

TOP TEN

medical advances

by the editors of yourhealth

This is our fourth year bringing you, our readers, the editors' choice for what we believe are the top medical advances of the year. In the past, we've had some doozies. In 2005, among other advances now in use, we brought you Gardasil, more than a year before the Food and Drug Administration approved the cancer vaccine. This year's list plays second fiddle to none. Our research has taken us to new depths, where we think we've found discoveries that will lead to the cures of two prominent diseases, as well as some great new technologies that make medicine more efficient.

1 A BAND-AID FOR YOUR BONES

Repairing a bone injury from trauma or cancer in the future might be as simple as placing a type of Band-Aid around it.

Researchers at Rice University and Radboud University in The Netherlands have found a way to grow denser bone tissue in rabbits by wrapping the bone with a special type of treated material. The porous material acts as a pattern for the bone and is sprinkled with a synthetic substance called carbon nanotubes. These carbon nanotubes are what promote the new bone growth. The researchers found that after 12 weeks the rabbits had three-times greater bone growth with this method than another one. However, they don't fully understand why this works and are doing further research.

Antonios Mikos, lead researcher and director of Rice's Center for Excellence in Tissue Engineering, says their finding offers a better alternative to the current method of re-growing bone with a bone graft from another part of the body. Mikos says the drawbacks to the current method are that we don't have that many areas to take a bone graft from and that you are basically repairing a defect in one area by creating a defect in another. **Available in the unforeseen future.**

2 SKIN DEEP CURE FOR DIABETES

Take a look at your hand. If you're a diabetic, the possibility of a cure is right there in your palm.

This discovery comes from researchers at the University of North Carolina, Chapel Hill School of Medicine, who have broken through to a new level of cell manipulation that allows them to turn skin cells into stem cells and manipulate those to perform specific functions including the secretion of insulin. The breakthrough holds promise for all diabetics, and could mean the end of daily insulin shots for people with type 1 diabetes, according to lead author of the study Yi Zhang, PhD, professor of biochemistry and biophysics at UNC.

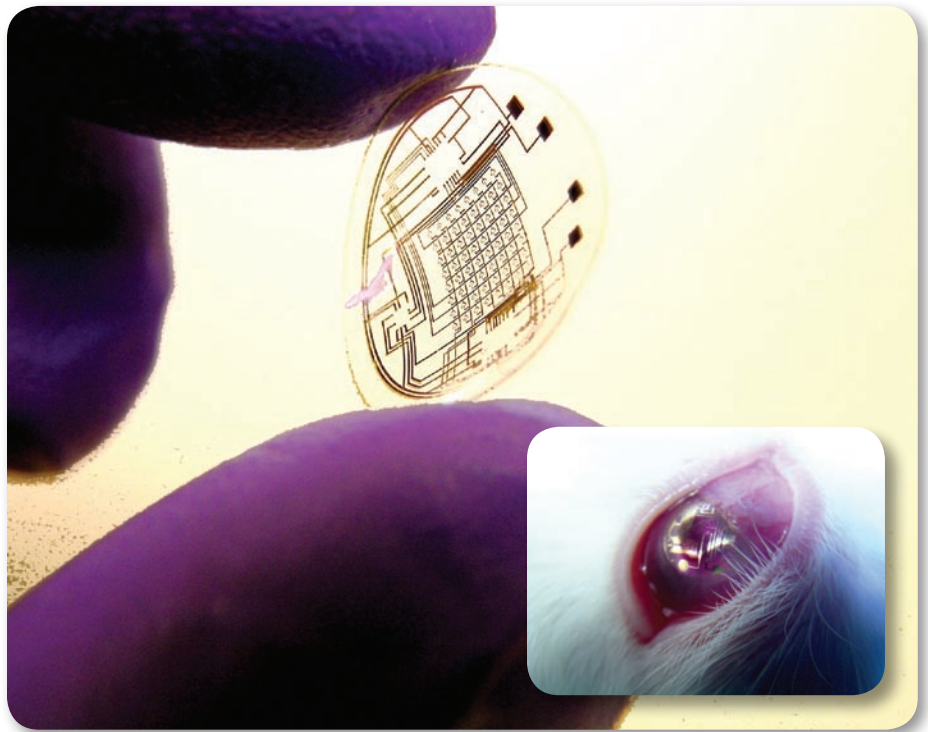
"If everything is successful, the patient will not need to do anything any more as the beta-cells in the transplanted islet-clusters should generate the needed insulin," Zhang explains.

This discovery could also lead to the earlier delivery of diabetes treatments that are currently under development but burdened with the need for matching organ donors as well as the suppression of patients' immune systems.

Currently, diabetes affects about 24 million people in the United States. **Available in about 10 years.**

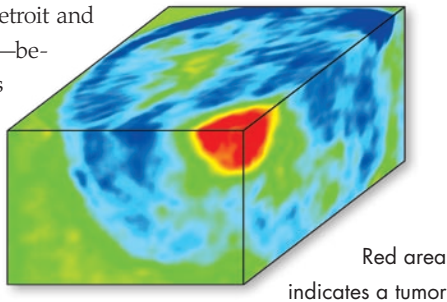
3 A BIONIC LOOK INTO THE FUTURE

Imagine a world where you can walk down the street and read your e-mails as if they were floating in front of you. That time may come sooner than you think. What you and I would like to *Terminator* vision has become a reality for some rabbits at the University of Washington. Researchers have developed a contact lens that generates semi-transparent virtual displays, meaning you could be immersed into a virtual world while still functioning in the real world. "In the future, we'd like to have a contact lens that would show you information and also... that would monitor what happens on the surface of the eye because that reflects what happens in the body," says Babak Parvis, assistant professor of electrical engineering at UW. While human tests have not been performed and they haven't built "a fully functional eye" at this time, the core technologies of the bionic device have proven effective in animal trials. **Available: In the unforeseen future.**



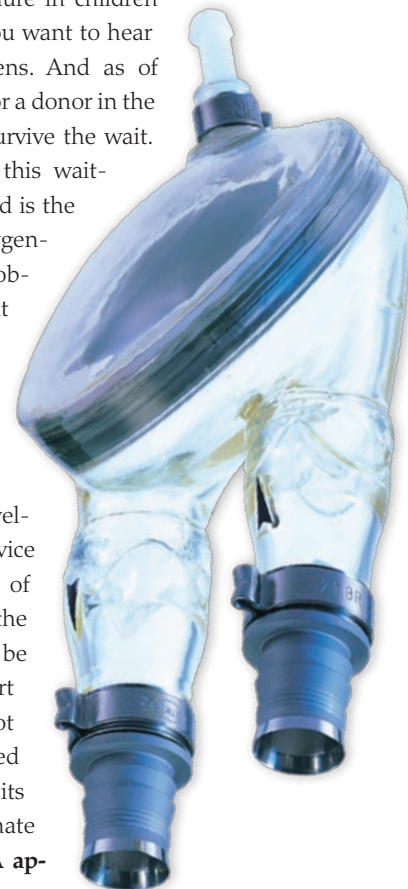
4 A TOTALLY UN-RAD WAY TO DETECT BREAST CANCER

Think of it as sonar for the body, but instead of using sound-wave propagation to locate massive submarines in deep oceans, the Ultrasound CT scan uses ultrasonic and infrasonic frequencies to detect tiny tumors in human breasts. "Patients lie face-down on a bed and the breast is immersed in a water tank through a hole in the bed," says Lianjie Huang, PhD. "The breast is surrounded by a ring-shaped ultrasound scanner with hundreds of ultrasound transducers." From there, a computer creates a 3D image of the breast, and tumors appear as bright as the midday sun. This device is under clinical trials at the Karmonos Cancer Institute in Detroit and researchers believe—because of lower rates of false positives and negatives—it could replace the mammogram and magnetic resonance imaging (MRI). "We have had overwhelmingly positive feedback on the comfort and speed of the exam," says Neb Durric, PhD, a principle investigator of the project at Karmonos. "The scan takes about a minute." With mammography, fears have been raised that the use of radiation can cause cancer and the compression of the breast can help cancer spread. The Ultrasound CT scan has neither of those faults. **Available: 3 to 5 years.**



5 A CRITICAL DEVELOPMENT FOR KIDS

Critical heart failure in children is not a condition you want to hear about, but it happens. And as of right now, a child holding out for a donor in the United States is fortunate to survive the wait. If complications arise during this waiting period, the current band-aid is the extracorporeal membrane oxygenation (ECMO) machine. The problem with this device is that it immobilizes the child, creating greater susceptibility to complications. But there is hope on the horizon and it comes from overseas. German-based company Berlin Heart has developed the Excor Pediatric, a device that supports both ventricles of the heart and allows children the freedom to move around and be active until their donor heart is ready. While the pump is not currently approved in the United States, the FDA has permitted its use 118 times for compassionate purposes. **Available: The FDA application is under investigation.**



6 TAKING THE STING OUT OF THE NEEDLE

Don't let its size fool you. The Accupal may not be very big, but it's making a giant impact on going to the dentist.

Developed by Michael Zweifler, DDS, of Little Rock, Ark., the Accupal uses four methods to help take the sting out of the often-painful injection of Novocain. Run on a single AAA battery, the device uses ultrasonic vibrations to stimulate the tissue and help numb nerve endings. At the same time, the vibration allows the standard topical gel to better penetrate the tissue. The needle itself is also vibrated as it is passed through a slot at the tip, which is angled at 90 degrees to help the needle enter the tissue with the smallest possible footprint. The end result is that the Accupal fools your brain into thinking nothing is happening.



"We merely provide a way (for) the dentist to disturb the tissue to the point where it distracts the patient's perception of the needle stick," Zweifler says. He adds that the Accupal works so well it's sometimes hard to tell if he has penetrated the tissue because there is no reaction from the patient. **Available: Presently.**

7 A MUCH BETTER BANDAGE

Gels, grafts, lasers and honey treatments are but a few of the options available to millions of people who live with chronic non-healing wounds from burns and diabetes, but research with silica fibers underway in Europe might provide the best cure yet.

Developed by scientists at the Fraunhofer Institute of Silicate Research ISC in Würzburg, Germany, the rapid wound dressing is made of silica gel fibers that are spun into fine threads to make a transparent, fleece-like web that is cut to size. The dressing provides a supportive matrix and environment where new skin cells are nourished

and grown. Once in place, it does not have to be removed because it will be absorbed fully by the body once optimal cell growth is established.

Katharina Jansen, PhD, a spokeswoman for Bayer AG, a partner in the development and marketing of the advanced bandage, says discussions are already in progress to improve the product so that it can deliver painkillers and antibiotics during the healing process.

"This is another project, even more in the future," Jansen explains. "When we first have the product 'pure' on the market, it should be the next step." **Available: As early as 2011.**

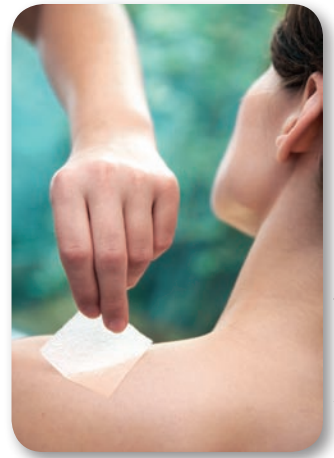


photo courtesy of Bayer Innovation GMBH

8 BRIGHTER DAYS AHEAD

Imagine your eyesight being controlled by a dimmer switch that turns toward darkness one click at a time, every day. Such is life for people with Leber congenital amaurosis (LCA), which usually begins at birth and robs a person's sight within 20 to 30 years.

There is no cure for LCA, which is a form of retinitis pigmentosa, but recent clinical trial results involving gene therapy show startling promise. Ongoing studies at University of Pennsylvania, University of Florida and University College London, England, did not restore 20/20 vision to the participants, but did improve eyesight in several of the volunteers.

Dr. Jean Bennett, a leader of the Pennsylvania study, said trial participants say they can now see numbers on their cell phones, recognize faces in restaurants and read letters on street signs as they were driven around town. Results also include a 9-year-old

T I M E L I N E

Minneapolis January 13

Researchers at the University of Minnesota create a beating heart in the lab. Using a process called whole organ decellularization, researchers grew functioning heart tissue by combining dead rat and pig hearts with live cells. The process could allow a person to receive transplantable organs made with their own cells.

Washington, D.C. April 23

The Food and Drug Administration approves marketing a new type of latex glove that could help people with allergies to traditional latex. The Yulex Patient Examination Glove is made from a new form of natural rubber latex called guayule latex. Research shows that people with high sensitivity to traditional latex did not react to the guayule latex.

Amsterdam May 27

Dutch researcher Agnes Berendsen saves teeth from falling out by using periodontal ligament regeneration. Using tissue engineering in a 3-D in-vitro model, Berendsen generated a viable periodontal ligament and prevented teeth from becoming detached. The process might also prove useful for restoring other tendons and ligaments in the body.

Atlanta June 20

A computer chip designed by engineers at Georgia Tech allows disabled individuals to control a powered wheel chair by moving their tongue. Called the Tongue Drive, a device the size of a small grain of rice is implanted in the user's tongue. It lets the user control a computer cursor or powered wheel chair.

Munich July 25

The world's first double arm transplant was completed by surgeons in Munich, Germany. It took 30 surgeons more than 16 hours to complete the surgery on a 54-year-old farmer who lost his arms in an accident six years earlier. It may take up to two years before the patient can move his new hands.

boy who was able to read schoolbooks again with his classmates.

The improvement came from injecting large quantities of the needed healthy gene into one eye of each person. Over time, their eyesight improved.

The results offer “a great deal of potential” for the future use of gene therapy in treating a number of blinding retinal diseases, according to Bennett, who says the best results would likely be found among children ages 6 months to 3 years. **Available: FDA approval expected in about two years.**

9 HEARING AID ON THE GROW

Children with hearing loss can present a great challenge to parents and teachers because their hearing needs change just as quickly as they grow. A new hearing system from Siemens Audiology offers to make that a little easier.

The Explorer 500 P hearing aid and ClinicalFit software is the first hearing system specifically designed to adapt to a child’s hearing needs as they grow. The hearing instrument itself includes features like a light to let parents and teachers know the device is operating and a locking battery compartment for safety. The Explorer also offers an omnidirectional microphone that allows a child to hear sound in all directions, which is important because very young children are learning language skills and need to hear everything in their environment. When the child grows older, the omni-directional microphone can be turned off and a directional microphone can be activated.


“We want to grow the instrument with the child,” says Thomas A. Powers, PhD, vice president for compliance and audiology at



Siemens. “As they change, as their need to interact with the environment changes, the hearing aid can change with them.” **Available: Presently.**

10 WHEN SECONDS MATTER, THE CRIC IS UNRIVALED

If you’ve ever had the wind knocked out of you, you’re familiar with the resulting helplessness as you gasp for breath. But, what if you couldn’t breathe through your mouth and had to rely on your trachea for air? This would mean that you need a cricothyrotomy, or procedure for people with an obstructed upper airway. Typically done in desperate situations, such as in the ER or on the battlefield, a cricothyrotomy is performed using a minimum of three tools, each separately packaged. “The CRIC kit takes this traditional cricothyrotomy procedure and a handful of disparate surgical tools and combines them all into one handy device,”

says David Christie, president and CEO of Pyng Medical Corp., the company that designed the CRIC kit in consultation with the U.S. military. “You can think of this as being the Leatherman or Swiss Army Knife of cricothyrotomy procedures,” Christie says. The advent of the CRIC kit means that a procedure that used to take minutes can now be performed inside of 20 seconds. “The obstructed upper airway is the number two preventable cause of death on the battlefields of Iraq and Afghanistan, but in the civilian setting, we understand that there (are) upwards of 20,000 cricothyrotomy procedures that need to be performed every year in the U.S. alone,” Christie says. **Available: FDA approval expected before the end of the year.** 

Boston July 16

A device first designed to help astronauts’ balance problems after they return to Earth is found to be of similar use to senior citizens. The iShoe was developed by a graduate student at the Harvard-MIT Division of Health Sciences and Technology. The insole measures and analyzes the pressure distribution of a person’s foot and reports the data to the doctor.

Pasadena, Calif. July 28

Engineers at the California Institute of Technology develop a “microscopic microscope” about the size of a dime. The device has the same magnifying power as a top of the line optical microscope. It can be mass-produced for about \$10 and can be used to analyze blood samples for disease in the field.

Taiwan August 7

Asus introduces a wireless mouse that can help keep track of your health. The Vito W1 monitors your heart rate to identify your mood and emotional condition. Software shows the users heart rate and an emotional icon in a widget on the computer screen.

Deerfield, Ill. September 29

Baxter Healthcare receives FDA clearance for the first antimicrobial needless intravenous (IV) connector. The V-Link with VitalShield has been shown to kill at least 99.9 percent of six common pathogens known to cause catheter-related bloodstream infections, including E. coli.

Malvern, Pa. October 8

The first therapy for adult depression not involving surgery or drugs is approved by the FDA. Neuronetics’ NeuroStar Transcranial Magnetic Stimulation Therapy system uses highly focused magnetic pulses to stimulate an area of the brain that is linked to depression.