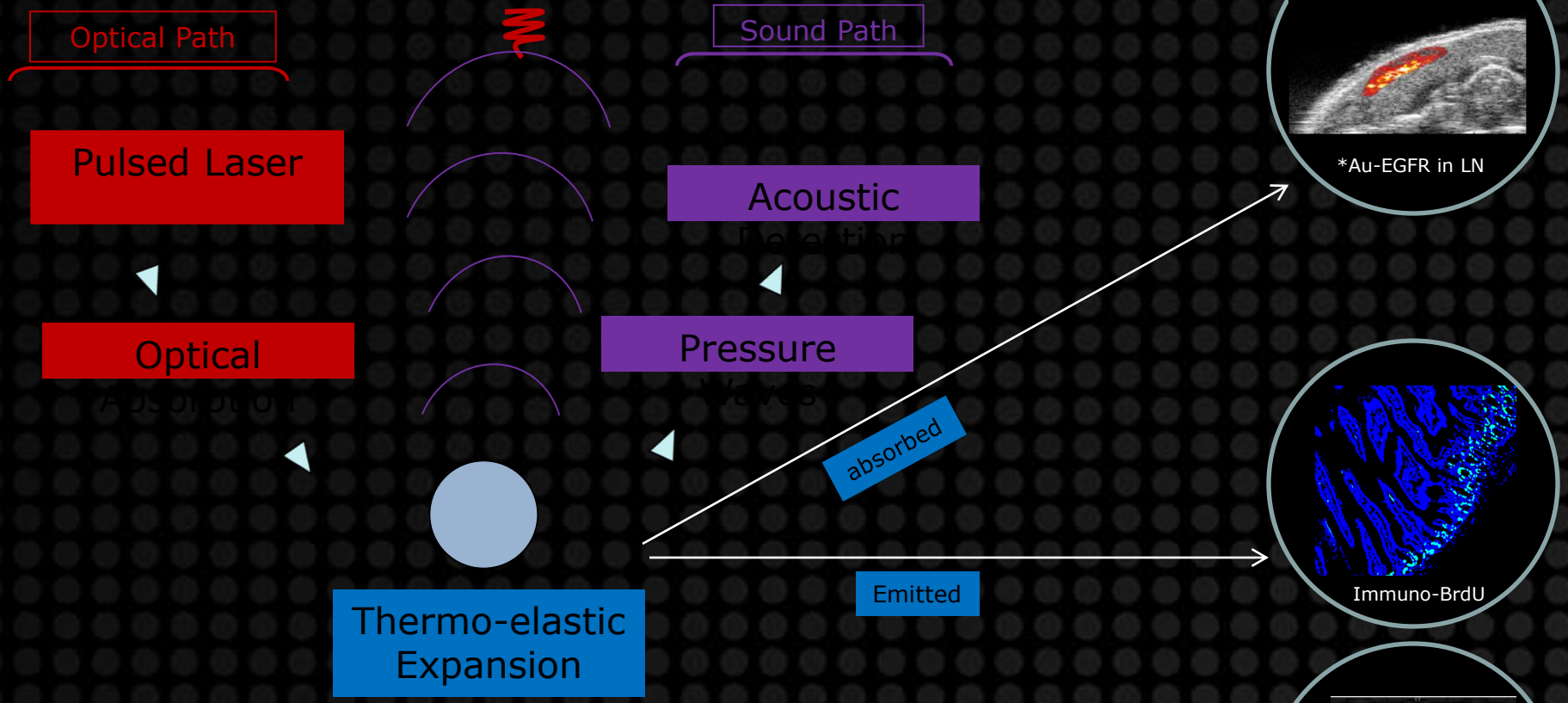
Overview

- Basics of Photoacoustics (PA) Imaging
- Introduction to PA contrast agents
- Nanoparticle Imaging
  - Untargeted Gold Nanorods
  - Targeted Nanoparticles
    - Surface antigens
    - Matrix proteins

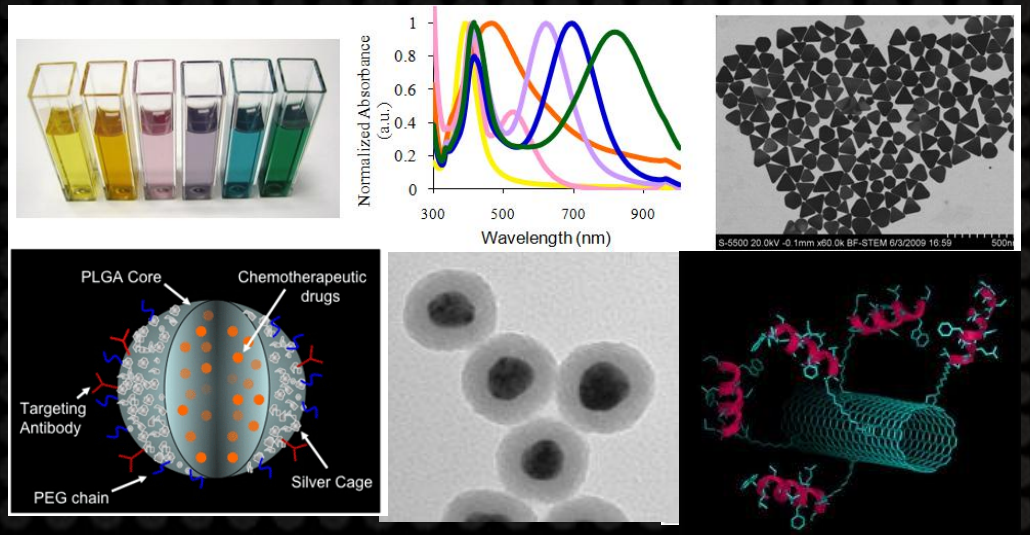
Photoacoustic Imaging



* Courtesy of Geoffrey Luke and Dr Stanislav Emelianov, University of Texas, Austin

Vevo LAZR® Contrast Applications

Exogenous Agents



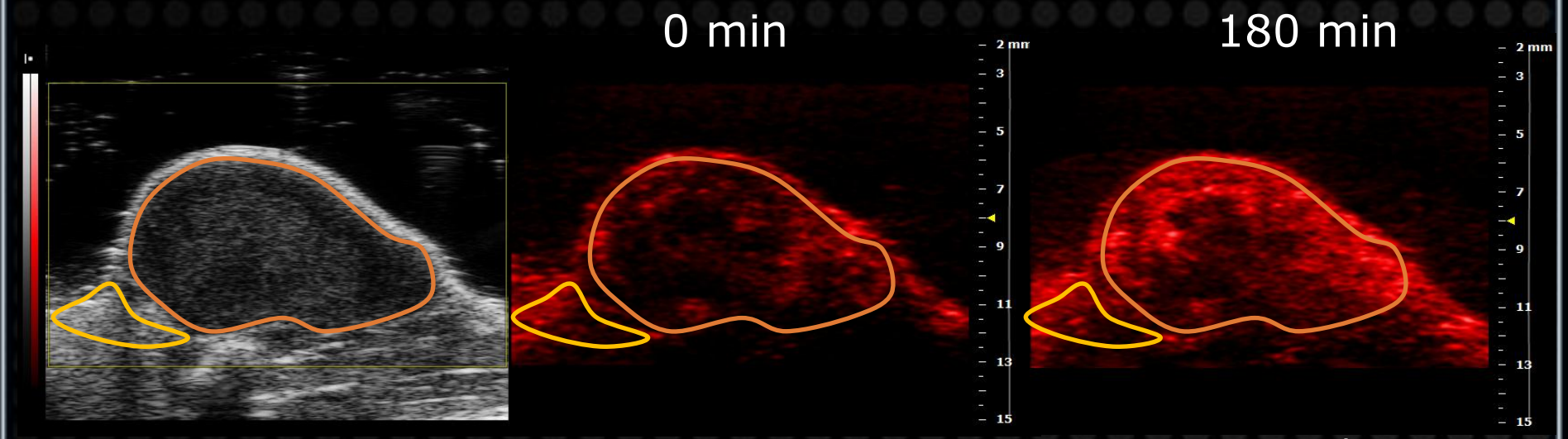
*Features of Compatible agents

- Peak absorbance in the range of 680-970nm
- Conjugatable Biochemistry
- Biocompatible

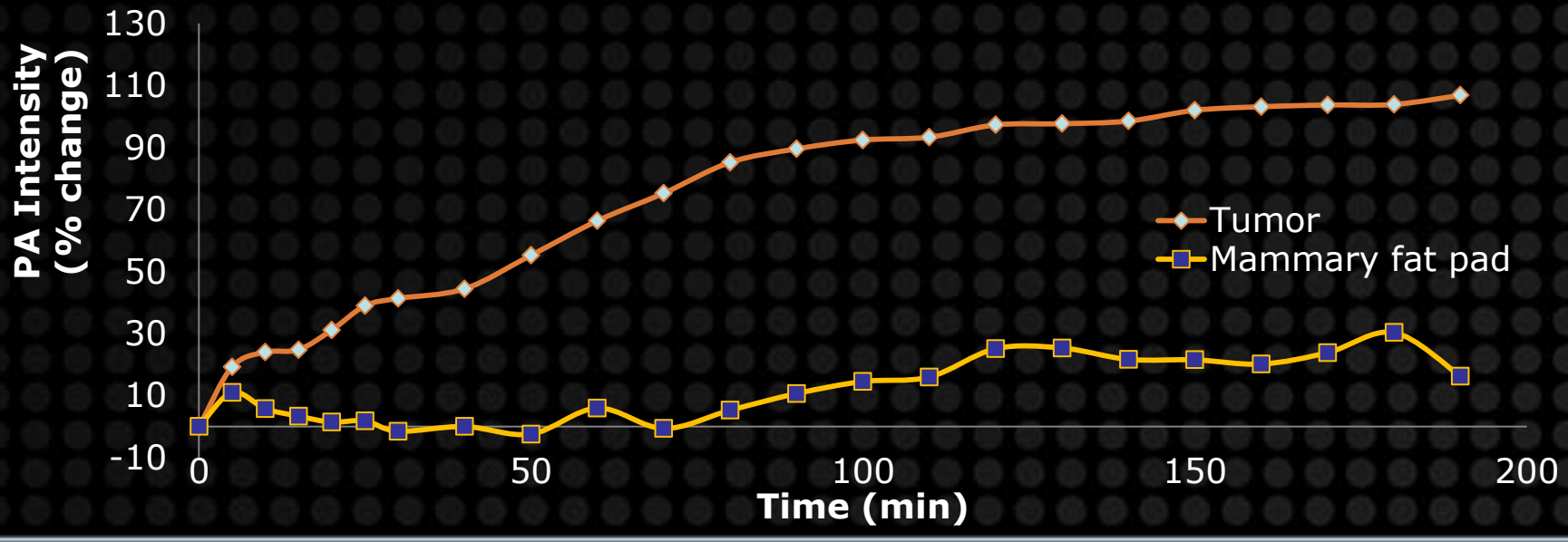
- Review: Luke, Yeager, Emelianov. Biomedical applications of photoacoustics using exogenous contrast agents. Annals of Biomedical Engineering, Vol. 40, 2011 pp. 422–437

Gold Nanorods in Tumor Biology

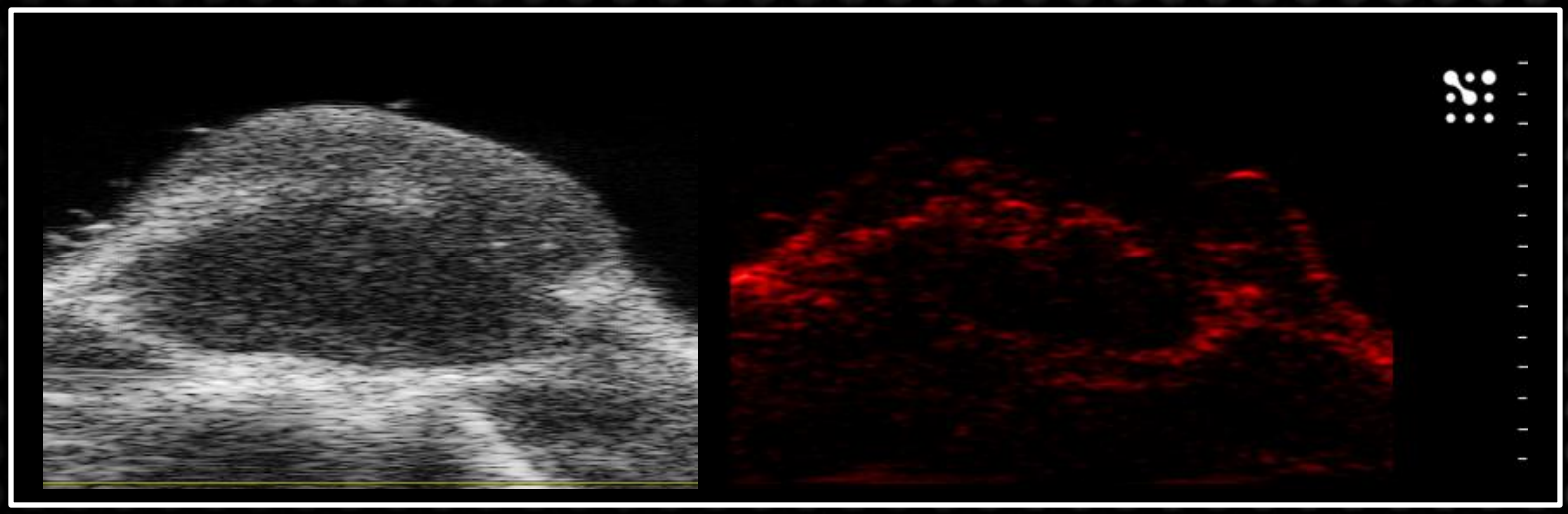
VevoLAZR

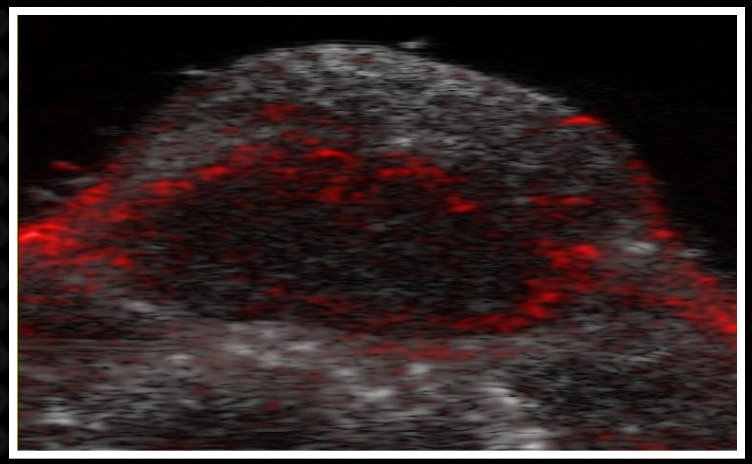


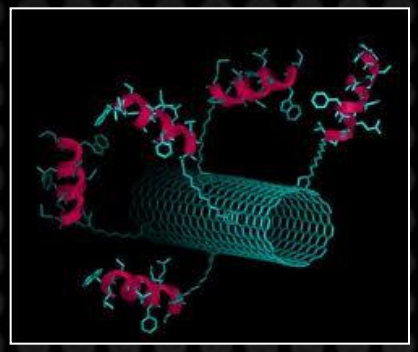
GNR accumulation



Targeted Imaging to Integrin

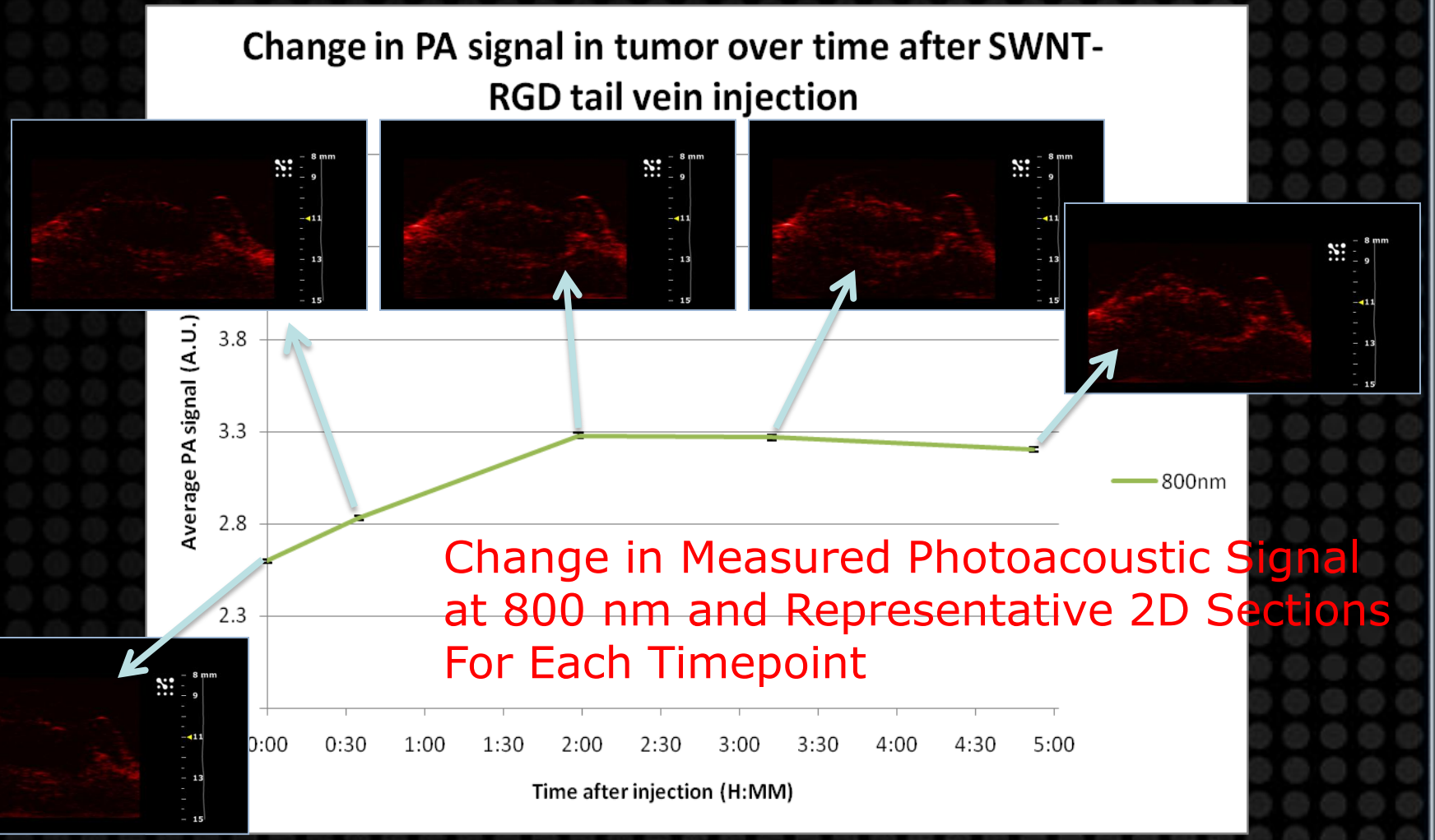






Single Walled Carbon Nanotubes conjugated to RGD peptide target $\alpha_v\beta_3$ integrins

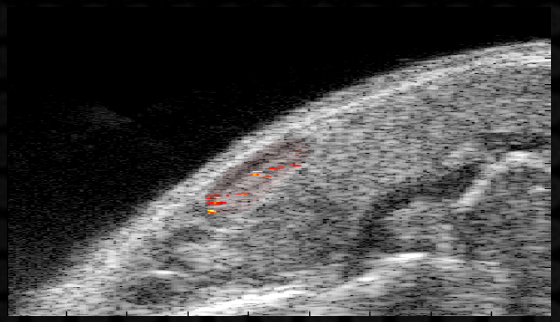
Targeted Imaging to Integrin

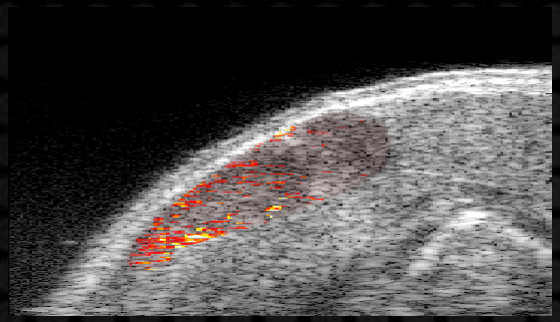


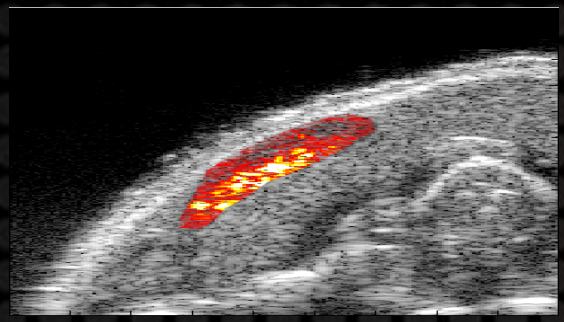
Targeted Imaging to EGFR

VevoLAZR

EGFR+ tumor cells metastasizing to sentinal lymph node
Primary tumor is in tongue (Emelianov Lab)





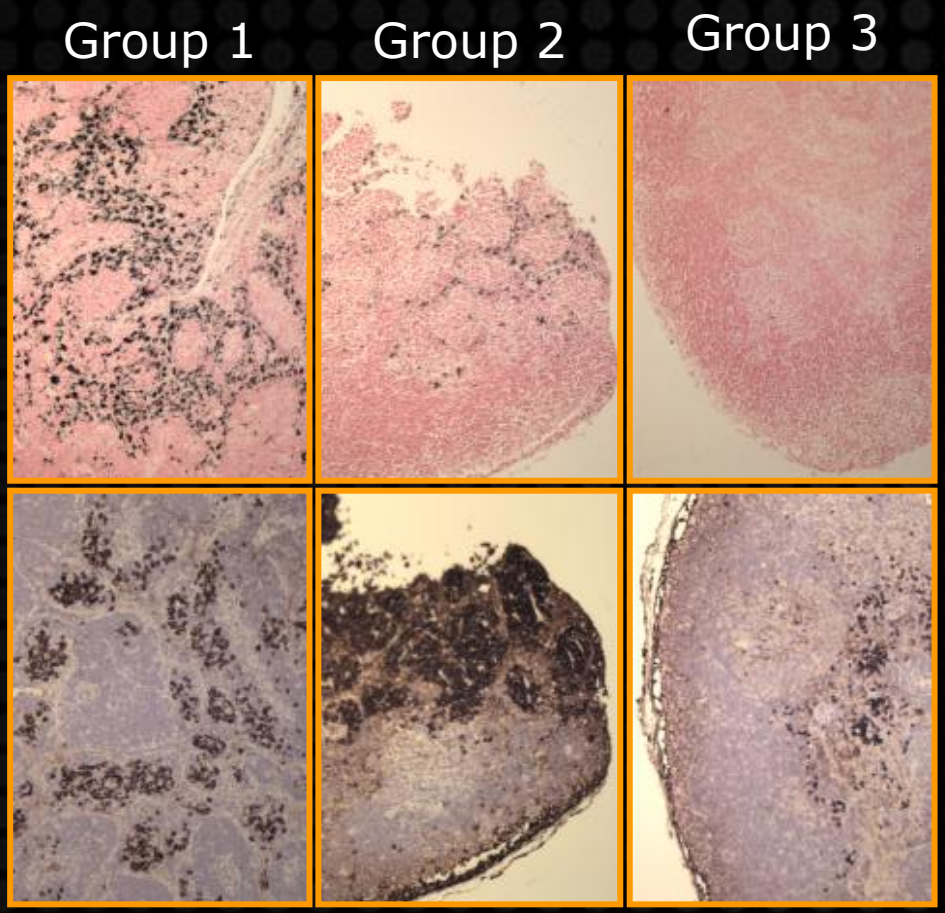


Group 1	Group 2	Group 3
No match	*Mismatch*	*Match*
No tumor (normal mouse)	EGFR-positive tumor	EGFR-positive tumor
EGFR targeted nanoparticles	PEGylated nanospheres	EGFR targeted nanoparticles

* Courtesy of Geoffrey Luke and Dr Stanislav Emelianov, University of Texas, Austin

Histological Analysis

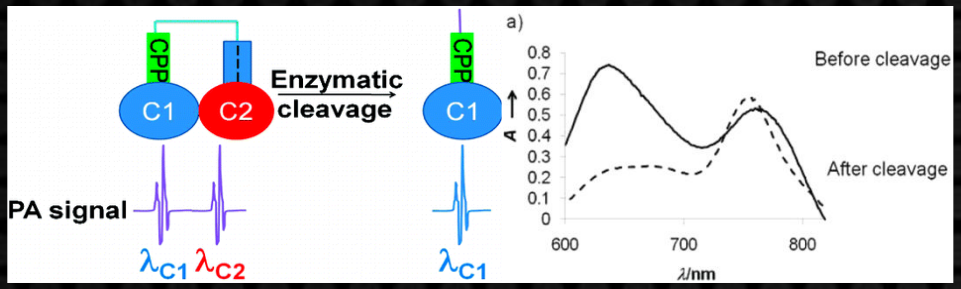
VISUALSONICS



- EGFR stain shows cancer cells in group 1 and 2
- Silver stain shows strong NP presence in group 1
- Group 3 shows no NP or EGFR or NP signal

Geoffrey Luke, University of Texas, Austin

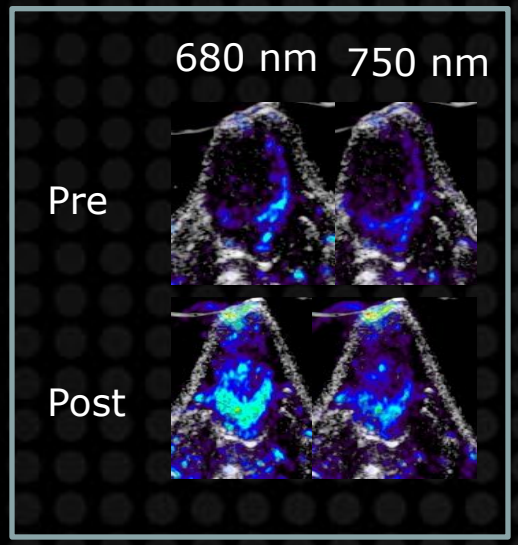
Targeted Imaging to MMP

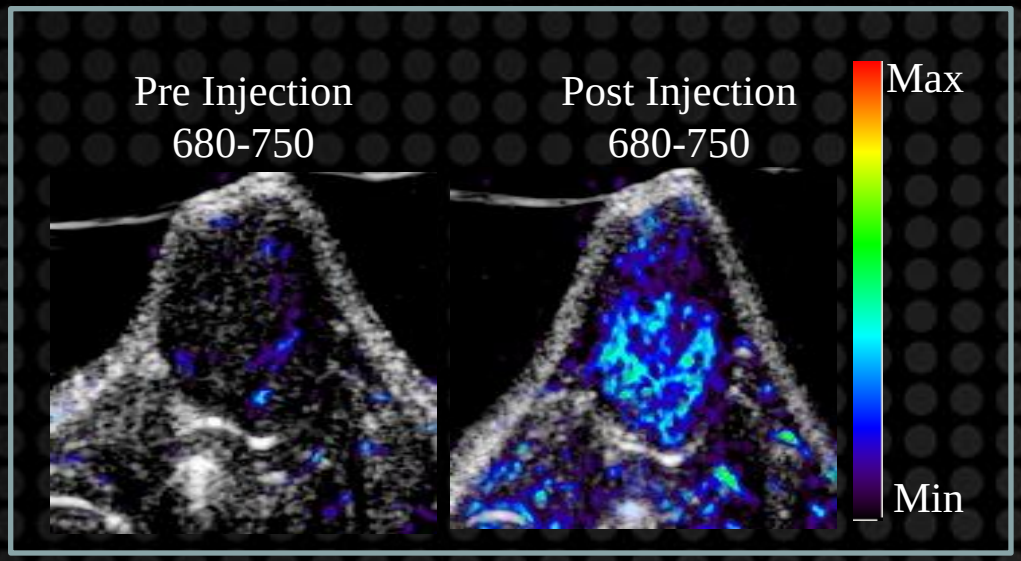


Levi et al. 2010

Figure 1. Scheme illustrating the probe design and mechanism of action. Non-activated probe produces a photoacoustic signal at two wavelengths (λ_{A1}, λ_{A2}) corresponding to the absorption maxima of the two chromophores A1 and A2. After the cleavage cell penetrating peptide (CPP) portion of the probe, carrying one of the chromophores, accumulates in cells and resulting in a photoacoustic signal at only one of the two wavelengths λ_{A1}. In the peptide, CXeeeeXPLGLAGrrrrrXK, small letters denote D amino acids, X is 6-aminohexanoyl acid. Enzymatic cleavage/activation of probe in this published example by MMP-2

Levi et al., Clin Cancer Res. 2013





Summary: Photoacoustic Imaging

- Real-time, non-invasive
- Sensitivity of optical image with the anatomical resolution of ultrasound
- 3D Molecular imaging
- Turn-key quantification and data analysis tools

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