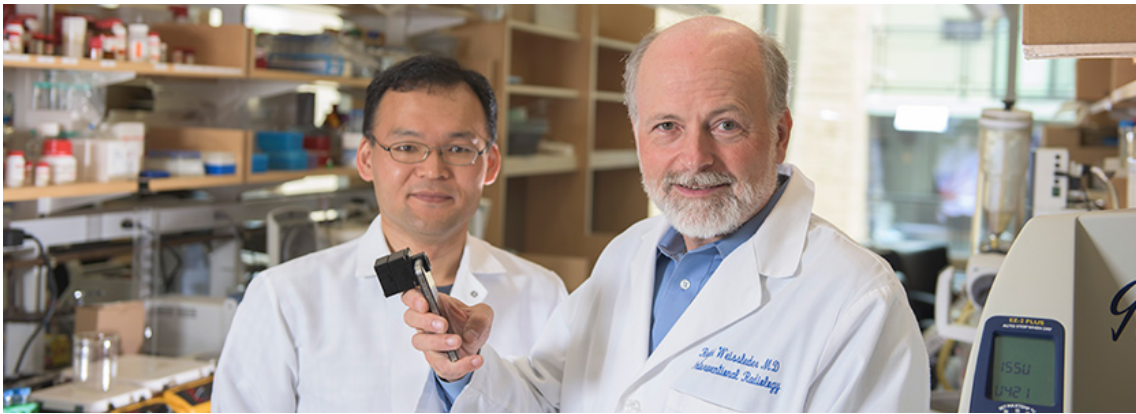


## Smartphone Device Can Quickly Diagnosis Cancer



Imagine your doctor could take some of your cells, slide them into a compartment on a smartphone and tell you if you had cancer in just an hour. You could be spared an agonizing wait for lab results. And your doctor could discuss the diagnosis and your treatment options in person.

A team led by Ralph Weissleder, MD, PhD, director of the [Center for Systems Biology at Massachusetts General Hospital](#), and Hakho Lee, PhD, also of the center, has created such a device.

It's called the D3 system—for digital diffraction diagnosis. Born of Dr. Weissleder's efforts to improve health care in a remote part of Africa, the D3 system is just one example of [Mass General's commitment to global health care](#). Worldwide, Mass General partners with universities, governmental agencies and local medical providers to find solutions that make it easier to deliver quality health care, especially in areas of great need. Like the D3, many of the resulting innovations can also benefit patients in this country.

### Fast Smartphone Diagnosis

D3 is convenient, efficient and easy to use. A medical professional collects cells from a patient. The cells might be obtained from a blood sample, a fine needle biopsy or, if cervical cancer is suspected, a Pap smear.

The cells are loaded onto a tiny slide, which is pushed into the D3 imaging system via a clip-on device attached to the smartphone. D3 features an imaging module with a battery-powered LED light and uses the smartphone's camera to record a high-resolution image.

The same camera you use to snap shots of your daughter riding her tricycle is now able to record data on more than 1 million cells from a blood or tissue sample— all in a single image.

That's more power than a traditional microscope.

### Finding Solutions Abroad

A few years ago, Dr. Weissleder traveled to South Africa to learn how technology could improve health care for people living in remote areas of the African nation. In many countries in Africa, there are few pathologists, and lab results are often delayed



“People walk for 20 miles to get an answer to why they are sick,” Dr. Weissleder says. “They can’t come back the next day.”



The device attaches to a smartphone, allowing the phone to take images of cells and samples.

In a pilot study at Mass General, D3 performed as accurately as pathologists.

And even in the U.S. it can take a week to get biopsy results back, he explains. The wait causes patients needless anxiety.

Dr. Weissleder observed that even in remote areas of Africa that people used smartphones. His team began creating D3 to work with a smartphone and added a coin-sized battery to address the sporadic electricity supply, which is a challenge for providers in Africa.

## Shining Antibodies

In a pilot study at Mass General, the D3 system reliably and promptly noted whether cervical biopsy samples were high-risk, low-risk or benign. D3 performed as accurately as pathologists. D3 also fared well in a second pilot study, where it correctly recorded the difference between samples from four patients who had lymphoma and four who had benign tumors.

The D3 system processes blood or tissue by sending tiny antibodies to find cancer-related molecules. When these special antibodies detect cancer, they send up a signal or shine.

“The smartphone picks up the shining of the antibodies when the photo is snapped. And researchers can use this signal to diagnosis a patient with cancer,” Dr. Weissleder says. “I am sure we will be able to detect other diseases too. It’s very similar to what a pathologist would actually do.”



Mass General research fellow Hyungsoon Im, PhD, demonstrates loading a sample into the smartphone device.

## Leading the Way

The team is about to receive funding from the [National Institutes of Health](#) for a large clinical trial in Africa. In addition to Dr. Weissleder, clinical team members include Bruce Chabner, MD; Cesar Castro, MD; Scott Dryden-Peterson, MD; Aliyah Sohani, MD; Elizabeth Bigger, MD; and Jeremy Abramson, MD. Engineering team members include Hakho Lee, PhD; Hyungsoon Im, PhD; and Misha Pivovarov, MS.

Dr. Weissleder envisions D3 having many applications. In large hospitals like Mass General, D3

could be used to obtain faster test results for patients.

At home, it might help monitor diabetes or detect sexually transmitted diseases. The technology could

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Cell phones have changed the world, Dr. Lee says, adding, “The next big push will be healthcare applications, and we are excited to lead the way.”

*To learn more about Dr. Weissleder’s research or to make a donation, please [contact us](#).*