See tumor cells in real time during an operation

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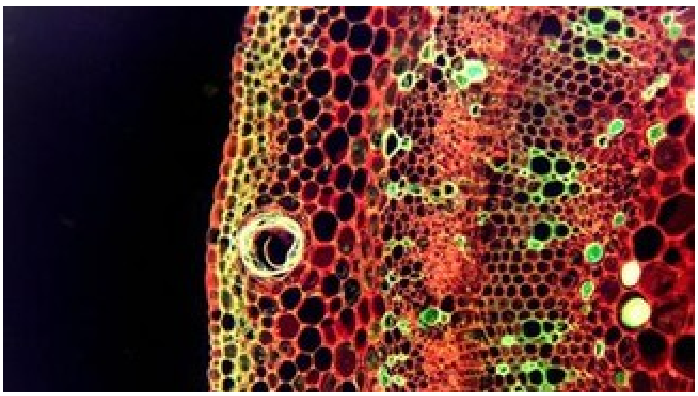

Credit: 2013 Samantree Technologies

(Phys.org) —The latest generation in surgical microscopes enables a surgeon to directly observe cell and microvasculature structures. This device developed by the EPFL spin-off Samantree makes it possible, for example, to ensure that all cancer cells have been removed during the extraction of a tumor.

Moving the microscopy lab into the operating room is the ambition of the start-up Samantree Technologies. With the unit they are developing, it's possible to view a close-up of human tissue during an operation. This saves time and money by directly identifying suspicious lesions. Designed initially for the detection of cancer – including breast cancer cells – it avoids the surgeon's typical wait for a laboratory analysis and also detects the disease at a very early stage.

The device, called HistoScope, can move to suspect areas and zoom in to observe the cellular and/or vascular structure. "Today over one-third of tumor surgeries must be repeated, since the edges of the tumors are not visible to the naked eye, and therefore, tumors often aren't completely removed during normal surgical procedures," emphasizes the other co-founder, Davor Kosanic. During an operation this new device quickly checks if suspicious cells are still present. "This is the 'Google Maps' of surgical microscopy," notes Bastien Rachet, co-founder of the EPFL spin-off.

A series of tiny microscopes

The secret? Several microscopes smaller than 1 mm are arranged beside one another. This technology circumvents the eternal dilemma with magnifying equipment: choosing between image resolution and its field of view. Confocal technology, meaning with a single focus, is typically used when dealing with thick tissues such as human samples. It limits the field of view to one square millimeter, but it can make thin slices of images of the investigated specimen. However, this advantage comes at a cost; the sample must be scanned point by point to obtain the entire image. Therefore, image formation may take a long time, depending on the desired resolution, the size of the area to be reproduced, and the method used to scan the sample. And above all, this type of microscope is large.

The technology patented by Samantree bypasses these difficulties by using the light captured in each small microscope to rapidly obtain an image area covering several square centimeters while maintaining high resolution. The instrument is miniaturized for medical applications. "The expansion of the order of 1000X is comparable to devices already on the market in the clinical field, because there is no need for greater, but it has a field of view at least 40 times greater," says Davor Kosanic. In real time the doctor can see on a computer screen placed at his side the area to be observed and any suspicious cells. Research in Microsystems Laboratory 1 has resulted in simpler and more miniaturized optical equipment for use in vivo, typically during laparoscopic procedures. Thanks to the size of their minute components, miniscule microscopes are placed on a surface that matches the area of the desired image (from a few square mm to a few square cm). Compared to the size of the apparatus, the image surface is dramatically increased, which makes the device more convenient to use in the operating room.

The main innovation lies in the miniaturization of focusing lenses. These microoptical elements must particularly be able to function in the same way with numerous wavelengths in order to work with natural light. When tissue to be observed is positioned in the focal zone of the micro-lenses' panel, the light collected by each of them is relayed on a panel of light detectors that measure, in parallel, information from the sample. This group work results in a gain of time and performance. Since the limited field of vision of each element is no longer a limitation precisely because there are several two-dimensional images, the image can be multiplied by 600.

Currently a prototype, the machine has received various financial support to help the start-up which is currently searching for a Series A investment of 1.5 million Swiss francs in order to proceed to clinical trials.

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