



ASU Engineers Developing Edible Medical Devices

If mass surveillance of your external self is troublesome, then micro/mass surveillance of your insides will really creep you out. Edibles, injectables and implantables are coming soon and will join the so-called Internet of Everything. □ TN Editor

Electronics can be wearable and implantable. Soon they'll be ingestible.

An Arizona State University professor has created a tool kit of food-based electronics that will be used to create edible medical devices.

Hanqing Jiang and his team of researchers last year [invented an edible supercapacitor](#) made from foods like activated charcoal, gold leaf, Gatorade, seaweed, egg white, cheese, gelatin and barbecue sauce that stored and conducted electricity.

Food as an electrical component is just beginning to be studied. Now, after exhaustive research, Jiang and his team have created a list of foods that conduct or insulate electricity and have measured to what extent

they carry out those roles.

Foods with lots of salt (like butter) and water (like fresh meat and vegetables) conduct electricity well. Carbonized cotton candy and flour can be used to build resistors. Vegetables with lots of cellulose, like broccoli and cabbage, can generate an electric charge. The researchers used the Food Guide Pyramid.

“You have to do something no one has done in the past,” said Jiang, a professor of mechanical engineering in the

The tool kit describes the properties of food-based electronic materials, how to create devices like an edible sensor and microphone, basic components and devices with integrated sensing and wireless signal transmission.

“This really does open the door for us for a much broader spectrum,” Jiang said.

Jiang and his team are now working on the next step: a functional device. They have two in mind: one that will study bacteria in the gastrointestinal tract and another bowel implant that is dissolvable.

It’s not easy. “The human body is very complicated,” Jiang said.

The devices they have built work in proof of concept. Bowel sounds from a 70-year-old man with abdominal pain were fed to a loudspeaker and recorded with the edible microphone. It successfully reproduced the original testing sound.

Edible electronics can’t compete with silicon-based devices, but they can solve a lot of problems. Ingestible electronics need to be passed from the body. If they break, there’s a possibility of contamination. Implantable electronics require surgery. Biodegradable electronics exist, but they have low energy density and battery size is limited.

Jiang envisions doctors doing real-time monitoring of the gastrointestinal tract. Edible electronics have the potential to revolutionize biomedical technologies and devices, he believes.

Research does have one painless aspect: “We can just eat it afterwards,” said Haokai Yang, a lab member and doctoral candidate studying mechanical engineering.

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