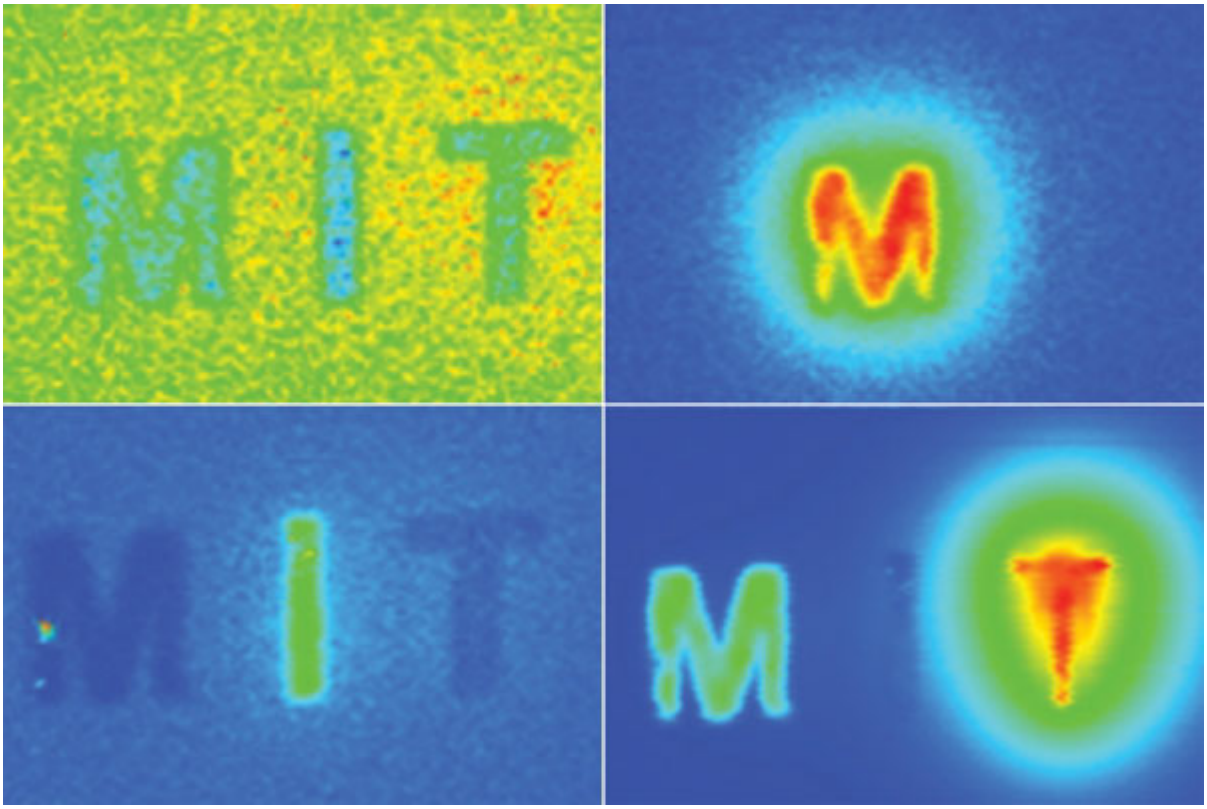
NIR Imaging System Could Help Identify Hard-to-Detect Cancers at Earlier Stage

CAMBRIDGE, Mass., March 12, 2019 – An optical imaging system developed by MIT researchers could enable physicians to identify tiny tumors deep within the body, leading to earlier detection and treatment of cancer. The researchers call their system DOLPHIN, which stands for "Detection of Optically Luminescent Probes using Hyperspectral and diffuse Imaging in Near-infrared." The team's goal with DOLPHIN is to detect cancer earlier by finding tiny tumors in a noninvasive way.



MIT researchers have devised a way to simultaneously image in multiple wavelengths of near-infrared light, allowing them to determine the depth of particles emitting different wavelengths. Courtesy of X. Dang, N. Bardhan, A. Belcher, et al.

DOLPHIN can be used to image very small groups of cells deep within tissue and without any kind of radioactive labeling. The system uses fluorescent probes that emit light at different NIR wavelengths, depending on the type of doping element that is used. Hyperspectral imaging is used to enable simultaneous imaging in multiple wavelengths of NIR light. Using algorithms they developed, the researchers can analyze the data from the hyperspectral scan to identify the location of fluorescent probes. By analyzing the light from the various wavelength bands within the entire NIR spectrum, the researchers can determine the depth at which a probe is located.

According to the researchers, to date, the maximum reported depth using second-window NIR (NIR-II: 1000 to 1700 nm) fluorophores is 3.2 cm through tissue. DOLPHIN was able to track a 0.1-mm fluorescent probe through the digestive tract of a living mouse and to detect a signal to a tissue depth of 8 cm. The researchers also demonstrated that they could inject fluorescent particles into the body of a mouse or a rat and then image through the entire animal, to a depth of about 4 cm, to determine where the particles ended up.

In ongoing work, they are using a related version of this imaging system to try to detect ovarian tumors at an early stage. “Ovarian cancer is a terrible disease, and it gets diagnosed so late because the symptoms are so nondescript,” said professor Angela Belcher. “We want a way to follow recurrence of the tumors, and eventually a way to find and follow early tumors when they first go down the path to cancer or metastasis. This is one of the first steps along the way in terms of developing this technology.”

The researchers have also begun working on adapting DOLPHIN to detect other types of cancers such as pancreatic cancer, brain cancer, and melanoma.

For more information:
https://doi.org/10.1038/s41598-019-39502-w