*Emerging Company Profile*

# iThera: Sight through sound

**By Erin McCallister**
**Senior Writer**

**iThera Medical GmbH**'s MSOT imaging technology combines the molecular capabilities of microscopy and PET imagining with the tissue penetration abilities of ultrasound. It has the potential to replace microscopy for drug discovery and to replace ultrasound in indications such as peripheral vascular disease and cancer.

Doctors and researchers use microscopy with fluorescently tagged biomarkers as well as PET imaging to diagnose conditions like Alzheimer's disease (AD), target tumors for surgery or track a compound in animals during drug discovery. However, microscopy is limited by its ability to detect molecular imaging markers beyond depths of 200-300 µm, at which point it loses resolution. PET can penetrate through the entire body, but its resolution is only 1-2 mm, according to iThera CEO Christian Wiest.

Ultrasound can penetrate several centimeters, but cannot differentiate fluorescent markers to distinguish benign and cancerous cells.

According to Wiest, iThera's multispectral optoacoustic tomography (MSOT) builds on the strengths of the two technologies while avoiding their weaknesses. MSOT is an imaging device that can penetrate depths similar to ultrasound and differentiate molecular markers that are injected into the patient.

The current MSOT system is a machine used in research laboratories for drug discovery and preclinical drug testing in animals. iThera now is developing a handheld device that could be used in a clinician's office.

The device would be similar in appearance to an ultrasound probe. But rather than emitting sound waves, the MSOT device would emit infrared laser light as it is passed over the tissue or organ of interest. The light is absorbed by photons within the tissue and triggers a transient heat increase, which causes thermoelastic expansion of cells. When the cells expand, they produce a pressure wave that is measured with acoustic detectors.

Similarly, if fluorescently tagged biomarkers are injected into the patient before the tissue is scanned, the photons are absorbed by the markers and converted to heat, which also induces a thermoelastic expansion.

## iThera Medical GmbH

Neuherberg, Germany
Technology: Multispectral optoacoustic tomography
Disease focus: Diagnostic
Clinical status: NA
Founded: 2010 by Christian Wiest, Vasilis Ntziachristos, Daniel Razansky and Ascension GmbH
University collaborators: Not disclosed
Corporate partners: Not disclosed
Number of employees: Not disclosed
Funds raised: Not disclosed
Investors: MEY Capital Matrix and Bay BG
CEO: Christian Wiest
Patents: None issued

iThera then uses a series of proprietary algorithms to translate the sound waves into an optical image in real time based on factors such as the speed of sound in the tissue and the amount of energy required to raise the temperature.

MSOT was discovered at the **Institute for Biological and Medical Imaging**. The institute built and tested prototypes in different applications before spinning out the technology into iThera in 2010.

MSOT operates in the near-infrared spectral region, which allows the technology to penetrate into the tissue without light scattering. The result is a resolution to 200-20 µm, which Wiest said is up to 10x greater than PET or other fluorescent technologies.

Published results showed MSOT had a resolution of 150 µm for deep tissue imaging of tumors in mice exposed to a tumor-specific probe.

iThera now is focused on scaling the product for point-of-care use.

According to Wiest, the handheld device will be used for applications close to the surface or about 2-3 cm deeper. Future adaptations will include MSOT catheters for intravascular endoscopes for use in colonoscopy and other endoscopic procedures.

While iThera isn't disclosing what specific area it will pursue first for the clinical development of MSOT, Wiest suggested that potential areas could include cancer, peripheral vascular disease and arthritis.

For cancer, doctors can only remove the portions of tumor mass they can visualize either via PET or during surgery. But a PET scan can only identify the primary tumor and metastases that are more than 1 mm in size.

"There are dozens of smaller metastases and you are not able to find those based on the PET you've done before surgery, our technology could locate those in real time" during surgery, Wiest said.

Prior to surgery, the patient would be injected with fluorescently tagged markers targeting the tumor of interest. The surgeon would then scan the tissue area with the handheld MSOT device.

iThera expects to have a point-of-care tool ready for market in two or three years.

"I would expect that we would partner the technology," Wiest said.

iThera isn't the only company combining infrared detection and acoustic imaging. **InfraReDx Inc.**'s TVC Imaging System combines intravascular ultrasound and near-infrared spectroscopy. The system is marketed as an aid to manage coronary artery disease (CAD).

Wiest noted that spectroscopy is not an imaging technique. Instead the actual image from the TVC system comes from the ultrasound, while the spectroscopy uses light to identify the chemical composition of substances like lipids and overlays the spectral data onto the image. Thus, it only provides 2D images with no depth information.

Additionally, the InfraReDx technology is limited to catheter-based intravascular applications, while iThera plans to develop MSOT for multiple applications.

COMPANIES AND INSTITUTIONS MENTIONED

**InfraReDx Inc.**, Burlington, Mass.
**Institute for Biological and Medical Imaging**, Neuherberg, Germany
**iThera Medical GmbH**, Neuherberg, Germany