Scientists engineer new portable gel that could save injured eyes

By Erica Rheinschild

When a soldier sustains a traumatic eye injury on the battlefield, any delay in treatment may lead to permanent vision loss. With medical facilities potentially far away and no existing tools to prevent deterioration, medics are in a high-stakes race against the clock.

A multidisciplinary team of scientists and engineers at USC are close to solving the problem. They have developed a reversible, temperature-sensitive temporary seal that changes from a liquid to a super-strong semi-solid when applied to the eye. When the patient is ready for surgery to permanently close the injury, doctors can remove the seal by adding cool water.

Results of the study were published on Dec. 6 in Science Translational Medicine.

“If you look at historical data over the last several decades, the rate of war-related ocular injuries has steadily increased from a fraction of a percent to as high as 10 to 15 percent. Some of that can be attributed to changes in warfare, especially with the use of improvised explosive devices,” said corresponding author John Whalen, PhD, assistant professor of research ophthalmology at the Keck School of Medicine of USC and member of the USC Institute for Biomedical Therapeutics.

The Department of Defense asked the scientific community to develop novel approaches to treating injuries to the eye. By February of 2000, Hall had become so ill that the VA entered him into palliative care. He was told he was in end-stage heart failure and would not get any treatment beyond managing his pain.

But on a Sunday morning in late March of 2000, Hall was feeling so sick that he drove to a nearby medical centre in Inglewood seeking help. Fortunately, a cardiologist told Hall about Keck Medicine of USC’s team. Keck School of Medicine of USC faculty members Vaughn A. Starnes, MD, Distinguished Professor and Chair, H. Russell Smith Foundation and Chair of the Department of Surgery, and Mark L. Barr, MD, associate professor of cardio-surgery, took on Hall’s case.

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It was a soldier’s heart移植 gives patients years of joy

By Lex Davis

Raymond Hall was told he had three months to live. That was more than 17 years ago.

Hall is a Vietnam-era Marine veteran. After he developed heart problems related to his service, he underwent years of treatments with the U.S. Department of Veterans Affairs (VA).

“They tried everything,” Hall said. “They did consultations with Stanford and so many other hospitals.” The VA enrolled Hall in experimental programs, one of which made him sicker than when he’d started. By February of 2000, Hall had become so ill that the VA entered him into palliative care. He was told he was in end-stage heart failure and would not get any treatment beyond managing his pain.

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By Zen Vuong

Your smartphone could be the key to a healthy heart. At least that’s what Nima Pahlevan, PhD, believes. The 39-year-old engineer has been developing an app that could allow people to use their iPhone cameras to measure heart health. The high-tech, low-cost tool would address America’s No. 1 cause of death: heart disease.

“This app doesn’t exist in the market yet, so people don’t know they need it,” said Pahlevan, an assistant professor of aerospace and mechanical engineering at the USC Viterbi School of Engineering. “Nearly 50 percent of heart attacks are silent — the heart is damaged, but people aren’t aware they just had a heart attack. So they don’t seek treatment to prevent future heart attacks. We are working to help doctors and our future app users identify silent heart attacks and, really, any kind of heart attack.

The algorithms and app Pahlevan and his colleagues have been working on are a form of preventive medicine. This biotech solution can also keep an eye on heart failure patients. People can spend as little as a couple of seconds to get a complete reading via this diagnostic tool, Pahlevan said.

All the user needs to do is place an iPhone camera or, eventually, any smartphone camera against their carotid artery pulse on the left or right side of their neck. Three major arteries provide blood to the brain, neck and face. The camera records the vibration of the blood vessel and provides a wave curve that contains information about how much blood the heart is pumping out per contraction, called the ejection fraction.

Pahlevan led a study published in the journal Critical Care Medicine this summer that found the iPhone diagnostic app his team created was slightly more accurate than an echocardiogram, the most common technique employed in clinical practice to identify heart failure.

“Now that Pahlevan has a proof of concept, his iPhone app has piqued the interest of many researchers and even the biotech industry. He is working with Keck Medicine of USC to test a more advanced algorithm that uses

The electrocardiogram cannot measure “left ventricular end diastolic pressure” (LVEDP), the most robust biomarker of whether a person’s heart is healthy. All the information will be input into our smartphone app and sent to their physician or cardiologist. This can be done from the comfort of their home, without disrupting their day.

“The initial tool we created for ejection fraction is like a Ferrari, and this new tool we’re working on is like a Ferrari, Pahlevan said. “You can get there much sooner, much faster.”

EYE: Study is collaboration between engineers, scientists

ocular injuries, we immediately thought of an advanced material we had previously worked with as a possible adhesive for a retinal implant.

The study represents the latest development from the USC Institute for Biomaterials Therapeutics, which fosters collaborations between scientists at the Keck School, chemists at the USC Dornsife College of Letters, Arts and Sciences and engineers at the USC Viterbi School of Engineering. USC has made research in convergent biotechnology and biotechnology priority to address health issues across the life span through the development of new diagnostic tools, treatments and biomedical devices.

A custom fit

The material the group was working with for retinal implants was a hydrogel called PNIPAM, poly(N-isopropylacrylamide), which had a unique attribute that made it a natural fit for this application. When cooled, the hydrogel became liquid for easy application, and when heated, it became a visco-elastic solid with strong adhesion. All that was needed was some tailoring.

“Since the initial hydrogel’s transition temperature was very close to the temperature of the human eye, we had to modify its properties to ensure that it would form a solid seal as soon as the gel was applied to the eye by a surgeon or medical device,” said lead author Niki Bayat, a doctoral candidate in the Mork Family Department of Chemical Engineering and Materials Science at USC Viterbi.

“Providing a perfect, yet reversible seal, the smart hydrogel shows promise for the next generation of tissue adhesives.”

Special delivery

The research team also developed a special syringe for the hydrogel. The syringe is easy to use on the front lines and capable of quickly cooling the hydrogel before application. The syringe has a cooling chamber filled with calcium ammonium nitrate crystals — the type used in instant ice cold packs. By adding water to the chamber, the crystals activate and cool the hydrogel to operating temperatures within 30 seconds. The customized seal and delivery system reduces the amount of time it takes to close penetrating eye injuries overall.

“This temporary intervention could decrease repair time from 30 minutes or longer to less than five minutes, freeing up valuable time for first responders and that can make all the difference,” said co-investigator Mark Hamynay, MD, PhD, University Professor of Ophthalmology and co-director of the USC Roski Eye Institute, director of the USC Institute for Biomaterials Therapeutics and a professor of biomedical engineering at USC Viterbi.

ALZHEIMER’S: Group to build network of clinical trial sites

Massachusetts General Hospital — both Harvard-affiliated hospitals in Boston — comprises the leadership team that will collaborate with others to create the Alzheimer’s Clinical Trial Consortium (ACTC).

The consortium is expected to receive nearly $70 million over five years, pending the availability of funds, to build an initial network of 35 Alzheimer’s disease trial sites at top universities across the nation. More sites may be added later, the NIH said.

“When we announced the funding opportunity for a new publicly supported clinical trials network, we envisioned a next-generation consortium, where shared expertise could enhance the ideas and approaches of individual investigators proposing and conducting trials,” said Laurie Ryan, PhD, chief of the Dementias of Aging Branch in the National Institute on Aging’s Division of Neuroscience, which leads NIH research on Alzheimer’s.

“I think we will have that now. I am particularly interested in how we can better engage diverse communities into research, so that trials can more effectively include and benefit everyone who is affected by Alzheimer’s.”

Specific clinical trials would be funded separately. The consortium expects to have the capacity to manage five to seven trials over the five years of the award.

“We must overhaul our current recruitment strategies for clinical trials, particularly to improve the diversity of our study participants. Families of people who do not yet have symptoms of Alzheimer’s disease for inclusion in clinical trials are often difficult to recruit,” said Sperling, who leads the Center for Alzheimer Research and Treatment at Brigham and Women’s Hospital and Harvard Medical School. “The new ACTC presents a terrific opportunity to innovate in recruitment, cognitive assessments and neuroimaging for the next generation of Alzheimer’s trials.”
After a fellowship in renal transplantation his general surgery residency at Los Angeles Medicine of USC in 1960 and completed surgery for 28 years. Thomas Berne member of the USC Oct. 27. He was 81.

Researchers: Subtle cues can dictate fate of stem cells

By Cristy Lytal

If you’ve seen one GSK3 molecule, do not assume that you have seen them all. A new study in Developmental Cell reveals important differences in two similar forms of GSK3, which, in excess, is implicated in diabetes, cancer, Alzheimer’s disease and ALS.

In the study, first author Xi Chen, a PhD student in the USC Stem Cell Laboratory of Qi-Long Mahaffey, describes how the two similar forms — known as GSK3-beta and GSK3-alpha — can produce very different reactions in embryonic stem cells. Inhibiting GSK3-beta can promote stem cell self-renewal, while inhibiting GSK3-alpha can trigger differentiation into neuron cells.

“The key message is that selective inhibition of GSK3-alpha and GSK3-beta has different effects on embryonic stem cell fate,” said Ying, professor of anesthesiology and regenerative medicine at the Keck School of Medicine of USC. “This is likely also true for other cell types.”

In order to selectively inhibit these two very similar forms of GSK3, the Ying Lab called upon the expertise of colleagues in the Department of Chemistry at the USC Dornsife College of Letters, Arts, and Sciences.

“For the first panel, we’re making the molecules that are inhibiting GSK3-beta. But if you wanted to target GSK3-alpha, the way that you would do that is by adding some complementary expertise. We employed an innovative chemical approach to tackle a biological problem that would be difficult to study using conventional methods,” said Chao Zhang, PhD, assistant professor of chemistry at USC Dornsife.

These findings carry implications for developing drugs that target specific GSK3 in certain patients with diabetes, cancer, Alzheimer’s disease and ALS. A drug that targets GSK3 in general could have unintended side effects. However, no drug can target a single form of GSK3 without the other, because of their high similarity. “One way to highlight the need for more refined approaches to treatment.”

Inhibiting only GSK3-beta could also provide a useful tool for producing stem cells that are not merely “pluripotent” but able to contribute to the formation of embryos. These so-called naïve pluripotent stem cells have not yet differentiated any cell type in the body. Currently, scientists have derived naïve pluripotent stem cells from mice and rats, but they have not yet discovered how to induce differentiation in human stem cells.

The Keck School’s Office of Student Affairs.

Mahaffey is responsible for helping keep Keck School students on track with their coursework and acts as a liaison between students and faculty at key points in their medical education. She provides both individual and group advising to medical students, helping to prepare them for some of the biggest milestones of their medical careers: choosing specialties and applying to residency programs.

When asked about the diversity of programs in medicine have become increasingly competitive in the U.S., career counselors such as Mahaffey help students better navigate the competitive landscape. Mahaffey noted that getting into residency programs, particularly for the most competitive specialties, has become more arduous in recent years.

“As things have gotten more competitive, medical school has become more stressful for students,” Mahaffey said. “Because of that, getting into residency programs and which students are not getting in as many.

That information helps staff and faculty identify the students that may need additional help to achieve their goals.

“Their nine years of experience and dedication to Keck School students is exemplary, and we are truly fortunate to have Caitlin here,” Zia said.

In memoriam: Thomas V. Berne, 81

By Leo Davis

Professor Emeritus Thomas V. Berne, MD, respected and beloved member of the Keck School of Medicine of USC. “In order to study using conventional methods,” said Chao Zhang, PhD, assistant professor of chemistry at USC Dornsife.

“Her nine years of experience and dedication to Keck School students is exemplary, and we are truly fortunate to have Caitlin here,” Zia said.

Caitlin Mahaffey, associate director of career advising at the Keck School of Medicine of USC, recently received an award from the Association of American Medical Colleges for her outstanding work she performs as an adviser to the students at the Keck School of Medicine of USC.

The award, dubbed the 2017 Careers in Medicine Excellence in Medical Student Career Advising Support Staff Award, recognizes one outstanding support staff member for excellence in implementing effective career advising services.

“The award is also a recognition of compiling current and pertinent information and her sincere interest in her students well-being, students along their medical school journey,” Caitlin’s contributions have played a key role in the success of Keck’s career advising program,” said Stephanie Ziu, MD, MACM, clinical assistant professor of medicine (clinician educator) and assistant dean for career advising at the Keck School’s Office of Student Affairs.

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Career adviser lauded

By Hope Hamashige

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**HSC Newsmakers**

A rundown of news items related to Keck Medicine of USC, which may include philanthropic donations, research grants, publication in academic journals and mentions in the news media.

**Employees share holiday spirit with Box of Love donations**

Each year, Keck Medicine of USC partners with nonprofit organization Canning Hunger for the Box of Love drive to donate boxes filled with food items to needy families in the east Los Angeles community. This year, Keck Medicine donated a total of 528 boxes and collected more than $4,100 in monetary donations, which is equivalent to an additional 613 boxes. Each box is filled with all of the trimmings for a complete Thanksgiving meal for a family of six to eight people. The Department of Radiology at Keck Hospital of USC filled more than 100 boxes, as they have done for the past four years. — L. Alexis Young

**Keck Medicine sponsors new Teaching Garden at local school**

On Nov. 28, Keck Medicine of USC volunteers and Honeyeck Middle School students dug in and got their hands dirty planting fruits and vegetables in a brand-new teaching garden, designed to educate students about the importance of healthy eating, all while having fun. The garden, donated by Keck Medicine of USC, is part of the American Heart Association’s Teaching Gardens program.

By Virginia Baca

The first new outpatient clinical space on the USC Health Sciences Campus in more than a decade is slated to open in January.

Norris Healthcare Center (HC3) will house the following departments and services: urology, a infusion center, women’s specialty care, breast imaging, transplant and an outpatient surgery center. HC3 is a seven-story, 116,000-square-foot building, designed with patient privacy and comfort as its top priorities.

Patient care floors are equipped with the latest diagnostic and treatment technologies and will feature welcome centers and waiting areas. Large, floor-to-ceiling windows on many floors will offer views of the San Gabriel Mountains and foothills, downtown Los Angeles and Dodger Stadium, and let plenty of natural light into the building.

“The building puts the needs of our patients and their families first, further elevating the high caliber of our care,” said Rod Hanners, CDO of Keck Medicine of USC and CEO of Keck Medical Center of USC.

An additional valet parking station will be added in front of the Willametta Keck Day Healthcare Center (HC2) building to accommodate patients for both HC2 and HC3. Self-parking for HC3 patients will be available in the Keck Hospital Parking Structure adjacent to HC3.

On Dec. 11, floors two through five of the building were licensed by the California Department of Public Health.

New clinical building to highlight patient comfort, privacy needs

**Students, faculty and residents inducted into honor society**

A ceremony for the newly elected members of the Gold Humanism Honor Society (GHHS), a prestigious national student organization, was held recently on the Health Sciences Campus. Twenty-three-fourth-year medical students, three faculty members, and five residents from the Keck School of Medicine of USC were recognized for their leadership, compassion and dedication to humanistic clinical care.

Newly elected members of the Gold Humanism Honor Society were recognized during a Nov. 29 event on the Health Sciences Campus.

**New clinical building to highlight patient comfort, privacy needs**

HSC Newsmakers

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