



# Career Cornerstone News

Volume V, Issue X

October, 2009



**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 Healthcare.**

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## American Graduation Initiative

Recently, President Obama proposed the American Graduation Initiative, a \$12 billion federal investment to substantially expand the capacity of the nation's community college system. If implemented, the new program would represent an historic new federal investment in the largest and fastest growing segment of higher education. Community colleges already enroll almost half of all U.S. undergraduates. The new support would be concentrated in four principal areas:

- \* Community College Challenge Fund to improve programs at

community colleges, with an emphasis on those for high-demand jobs. Funds would also be focused on increasing high school dual enrollment programs.

- \* College Access and Completion Fund to support innovative programs to increase student success.
- \* Renovation/Construction Fund to pay the interest on bonds or other debt, seed capital campaigns, or create state revolving loan funds.
- \* National Online Skills Laboratory of high quality open web-based career-oriented high school and college-level courses.

About 6.7 million students are earning credits at



1,177 community, technical and junior colleges. During the extended economic downturn, the almost 1,200 two-year colleges have seen dramatic enrollment growth, fueled by high school graduates seeking a lower cost entry into college and adult learners needing new skills to gain employment or keep their jobs. Find out more about all academic degree options at [www.careercornerstone.org](http://www.careercornerstone.org).

## International Chemistry Olympiad

The U.S. high school student team competing in the 41st International Chemistry Olympiad won one gold and three silver medals at the event held in Cambridge, England. The students, from Georgia, Indiana, New Jersey and New York, competed against more than 250 students from 65 countries. The four U.S. students were selected from a beginning pool of more than 11,000 high school chemistry students who vied to be on the team. These four emerged after

a two-week training camp held for the 20 student finalists last summer at the U.S. Air Force Academy.

Participating in local, regional, and national programs and projects is a great way for students to network with other kids who enjoy math, science, computing, and engineering. Many projects encourage teamwork, provide a chance to do hands on science, math, and engineering, and can



expose students to resources that can augment classroom experiences.

An extensive list of projects in many disciplines is at [www.careercornerstone.org](http://www.careercornerstone.org) — just click on "precollege ideas!"

## DNA Does Yoga!

Researchers have figured out how to make DNA bend and twist into a variety of new shapes. These curvy new molecules could someday be used to build nanoscale devices – smaller than the width of a human hair -- for delivering drugs inside the body, growing new tissues or studying single proteins.

The exciting thing about this research is that it gives scientists a way to make nanoscale objects with curving surfaces. For comparison, imagine if we could not make the curved objects we see in daily life – we'd have no wheels, arches, hooks, etc. This is the same kind of limitation

nanotechnology researchers have been facing.

Hendrik Dietz of the Dana-Farber Cancer Institute and Harvard Medical School and colleagues now describe a way to make continuously curving nanoscale shapes. They designed bundles of DNA strands, arranged in a honeycomb lattice (somewhat like a nanosized piece of Twizzlers candy). By adding extra DNA "letters" to some strands and removing them from others, the researchers created stresses that helped the bundles assemble into shapes that could twist and bend sharply. By combining differently



These are models of twisted and curved DNA-origami nanostructures.  
Image Credit: © Science/AAAS. Rendering in Autodesk Maya by Hendrik Dietz

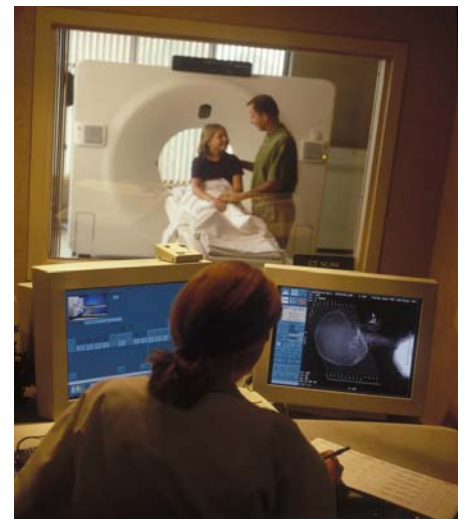
shaped DNA molecules, the researchers built complex shapes such as gears and beachballs, which they described in the 7 August issue of the journal Science.

## Degree Profile: Radiation Therapist

Treating cancer in the human body is the principal use of radiation therapy. As part of a medical radiation oncology team, radiation therapists use machines -- called linear accelerators -- to administer radiation treatment to patients. Linear accelerators, used in a procedure called external beam therapy, project high-energy x-rays at targeted cancer cells. As the x-rays collide with human tissue, they produce highly energized ions that can shrink and eliminate cancerous tumors. Radiation therapy is sometimes used as the sole treatment for cancer, but is usually used in conjunction with chemotherapy or surgery. Working with cancer patients can be stressful, but many radiation therapists also find it rewarding. Radiation therapists hold about 15,000 jobs in the

United States. About 73 percent worked in hospitals, and about 17 percent worked in the offices of physicians. A small proportion worked in outpatient care centers.

In terms of preparation, employers usually require applicants to complete an associate or a bachelor's degree program in radiation therapy. The median annual earnings of wage-and-salary radiation therapists is about \$66,170 in the United States. Employment of radiation therapists is projected to grow by 25 percent between 2006 and 2016, which is much faster than the average for all occupations. As the U.S. population grows and an increasing share of it is in the older age groups, the number of people needing treatment is expected to increase and to spur



demand for radiation therapists. In addition, as radiation technology advances and is able to treat more types of cancer, radiation therapy will be prescribed more often.

More information about a career as a radiation therapist is at [www.careercornerstone.org](http://www.careercornerstone.org).

## Physicists Make Room for Oddballs

Here's a question. How many gumballs of different sizes can fit in one of those containers at the mall so as to reward a well-spent quarter? It's hard to believe that most people never consider it even when guessing the number of candies in a bowl at Halloween.

But physicists at the Materials Research Science and Engineering Center at New York University recently developed a new way to help answer the question. They say the solution is found in how the particles pack in terms of how many neighboring gumballs a single gumball can randomly touch within a given container.

Though it may seem intuitive, confirming the answer has long proven elusive because of super complex geometry when dealing with three-dimensional objects of mixed sizes and shapes. But in a recent breakthrough, researchers Maxime Clusel, Eric Corwin and Alex Siemens led by NYU physics professor Jasna Brujic, derived and tested a statistical model that

potentially could help industry sort through a variety of packing problems from gumballs in vending machines to grain storage in silos or dry clothes detergent in retail boxes.

The new model predicts the geometry of randomly packing spheres of different sizes in terms of how many nearest neighbors a particle can have, how far apart those neighbors can be and how free space is distributed throughout the packing. It does all this by determining geometric possibilities from the viewpoint of a single particle, which the authors term the "granocentric" view.

The structure of a packing of spheres of equal size is an old problem, whose complexity has challenged mathematicians and physicists for centuries. At first one would think that the structure of packings of spheres of random sizes is even more complex, but surprisingly, the researchers discovered that this is not the case.

The results could be used in a



variety of industrial packing processes. For example, the model could be used to determine how finely to mill medicines that pharmaceutical companies pack into drug capsules, producing more effective pills that are smaller and easier to swallow.

Find out more about careers in physics at [www.careercornerstone.org](http://www.careercornerstone.org).

## Sponsor the Sloan Career Cornerstone Center



The Sloan Career Cornerstone Center has a limited number of endowment and sponsorship opportunities for organizations, foundations, or corporations who wish to support those considering career paths in science, technology, engineering, mathematics, or healthcare.



More details on sponsorship: [www.careercornerstone.org/sponsorship](http://www.careercornerstone.org/sponsorship)

## Math May Reduce Guesswork in Tissue Transfer Surgery

Plastic surgeons are turning to mathematics to take the guesswork out of efforts to ensure that live tissue segments that are selected to restore damaged body parts will have enough blood and oxygen to survive the surgical transfer. In the world's first published mathematical model of tissue transfer, mathematicians have shown that they can use differential equations to determine which tissue segments selected for transfer from one part of the body to another location on the same body will receive the level of oxygen required to sustain the tissue.

The most common tissue transfers are used to restore body parts destroyed by cancer and trauma. The researchers say reliable mathematical modeling of the blood supply and oxygen in tissue segments will not only reduce

failures in reconstructive surgery, but will also improve understanding of conditions in which an adequate blood supply is a basic problem, such as heart disease, cancer and stroke. To obtain tissue for reconstructive surgery, plastic surgeons cut away a segment of tissue, called a flap, that is fed by a single set of perforator vessels – an artery and vein that travel through underlying muscle to support skin and fat. Surgeons generally agree that vessels at least 1.5 millimeters in diameter are required to sustain oxygen flow within the flap intended for transfer.

"That guideline is based upon experience, trial and error. What we need is a more precise ability to determine what the necessary blood vessel size really is," said Michael Miller, professor of surgery and director of the division of plastic surgery at Ohio State



University and a senior author of the research. "I'm convinced that there is a relationship that's probably very predictive between the diameter and blood flow in the vessel and the ability of the piece of the tissue we're transferring to survive based on that."

Mathematicians working on the problem have set out to model that relationship. Find out more at [www.osu.edu](http://www.osu.edu), and explore career path in mathematics, medicine, and healthcare at [www.careercornerstone.org](http://www.careercornerstone.org).

## Teens Say "Count Me In!" for Mathematics

This school year, teens across the nation are pledging to support math literacy by signing the Texas Instruments Count Me In! Pledge and committing to tell others why math education is so important to the future of their world. Students also are encouraged to challenge themselves to consider taking higher-level math courses to broaden their college and career options. Teachers also can sign the pledge to win free TI classroom technology and professional development. Studies have shown that high school students who complete math beyond Algebra II continue to college at much higher rates. By the time today's high school students graduate from college, more than 6 million jobs will require the skills and understanding of math, science, and students who take more math classes have more earning potential than those who do not. Now through October 15, teens, their parents and teachers can sign the pledge at [www.countmeinpledge.com](http://www.countmeinpledge.com) to support math literacy and be registered for a chance to win the student or teacher grand prize packages, as well as one of 84 daily prize pack drawings for students and teachers. There are also loads of other educational resources at [www.education.ti.com](http://www.education.ti.com), and a special section for students at <http://education.ti.com/studentzone/>.

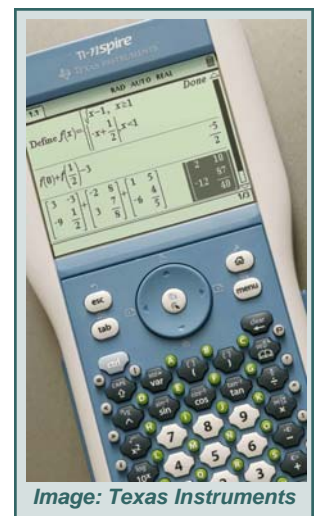


Image: Texas Instruments