| • Area 4: Scientific Reasoning and Discovery | -- |
| • Area 5: Quantitative and Symbolic Reasoning | -- |
| • Area 6: Creativity and Aesthetic Experience | 3 credits |
| • Area 7: Critical Issues in a Global Context | 3 credits |

Total: 24 credits

Required Nanoscience Courses:

- Introduction to Nanoscience 6 credits
- Introduction to Quantum Physics of Nanostructures 3 credits
- Synthesis and Self-Assembly of Nanomaterials 3 credits
- Fabrication and Characterization of Nanostructures 3 credits

Integrated lecture-lab courses:

- Nanomedicine 4 credits
- Nanoscience and the Environment 4 credits
- Nanomaterials and Devices 4 credits

Total: 27 credits

Undergraduate Research (4 semesters @ 3 credits): 12 credits
(One full summer = 2 semesters)

Seminar: Research talks, lab rotations, modeling 4 credits
(2 semesters @ 1 credit, one @ 2 credits):

Electives (from existing programs) 10 credits

Grand Total: 120 credits

Search within Interdisciplinary Graduate Education

Search **GO**

- ▶ Virginia Tech Home
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- ▶ Interdisciplinary Graduate Education Home

Interdisciplinary Graduate Education (IGE) at Virginia Tech

Interdisciplinary Graduate Education Programs (IGEPs)

- ▶ SuN
- ▶ TPS
- ▶ WATER
- ▶ MultiSTEPS
- ▶ GBCB
- ▶ MACR
- ▶ Translational Obesity Research
- ▶ Regenerative Medicine
- ▶ Remote Sensing
- ▶ CTE

Other - ID Academic Programs

- ▶ Other - Institutes
- ▶ Other - IGERT

▶ IGEP Proposal Resources

▶ Interdisciplinary Research



Welcome

Graduate education at Virginia Tech is transcending traditional disciplinary perspectives and promoting collaborations across colleges, departments, and academic units. Today's societal problems are complex and must be understood and solved through the collaboration of multiple disciplines rather than by insulated thinking and action (Repko, 2008). As Karl Popper states, "We are not students of some subject matter, but students of problems. And problems may cut right across the borders of any subject matter or discipline" (The National Academy of Sciences, 2005, p.16). Interdisciplinary education and research embraces diversity, inclusiveness, educational breadth, and inter-dependence, promoting a person-oriented rather than a product oriented attitude towards graduate education, thus creating novel learning and discovery opportunities that are needed to train our future professoriate, workforce, and leaders. Committee on Facilitating Interdisciplinary Research, National Academy of Sciences, National

News & Events

NSF Toolbox for Interdisciplinary Research: Open Forum with Faculty and Graduate Students

Please Join us!

Open Forum with Faculty and Graduate Students:
Wednesday September 26th, 2:00-3:30p GLC rm F

Michael O'Rourke,...

Read more ...

Search within Interdisciplinary Graduate Education

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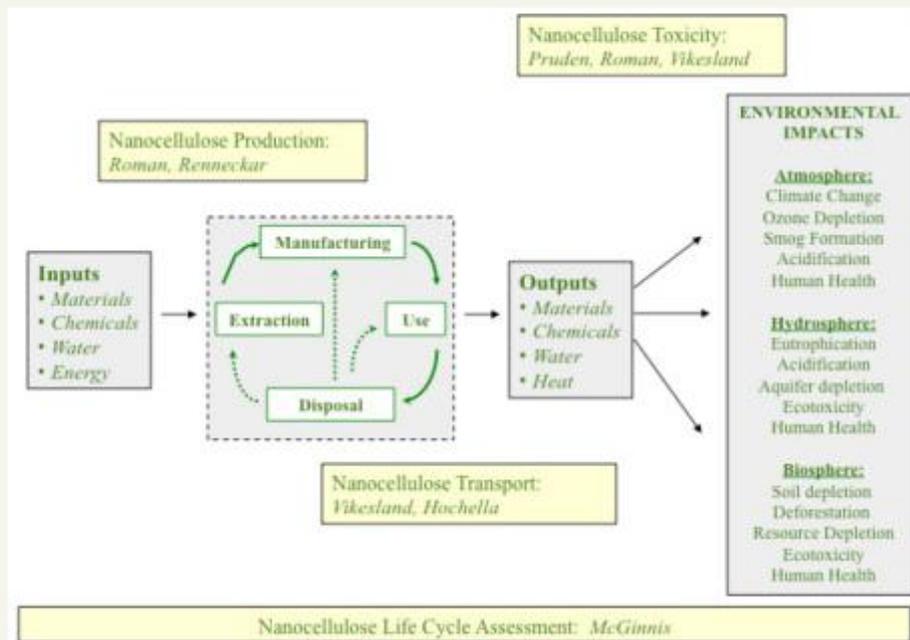
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Sustainable Nanotechnology (SuN)



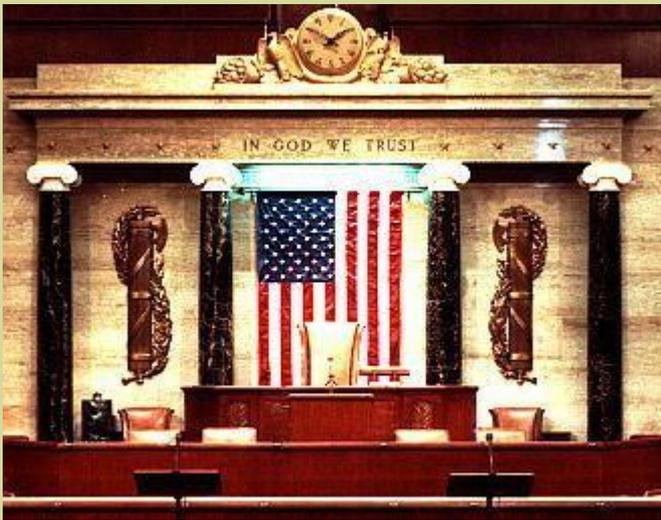
Contact Information:

Peter Vikesland
Associate Professor

Civil & Environmental Engineering
415 Durham Hall
Blacksburg, VA 24061

Phone: (540) 231-3568
E-mail: pvikes@vt.edu

The primary research goal of the SuN IGEP is to facilitate the incorporation of sustainable design concepts in the nanotechnology field. The sustainability of a particular technology is often an afterthought in the design process; however, because nanotechnology is still in its infancy there is significant potential to proactively direct the field towards sustainable design. Achievement of this ambitious goal will require substantial longterm effort and a range of expertise that incorporates not only scientists and engineers, but also economists and social scientists. In the short-term it is necessary to firmly establish SuN as a player in the science of sustainable nanotechnology and we will collectively focus our efforts on the evaluation of the sustainability of one particular type of nanomaterial: nanocellulose. Because of its natural origin, nanocellulose production is often considered to be sustainable and intrinsically safe for the environment. However, nanocellulose is highly modified with respect to its crystallinity and surface chemistry relative to the natural cellulose found within plants and there is growing concern about its environmental implications. Across the SuN group, we will collectively evaluate the sustainability of nanocellulose production, nanocellulose toxicity, and nanocellulose transport in the environment in the context of a life cycle assessment.



Rebecca French and Senator Bernie Sanders