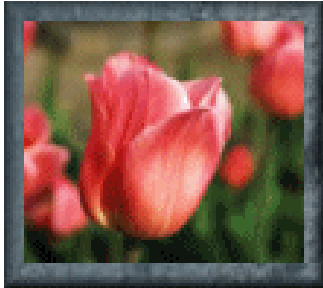




Career Cornerstone News

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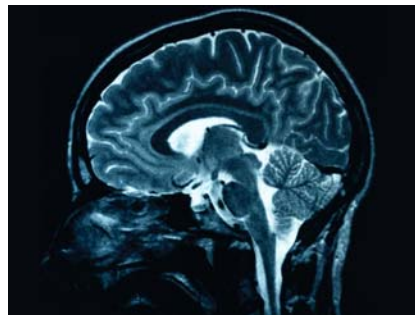
Career Cornerstone News is a Publication of the Sloan Career Cornerstone Center, the Premier Online Resource for Exploring Career Paths in Science, Technology, Engineering, Mathematics, Computing, and Medicine.

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April is Mathematics Awareness Month!

The theme for Mathematics Awareness Month 2007 is "Math and the Brain." Did you know that mathematical scientists are helping to unlock the mysteries of the brain? They have modeled electrical activity of neurons; designed methods for transforming MRI and



other signals into clear images; modeled dynamics of neurological networks, such as those related to epilepsy and Parkinson's disease, learning, memory, and schizophrenia; and developed algorithms for imaging the brain for diagnosis of tumors, disease, and psychological states. Throughout April, many college and university departments, institutional public information offices, student groups, and others are sponsoring events and developing



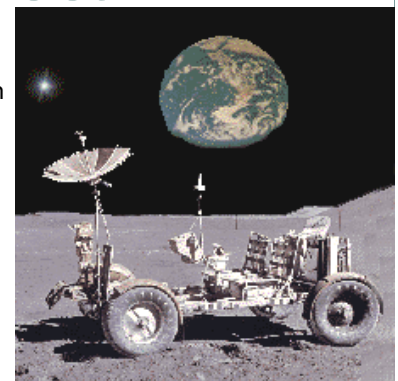
resources to help explore the impact of mathematics on the world around us. More details are at www.mathaware.org.

The Sloan Career Cornerstone Center provides extensive resources about careers in mathematics, statistics, and actuarial science at www.careercornerstone.org.

NASA's Great Moonbuggy Race

This month, NASA, is searching for the next generation of space explorers to meet the challenge of designing and building their own version of NASA's lunar rover or "moonbuggy" by competing in the Great Moonbuggy Race. College and high school students from across the country will put their knowledge to work in a real-world environment as they discover practical uses for science, technology, engineering, and math in the unique competitive

atmosphere of the race. Student teams are challenged to meet design criteria set by scientists and engineers at NASA's Marshall Space Flight Center, Huntsville, AL, where the original lunar rover was designed and tested before it was driven by astronauts on the moon during the last three Apollo missions in the 1970s. The first Great Moonbuggy Race was run in 1994 to commemorate the 25th anniversary of the Apollo 11 lunar landing. Teams will



compete for the best time around a half-mile, simulated lunar course. Find out more at <http://moonbuggy.msfc.nasa.gov>.

Fighting Cancer with Nanotechnology

Nanotechnology is the development and engineering of devices so small that they are measured on a molecular scale. Nanoscale devices are somewhere from one hundred to ten thousand times smaller than human cells. They are similar in size to large biological molecules ("biomolecules") such as enzymes and receptors. As an example, hemoglobin, the molecule that carries oxygen in red blood cells, is approximately 5 nanometers in diameter. Nanoscale devices smaller than 50 nanometers can easily enter most cells, while those smaller than 20 nanometers can move out of blood vessels as they circulate through the body.

In the fight against cancer, nanotechnology introduces unique approaches to diagnosis and treatment that could not even be imagined with conventional technology. New tools engineered at sizes much smaller than a human cell will enable researchers and clinicians to detect cancer earlier, treat it with much greater precision and fewer side effects, and possibly stop the disease long before it can do any damage. Imagine a nanoparticle that can be used to light up a tumor in an MRI, destroy cancer cells by converting magnetic fields into heat, and allow the physician to visually track the progress of treatment. To help meet



the goal of eliminating suffering and death due to cancer, the National Cancer Institute, part of the National Institutes of Health, is engaged in efforts to harness the power of nanotechnology to radically change the way we diagnose, treat, and prevent cancer. Find out more at <http://nano.cancer.gov>.

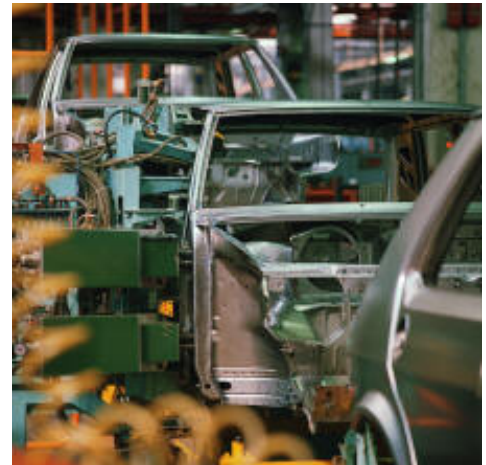
Degree Profile: Manufacturing Engineering

Manufacturing engineers are involved with the process of manufacturing from planning to packaging of the finished product. They work with tools such as robots, programmable and numerical controllers, and vision system to fine tune assembly, packaging, and shipping facilities. They examine flow and the process of manufacturing, looking for ways



to streamline production, improve turnaround, and reduce costs. Often, a manufacturing engineer will work with a prototype, usually created electronically with computers, to plan the final manufacturing process. In a globally competitive marketplace, it is the job of the manufacturing engineer to figure out methods and systems to produce a product in an efficient, cost-effective way to provide a marketing edge for the final product.

Manufacturing engineering graduates may work in any field that produces goods -- from automobiles and boats and airplanes, to electronic products to educational toys, to food and clothing. They must have strong analytical skills and be detail



oriented. They must also work well in team situations as they are often called upon to work in a group setting with other engineers and others outside of engineering.

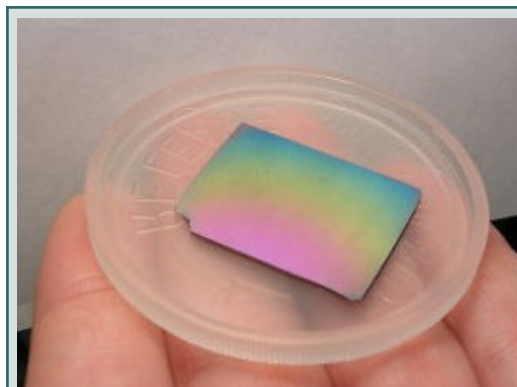
Find out more about careers in manufacturing engineering at www.careercornerstone.org/manueng/manueng.htm.

Melts in Your Body, Not in Your Hand

Leaded crystal and common glass may look similar, but the crystal is made of a rigid scaffolding of atoms, while the glass is a disordered, atomic slurry. Researchers at the University of Wisconsin-Madison have developed a method for crafting some of the most stable glasses ever formed -- materials that are strong and durable like crystal and yet free of the confining properties of an ordered atomic skeleton. They hope the new method will enable drug manufacturers to take advantage of chemicals that had been too insoluble as crystals and too unstable as glasses.

The findings, appearing in *Science*, announce a method to deposit glass materials layer by layer as a vapor onto a surface with an ideal temperature for yielding stable glasses, an advancement over earlier vapor deposition efforts and different from the practice of quenching molten material.

Chemist Mark Ediger and his colleagues at the university collaborated with researchers at the National Institute of Standards and Technology to craft and study stable glasses. One such glass, formed from the anti-inflammatory drug indomethacin, is a test for how pharmaceuticals could benefit from the new technique. The latest wonder drugs work only if they arrive in the body where they are needed and at the right concentration at the right time. Some potential pharmaceuticals are hindered by being too crystalline -- not dissolving quickly enough, or at all, in the body -- or too glassy, breaking down too quickly or in uncontrollable ways. Though the new glasses do not reach the precision of crystals, they are denser and far stronger than traditional glass. "We were just



A type of glass created by researchers at the University of Wisconsin-Madison using a new vapor-deposition method is extremely stable. The rainbow of colors in this super-stable glass comes from variations in its thickness. Credit: University of Wisconsin-Madison

astonished," says Ediger. "These materials were so unusual, it took a whole year to understand what was going on." Ediger estimates that the more stable glass would take at least 10,000 years to make using conventional technology, because the liquid glass would have to be cooled extremely slowly. With the new vapor deposition method, it takes about an hour.

Career Cornerstone Explores Career Paths in...

- Actuarial Science
- Aerospace Engineering
- Agricultural Engineering
- Architectural Engineering
- Bioengineering
- Biology
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Engineering
- Computer Science
- Dentistry
- Electrical Engineering
- Engineering Technology
- Environmental Engineering
- Geosciences
- Industrial Engineering
- Manufacturing Engineering
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Medicine
- Mining Engineering
- Nuclear Engineering
- Nursing
- Petroleum Engineering
- Physics
- Software Engineering
- Statistics
- Veterinary Science
- - - and more to come...



Find out more at www.careercornerstone.org

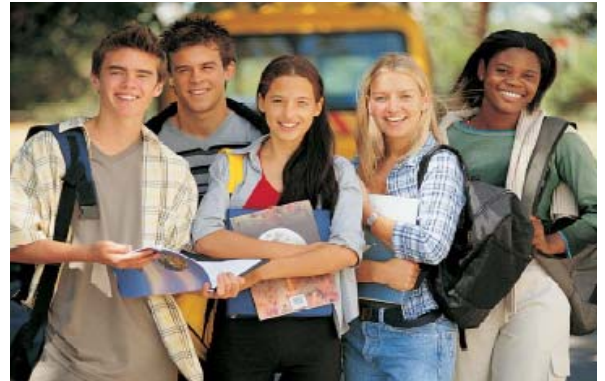
What High School Transcripts Tell Us

Just how prepared for college are Americans? A recent report (<http://nces.ed.gov/pubs2007/2007316.pdf>) by the Department of Education's National Center for Education Statistics (NCES) offers information about the level of academic preparation of the high school graduating class of 2004. The report provides an examination of the course selection patterns of graduates, with a particular focus on participation in math, science, and Advanced Placement and International Baccalaureate. Also, the report links these patterns with test achievement in math, grade point averages, and expectations for future educational attainment. Among the notable findings:

- ◆ The Class of 2004 earned an average of 4.3 English credits, 3.6 math credits, 3.3 science credits, 3.9 social studies credits, 2.0 fine arts credits, and 2.0

credits in non-English language courses.

- ◆ About 30% of the Class of 2004 earned credit in AP or IB courses.
- ◆ In math, 5% of graduates got no further than basic math or pre-algebra; 45% completed at least Algebra I or II; 36% completed at least trigonometry, statistics, or pre-calculus coursework; and 14% completed calculus. (Seniors who got no further than basic math or pre-algebra had an overall GPA of 2.3; seniors who completed calculus had an GPA of 3.5.)
- ◆ Class of 2004 students expecting to get a graduate or professional degree earned 21 academic credits, while students expecting to have some college experience



(but not get a degree) earned 17 credits.

The Sloan Career Cornerstone Center suggests that precollege students interested in studying toward degrees in science, mathematics, computing, engineering, technology, or medicine take as many math and science courses as possible -- both in school and after school programs. Find out more at www.careercornerstone.org/precolprep.htm.

Tiny Worm Exhibits Nicotine Dependence

The unassuming *C. elegans* nematode worm, a 1-millimeter workhorse of the genetics lab, is quite similar to human beings in its genetic susceptibility to nicotine dependence, according to University of Michigan researchers. This finding should allow researchers to better understand how nicotine dependence works, and perhaps devise new ways to block the craving that keeps humans smoking cigarettes. Nicotine is the addictive substance in tobacco. Dependence on nicotine drives many of the most preventable causes of death in the U.S. A team led by X.Z. Shawn Xu, assistant research professor at the Life Sciences Institute and assistant professor of physiology at U-M Medical School, has completed a series of experiments which establish that *C. elegans* can get hooked on nicotine. Like humans, the nicotine-sensitive worms showed acute responses to nicotine exposure, as well as tolerance, sensitization and withdrawal. Xu and his team found that the genes known to underlie nicotine dependence in mammals are also present in the worms. Having established worms as a model, the Xu team then tried to identify new genes important for nicotine dependence. They found for the first time that TRP channel genes which enable cells to respond to various external stimuli are a part of the nicotine response. In fact, when they knocked the TRP gene out of worms, the animals no longer responded to nicotine exposures. But when a new generation of worms had that missing gene replaced by a human version of the TRP gene, the worms returned to being nicotine-sensitive. "This demonstrates that human TRP genes have the capacity to mediate nicotine dependence, suggesting that human TRP genes are important for nicotine dependence in humans," Xu said. It also makes TRP genes a potential target for the development of drugs to treat tobacco addiction, and the worms can help in that research. More details are at <http://lsi.umich.edu>.

