USING PHOTOACOUSTIC IMAGING TO MAP THE TOPOLOGY OF HUMAN TUMOR LANDSCAPE

Although medical diagnostics can evaluate intracellular characteristics of tumors (e.g., genomics, proteomics), we lack diagnostic methods that interrogate the extracellular tumor microenvironment including extracellular hypoxia and acidosis.

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What is the research problem?

The extracellular tumor microenvironment is often hypoxic and acidic, which drives invasion, metastasis, and chemoresistance. Medical imaging is ideal for interrogating the tumor microenvironment, because the extracellular tumor space must be evaluated within in vivo tissues without perturbing this microenvironment. Yet medical imaging lacks methods that accurately and precisely measure small differences in hypoxia and acidosis within tissues.

What is your proposed solution?

Most imaging methods provide insufficient information for truly quantitative imaging. We propose to develop and apply a single PET/MRI contrast agent that can accurately and precisely measure extracellular pH, which is a quantitative measure of tumor acidosis. The combined signals from PET and MRI provide synergistic, sufficient information to measure pH while also accounting for the concentration of the agent within the tumor tissue.

Furthermore, we propose to use photoacoustic imaging to measure relative distributions of hypoxia in tumors. Light scattering and absorbance in tissues is a notorious problem for optical-based imaging, which has limited most optical imaging to surface imaging. We will apply our patented MRI analysis algorithms to photoacoustic imaging to provide accurate and precise maps of tumor hypoxia as deep as 2-5 cm in tissues.

How will your solution make a difference?

Accurate and precise measurements of extracellular hypoxia and acidosis in tumors will improve cancer diagnoses, and will also support personalized medicine by improving decisions regarding treatment options for each individual patient that are influenced by hypoxia and acidosis.