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DIVISION OF RESEARCH
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DEVELOPMENT

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Momentum:

Research & Innovation

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Momentum:

Research & Innovation

Welcome to the latest issue of *Momentum: Research and Innovation*. In this issue, the broad spectrum of excellence in scholarly activity and research ongoing at the University of Rhode Island is highlighted. The University is very proud that we can show you the excellence in scholarly works in a wide range of subjects, from music to high technology. The wide breadth of scholarly excellence allows the University of Rhode Island to serve our students and faculty well, and is a major contributor to the University's reputation as a leading research university. We hope that you will enjoy this issue and come back to *Momentum: Research and Innovation* in the future to discover more about the University of Rhode Island.

Sincerely,

Gerald Sonnenfeld, Ph.D.
Vice President for Research
and Economic Development

What's inside

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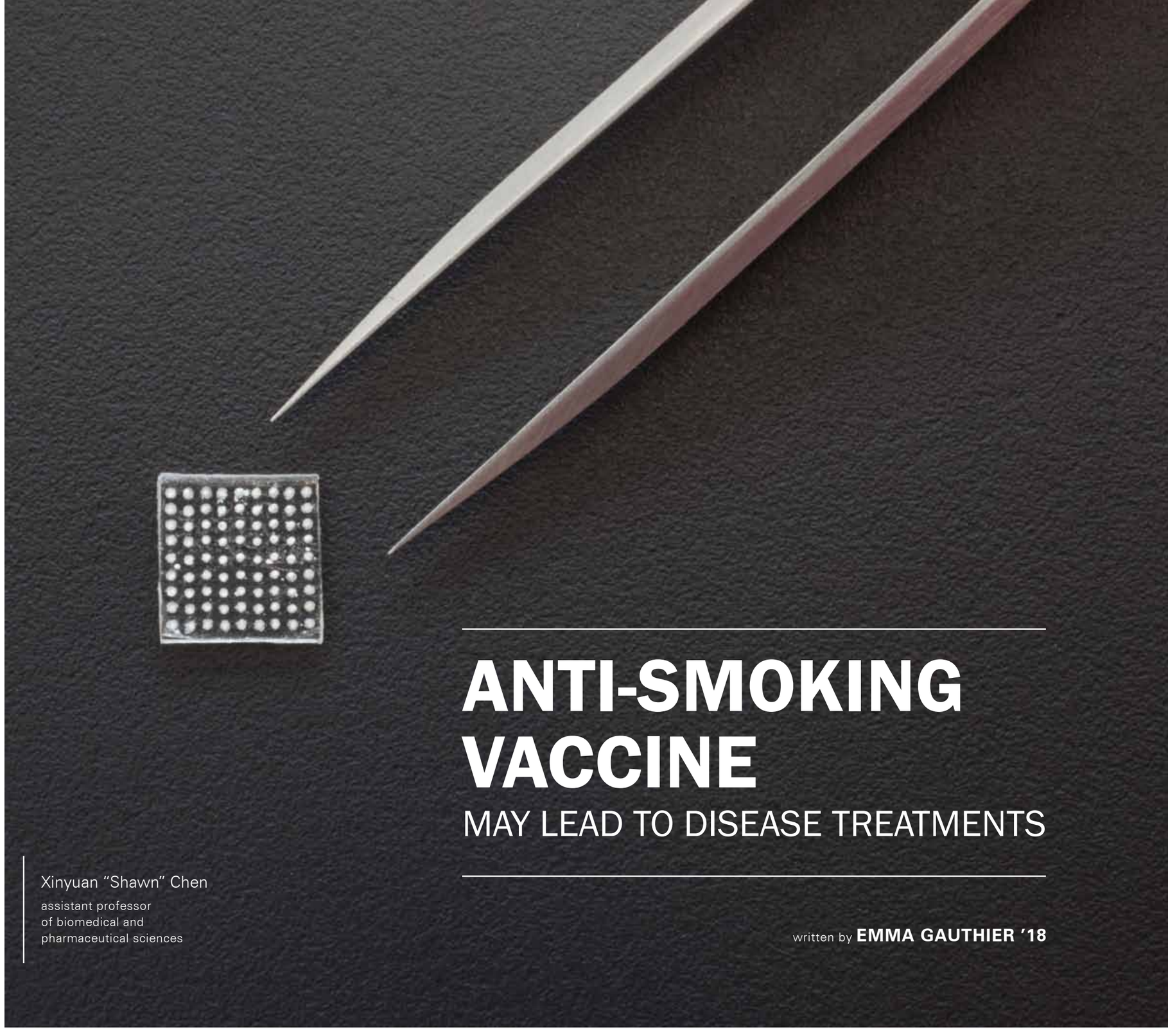

ANTI-SMOKING VACCINE

MAY LEAD TO DISEASE TREATMENTS

Xinyuan "Shawn" Chen
assistant professor
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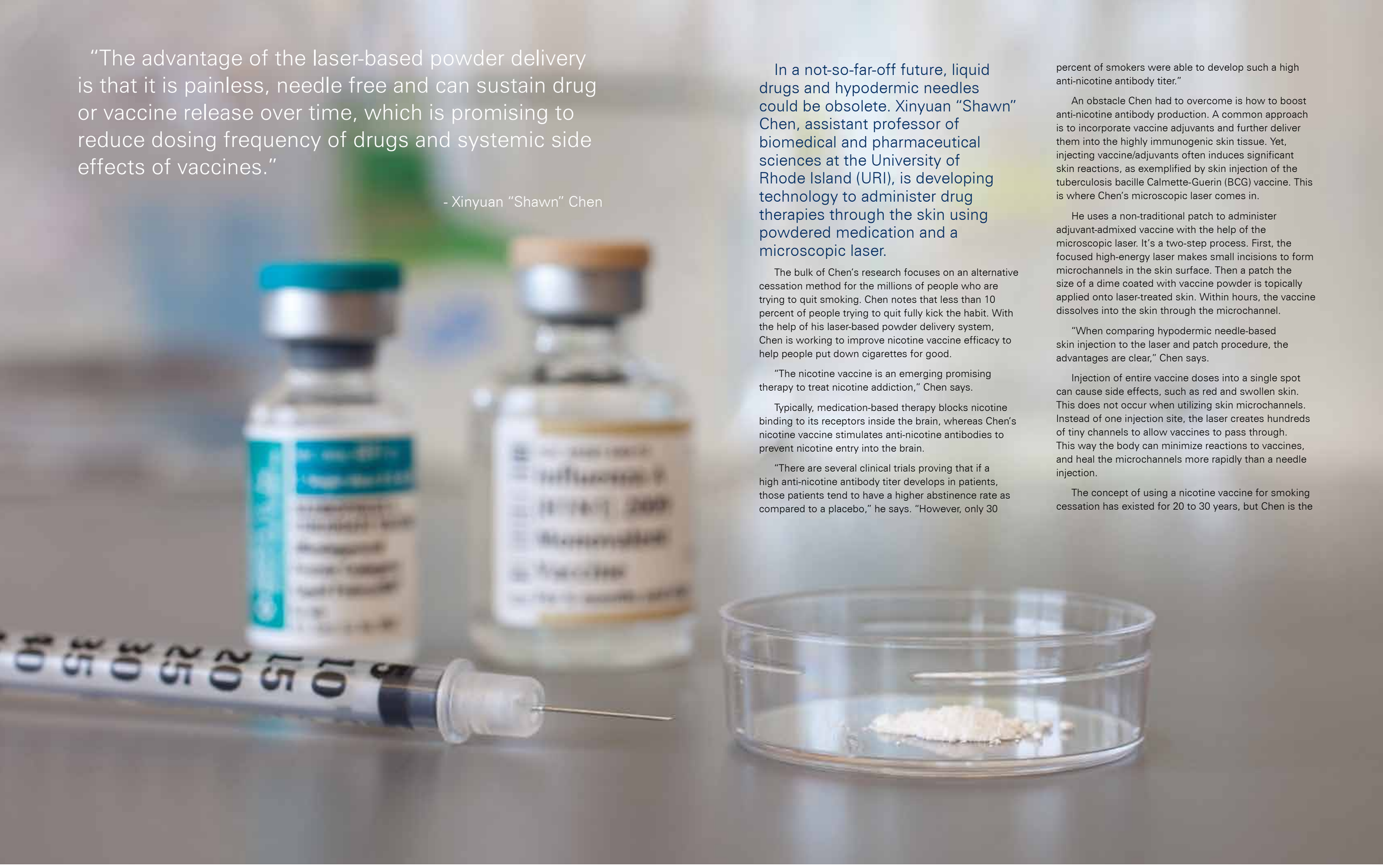
pharmaceutical sciences

written by **EMMA GAUTHIER '18**



"The advantage of the laser-based powder delivery is that it is painless, needle free and can sustain drug or vaccine release over time, which is promising to reduce dosing frequency of drugs and systemic side effects of vaccines."

- Xinyuan "Shawn" Chen

In a not-so-far-off future, liquid drugs and hypodermic needles could be obsolete. Xinyuan "Shawn" Chen, assistant professor of biomedical and pharmaceutical sciences at the University of Rhode Island (URI), is developing technology to administer drug therapies through the skin using powdered medication and a microscopic laser.

The bulk of Chen's research focuses on an alternative cessation method for the millions of people who are trying to quit smoking. Chen notes that less than 10 percent of people trying to quit fully kick the habit. With the help of his laser-based powder delivery system, Chen is working to improve nicotine vaccine efficacy to help people put down cigarettes for good.

"The nicotine vaccine is an emerging promising therapy to treat nicotine addiction," Chen says.

Typically, medication-based therapy blocks nicotine binding to its receptors inside the brain, whereas Chen's nicotine vaccine stimulates anti-nicotine antibodies to prevent nicotine entry into the brain.

"There are several clinical trials proving that if a high anti-nicotine antibody titer develops in patients, those patients tend to have a higher abstinence rate as compared to a placebo," he says. "However, only 30 percent of smokers were able to develop such a high anti-nicotine antibody titer."

An obstacle Chen had to overcome is how to boost anti-nicotine antibody production. A common approach is to incorporate vaccine adjuvants and further deliver them into the highly immunogenic skin tissue. Yet, injecting vaccine/adjuvants often induces significant skin reactions, as exemplified by skin injection of the tuberculosis bacille Calmette-Guerin (BCG) vaccine. This is where Chen's microscopic laser comes in.

He uses a non-traditional patch to administer adjuvant-admixed vaccine with the help of the microscopic laser. It's a two-step process. First, the focused high-energy laser makes small incisions to form microchannels in the skin surface. Then a patch the size of a dime coated with vaccine powder is topically applied onto laser-treated skin. Within hours, the vaccine dissolves into the skin through the microchannel.

"When comparing hypodermic needle-based skin injection to the laser and patch procedure, the advantages are clear," Chen says.

Injection of entire vaccine doses into a single spot can cause side effects, such as red and swollen skin. This does not occur when utilizing skin microchannels. Instead of one injection site, the laser creates hundreds of tiny channels to allow vaccines to pass through. This way the body can minimize reactions to vaccines, and heal the microchannels more rapidly than a needle injection.

The concept of using a nicotine vaccine for smoking cessation has existed for 20 to 30 years, but Chen is the

Chen uses a non-traditional patch to administer adjuvant-admixed vaccine with the help of a microscopic laser.

first to combine it with a novel transdermal delivery to improve efficacy. In his lab on URI’s Kingston Campus, he is developing this research with one postdoc, two doctoral and two undergraduate students.

Chen’s research is not limited to anti-smoking vaccines. His methods can be utilized for other vaccines or medications for disease treatment.

The thought of laser incisions may sound daunting to some people. But because the microchannel is less than 100 micrometers in diameter and 200 micrometers in depth, Chen says the procedure is mostly painless for human use. Chen’s lasers are the same as used in clinics for procedures such as wrinkle removal, except a low-laser energy is used for vaccine and drug delivery purposes.

“The advantage of the laser-based powder delivery is that it is painless, needle free and can sustain drug or vaccine release over time, which is promising to reduce dosing frequency of drugs and systemic side effects of vaccines,” Chen says.

Additionally, the powder form is more convenient than the traditional liquid form. Powdered medications tend to have a longer shelf life, smaller packaging size, and eliminate human errors during reconstitution processes.

“When comparing hypodermic needle-based skin injection to the laser and patch procedure, the advantages are clear.”

- Xinyuan “Shawn” Chen

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