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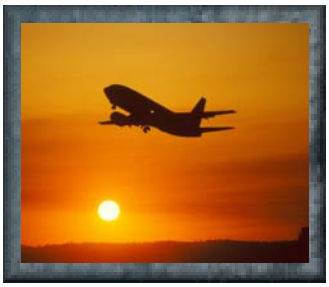
Career Cornerstone News

Volume III, Issue IX September, 2007

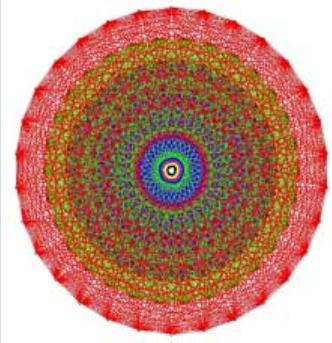


Career Cornerstone News is a Publication of the Sloan Career Cornerstone Center, the Premier Online Resource for Exploring Career Paths in Science, Technology, Engineering, Mathematics, Computing, and Medicine.

Inside this issue:

So Just What is E8?

Ever since 1887, when Norwegian mathematician Sophus Lie discovered the mathematical group called E8, researchers have tried to understand the extraordinarily complex object described by a numerical matrix of more than 400,000 rows and columns. Now, an international team of experts using powerful computers and programming techniques has mapped E8 -- a feat numerically akin to the mapping of the human genome -- allowing for breakthroughs in a wide range of problems in geometry, number theory, and the physics of string theory. "Although mapping the human genome was of fundamental importance in biology, it doesn't instantly give you a miracle drug or a cure for cancer" says Jeffrey Adams, project leader and mathematics professor at the University of Maryland. "This research is similar: it is critical basic research, but its implications may not become known for many years." Team member David Vogan, a professor of mathematics at the Massachusetts Institute of Technology (MIT), presented the findings. The effort to map E8 is part of a larger project to map out all of the Lie groups--mathematical descriptions of symmetry for continuous objects like cones, spheres and their higher-dimensional counterparts. Many of the groups are well understood; E8 is the most complex. More details are at http://aimath.org/E8.



The E8 root system consists of 240 vectors in an 8-dimensional space. *Credit: American Institute of Mathematics*

Positive Trend in Starting Salaries

Starting salary offers to new college graduates continue to rise, reflecting the positive job market for Class of 2007 graduates, according to a new report from the National Association of Colleges and Employers. Computer science graduates saw their average offer bump up 2.5 percent to $52,177. The engineering fields also enjoyed across-the-board increases, although none were spectacular. Chemical engineering graduates, typically one of the highest paid majors reported in *Salary Survey*, saw their average offer climb by 5.6 percent over last year at this time to $59,707. Civil engineering graduates posted a solid increase; their average rose 4.8 percent to $47,750. The average offer to computer engineering graduates rose 3.2 percent to $55,946. Electrical engineering graduates posted a mere 1.6 percent increase; still, their average offer stands at a hefty $54,915. Mechanical engineering graduates saw one of the higher-end increases of the engineering disciplines. Their average salary offer rose 5.7 percent to $54,695, pushed along by a good number of offers from aerospace manufacturers who extended an average offer of $56,382 to mechanical engineering grads.

Top Ten Materials Moments in History

The Minerals, Metals and Materials Society has released the Greatest Materials Moments in History:

1. The Periodic Table of Elements - the indispensable reference tool for those in the field.

2. Fe Smelting - Around 3500 B.C., Egyptians smelt iron for the first time, using tiny amounts, mostly for ornamental or ceremonial purposes. This is the first processing secret of what will become the world's dominant metallurgical material.

3. Transistor - This becomes the building block for all modern electronics and the foundation for microchip and computer technology.

4. Invention of Glass - Around 2200 B.C., northwestern Iranians invent glass. This becomes the second greatest nonmetallic engineering material (following ceramics).

5. Optical Microscopy - In 1668, Anton van Leeuwenhoek develops optical microscopy, capable of magnifications of 200 times and greater, enabling study of the world invisible to the human eye.

6. Modern Concrete - In 1755, John Smeaton invents modern concrete.

7. Crucible Steel Making - Around 300 B.C., metal workers in south India develop crucible steel making, producing "wootz" steel.

8. Cu Extraction and Casting - Approximately 5000 B.C., people in the region of modern Turkey discover that liquid copper can be extracted from malachite and azurite, and that the molten metal can be cast into different shapes.

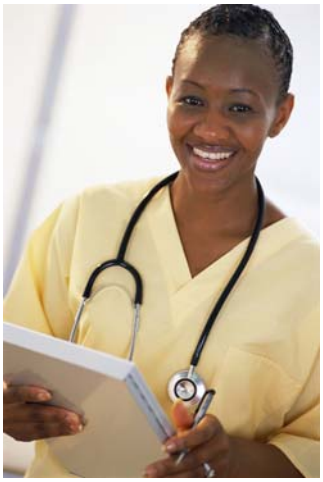
9. X-ray Diffraction - In 1912, Max von Laue discovers the diffraction of x-rays by crystals, inspiring the theory of diffraction by crystals.

10. Bessemer Process - In 1856, Henry Bessemer patents a bottom-blown acid process for melting low-carbon iron, leading to the era of cheap, large tonnage steel, enabling massive progress in transportation, building construction and general industrialization.

Find out more at www.materialmoments.org.

Degree Profile: Nursing

Registered nurses (RNs), regardless of specialty or work setting, perform basic duties that include treating patients, educating patients and the public about various medical conditions, and providing advice and emotional support to patients' family members. RNs record patients' medical histories and symptoms, help to perform diagnostic tests and analyze results, operate medical machinery, administer treatment and medications, and help with patient follow-up and rehabilitation.



RNs teach patients and their families how to manage their illness or injury, including post-treatment home care needs, diet and exercise programs, and self-administration of medication and physical therapy. Some RNs also are trained to provide grief counseling to family members of critically ill patients. RNs work to promote general health by educating the public on various warning signs and symptoms of disease and where to go for help. RNs also might run general health screening or immunization clinics, blood drives, and public seminars on various conditions.

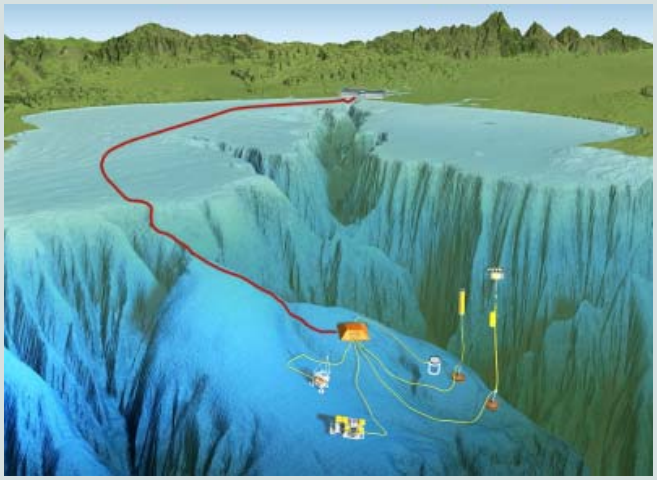
RNs can specialize in one or more patient care specialties. The most common specialties can be divided into roughly four categories -- by work setting or type of treatment; disease, ailment, or condition; organ or body system type; or population. RNs may combine specialties from more than one area -- for example, pediatric oncology or cardiac emergency -- depending on personal interest and employer needs. Find out more about nursing at www.careercornerstone.org.

Thirty-Two Mile Cable Installed for First Deep-Sea Observatory

Oceanographers have completed an important step in constructing the first deep-sea observatory off the continental United States. Workers in the multi-institution effort laid 32 miles (52 kilometers) of cable along the Monterey Bay sea floor that will provide electrical power to scientific instruments, video cameras, and robots 3,000 feet (900 meters) below the ocean surface. The link will also carry data from the instruments back to shore, for use by scientists and engineers from around the world.

The Monterey Accelerated Research System (MARS) observatory, due to be completed later this year, will provide ocean scientists with 24-hour-a-day access to instruments and experiments in the deep sea. The project is managed by the Monterey Bay Aquarium Research Institute (MBARI) and funded by the National Science Foundation (NSF).

Currently, almost all oceanographic instruments in the deep sea rely on batteries for power and store their data on hard disks or memory chips until they are brought back to the surface. With a continuous and uninterrupted power supply, instruments attached to the MARS observatory could remain on the sea floor for months or years. If something goes wrong with the instruments, scientists will know immediately, and will be able to recover or reprogram them as necessary.



An illustration of the MARS undersea observatory shows its cabled links.
Credit: David Fierstein, MBARI

Slightly thicker than a garden hose, the MARS cable is buried about 3 feet below the sea floor along most of its route, so it will not be disturbed by boat anchors or fishing gear.

MARS also will serve as a testing ground for technology that will be used on more ambitious deep-sea observatories. As planned, such observatories will use thousands of kilometers of undersea cables to hook up dozens of seismographs and oceanographic monitoring stations. They will provide scientists with new views of sea floor life, and a new understanding of the global tectonic processes that spawn earthquakes and tsunamis. Find out more at www.mbari.org/mars.

What Can You Find At Career Cornerstone?

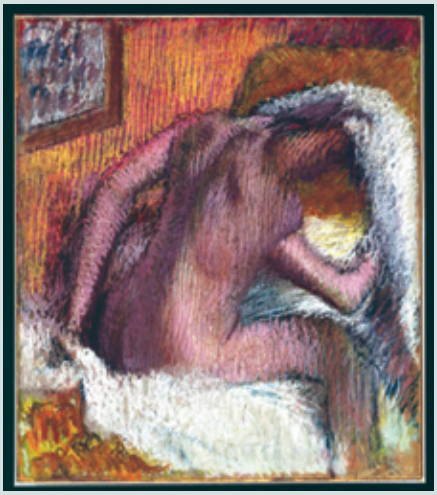
- **Resources for Women**
- **Degree Summaries**
- **Careers Newsletter**
- **Pre-college Ideas**
- **Current Salary Data**
- **Employer Lists & Links**
- **University Lists & Links**
- **Association Support**
- **Career Path Options**
- **Science Centers**
- **Video Profiles**
- **Career Planning**
- **Job Hunting Tips**
- **Diversity Issues**
- **Summer Camps**
- **National Programs**
- **Podcasts, PDFs, and PowerPoints!**

Eye Disease Gave Great Painters Vision!

Michael Marmor, MD, wanted to know what it was like to see through the eyes of an artist. Literally. After writing two books on the topic of artists and eye disease, the Stanford University School of Medicine ophthalmologist decided to go one step further and create images that would show how artists with eye disease actually saw their world and their canvases. Combining computer simulation with his own medical knowledge, Marmor has recreated images of some of the masterpieces of the French impressionistic painters Claude Monet and Edgar Degas who continued to work while they struggled with cataracts and retinal disease. The results are striking. In Marmor's simulated versions of how the painters would most likely have seen their work, Degas' later paintings of bathers become so blurry it's difficult to see any of the artist's brushstrokes. Monet's later paintings of the lily pond and the Japanese bridge at Giverny, when adjusted to reflect the typical symptoms of cataracts, appear dark and muddied. The artist's signature vibrant colors are muted, replaced by browns and yellows.

"These simulations may lead one to question whether the artists intended these late works to look exactly as they do," said Marmor who has long had interest in both the mechanics of vision and vision in artists. "The fact is that these artists weren't painting in this manner totally for artistic reasons."

Degas and Monet were both founders of the Impressionist era, and the style of both painters was well-formed before their eye disease affected their vision. But their paintings grew significantly more abstract in later life as, coincidentally, their eye problems increased. Find out more at http://med.stanford.edu.



By the time Degas completed "Woman Drying Her Hair" in 1905, his eyesight had dropped to somewhere between 20/200 and 20/400. Marmor notes that after 1900, there was virtually no detailing of faces or clothing in Degas' artwork.
Credit: ©Norton Simon Art Foundation

Challenge: Design a Self-Driving Car

Free of drivers or remote control, a handful of cars, vans and SUVs guided only by on-board computers will drive a closed, urban course, bypassing obstacles and each other in a race on November 3, 2007. The race demonstrates how these unmanned vehicles help the United States military safely operate supply missions.

The Defense Advanced Research Projects Agency Grand Challenge is a competition in which teams from around the country conceive, design and implement autonomous vehicles capable of driving themselves. In 2004 and 2005, the grand challenge involved driving up to 150 miles in desert environments, at speeds of up to 40 miles per hour. This year's grand challenge race, the Urban Challenge, which will involve driving up to 60 miles on city streets, including interacting with other (autonomous) vehicles.

Find out more at www.darpa.mil.

The autonomous van "Alice" is Caltech's competitor for the Defense Advanced Research Projects Agency Grand Challenge, a race that features autonomous ground vehicles. The challenge demonstrates how the U.S. military safely conducts supply missions in cities with heavy traffic.
Credit: Caltech