INSIGHT

TAPPING INNOVATIVE SOLUTIONS & TECHNOLOGY AT JOHNS HOPKINS MEDICINE

JUNE 2016 PUBLISHED BY JOHNS HOPKINS MEDICINE MARKETING AND COMMUNICATIONS

Ultrasound Device Invented at Johns Hopkins Now in Clinical Use

Ultrasound imaging systems can help clinicians guide tools like needles toward targets inside the body. However, the images are two-dimensional, requiring continual adjustments of both the ultrasound probe and the needle during procedures such as biopsies, anesthesia and ablations.

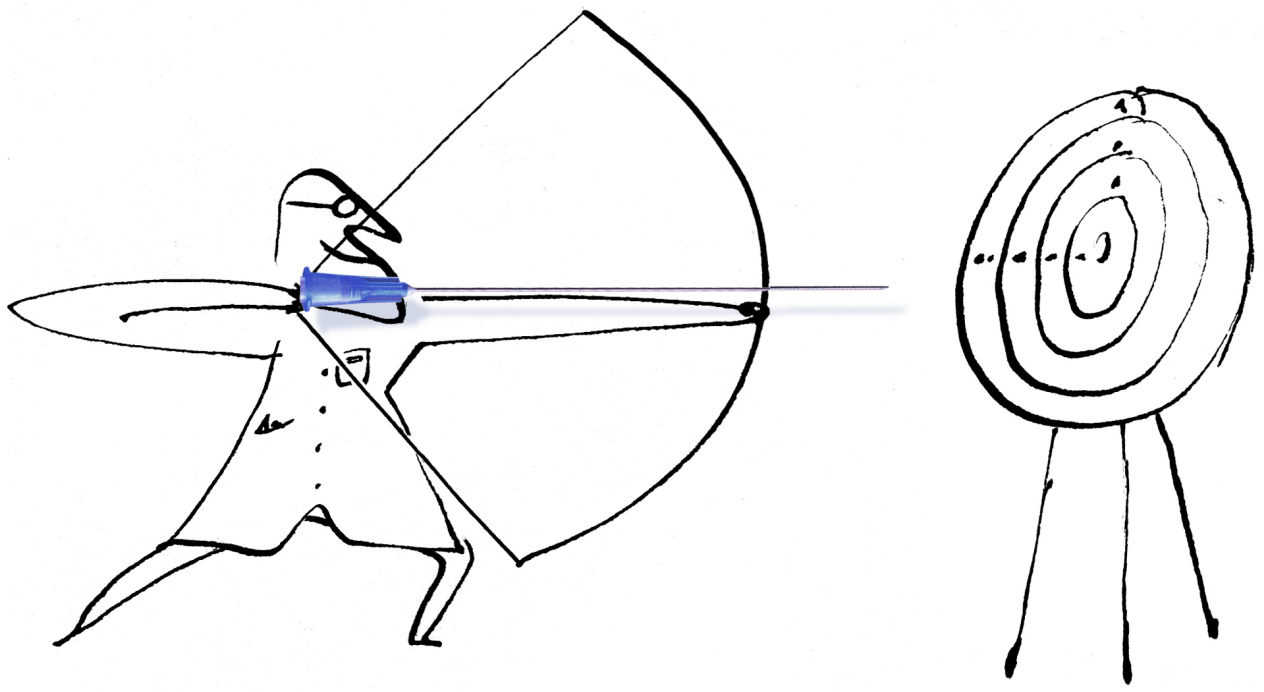
The Johns Hopkins Hospital and the National Institutes of Health Clinical Center are now using Clear Guide ONE, a device that calculates a needle's trajectory, helping clinicians reach a target on the first try.

A prototype was created in 2009 by computer scientist and engineer Emad Boctor and postdoctoral fellow Philipp Stolka in Boctor's Medical UltraSound Imaging and Intervention Collaboration (MUSiiC) lab. They affixed two small cameras to the ultrasound probe, creating stereo images that work with computer software to show the needle's path and target on a live ultrasound image.

Fine-tuning took place at Clear Guide Medical, the private company co-founded by Boctor, Stolka, computer science professor Greg Hager and CEO Dorothee Heisenberg. Support came from grants and from FastForward, the Johns Hopkins Technology Ventures accelerator. In 2014, the company won clearance to market the device from the Food and Drug Administration and its Canadian and European equivalents.

Early in 2016, the FDA cleared a second generation of the technology, which allows pre-acquired CT images to move in concert with the ultrasound, creating 3-D navigation.

Meanwhile, Boctor continues to pursue innovations in his MUSiiC lab. One would use ultrasound energy to test fetal brain health. Another would use imaging to guide infertility treatment procedures.



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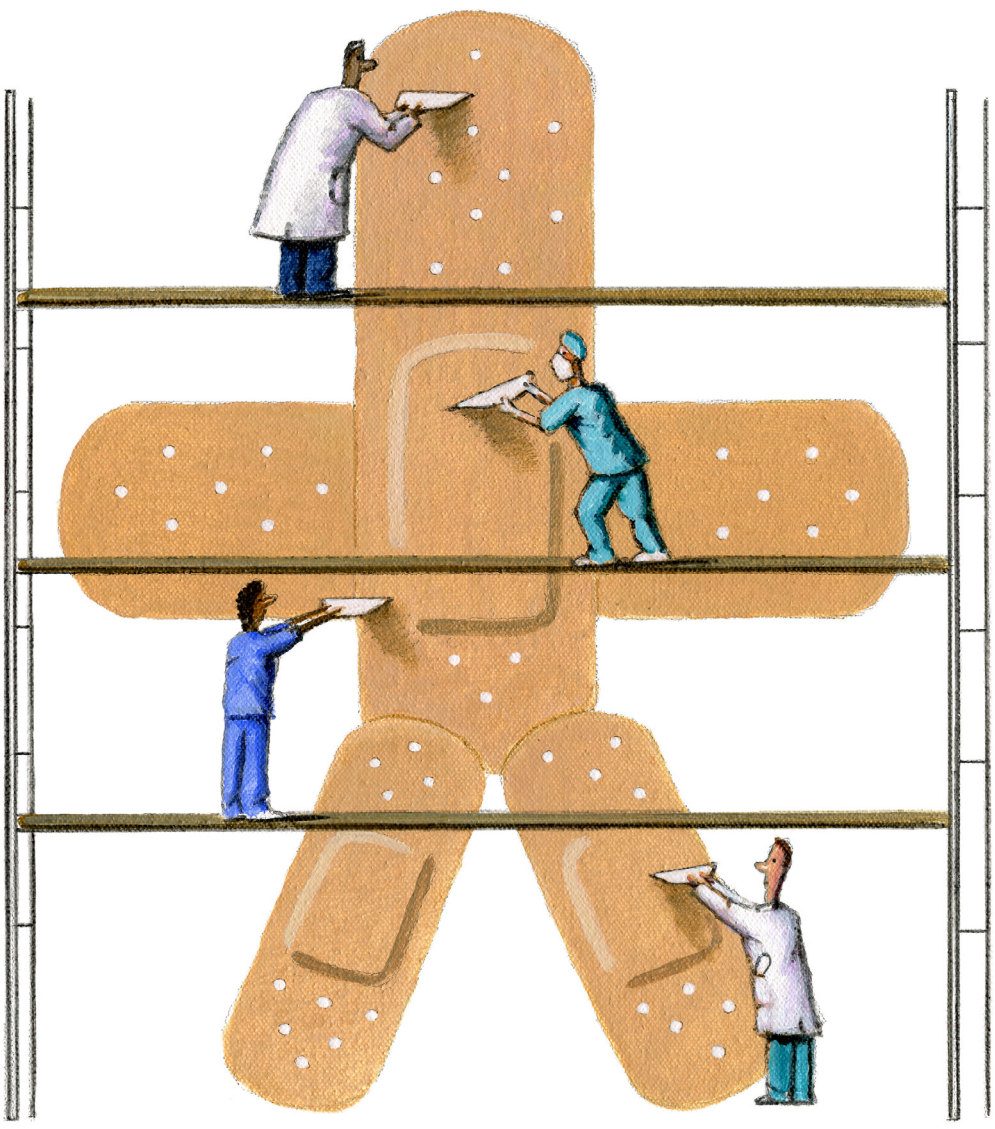
WEB EXTRA: Watch a video of the ultrasound guidance device by clicking on this article at hopkinsmedicine.org/insight.



PAUL ZWOKAK / MARLENA AGENCY

2 Treatments Licensed to Heal Stubborn Sores

Wounds that just won't heal may soon have ammunition to fight harder. Baltimore startup Gemstone Biotherapeutics is developing two new wound treatments—one out of Sharon Gerecht's lab at the Whiting School of Engineering, and another from gerontologists in the school of medicine.

The company is developing the topically applied remedies that CEO George Davis hopes will enter the market by 2018. In early testing, the treatments closed wounds faster than did standard care.

The first innovation, from Gerecht, contains a microscopic scaffold, or structure, that new cells can populate, healing the wound faster than you can say "biosynthetic scaffolding." In early testing, mice had 100 percent wound closure after 14 days. Mice treated with basic dressings had less than 15 percent closure after two weeks.

"Our bodies can recognize the scaffold, which replicates natural extracellular structure, and recruit cells to fill it up," says Davis.

The second remedy recharges mitochondria—the tiny energy factories inside cells—in and around the foot sores of people with diabetes. Early testing in animals showed 12 chronic wounds closed after six weeks, while only one wound treated with standard care and placebo closed.

Gerontologists Jeremy Walston and Peter Abadir came up with the treatment when they repurposed an oral hypertension drug to rev up the mitochondria of aging cells to promote healing.

Gemstone licensed the scaffold technology from The Johns Hopkins University in 2013, the same year Davis co-founded the company with business partner David Oros, Gerecht, the university and Baltimore venture capital firm Gamma3. Gemstone licensed the second innovation earlier this year.

Headquartered in Federal Hill, Gemstone has lab space at Johns Hopkins' FastForward innovation hub. The company is currently gearing up for initial FDA submittals and clinical trials.

TECH/ENVY

A look at innovative developments outside the halls of Johns Hopkins Medicine

Innovations to Fight Cancer

From disease prevention to personalized medicine, organizations across the country are dispatching innovative efforts to win the fight against cancer.

The Collaborative Cancer Cloud aims to make precision medicine for cancer possible by 2020. Technology company Intel joined forces with Dana-Farber Cancer Institute, Oregon Health & Science University, and the Ontario Institute for Cancer Research to share and process large amounts of de-identified data about patients with cancer, including genetic, imaging and clinical data. Ultimately, the group wants to provide affordable, individualized treatments for patients within one day.

Tiny, implantable drones are on a misson to target and kill cancer cells inside the body. A Brigham and Women's Hospital doctor created the rice-size drones to carry immunotherapy medicine and nanoparticles that amplify the effect of radiation. The drones are implanted into tumors and programmed to trigger the release of the medication on a specific schedule. Once the therapy is released, the drones biodegrade.

Prevention coaches armed with an interactive, Web-based application are empowering patients in the clinic to create cancer prevention plans. Winner of a Patient Shark Tank competition at the Harvard Center for Primary Care's Innovations Conference, the preventive care model makes it easy for patients to consult with a coach, develop a personalized prevention plan and schedule appointments for cancer screenings, such as a colonoscopy or mammography.

Cloud Storage for Digital Slides Helps Connect Researchers and Clinicians

A senior biomedical engineering student has launched cloud storage software for digital pathology slides, thanks in part to a $10,000 grant from Johns Hopkins Technology Ventures' Ralph O'Connor Undergraduate Entrepreneurship Fund.

MARTIN LEON BARRETO / MARLENA AGENCY

Proscia, founded by David West Jr., is offering Pathology Cloud as a way for hospitals, research institutions, pharmaceutical companies and others to store, manage, analyze and collaborate on digital pathology slides.

Currently, pathologists make most tissue-based diagnoses by analyzing glass slides under microscopes. For second opinions, they often ship slides to other pathologists or labs, but that involves time and potential damage.

Pathology slides digitized with the help of a scanning system can be shared more quickly and easily, but institutions and businesses can face storage challenges when working with thousands of digital pathology slides. Certain slides alone can take roughly 1 gigabyte of storage space.

West started Proscia after seeing the potential and challenges of digital pathology slides in urologist Robert Veltri's lab, where a friend of West's was working. Today, Veltri is an adviser to Proscia.

Digital pathology is an emerging field. While the FDA has yet to approve it for initial patient diagnoses in the U.S., it's used for research and teaching at Johns Hopkins. A program focused on using it for secondary consultations for international patients is also in development.

Pathology Cloud allows clients to store millions of digital slides online and work with others through secure image sharing. West is also working on machine-learning software to analyze these images and develop algorithms that could help improve cancer detection.

"We've seen a lot of cool technology solve problems of subjectivity in many other fields and medicine, but it hasn't really touched pathology until now," says West.

Radiology Dashboard Modernizes Education

A few mouse clicks are now all that separate diagnostic radiology residents from seeing a comprehensive, real-time assessment of their performance.

The residents began using an online dashboard tool created by the Technology Innovation Center last fall. Rolled out by the Department of Radiology and Radiological Science, the dashboard compiles various types of data, from the number of radiology examinations they've analyzed to the number of morning conferences they've attended, as well as evaluations by their attendings.

"It's often said that the things that are measured are the things that get done," says fourth-year medical student Fiona Gispen, who helped design the dashboard. "Our dashboard helps residents measure their performance so that they can effectively work to improve."

Diagnostic radiology is one of several residency programs using dashboards built by the Technology Innovation Center.

"The unique approach to this dashboard is its combination and transformation of many real-time data sources in one place for residents' use," says Gorkem Sevinc, the Technology Innovation Center's managing director. Residents can also see how they rank among their anonymized peers, he adds.

Much of a radiologist's work involves accurately and efficiently analyzing images, like MRI scans, for abnormalities and dictating reports on them. The radiology dashboard informs residents whether the number of cases they've read meets the quotas set by the Accreditation Council for Graduate Medical Education and the radiology program. It also provides residents with feedback from attendings on their radiology interpretations. "They can see if they read a sufficient number of ultrasounds but may need to increase their experience with head CTs," says Pamela Johnson, radiology residency program director.

Residents access the dashboard by logging on to Johns Hopkins' private network.

WEB EXTRA: Learn about the Technology Innovation Center's Entrepreneurial Accelerator Program for students and clinicians who have ideas for new health care technologies. Click on this article at hopkinsmedicine.org/insight.