INSIGHT

TAPPING INNOVATIVE SOLUTIONS & TECHNOLOGY AT JOHNS HOPKINS MEDICINE

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Johns Hopkins Technology Improves Facial Transplant Results

VIGG / THREE IN THE BOX

In 2008, when craniofacial plastic surgeon Chad Gordon participated in the world's first facial transplant surgery involving an upper jaw and teeth, he was frustrated to see that functionality could not be a primary goal.

"All that mattered initially was whether the face, bones and teeth would survive and not reject, but that didn't mean our patient would chew without a problem," says Gordon, co-director of the Multidisciplinary Adult Cranioplasty Center.

To ensure optimal chewing function, surgeons end up revising most face-jaw-teeth transplants, but Gordon aims to improve the situation with his Computer-Assisted Planning and Execution system. Developed with a team from Walter Reed National Military Medical Center, its biomechanical simulation function will allow surgeons "to calculate—before and during surgery—where patients' jaws and teeth should be for them to chew as well as function their best," Gordon says.

"Antennae attached to patient and donor heads transmit the faces' locations to the software platform so the system can direct surgeons where to cut and affix."

In Gordon's system, a surgery team uploads CT scans of patient and donor facial skeletons to a software platform to digitally visualize the surgery's results ahead of time. During two simultaneous operations—one extracting the transplant, and the other affixing it to the patient—antennae attached to patient and donor heads transmit the faces' locations to the software platform so the system can direct surgeons where to cut and affix. Surgeons also use customized cutting templates—created before surgery and placed on patient and donor faces during surgery—with three-dimensional tracking devices to guide the operations. Surgeons must cut and affix the face-jaw-teeth transplant in just the right way to make chewing ideal.

Gordon and his team are perfecting the system through swine trials, and they're talking with several major technology companies about integrating the platform with operating room computers. They also have taken out nine patents and received several national grant awards, and they expect to release the system within four to six years.

MIGUEL MONTANER / MARLENA AGENCY

Collaboration Creates Composite to Fill Surgical Cavities

When a patient has a tumor removed, surgeons may fill the cavity using silicone implants, soft tissue from another part of the patient's body—or use no filler at all. Each option has drawbacks, such as scar formation, the need for replacement, additional surgical procedures or concerns about appearance.

But now, Johns Hopkins plastic surgeons and biomedical engineers have invented a composite material that supports a surgical cavity while encouraging new tissue growth within it. The composite has performed well in small-animal tests.

Two years ago, plastic and reconstructive surgeon Justin Sacks and surgical resident Sashank Reddy approached materials engineer Hai-Quan Mao in the Translational Tissue Engineering Center with a new idea. They wanted to reconstruct new soft tissue for patients after breast cancer removal using a soft material that surgeons could custom fit to fill a cavity.

Mao suggested trying hydrogels because they are jellylike and have elastic properties that mimic the feel of soft tissue. Some hydrogels are already in use to fill small-volume defects for cosmetic reconstruction. However, it can be difficult to achieve both material strength that matches soft tissues and sufficient pore structure that encourages new tissue growth.

In the end, the team developed a new material that combined hydrogel and nanofibers made with the same polymer materials used in degradable sutures. "We bonded the nanofibers with the hydrogel and made a stronger composite that can hold its shape until new tissue grows in the pores of the composite," says Mao.

As new cells and blood vessels grow in the framework, the composite slowly degrades.

Mao and the team have submitted a patent on the composite and recently received a Johns Hopkins-Coulter Translational Partnership grant for large-animal studies to prepare for the clinical translation to treat patients within the next few years.

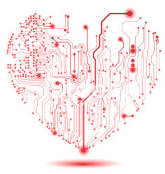
TECH/ENVY

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

Organs-on-Chips

Organs-on-Chips technology notably received the international Design of the Year Award from London's Design Museum.

Developed by researchers from **Harvard University's Wyss Institute for Biologically Inspired Engineering**, the microchips are lined with microfluidic tubes containing human cells that mimic organs, such as lungs, kidneys, livers and hearts. The innovation allows research on new drugs without testing on animals.



In 2014, Emulate Inc. launched out of the Wyss Institute to bring Organs-on-Chips to commercialization. The company is developing a platform that would allow for the personalized treatment of patients based on tests using their own living cells.

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Virtual reality headsets could change the way brain surgery is performed. At **UCLA**, neurosurgeons are now using the technology to go inside their patients' brains to practice maneuvers before and during surgery.

"It's just amazing to see every little opening in the skull where a nerve goes through," Neil Martin, chairman of UCLA's Department of Neurosurgery, told CBS News. "I'm virtually inside the skull of the patient, walking around, floating around."

Martin says use of the technology could lead to shorter, safer surgeries.

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The **FDA** has developed a **drug shortages app** to quickly provide public access to important—and sometimes critical—information about shortages. The app identifies drug shortages, resolved shortages and discontinuations of drug products.

Users search or browse by a drug's generic name or active ingredient, or by therapeutic category. Users can also report a suspected drug shortage or supply issue to the FDA through the app. It is available for free via iTunes and Google Play by searching "FDA Drug Shortages."

Eye-Tracking Device Helps Accurately Identify Stroke

Studies show that $1 billion is wasted each year on unnecessary tests and hospital admissions for people with dizziness who are suspected of having a stroke but who actually have benign inner ear problems. On the other hand, about 40,000 to 70,000 patients have strokes each year that are initially missed when they come to the emergency room presenting dizziness.

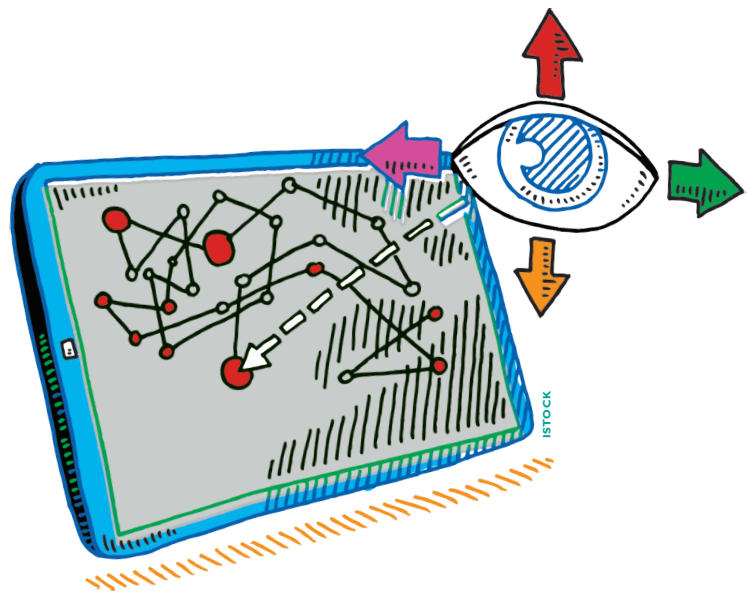
To differentiate stroke from other conditions that cause dizziness, neurologist David Newman-Toker devised a technique that looks for minute differences in eye movements.

A 2009 study showed that the test can outperform more standard clinical tests for stroke, including an MRI or CT scan, but they come with a drawback. "Learning to administer these tests correctly requires months to years of mentorship and can be extremely difficult, even for specialists," he says.

To automate the process, Newman-Toker turned to video-oculography. While researchers and physicians have been using the approach for years to diagnose balance issues, it has never been used for stroke.

He is now testing the capability of a pair of computerized eye goggles to administer this exam. The technology resembles a pair of swim goggles and uses a video camera connected to a computer to examine eye movements. In patients with severe dizziness, if the goggles find the eyes stay stable when the head is rotated, eye jerking changes direction or either eye is higher, the patient has a stroke; otherwise, it is a benign postviral ear condition known as vestibular neuritis.

Newman-Toker is working to demonstrate the device's accuracy and utility in emergency room clinical practice and says the technology could be in use in about five years.



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Stroke Tests

	EYE-TRACKING GOGGLES	MRI	CT SCAN
ACCURACY…	**99%**	80%	16%
COST*……	**$40**	$1,500	$300

**Cost refers to the average amount reimbursed by insurers for each test.*

Social Media Command Center Monitors and Protects

The Johns Hopkins Medicine social media team tracks, responds to and makes sense of 480,000 brand mentions, 583,573 followers on Facebook and Twitter, and more than 1,500 questions each year—an enormous task. The social media command center allows the institution to monitor and protect the brand in the increasingly important world of social media.

The term "social media command center" might conjure visions of NASA's Mission Control Center, with its large monitors and streaming social content. It's actually a dedicated space within the Marketing and Communications Department that enables social media team members to see all social data that impact the brand.

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To request information about the social strategy for your department, visit hopkinsmedicine.org/webrequest.

"The command center allows the team to act quickly and efficiently, mitigate risk around crisis situations, and take advantage of opportunities to resolve patient complaints and provide expert commentary on trending topics," says Therese Lockemy, director of Internet marketing and social engagement.

Each team member has three monitors showing five different data streams of social information. They include:

- **All activities on Johns Hopkins Medicine social channels:** The team is responsive to questions and provides service recovery. For example, if a patient posts a comment to Facebook about a bad experience, the team can reach out to that patient and connect him or her to the best resources and staff to resolve the issue.
- **All brand mentions:** The team watches for any issues or crises developing on a social channel or website so they can respond before the information reaches media outlets. The team works closely with subject matter experts to respond quickly.
- **Scheduled posts:** These offer visibility into what is scheduled for the institution's official channels—Facebook, Twitter, YouTube, LinkedIn, etc.
- **Other social posts:** The team can quickly cross-promote and share content from other areas of the institution soon after the content is published.
- **Trending topics:** The team sees currently trending topics in health care, science and medicine, providing opportunities for Johns Hopkins experts to comment.

WEB EXTRA: See examples of the above data streams at hopkinsmedicine.org/insight.