state-of-the-art gadget will flop if no one needs or wants it. That’s why Cheng takes a “problem-oriented approach,” starting each project by working with doctors to identify a problem, rather than looking for jazzy applications of new technology.

Lan learned this lesson firsthand, when Han and her surgical colleague, Samilia Obeng-Gyasi, gently vetoed his proposal to use the HoloLens: the headset was just too heavy for a surgeon to wear for the duration of a surgery, they said. So Lan changed course, deciding to project the AcouStar guidance onto a tablet display instead.

In the spring of 2017, after three months testing a prototype on a silicone breast model called a “phantom,” Cheng, Lan, and their team were ready for a more realistic trial. At this proof-of-concept stage, they couldn’t yet test it on a real patient. But they could try it out on a cadaver breast.

The team would have access to the cadaver for only three days, and Obeng-Gyasi would act as surgeon. On her first try, she was able to completely excise the “pseudotumor,” but the researchers realized that the patch they had used to fix the sensors to the body wasn’t sticky enough; it kept moving around during the surgery.

Two months later, after tweaking the sensor patch design, the team was ready to try again. They spent hours reviewing video footage of their previous attempt, figuring out how they could make the procedure faster and more accurate. The surgery was a success, and the team published their work in May 2018.

Now, working with Vibronix, a company founded in 2014 by Cheng and his colleague Pu Wang, and with support from the National Science Foundation’s Small Business Innovation Research program, AcouStar is getting ready to move beyond the prototype stage. That means demonstrating that the fiber-optic guide wire is safe in the body for up to 24 hours, as well as making the AcouStar platform smaller and easier to use. Ultimately, Cheng believes AcouStar could be used not just for breast cancer surgery but for a wide variety of procedures that require surgeons to locate something they can’t see or feel with pinpoint accuracy.

New Self-Lubricating Condom Would Revolutionize Safe Sex

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ther than new flavors and colors, it’s been nearly 50 years since a major advancement in the design of condoms. That may have changed in October, when Boston University researchers announced the invention of a self-lubricating condom that could help prevent sexually transmitted infections and unplanned pregnancies.

“Preventing the spread of HIV and other diseases is critically important,” says Mark Grinstaff, a College of Arts & Sciences professor of chemistry and a College of Engineering professor of biomedical engineering, coleader of the interdisciplinary research team that announced the new condom design in a paper published in the British journal Royal Society Open Science. “That really was the driving force for creating new technology here.”

The actual condom has not been tested yet. What has been done is a touch test: individuals were given three pieces of latex—a standard, nonlubricated latex condom, a standard condom with a personal lubricant applied to it, and the self-lubricated condom developed by Grinstaff’s team.

The results were promising: 85 percent of study participants who felt the new condom material and compared them to latex condoms and condoms wetted by personal lubricant products found that Grinstaff’s was the most slippery to the touch.

“People found that to be an attractive feature,” says Grinstaff, who is also ENG’s Distinguished Professor of Translational Research. “Those in our survey who don’t typically use a condom said they would consider using a condom if it stayed slippery like this.”

Of every 10 participants in the group, 9 indicated that if it were on the market, they would prefer to use the self-lubricating condom over a standard latex version.

To the naked eye, the self-lubricating condom prototype looks like a typical

ENG's
Mark Grinstaff

Development by BU team, it may help reduce disease spread, unwanted pregnancies

/ BY KAT J. MCALPINE

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male latex condom. The technological improvement is in the way that it feels to the touch.

In contrast to the popular silicone-based lubricants found in many condoms, which repel moisture and can be tacky and messy, the newly designed condom is coated in polymers that capture moisture from water and bodily fluids and trap those liquids on the condom surface. The result is essentially a continuously self-lubricating condom that could consistently provide a slippery sensation throughout sexual activity for extended lengths of time, without the need to stop and add any artificial lubricant.

It took Grinstaff’s group, which specializes in solving medical problems, more than three years of research and testing nearly 1,000 formulations to find a winning combination of latex and lubrication.

It started back in 2015 with a call for proposals from the Bill & Melinda Gates Foundation, which was seeking ideas for new technologies that would increase condom usage around the world. The Gates Foundation awarded grants of $100,000 each to 11 researchers, including Ducksoo Kim, a School of Medicine professor of radiology and Boston Medical Center director of interventional radiology, who partnered with Grinstaff to bring the idea of a self-lubricating condom to reality. “We have a coating on the latex that maintains all the properties of latex,” Grinstaff explains. “It’s durable and strong. It is a coating that when you get a thin layer of moisture on it, it becomes slippery. It’s quite exciting technology.”

The US Centers for Disease Control and Prevention and other global health organizations warn that sexually transmitted diseases (STDs) are alarmingly on the rise. Nearly 2.3 million STDs were diagnosed in 2017 in the United States; infections are also rising for syphilis and gonorrhea in some countries.

Condoms are 98 percent effective in preventing pregnancy when used properly. They are the only form of contraception that effectively protects against sexually transmitted infections (STIs), yet many people don’t use them. Poor lubrication is a major factor, according to the World Health Organization, the National Institutes of Health, and the Gates Foundation.

The persistent slick feel of the self-lubricating condom could help people overcome some of the biggest self-reported turnoffs about using condoms, which include complaints that traditional latex condoms create too much friction, reducing pleasure and causing discomfort to sensitive skin.

“Poor lubrication encourages condom misusage,” says Stacy Chin (GRS’17), a coauthor on the study and CEO of start-up HydroGlyde Coatings, a BU spin-off that will help bring the coated condoms to consumers. She says the team knew if they could “improve comfort for users, we can enable them to wear condoms more consistently and appropriately, preventing STIs and unplanned pregnancies.”

Chin hopes HydroGlyde Coatings—which has already raised $1.4 million in funding from the NIH Small Business Innovation Research program, the Massachusetts Tech Transfer Center, and the Massachusetts Life Sciences Center—will have its first product, a self-lubricating latex-based male condom, on the market in two years.

The last significant advancement in condom technology was the lubricant now in 99 percent of condoms. “Glow-in-the-dark condoms and flavored condoms are clever gimmicks that don’t help performance,” says Grinstaff. “I think we can do better.”