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Chicago Confidential

The shape of things to come in science

At the end of every year, I feature three teams of Chicago innovators whose ideas won't hit the big-time soon but have the potential to improve, even save, our lives a decade from now.

Soft robots

Imagine a robot that can change its shape, squeeze through a hole and then revert to its original form upon exit.

University of Chicago scientist **Heinrich Jaeger** is part of a team that built such a robot.

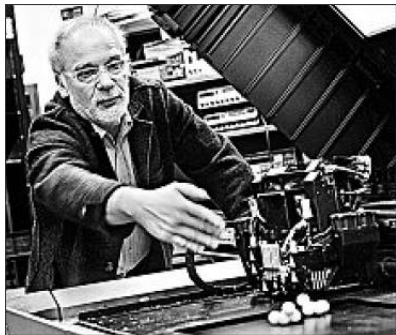
The prototype, called a JamBot, is the result of a collaboration among iRobot, the Massachusetts-based maker of the Roomba vacuum; Jaeger's lab at the University of Chicago; and chemist **Joseph DeSimone** and his team at the University of North Carolina at Chapel Hill. The Department of Defense's Advanced Research Project Agency, or DARPA, and the National Science Foundation, funded the project.

"In the robotics world this is very, very exciting because it's a blob that has no hard components in it," Jaeger said. "For us mere mortals, we would say, 'Well, gee, isn't that just a deflated soccer ball?' But it is a big deal because of the potential that it holds. ... You can imagine that it would have, for example, a payload that it could take with it and then disperse at the other end. Or it could pick up some liquid that's

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PHIL VELASQUEZ/TRIBUNE PHOTO

University of Chicago physicist Heinrich Jaeger is working on a soft robot and the concept of "jamming."

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may be dangerous and bring it to a decontamination area."

Jaeger's team supplied the physics behind the materials used in the blob and other soft robots in development. The role of Jaeger's team was to determine whether a new class of soft robots could be built based on the concept of "jamming." Think about a traffic jam — cars flow smoothly until, suddenly, they become a solid, hulking mass of stalled machinery.

"What we claim is that jamming may be a valid way, for example, to understand why window glass is solid-like," Jaeger said. "If you looked at where the molecules are in window glass, it would be like a liquid. They're all randomly in there. Yet it behaves like a solid. Many of the world's most interesting, high-tech materials are composed of molecules in such disordered arrangements ... and in these types of disordered arrangements, small fluctuations can produce a transition from liquidlike to solidlike."

So on the molecular level, what the JamBot really does is morph into something liquidlike in order to get itself through the hole and then back into something solidlike once it's out.

Chris Jones, iRobot's director for research advancement, said he believes the JamBot is the first project to incorporate jamming.

The JamBot "has these red tethers still connected to it, but the final version would have everything built inside," Jaeger said. "It would have its own little camera in there so it would know where to go. It would search for something."

chicagotribune.com/softrobot



Business columnist Melissa Harris discusses the latest invention from iRobot.



ARMANDO L. SANCHEZ/PHOTO FOR THE TRIBUNE

Eva Redei is a professor in psychiatry and behavioral sciences and physiology at Northwestern.

A blood test for depression

Northwestern University professor Eva Redei is developing a blood test for depression.

"It reduces the stigma — because once it's measurable, nobody will say, 'Just get yourself together,'" Redei said. "It also can identify different types of depression because it's clearly not one disease but a group of illnesses with similar symptoms. Once that can be done, perhaps treatment can be better tailored to individuals. It's a beginning stab at personalized medicine. It's the future."

The New York Times earlier this year named Redei's research one of 32 innovations that would "change your tomorrow." The Hungarian-born scientist, who joined Northwestern's medical school faculty in 1996, has been working to find "markers" for depression in blood for a decade.

After identifying 26 of them in rats, Redei and Kathleen Pajer, of Dalhousie University in Canada, directed Brian Andrus, who works in Redei's lab, to test blood samples from 28 teenagers, half of whom had been diagnosed with major depression. Redei and Andrus were blind to the diagnoses of the teens.

The study found 11 markers that could distinguish between a depressed and nondepressed teen. The results were published this year in the journal "Translational Psychiatry." Redei is seeking funding to repeat the experiment on a larger scale.

"I've gotten so many emails, so many phone calls from parents wanting their sons or their daughters to be tested," Redei said. "We won't lack subjects, but we need money to be able to carry the study out. Once that's done, it's not a long way from there."

Last year's class

Lithium-air batteries (Argonne National Laboratory)

Computer coding academies (Neal Sales-Griffin and Mike McGee of Code Academy, now The Starter League)

From-home STD testing (Dan Malven and Sridhar Murthy of Analyte Health)



JOHN J. KIM/TRIBUNE PHOTO

Julian Gordon, left, and Prasanthi Gandhi have a patent and a prototype for a small air collector.

A universal air test

Julian Gordon and Prasanthi Gandhi are working on an all-in-one, easy-to-carry device that will collect and instantly test the air for pathogens — such as the flu, tuberculosis, legionella and MRSA — and then make those results accessible to all via smartphone apps.

A universal air-tester is a long way off. But Gordon and Gandhi already have a patent and a prototype for a small air collector. Samples could then be tested for any biological agent, such as pathogens (the flu), toxins (anthrax) and allergens (mold). Those tests, however, still would have to be conducted in a lab.

"The only systems available today are collectors being used in the biodefense space for pathogens like anthrax," Gandhi said. "They're very expensive, very cumbersome, very noisy and difficult to use. Our collector will be a competitor of those but portable, compact, affordable and quiet."

Applications for the device range from health care clinics in the Third World to Chicago schools. But its homeland security application is what landed Gordon and Gandhi a patent in just seven months instead of several years.

Gordon and Gandhi's company, Inspirotec, has received its seed funding from Pay Pal co-founder Peter Thiel's Breakout Labs program.

"Our next-generation device will be an all-in-one detector," Gandhi said. "No such device exists today. We compare it to an early warning system, such as a carbon monoxide alarm or smoke detector."

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