

A 3D visualization of a tumor microenvironment. The image shows a complex network of blue and purple structures, representing blood vessels and tissue, with a central, more densely colored region indicating the tumor core. The overall appearance is a translucent, glowing 3D model of a biological structure.

3D multi-modal photoacoustic and super-resolution ultrasound localization imaging to probe the tumor microenvironment

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— Diagnosis & Treatment with Light and Sound

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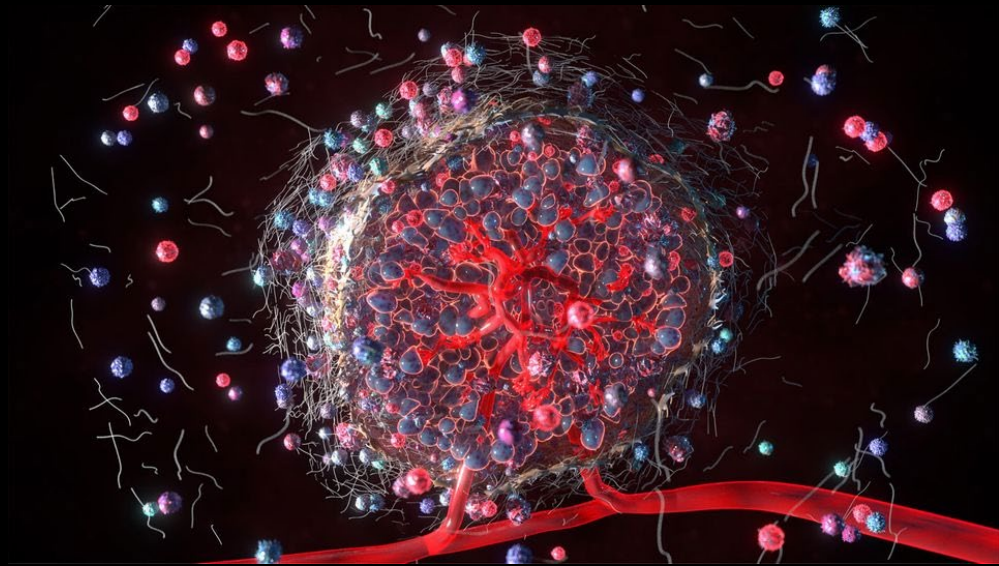
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Peering into the unknown: imaging gaps in the tumor microenvironment

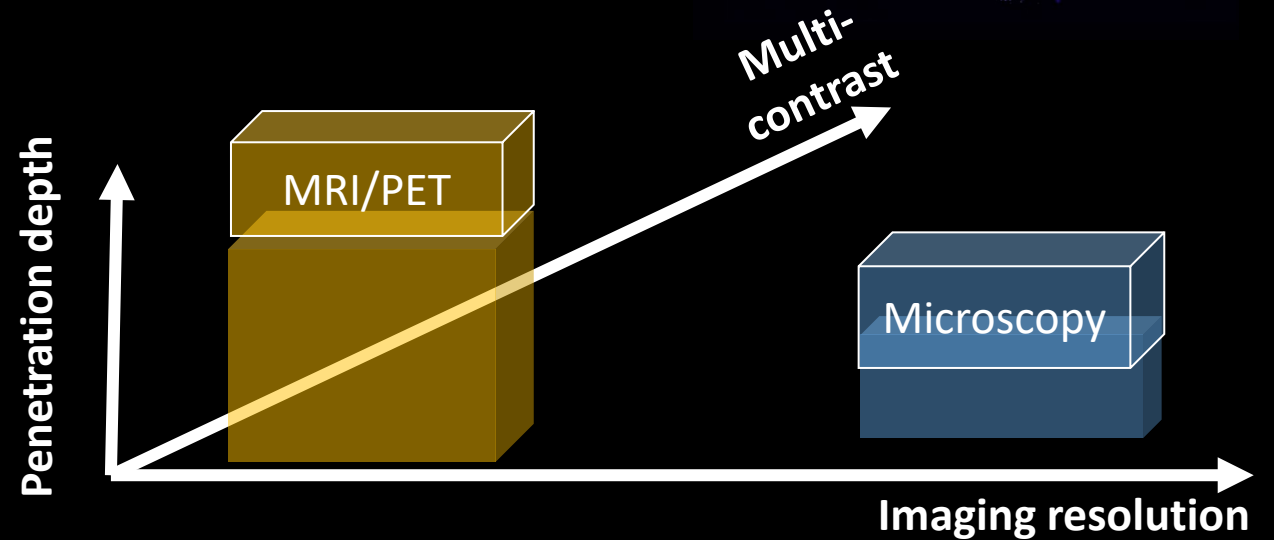
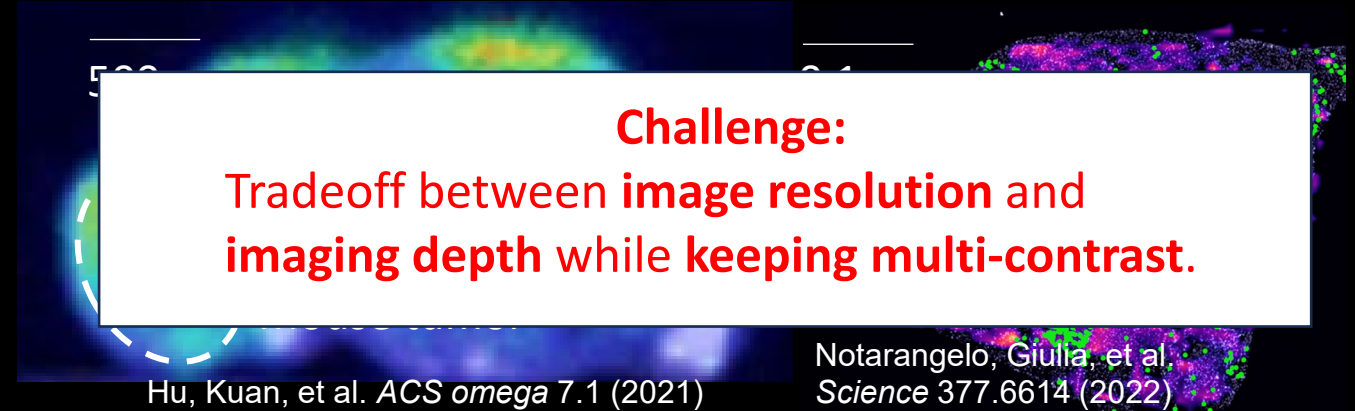
Tumor microenvironment

Not just tumor cells, but also their neighboring cells, all working together to support tumor growth, immune evasion, and metastasis.



MRI/PET provides deep blurry

Microscopy captures shallow details

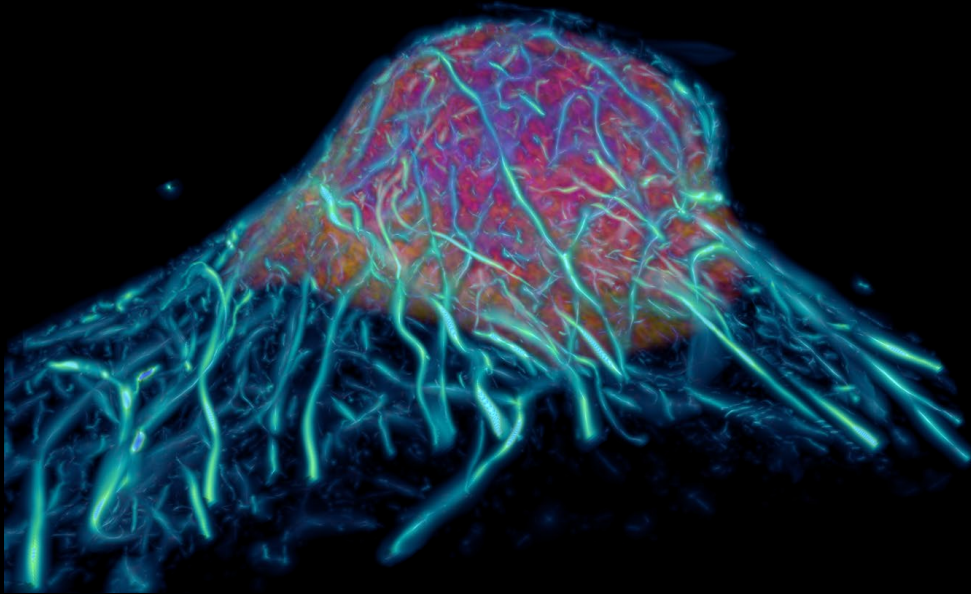


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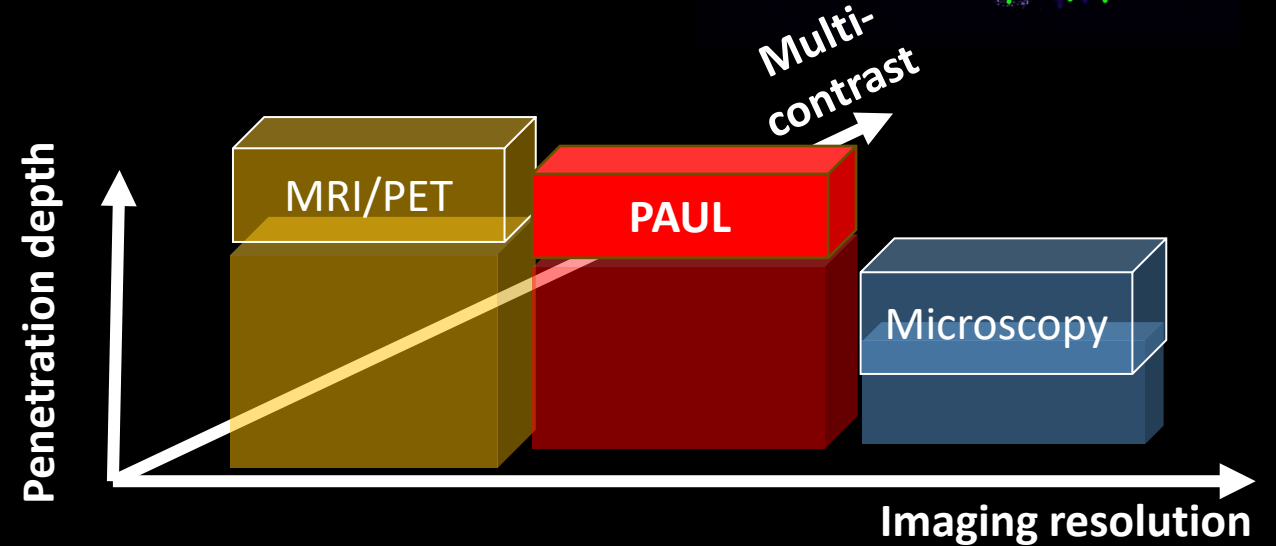
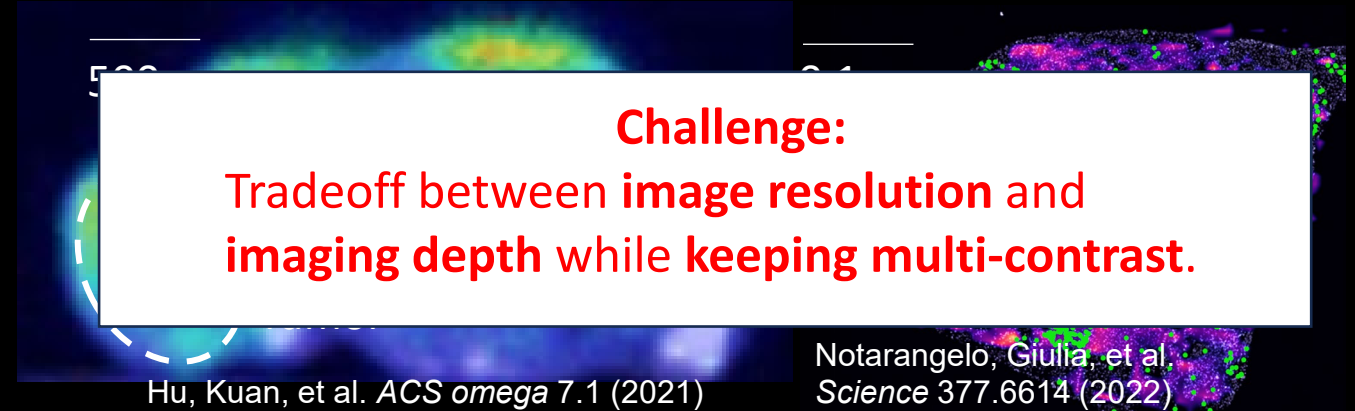
Peering into the unknown: imaging gaps in the tumor microenvironment

Solution:
**Multi-parametric photoacoustic/ultrasound
localization (PAUL) imaging**



MRI/PET provides deep blurry

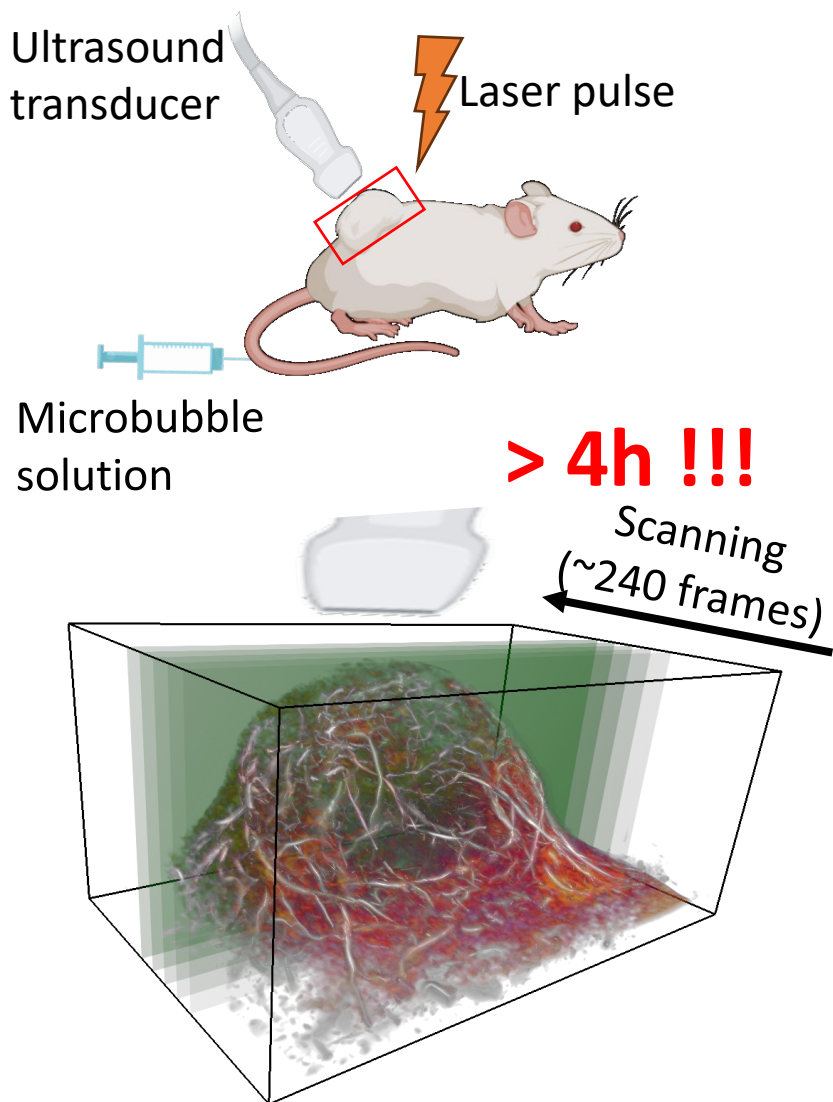
Microscopy captures shallow details



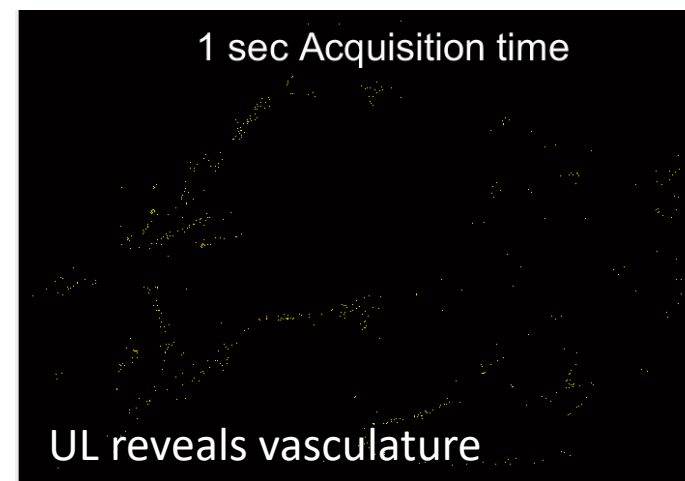
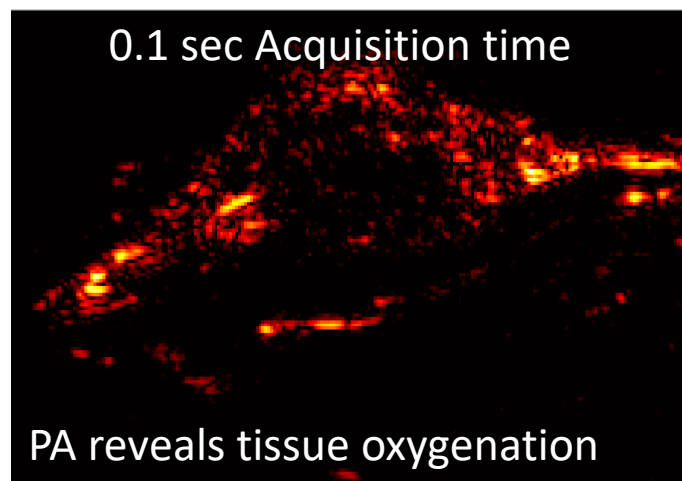
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Limitations of photoacoustic/ultrasound localization (PAUL) imaging for 3D tumor mapping

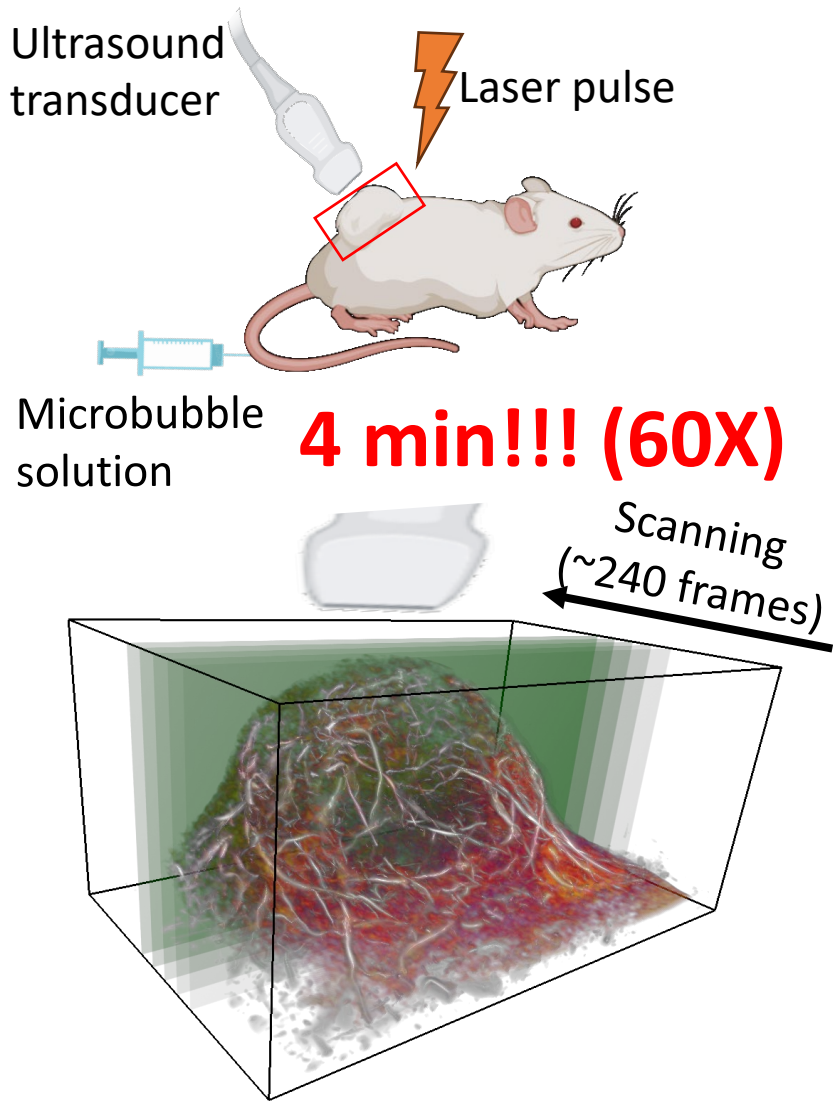


- **Challenge:**
- Slow acquisition make it **infeasible** for whole tumor microenvironment visualization (microbubbles) in the bloodstreams.

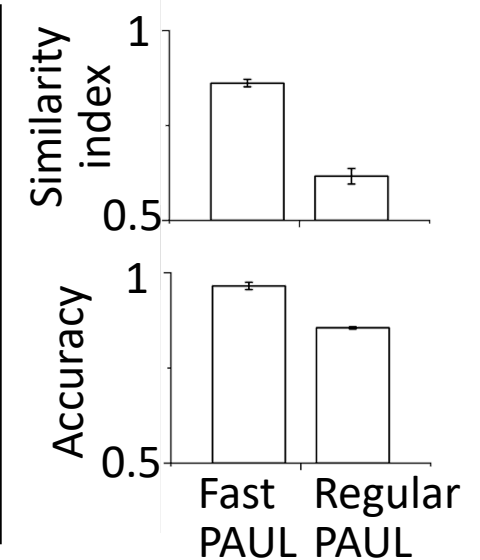
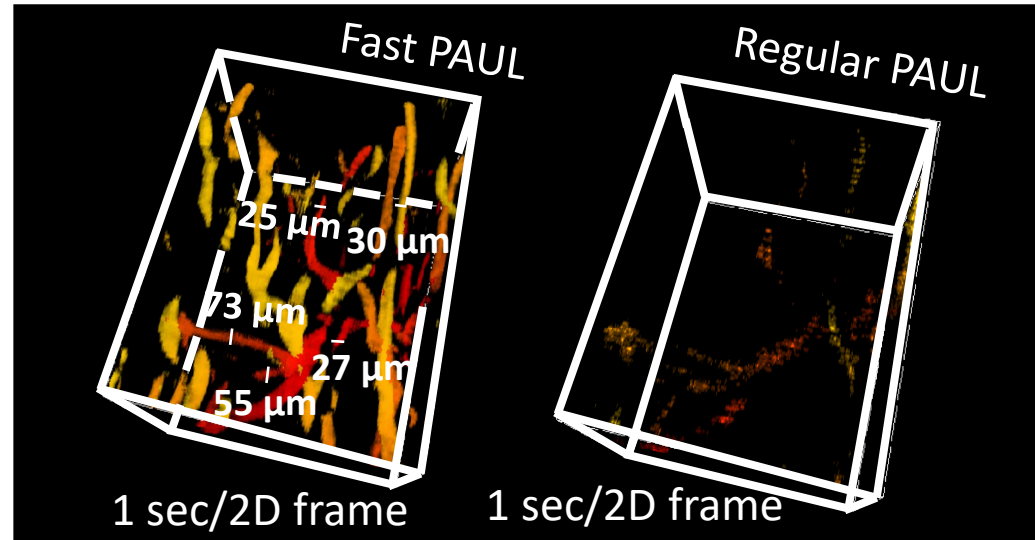
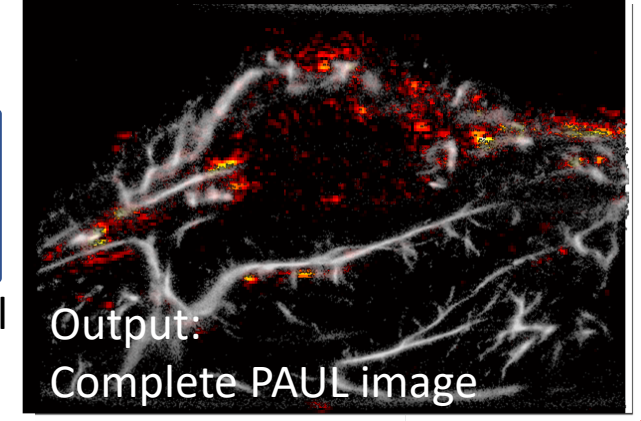
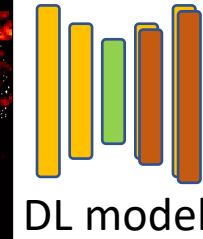
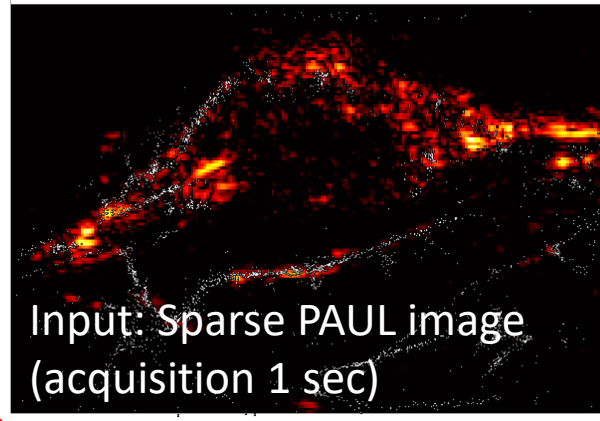


Shensheng Zhao, et al. *Nature Communications* 14.1 (2023)

Deep Learning enables fast and accurate 3D PAUL Imaging

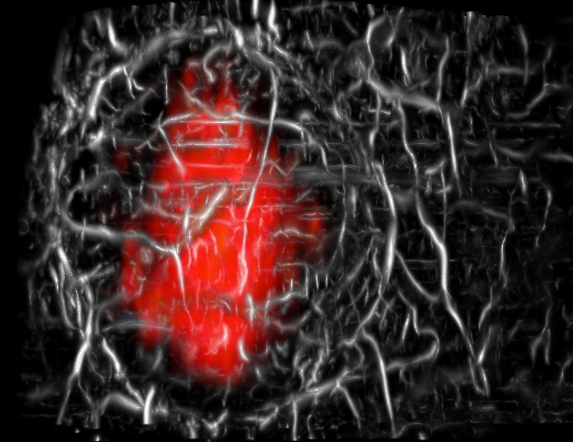


Deep learning enhanced fast imaging



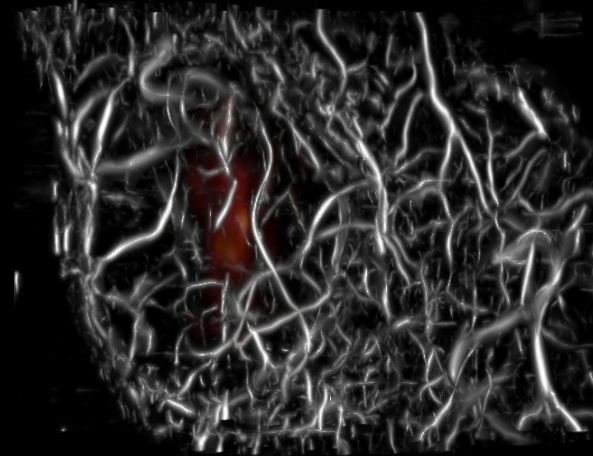
Fast 3D PAUL imaging uncovers tumor molecular features

Group 1: A421 tumor targeting probe (AF790-labeled anti-EGFR antibody)



1 sec/frame scan,
240 sec total

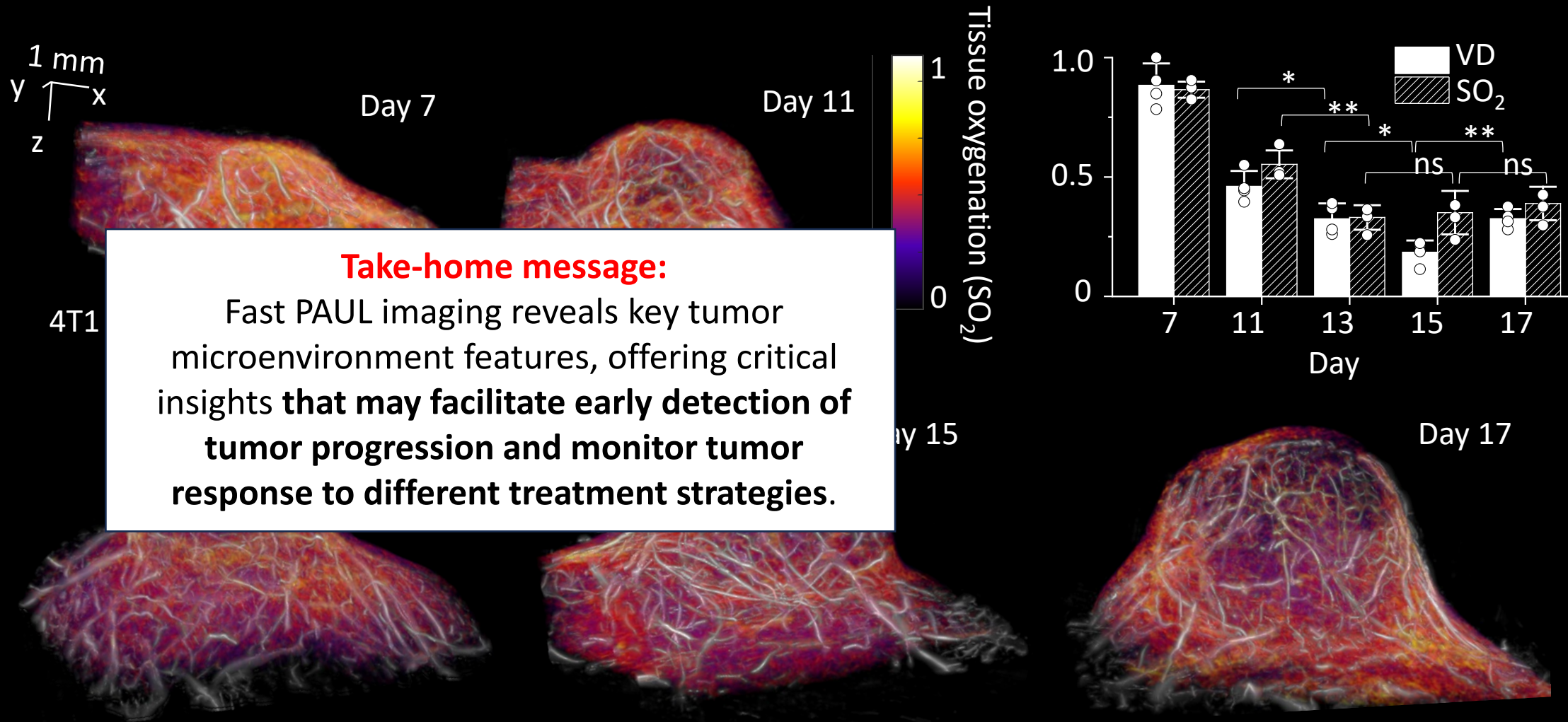
Group 2: Control probe (AF790-labeled IgG antibody)



et al. Unpublished data



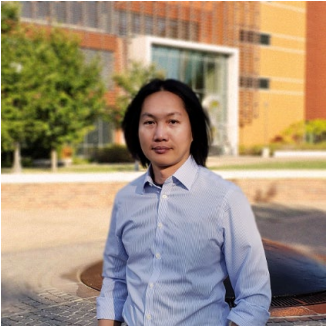
Fast 3D PAUL imaging maps tumor growth through vessels and oxygenations



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