TryEngineering Today!

The monthly newsletter of TryEngineering - find out more at www.tryengineering.org

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Physical Therapists Test Mechanical Arm

Physical therapists at University of Texas Southwestern Medical Center in the U.S. are evaluating a new mechanical arm that allows people recovering from neurological injuries such as strokes and traumatic brain injury to enter a virtual world where they can repeatedly practice movements needed to regain arm strength and movement. Other sites are also testing how the Armeo device, with its virtual environment and weight support system for the arm, stacks up against traditional therapies in which individuals physically pick up objects. Studies have demonstrated that repetition is key to quicker recovery from neurological injuries, and researchers hope that Armeo's ability to counter gravitational forces will allow patients to perform the required tasks more often than when they are aided by therapists. Armeo's weight support system allows an individual to master a wide range of movements and complete a highly repetitive number of tasks, even with limited function in the affected arm. More information is at www.utsouthwestern.edu.

Texas A&M student Aubrey White, under the direction of Dr. Patricia Smith, is improving her arm's function by using a mechanical arm that allows people recovering from neurological injuries.
Image Credit: UT Southwestern Medical Center

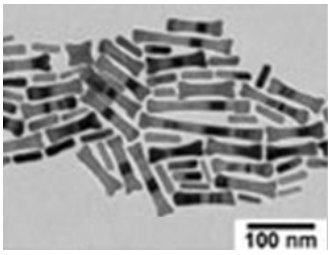
Nanoparticles That Carry Multiple Drugs

Using tiny gold particles and infrared light, MIT researchers have developed a drug-delivery system that allows multiple drugs to be released in a controlled fashion. Such a system could one day be used to provide more control when battling diseases commonly treated with more than one drug, according to the researchers.

Delivery devices already exist that can release two drugs, but the timing of the release must be built into the device -- it cannot be controlled from outside the body.

The new system is controlled externally and theoretically could deliver up to three or four drugs. The new technique takes advantage of the fact that when gold nanoparticles are exposed to infrared light, they melt and release drug payloads attached to their surfaces. Nanoparticles of different shapes respond to different infrared wavelengths, so "just by controlling the infrared wavelength, we can choose the release time" for each drug, said Andy Wijaya, graduate student in chemical engineering and lead author of the paper.

Inside this issue:



A mixture of gold nanoparticles. The longer particles are called nanobones, and the smaller are nanocapsules.
Image Source: MIT
Credit: Andy Wijaya

Filtration Investigation

Each issue, TryEngineering Today profiles one of the many lesson plans available on TryEngineering.org. Each lesson plan is aligned with education standards to allow teachers and students to apply engineering principles in the classroom.

The provision of a safe, sustainable supply of water has been a challenge for millennia. It remains the most pressing environmental problem in much of the developing world, and is increasingly difficult even in the developed world.

The "Filtration Investigation" lesson focuses on how filtration systems solve many problems throughout the world such as improving drinking water. Through this lesson, students work in teams to design and build a filtration system to remove dirt from water out of everyday items.

It explores how gravity can help with filtration and explores the many materials can be used for making a filter, including cotton balls, sand, rocks, cornmeal, flour, grass, and charcoal.

Students select from everyday items to build their filter, test the resulting system evaluate the effectiveness of their filters and those of other teams, and present their findings to the class.

The lesson can be adapted for ages 8-18, and includes teacher and student handouts and worksheets. It also is aligned to a variety of standards.

Find this and other lessons at www.tryengineering.org/lesson.php.

Magnetic Refrigeration Technique

A refrigerator's humming, electricity-guzzling cooling system could soon be a lot smaller, quieter and more economical thanks to an exotic metal alloy discovered by an international collaboration between the U.S. National Institute of Standards and Technology (NIST), Beijing University of Technology, Princeton University, and McGill University. The alloy may prove to be a long-sought material that will permit magnetic cooling instead of the gas-compression systems used for home refrigeration and air conditioning. The magnetic cooling technique, though used for decades in science and industry, has yet to find application in the home because of technical and environmental hurdles -- but the NIST collaboration may have overcome them. Magnetic cooling relies on materials called magnetocalorics, which heat up when exposed to a powerful magnetic field. After they cool off by radiating this heat away, the magnetic field is removed, and their temperature drops again, this time dramatically. The effect can be used in a classic refrigeration cycle, and scientists have attained temperatures of nearly absolute zero this way. The team used NIST's neutron diffraction equipment for research.

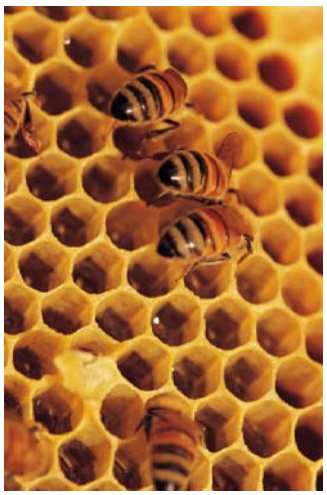
Hybrid Foams for Lightweight Construction

Germany's Fraunhofer Institute for Chemical Technology is looking into how hybrid foams can result in major benefits to construction projects. A special process will make it possible to improve the mechanical, thermal, and acoustic properties of foams in the future. This will be of particular benefit to lightweight construction.

Mother nature is a smart builder. The cell structure of bones and honeycombs, for example, is particularly resilient and gets by with extremely little material. The process by which these lightweight structures form is just as suitable for foaming metals, plastics and ceramics. These foams have specific properties depending on the material they are made of. While plastic foams are light and flexible but cannot withstand high temperatures, metal foams are extremely tough but are heavy and not very flexible. Ceramic foams are quite stiff and can resist even very high temperatures, but are rather difficult to shape.

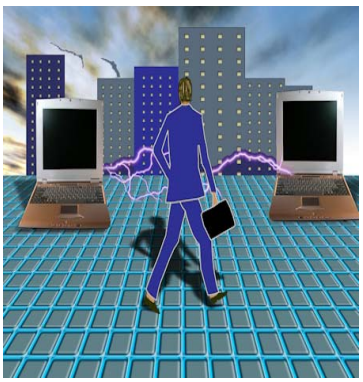
In the automotive and aerospace industries, it would be more effective and resource-saving to combine the flexibility of plastic with the resilience of metal to create a material with entirely new properties. This is exactly what the Fraunhofer researchers are striving to do by developing hybrid foams. What is special about these materials is that they have the potential to acquire completely new characteristics, while at the same time eliminating the specific weaknesses of each constituent, such as the heavy weight of the metal foam.

Find out more at www.fraunhofer.de.



Computing on a Grid

Many engineering research projects are so large or complicated that they need hundreds or even thousands of computers to work together to solve a problem. When computers coordinate their efforts, the work is called grid computing. Through the process, software will divide up the work to be done by each machine. To find out more and explore this process on your own, TryEngineering.org links to an interactive game called "Grid Computing" which was developed by "Try Science." The game challenges you to create a computer grid system to model the volcanic activity of Mt. Vesuvius without taking power from other computing jobs. Site visitors act at the "grid master" and have to divide out the grid's power to each project based on its urgency and impact on humanity. The goal is to balance the volcano research project with other high-priority grid problems. There are also several offline activities regarding grid computing to try out! For the link to "Grid Computing" and other engineering games, click on "Play Games!" at www.tryengineering.org.



Clean Water for a Crowded World

More than 1 billion people worldwide lack access to clean water and, in developing countries, more than 2 million people a year die from water-related problems, with the numbers growing. In some areas, demand for potable water exceeds available resources. This worldwide water crisis is made worse by aging infrastructure, growing population, contamination and high demand for water in energy-generating processes. To help address these issues, the Center of Advanced Materials for Purification of Water with Systems at the University of Illinois at Urbana-Champaign, U.S., is developing sensors with specially designed and synthesized DNA to detect trace amounts of lead, mercury, arsenic and other contaminants. The sensors can be produced in the form of sophisticated testing instruments suitable for use by metropolitan water districts or in the form of test strips similar to those used in home pregnancy tests for households and other limited water users. The center's research efforts are now able to detect specific contaminants in the parts per trillion range, where only parts per million was previously possible. The ability to detect toxic compounds at these levels will allow research to be conducted on health impacts of certain contaminants at these lower levels. The technologies also allow for real-time detection and reduction of contaminants. Real-time instantaneous contaminant detection and online catalytic reduction systems could save lives and increase end-user health. TryEngineering offers a lesson plan about water filtration at www.tryengineering.org.

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TryEngineering.org

is a resource for students (ages 8-18), their parents, their teachers and their school counselors. It is a portal about engineering and engineering careers, developed to help young people understand better what engineering means, and how an engineering career can be made part of their future.

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