Got flow cytometry? All you need is five bucks and a cell phone

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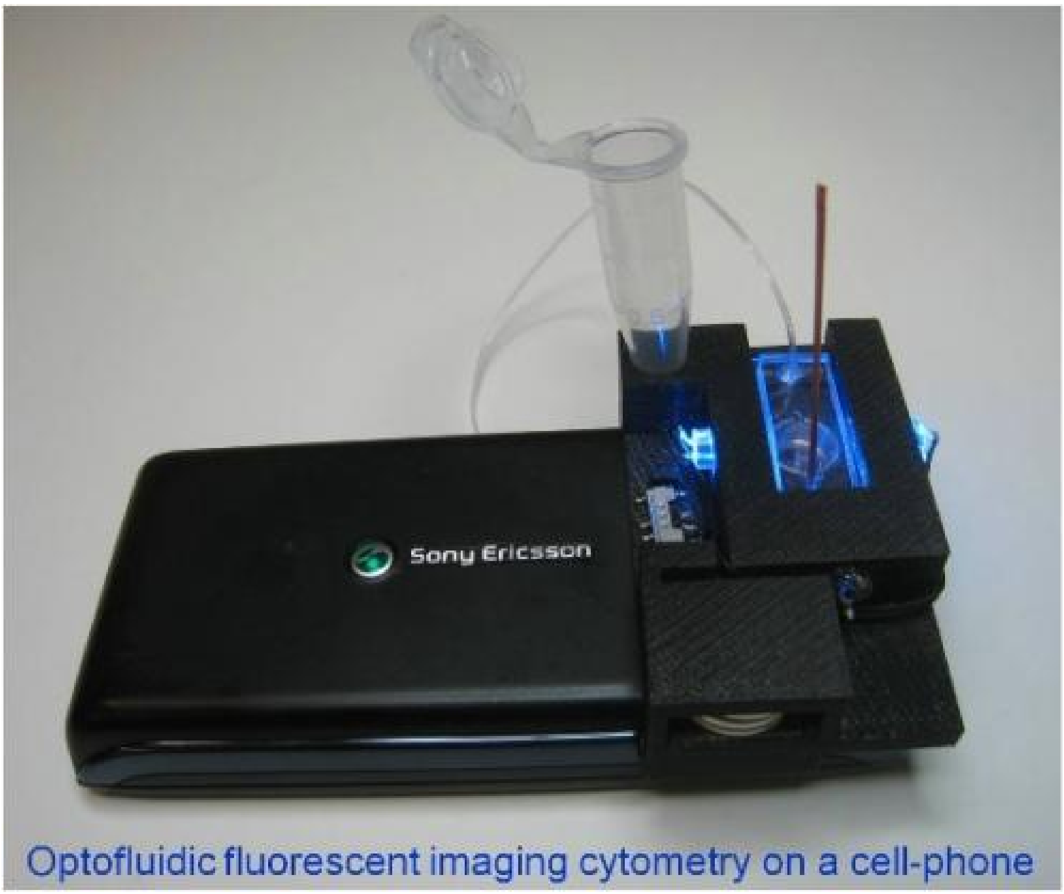

Optofluidic fluorescent imaging cytometry on a cell-phone

(PhysOrg.com) -- Flow cytometry, a technique for counting and examining cells, bacteria and other microscopic particles, is used routinely in diagnosing disorders, infections and cancers and evaluating the progression of HIV and AIDS. But flow cytometers are big, bulky contraptions that cost tens of thousands of dollars, making them less than ideal for health care in the field or other settings where resources are limited.

Now imagine you could achieve the same results using a device that weighs about half an ounce and costs less than five dollars.

Researchers at the BioPhotonics Laboratory at the UCLA Henry Samueli School of Engineering and Applied Science have developed a compact, lightweight and cost-effective optofluidic platform that integrates imaging cytometry and florescent microscopy and can be attached to a cell phone. The resulting device can be used to rapidly image bodily fluids for cell counts or cell analysis.

The research, which was led by Aydogan Ozcan, a professor of electrical engineering and bioengineering and a member of the California NanoSystems Institute at UCLA, is currently available online in the journal *Analytical Chemistry*.

"In this work, we developed a cell phone–based imaging cytometry device with a very simple optical design, which is very cost-effective and easy to operate," said Hongying Zhu, a UCLA Engineering postdoctoral scholar at the BioPhotonics Lab and co-author of the research. "It has great potential to be used in resource-limited regions to help people there improve the quality of their health care."

The device is the latest advance by Ozcan's research team, which has developed a number of innovative, scaled-down, cell phone–based technologies that have the potential to transform global health care.

"We have more than 5 billion cell phone subscribers around the world today, and because of this, cell phones can now play a central role in telemedicine applications," Ozcan said. "Our research group has already created a very nice set of tools, including cell phone microscopes, that can potentially replace most of the advanced instruments used currently in laboratories."

How it works

Ozcan's group integrated compact optical attachments to create the optofluidic fluorescent cytometry platform. The platform, which weighs only 18 grams, includes:

- 1 simple lens (less than $3)
- 1 plastic color filter (less than $1)
- 2 LEDs (less than 30 cents each)
- Simple batteries

The microfluidic assembly is placed just above a separate, inexpensive lens that is put in contact with the cell phone's existing camera unit. This way, the entire cross-section of the microfluidic device can be mapped onto the phone's CMOS sensor-chip. The sample fluid is delivered continuously through a disposable microfluidic channel via a syringe pump.

The device is illuminated from the side by the LEDs using a simple butt-coupling technique. The excitation light is then guided within the cross-section of the device, uniformly exciting the specimens in the imaging fluid. The optofluidic pumping scheme also allows for the use of an inexpensive plastic absorption filter to create the dark-field background needed for fluorescent imaging.

In addition, video post-processing and contour-detection and tracking algorithms are used to count and label the cells or particles passing through the microfluidic chip.

In order to demonstrate proof-of-concept for the new platform, the team used the device to measure the density of white blood cells in human whole-blood samples, as white blood cell density is routinely tested to diagnosis various diseases and infections, including leukemia, HIV and bone marrow deficiencies.

"For the next step, we'd like to explore other potential applications of this device," Zhu said. "For example, we also want to utilize this device to count potential waterborne parasites for water-quality monitoring."

"We'd like to translate our devices for testing in the field and start using them in places they're supposed to be used," Ozcan said. "So I think the next stage for several of our technologies, including this one, is to deploy and test them in extremely poor-resource countries."

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