



Career Cornerstone News

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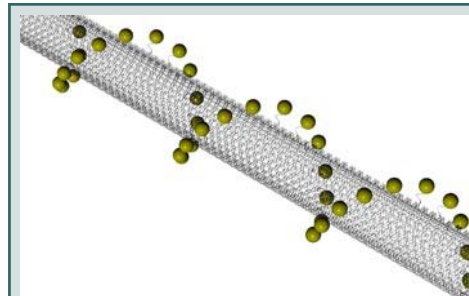
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Mother Nature Knows Nano

The future of the nanotechnology field depends on our ability to reliably and reproducibly assemble nanoparticles into 3D structures we can use to develop new technologies. One approach to production of nanoscale architecture is creation of nanoparticles that assemble themselves into the desired structure. DNA molecules are an elegant biological example of small particles that self-assemble to form higher order 3D structures. Inspired by this prototype, Hao Yan and Yan Liu at Arizona State University looked to Mother Nature to solve

their nano-sized problem. They attached gold nanoparticles to DNA, taking advantage of its self-assembling biochemical properties to engineer nanotubes that form a number of different 3D structures. Yan is hopeful this groundbreaking work will serve as the foundation on which emerging fields and new technologies may be built. In the future, use of nanotubes may reduce the size of cell phones and other electronic devices even further. Scientists also envision using



This cartoon depicts a single nanotube formed from DNA tile arrays with gold particles attached.
Credit: Hao Yan, Arizona State University

nanotubes for a number of biological applications including gene and drug delivery. Drugs or other treatments specifically delivered using nanotubes would target only affected tissues, potentially eliminating toxic side effects.

Mathematics and Climate

One of the most important challenges of our time is modeling global climate. Calculus, differential equations, numerical analysis, probability, and statistics are just some of the areas of mathematics used to understand the oceans, atmosphere, and polar ice caps, and the complex interactions among these vast systems. Indeed, analyzing feedback effects is a crucial component of global climate modeling and often a significant factor

in long-term predictions. For example, warmer temperatures cause ice to melt, exposing more land and water, so that more sunlight is absorbed-instead of being reflected, in turn leading to more warming. Math and science are central to the development of both traditional and alternative energy sources, and to the evolution of other strategies for mitigating the effects of climate change. Mathematics and Climate is the theme for



Mathematics Awareness Month - April 2009 (www.mathaware.org). Mathematics, statistics, and actuarial science career information, is at www.careercornerstone.org/math.

Advanced Imaging Technology for Spinal Surgery

Using a three-dimensional (3D) image-guided system to help place screws in the spines of patients results in safe and accurate surgery with a decrease in the number of misplaced screws, and subsequent injuries, seen in more traditional operations, says Mayo Clinic neurosurgeon Eric Nottmeier, M.D., the lead investigator of a recent study. The screws are used to stabilize the spine in patients who suffer from collapsed discs or compressed nerves. Specifically, after implanting 1084 "pedicle" screws in 220 patients, surgeons reported a nerve injury rate of less than 1%. Additionally, less than 1% of the screws in this

study were considered to be significantly misplaced. That compares to a reported nerve injury rate of up to 8% and a misplacement rate of up to 55% using standard technology. The technology uses a special camera on a computer that uses infrared light to track a surgical instrument in 3D space. The surgeon places the instrument on the patient's spine and navigates the spine using the computer. The surgical instrument is used to determine the best entry point and trajectory for each screw. An image-guided screwdriver is used to place a screw. Almost all patients in this study were given a CT scan following surgery so that

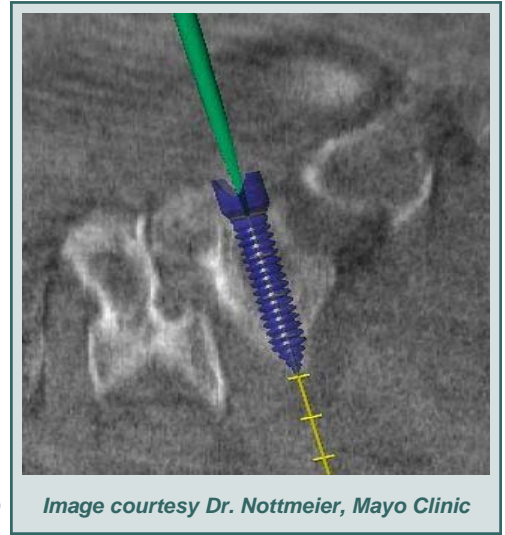


Image courtesy Dr. Nottmeier, Mayo Clinic

a radiologist could independently determine how well the screws were placed. Find out more about careers in technology and healthcare at www.careercornerstone.org.

Degree Profile: Engineering

Engineers apply the theories and principles of science and mathematics to research and develop economical solutions to technical problems. Their work is the link between perceived social needs and commercial applications.

Engineers design products, machinery to build those products, plants in which those products are made, and the systems that ensure the quality of the products and the efficiency of the workforce and manufacturing process. Engineers design, plan, and supervise the construction of buildings, highways, and transit systems. They develop and implement improved ways to extract, process, and use raw materials, such as petroleum and natural gas.

They develop new materials that both improve the performance of products and take advantage of advances in technology. They harness the power of the sun, the Earth, atoms, and electricity for use in supplying the Nation's power needs, and create millions of products using power. They analyze the impact of the products they develop or the systems they design on the environment and on people using them. Engineering knowledge is applied to improving many things, including the quality of healthcare, the safety of food products, and the operation of financial systems.

A bachelor's degree in engineering is required for most entry-level engineering jobs. Engineering programs involve a concentration of study in an engineering



specialty, along with courses in both mathematics and science. Those considering a career in engineering should seek a program that has been accredited. Over 1,800 U.S. engineering programs are accredited by ABET, Inc. The Sloan Career Cornerstone Center provides links to each program and more information at www.careercornerstone.org/engineering.

Exploding Asteroid over North America?

Was the course of life on the planet altered 12,900 years ago by a giant comet exploding over Canada? Geological evidence found by University of Cincinnati Assistant Professor of Anthropology Ken Tankersley and colleagues suggests the answer is affirmative. It has strengthened the case that a cataclysmic comet or asteroid explosion over Canada 12,900 years ago resulted in a phase of extinction for animals and humans at the end of the last Ice Age.

A comet/asteroid theory advanced by Arizona-based geophysicist Allen West in the past two years says that an object from space exploded just above the earth's surface at that time over modern-day Canada, sparking a massive shock wave and heat-generating event that set large parts of the northern hemisphere ablaze, setting the stage for the extinctions.

Now Tankersley has verified evidence from sites in Ohio and Indiana that offers the strongest support yet for the exploding comet/asteroid theory. Samples of

diamonds, gold and silver that have been found in the region have been conclusively sourced through X-ray diffractometry in the lab of UC Professor of Geology Warren Huff back to the diamond fields region of Canada. The only plausible scenario available now for explaining their presence this far south is the kind of cataclysmic explosive event described by West's theory. "We believe this is the strongest evidence yet indicating a comet impact in that time period," says Tankersley. Ironically, Tankersley had gone into the field with West believing he might be able to disprove West's theory.

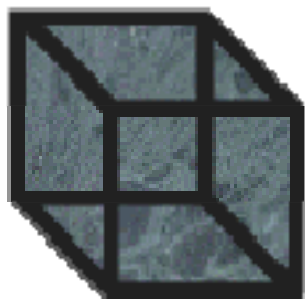
The timing attached to the theory of about 12,900 years ago is consistent with the known disappearances in North America of the woolly mammoth population and the first distinct human society to inhabit the continent, known as the Clovis civilization. At that time, climatic history suggests the Ice Age should have been drawing to a close, but a rapid change known as



Ken Tankersley
Image Source: University of Cincinnati

the Younger Dryas event, instead ushered in another 1,300 years of glacial conditions. A cataclysmic explosion consistent with West's theory would have the potential to create the kind of atmospheric turmoil necessary to produce such conditions. More details are at www.uc.edu. Find out more about careers in science at www.careercornerstone.org.

Link to the Sloan Career Cornerstone Center



Why not link to the Sloan Career Cornerstone Center from your website? Link to individual pages such as precollege resources, to degree profiles, or to our podcasts or newsletter. We're happy to provide you with a custom graphic or any materials you need!

Find out more at www.careercornerstone.org/addalink.htm

Noyce Scholars Learn Classroom Skills

The recruitment and preparation of teachers with strong backgrounds in science and mathematics is important to American competitiveness and essential for developing the next generation of innovators. The Robert Noyce Scholarship Program at California State University, Fresno (CSU Fresno), has recruited 81 new math and science teachers to teach in high-need school districts in California's Central Valley. The Noyce scholars, funded by the National Science Foundation, are selected from undergraduate science and mathematics majors and science, technology, engineering and mathematics, or STEM, professions. They are placed in a science or mathematics classroom under the guidance of a selected mentor teacher for 6-10 hours per week. The experience affords Noyce scholars a chance to

develop classroom "survival skills" early on and to experience a wide range of activities associated with the teaching profession well before their student teaching semester.

Noyce scholars also have an opportunity to participate in cutting edge research through summer internships in Department of Energy laboratories.

The CSU Fresno project is one of 135 projects funded under NSF's Robert Noyce Teacher Scholarship program that provides funds to institutions of higher education to support scholarships, stipends, and academic programs for undergraduate STEM majors and post-baccalaureate students holding STEM degrees who commit



to teaching in high-need K-12 school districts. A new component of the program supports STEM professionals who enroll as NSF Teaching Fellows in master's degree programs leading to teacher certification by providing academic courses, professional development, and salary supplements while they are fulfilling a four-year teaching commitment in a high need school district. Find out more at www.nsf.gov.

STEM Programs for Precollege Students

Students considering careers in science, technology, engineering, mathematics, computing, or healthcare are encouraged to participate in programs and projects while in middle and high school that encourage them to try out these areas first-hand. There are many programs to choose from, and an extensive list is available at www.careercornerstone.org/pcprogproj.htm.

One example is the FIRST Robotics Competition (www.usfirst.org), an annual competition that helps high school students discover the rewards and excitement of science, engineering, and technology. More than 42,000 high-school students on 1,686 teams are participating in this year's competition. MATHCOUNTS (www.mathcounts.org) is another program to consider. It is a national math enrichment, coaching and competition program that promotes middle school mathematics achievement. In addition to the free Math Club Program available to any middle school that wants to form a math club, The MATHCOUNTS Competition Program helps prepare students for the national Math Bee that will be held in May in Orlando, FL.

