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Photoacoustic imaging (PAI), also called photoacoustic spectroscopy, is based on the principle of thermal expansion of an object caused by the absorption of light. When the emitted light is pulsed, it induces an oscillating movement in the tissue, resulting in pressure waves that can be interpreted as a sound signal.

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Photoacoustic imaging is a non-invasive imaging modality which allows structural, functional, and molecular imaging. The method relies on the photoacoustic effect which describes conversion between light and acoustic waves due to absorption of electromagnetic waves and localized thermal excitation.

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Photoacoustic imaging prototype system for in vitro studies. As a first step toward designing an in vivo PA imaging system, we have developed a prototype PA in vitro imaging system to detect any malignancies present in an excised tissue as illustrated in Figure 2. The system design was optimized to generate focused coronal plane (C-scan) images using acoustic lens technology.

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Photoacoustic spectroscopy has become a powerful technique to study concentrations of gases at the part per billion or even part per trillion levels. Modern photoacoustic detectors still rely on the same principles as Bell's apparatus; however, to increase the sensitivity, several modifications have been made.

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The new technology is based on photoacoustic spectroscopy and is called Mid-infraRed Optoacoustic Microscopy (MiROM). Specific molecular vibrations are targeted with mid-infrared lasers, triggering a thermoelastic expansion, the ultrasound waves from which are detected and processed to form an image of the distribution of specific molecules, de-

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Photoacoustic spectroscopy Gases can be detected very precisely and selectively by means of photoacoustic spectroscopy (PAS). Alexander Graham Bell already described the basic measurement principle in 1880: If a gas sample in a measuring cell is irradiated with a pulsed light source, the gas molecules will absorb the light and the gas sample will heat up.

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