Make your own microfluidic device with new kit from U-M

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A type of device called a "lab-on-a-chip" could bring a new generation of instant home tests for illnesses, food contaminants and toxic gases. But today these portable, efficient tools are often stuck in the lab themselves. Specifically, in the labs of researchers who know how to make them from scratch.

University of Michigan engineers are seeking to change that with a 16-piece lab-on-a-chip kit that brings microfluidic devices to the scientific masses. The kit cuts the costs involved and the time it takes to make a microfluidic device from days to minutes, says Mark Burns, a professor in the departments of Biomedical Engineering and Chemical Engineering who developed the device with graduate student Minsoung Rhee.

"In a lot of fields, there can be significant scientific advances made using microfluidic devices and I think that has been hindered because it does take some degree of skill and equipment to make these devices," Burns said. "This new system is almost like Lego blocks. You don't need any fabrication skills to put them together."

A lab-on-a-chip integrates multiple laboratory functions onto one chip just millimeters or centimeters in size. It is usually made of nano-scale pumps, chambers and channels etched into glass or metal. These microfluidic devices that operate with drops of liquid about the size of the period at the end of this sentence allow researchers to conduct quick, efficient experiments. They can be engineered to mimic the human body

more closely than the Petri dish does. They're useful in growing and testing cells, among other applications.

Burns' system offers six-by-six millimeter blocks etched with different arrangements of grooves researchers can use to make a custom device by sticking them to a piece of glass. Block designs include inlets, straight channels, Ts, Ys, pitchforks, crosses, 90-degree curves, chambers, connectors (imprinted with a block M for Michigan), zigzags, cell culture beds and various valves. The blocks can be used more than once.

Most of the microfluidic devices that life scientists currently need require a simple channel network design that can be easily accomplished with this new system, Burns said. To demonstrate the viability of his system, he successfully grew E. coli cells in one of these modular devices.

Burns believes microfluidics will go the way of computers, smaller and more personal as technology advances.

"Thirty or 40 years ago, computing was done on large-scale systems. Now everyone has many computers, on their person, in their house…. It's my vision that in another few decades, you'll see this trend in microfluidics," Burns said. "You'll be analyzing chicken to see if it has salmonella. You'll be analyzing yourself to see if you have influenza or analyzing the air to see if it has noxious elements in it."

A paper on the new system called "Microfluidic assembly blocks" will be published in *Lab on a Chip*. It is available early online at: www.rsc.org/Publishing/Journal … cle.asp?doi=b805137b

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