研究介紹
生物醫學超音波影像實驗室

李百祺

台大基因晶片線上分析系統（NTUMAPs）

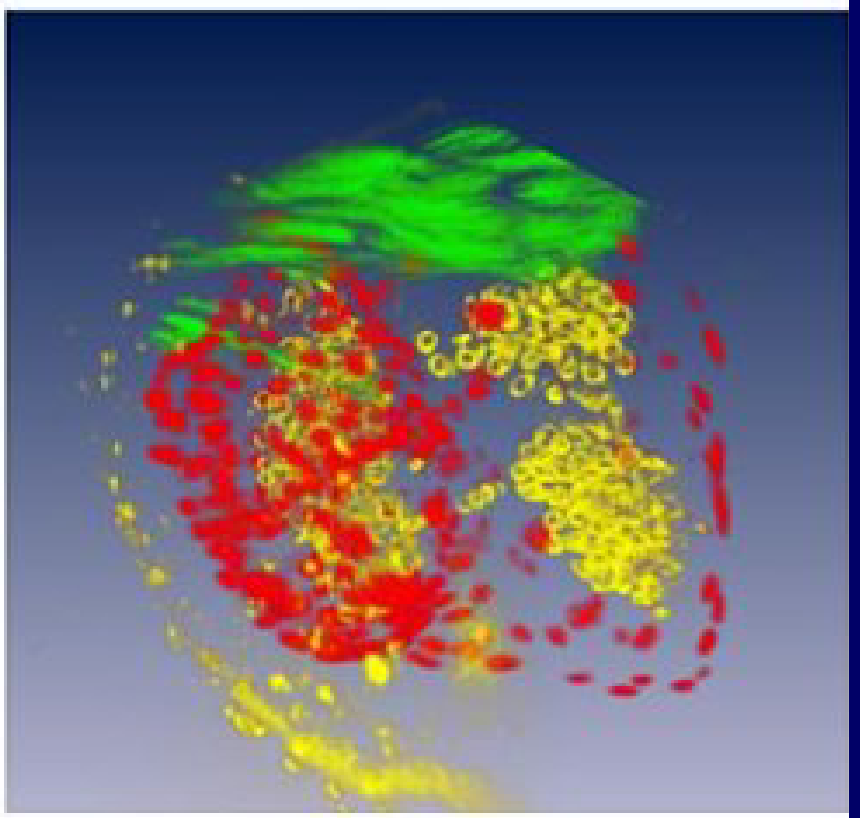
- 9/20/2006
- 台灣大學成果發表會：*生物醫學與電子資訊創新結合跨國界合作共創基因分析新紀元*
- 發表人：莊曜宇教授

即時疾病偵測及通報技術新突破

- 9/4/2006
- 台灣大學成果發表會：*半導體和生醫技術的新結合--即時疾病偵測及通報技術新突破-開啟簡便可攜式/穿戴式健康監控的應用*
- 發表人：呂學士教授

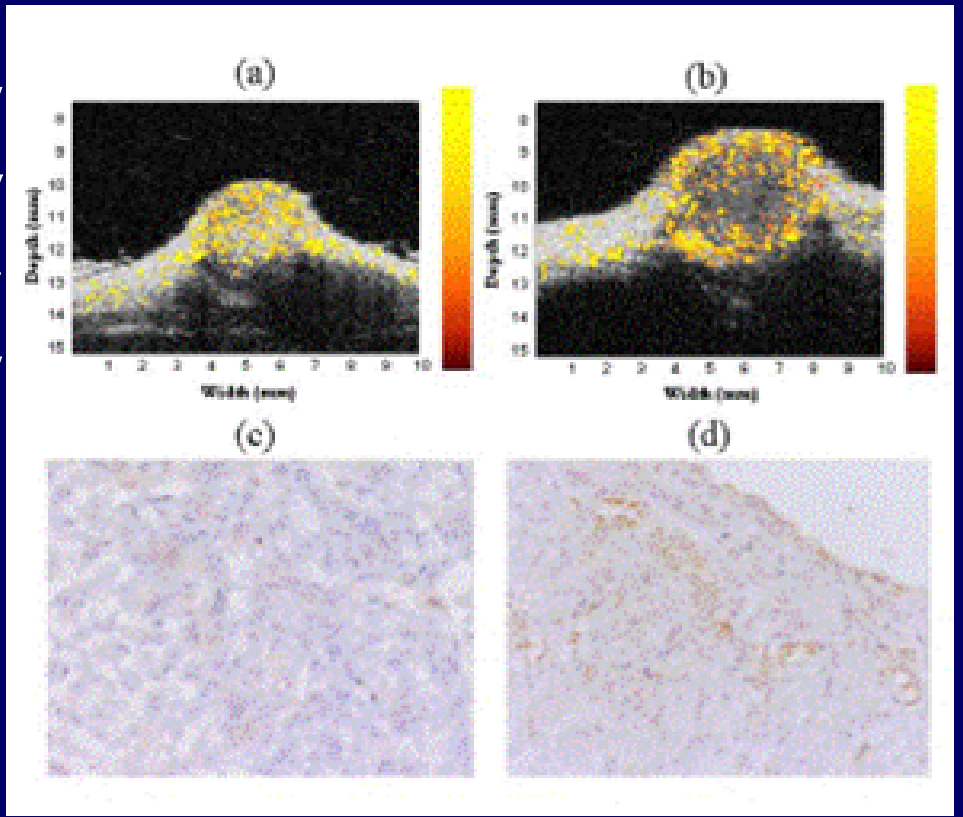
雷射、倍頻、新顯微術—直接觀察活體內細胞的創新研究

- 8/23/2006
- 國衛院成果發表會：*成功突破雷射穿透限制，並避免生物組織的光破壞性，建立一套如同隔牆照像的生物顯微影像取得技術。*
- 發表人：孫啟光教授



老鼠雖小五臟俱全：以小動物影像探索生物科技之奧秘

- 3/23/2006
- 國科會成果發表會：*較臨床系統有更優異十倍之解析度與千倍之靈敏度，充分發揮影像之功能，達到提升生物科技研究品質之目標，造福人類。*
- 發表人：李百祺教授

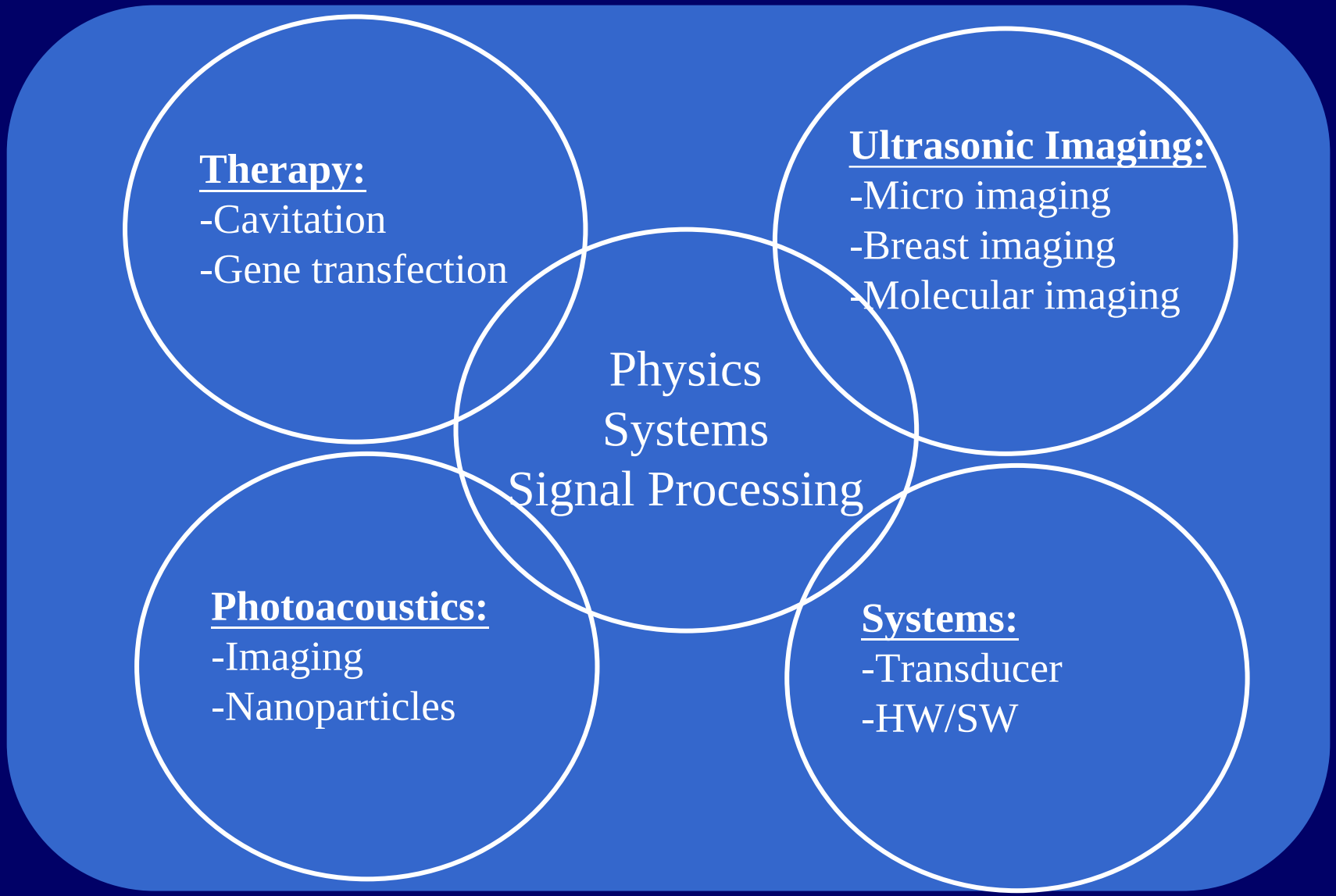


結合生物醫學與電子資訊科技已是前瞻研究趨勢！

- 跨領域研究
  - 很有趣
  - 很有意義
  - 很有挑戰性

What is Biomedical Engineering?

- Interdisciplinary area of *Biology, Medicine and Engineering*.
- Prevention, diagnosis and therapy of diseases.
- Science, engineering and clinical applications.
- Full of innovations and combination of the state of the arts.

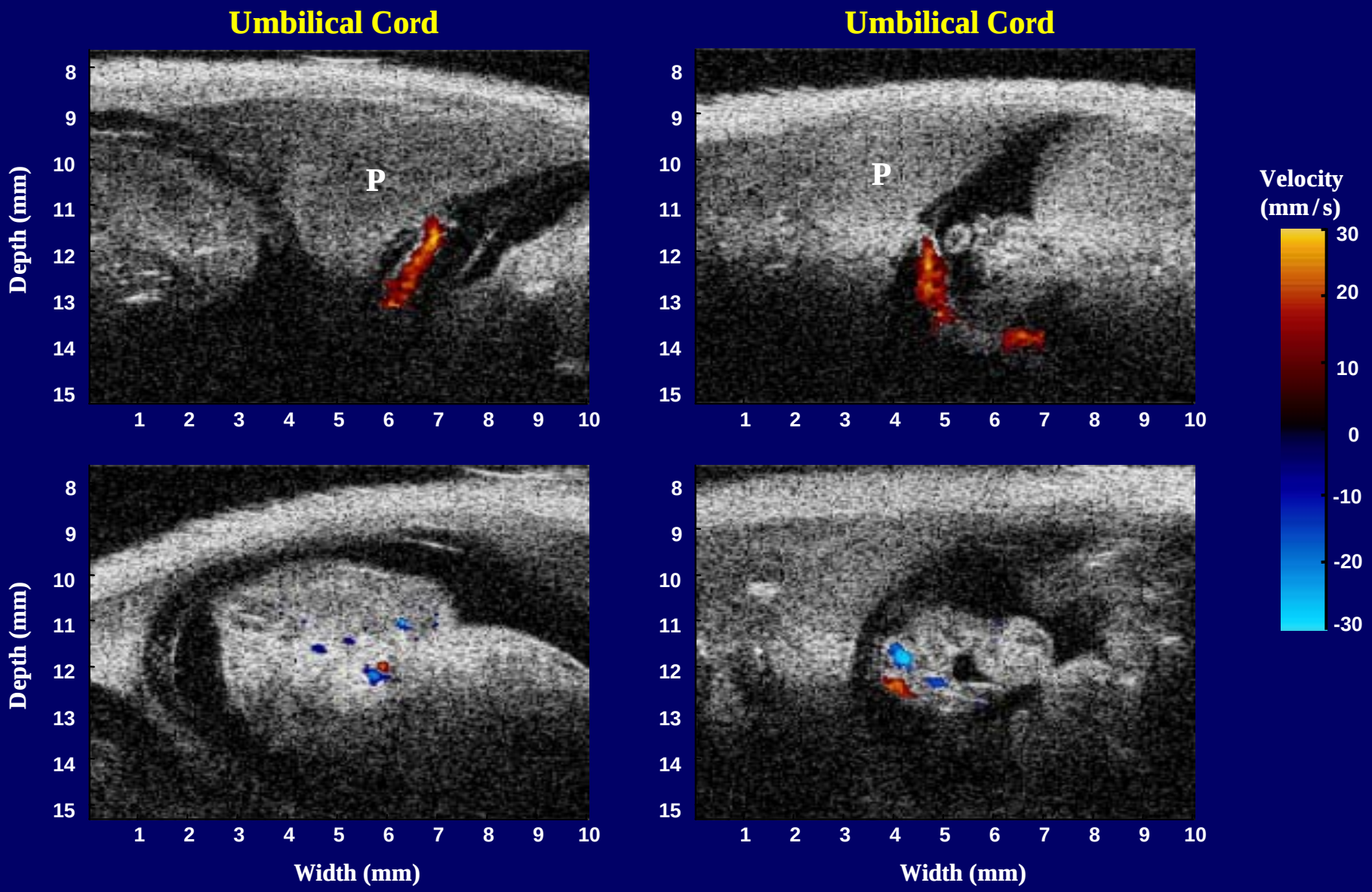


合作團隊：臺大醫學院、生命科學院、基因體中心、奈米中心、國家衛生院、成大、師大、中正、暨南,…等單位。

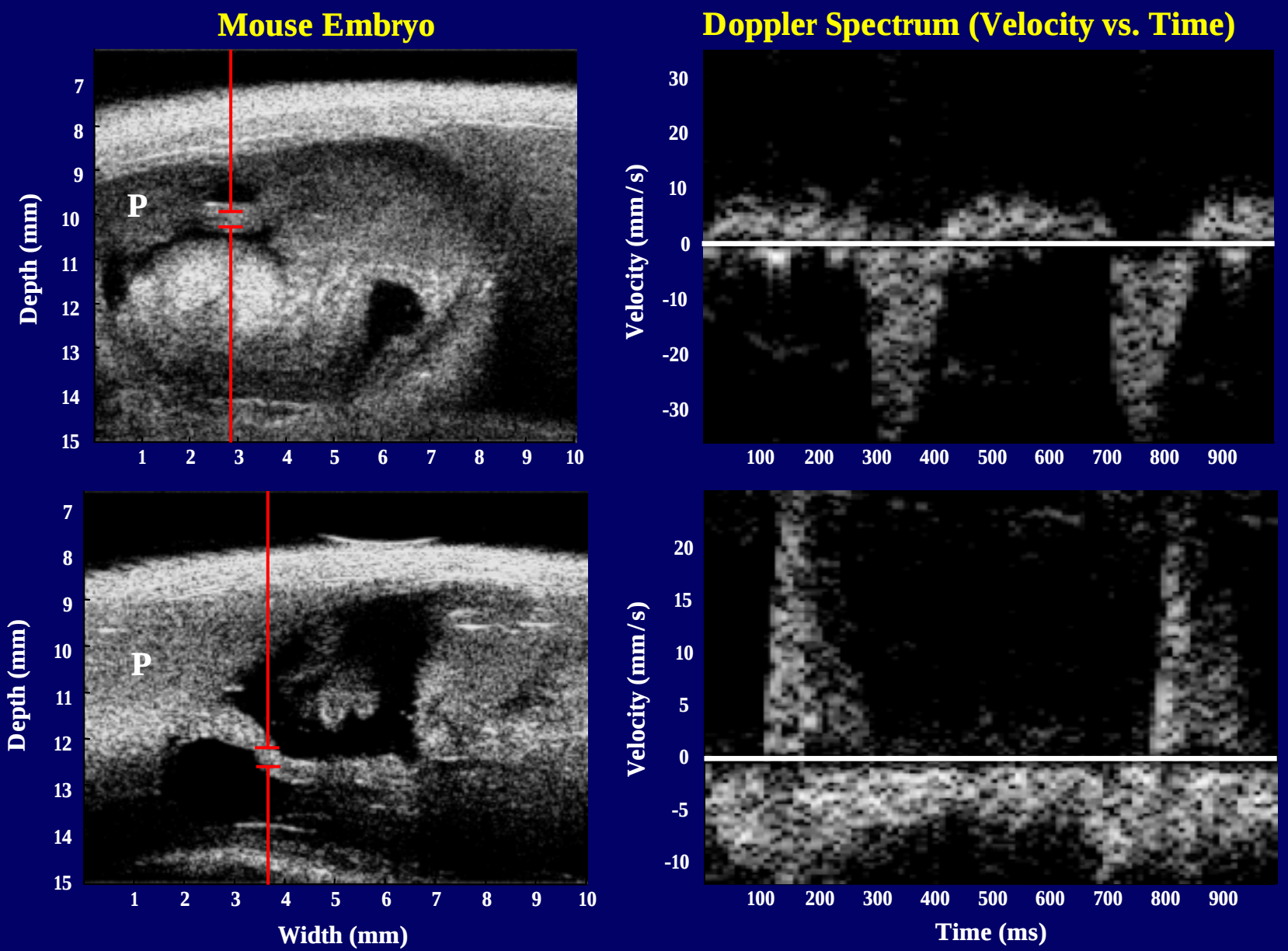
跨領域研究：電子、物理、醫學、生命科學、化學、奈米材料。

Ultrasonic Micro-Imaging

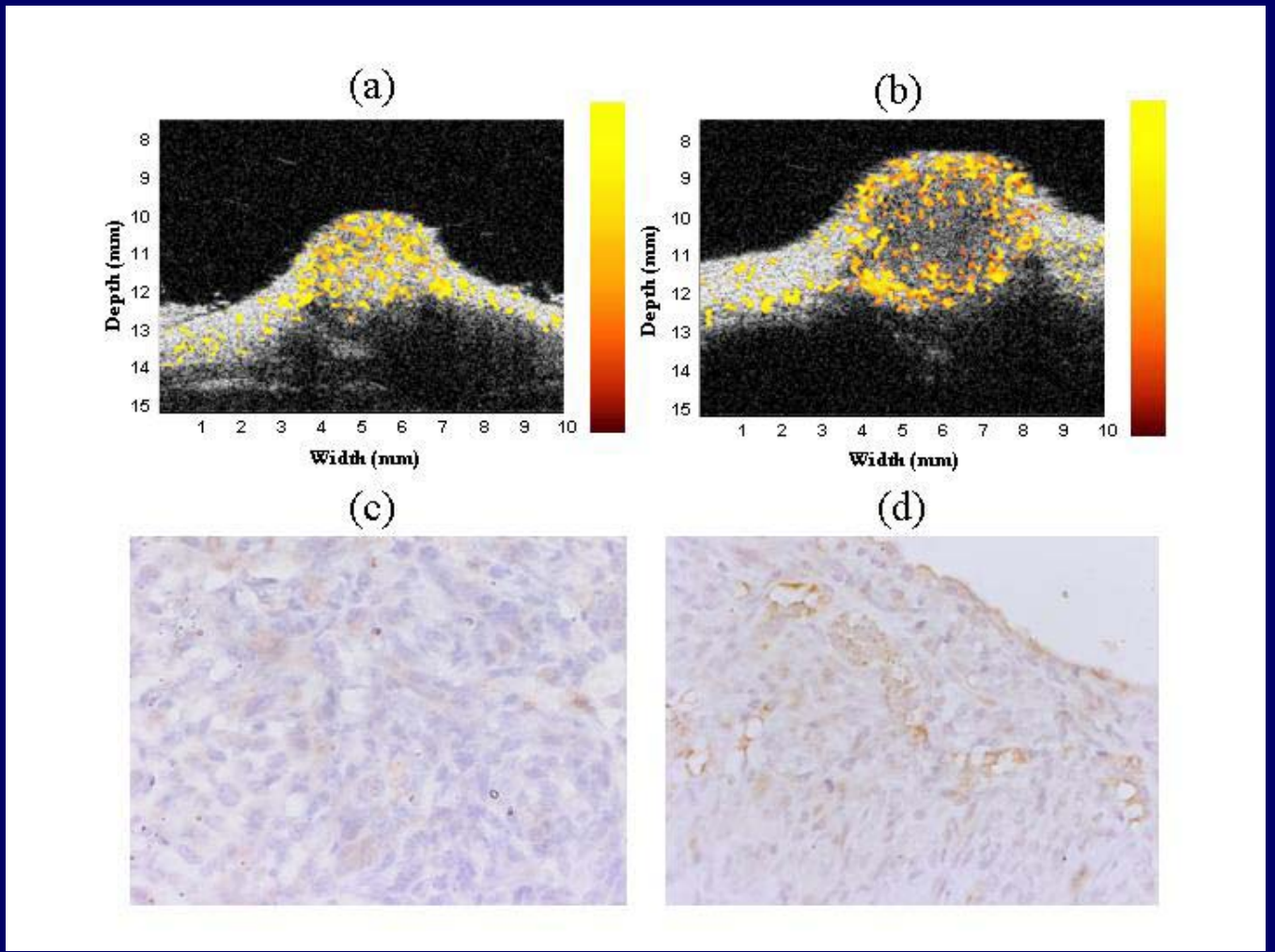
Mouse Embryo Micro-Imaging



Mouse Embryo Micro-Imaging



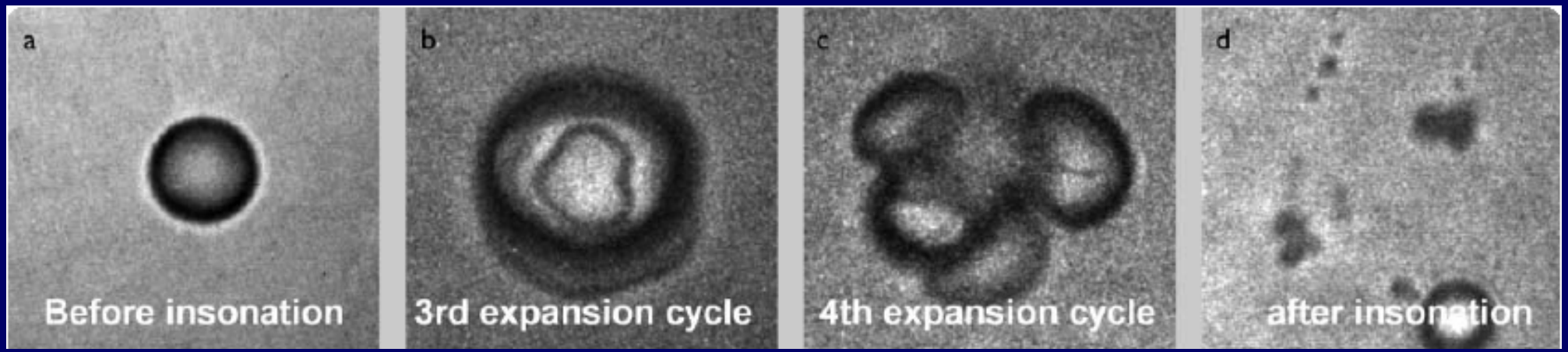
Mouse Tumor Micro-Imaging



Cover of IEEE Trans. on UFFC, Jan. 2004

Ultrasound Assisted Therapy

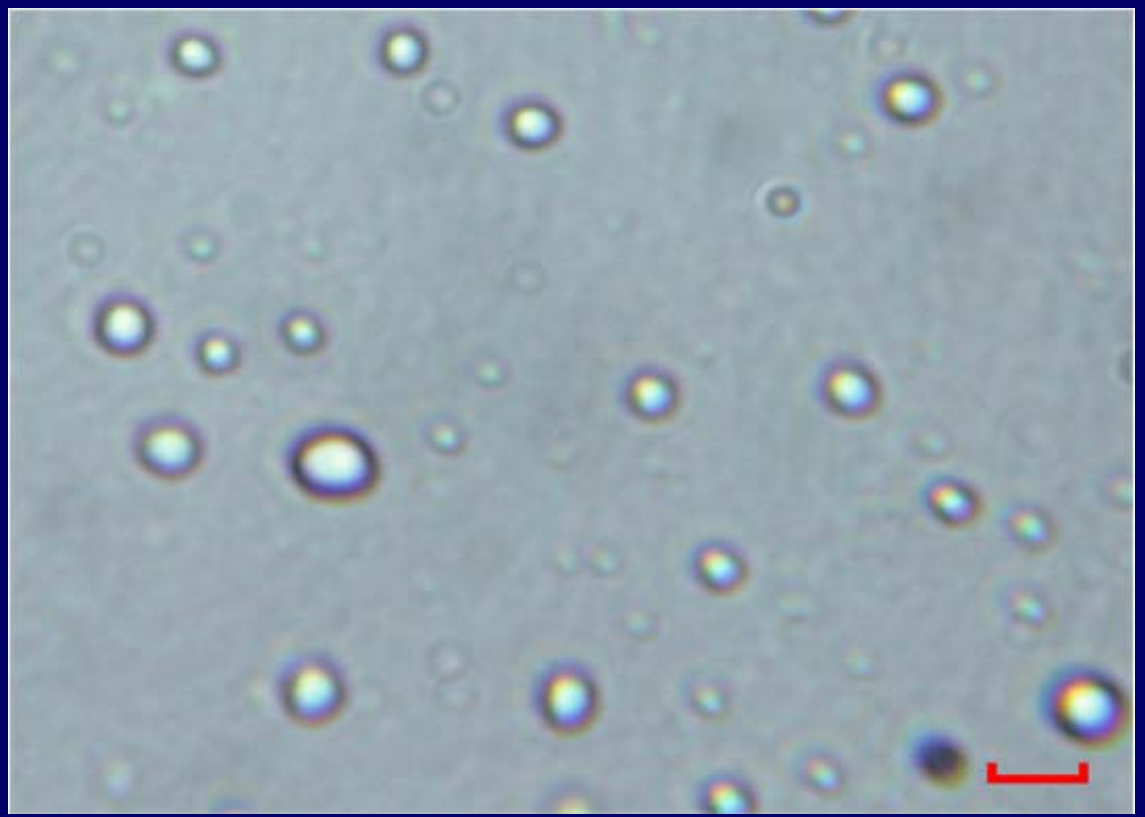
Microbubbles and Cavitation



From UC Davis

Liposome Microbubbles

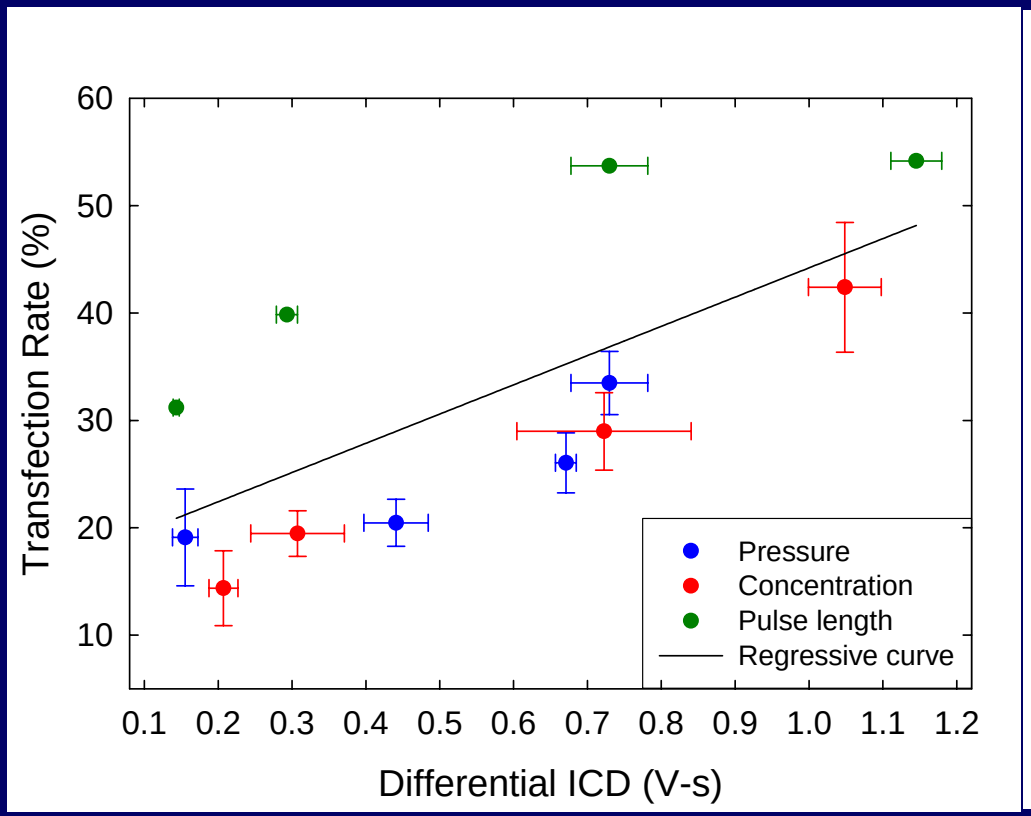
- PC : PE : PG : CH = 69 : 8 : 8 : 15 (mol %)

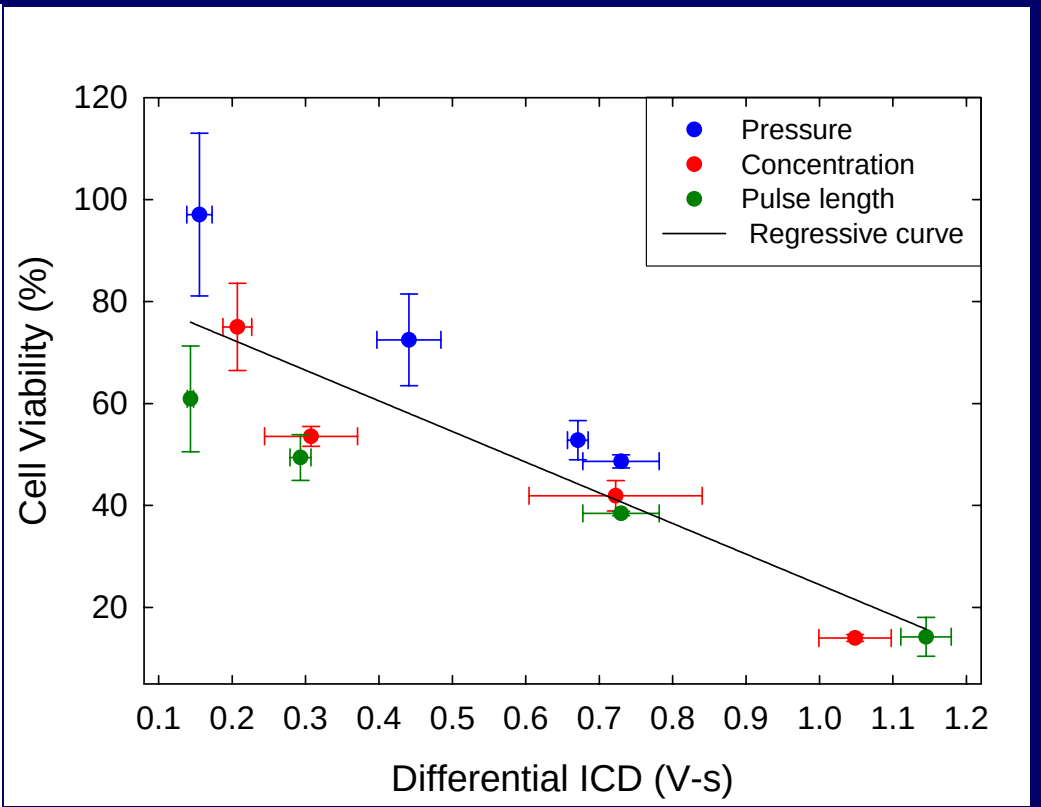


bar = 5μm

- B-mode image

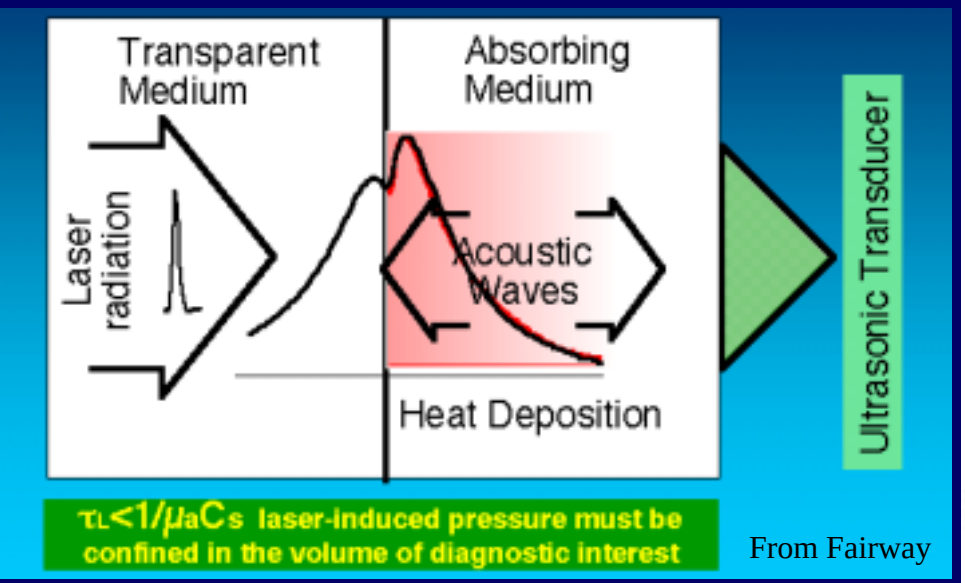
Cavitation vs. Gene Transfection/Cell Viability



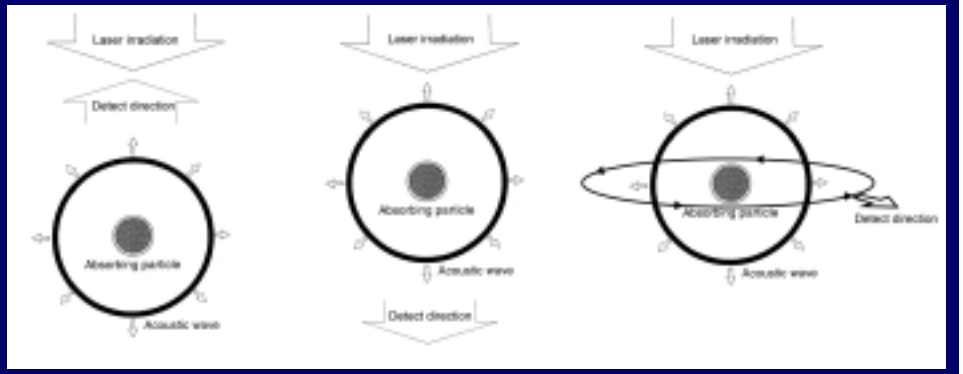


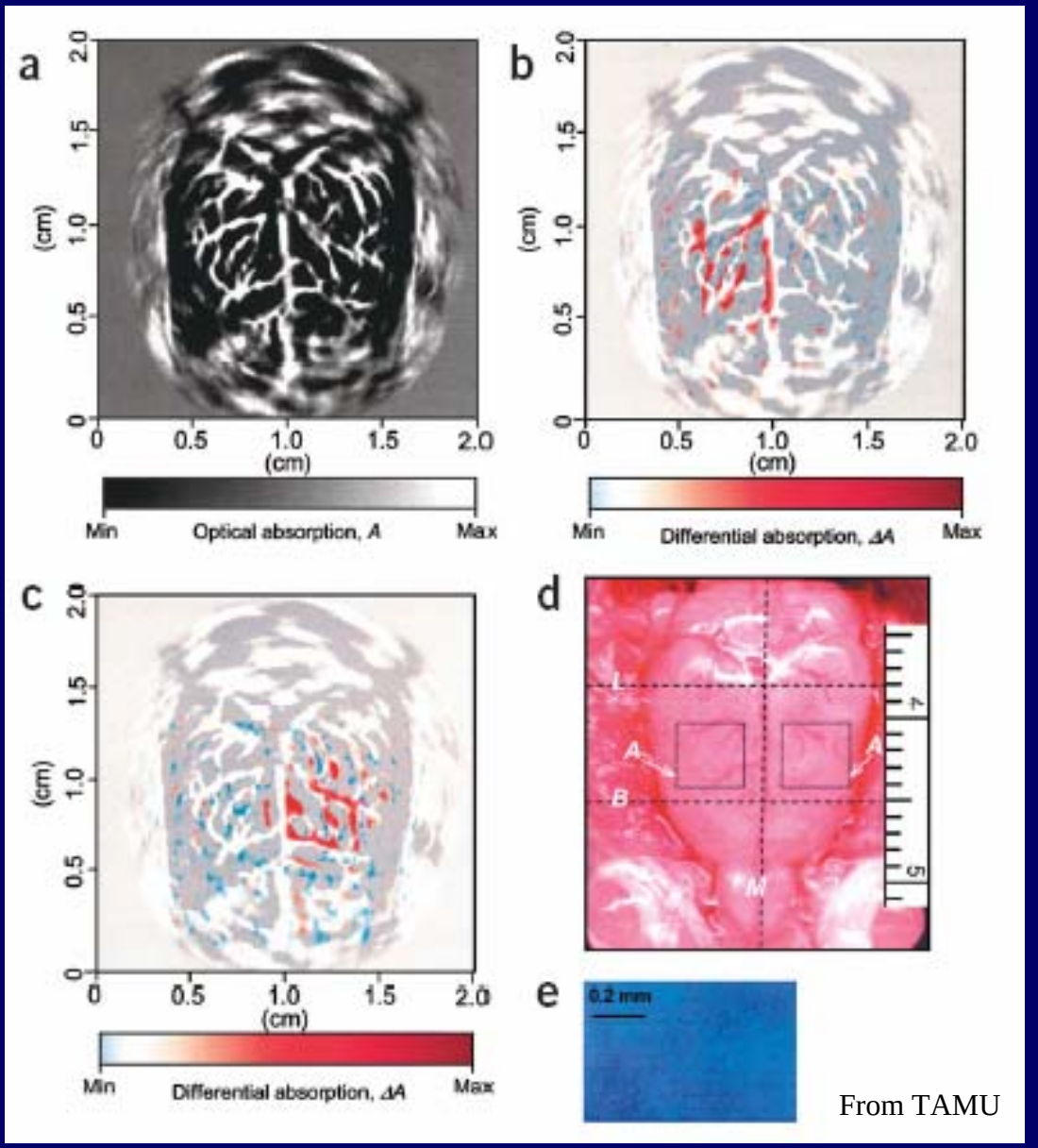
Photoacoustic Imaging and Gold Nanoparticles

Optoacoustic (Photoacoustic) Imaging



From Fairway





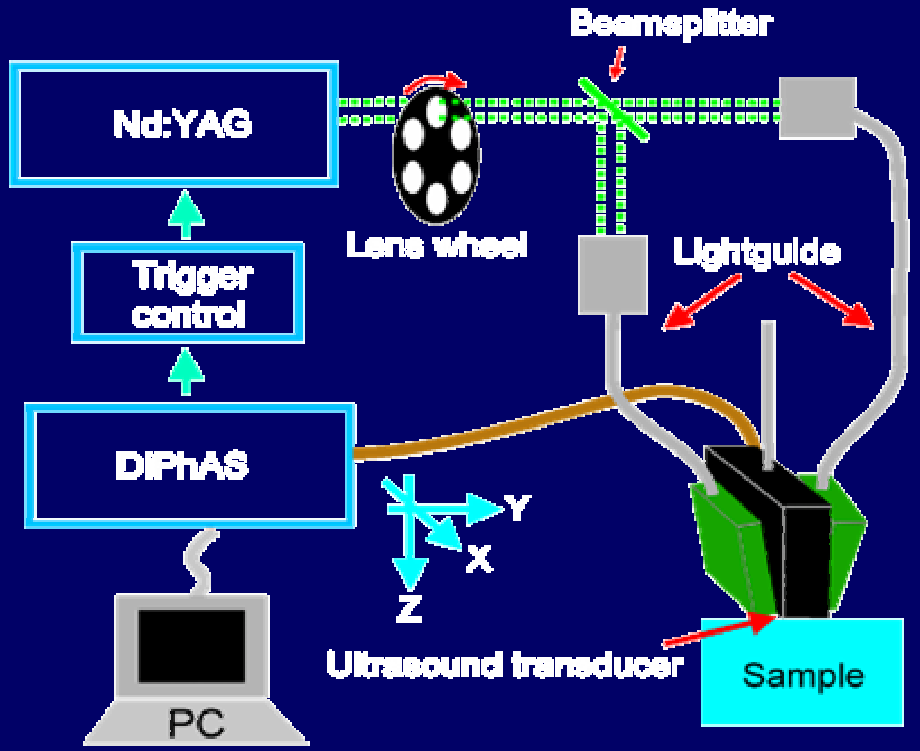
From TAMU

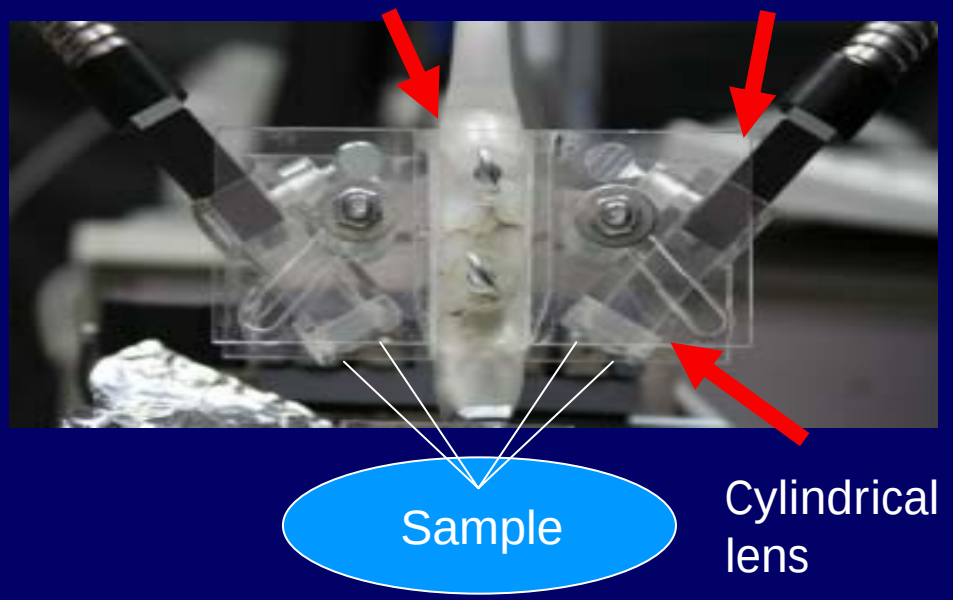
Digital Phased Array System

Number of Receive Channels	**64** (up to 192 channels)
Gain	**0~80 dB**
Gain Bandwidth (6 dB)	**20 MHz**
Scan Depth per Zone	**3.84 cm (20 Msamples/second)**
A/D Conversion	**12 bit, 40 Msamples/s, 4 V**
Acquisition Time	**4 ms (250 frames/s)**

*http://www.diphasfemmina.com/

High frame rate photoacoustic imaging system





Laser system: Q-switched Nd:YAG

(wavelength 1064 nm, pulse duration 8 ns

Pulse repetition freq. **15 frames/s**)

Lightguides: fiber bundle (15,000 fibers)

(output: 3 mm X 30 mm illumination area)

Photoacoustic probe:

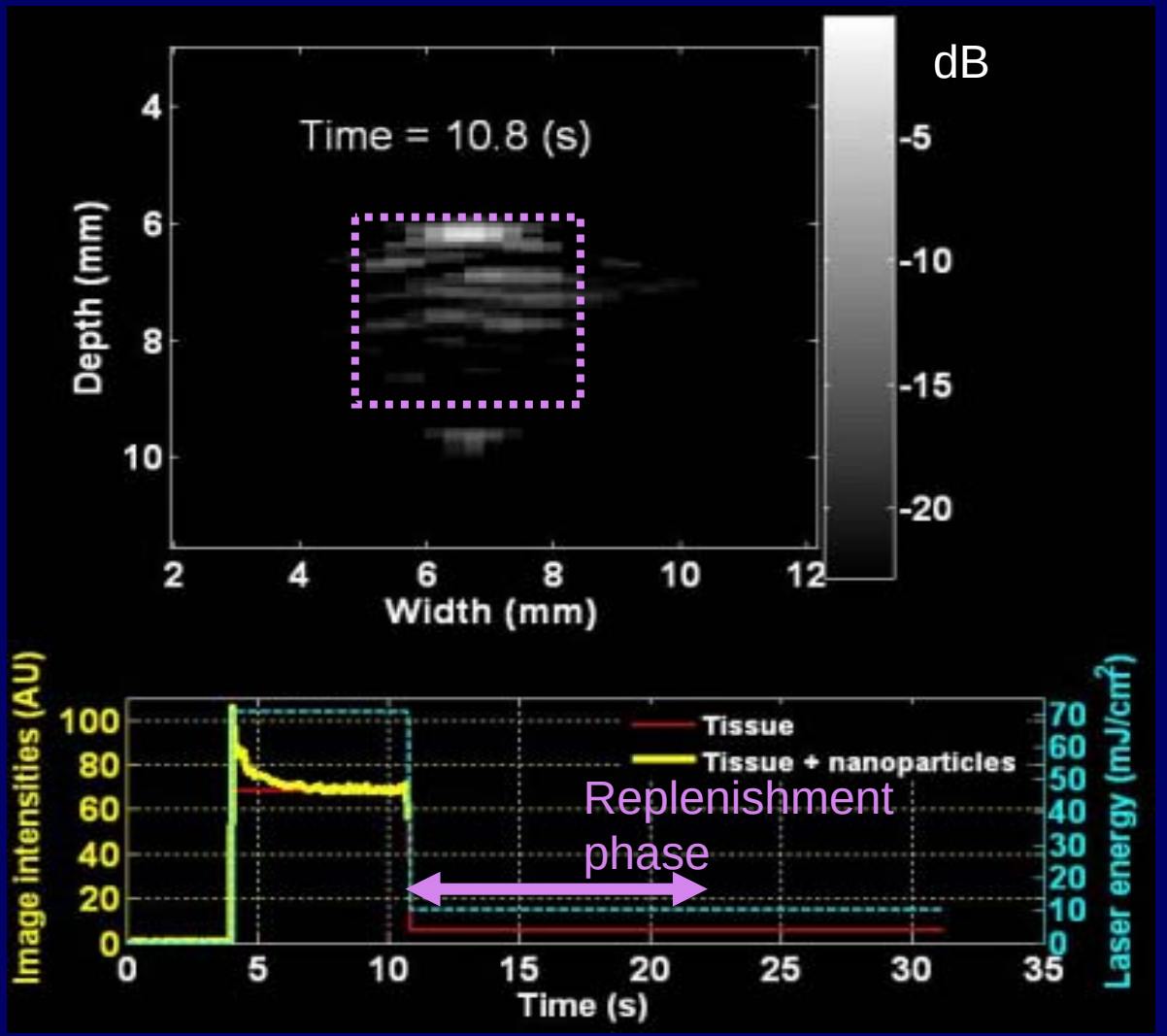
Optical: Light guide with cylindrical lens

Acoustic: Linear array with 128 channels

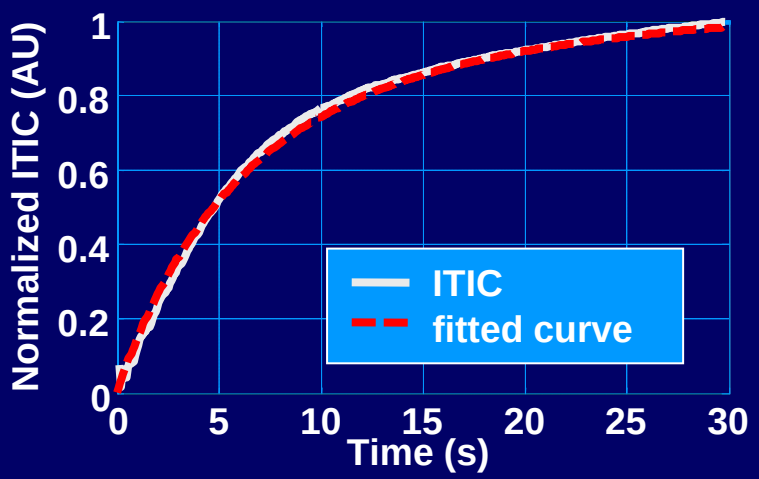
(pitch : 0.3 mm, f_c = 5 MHz)

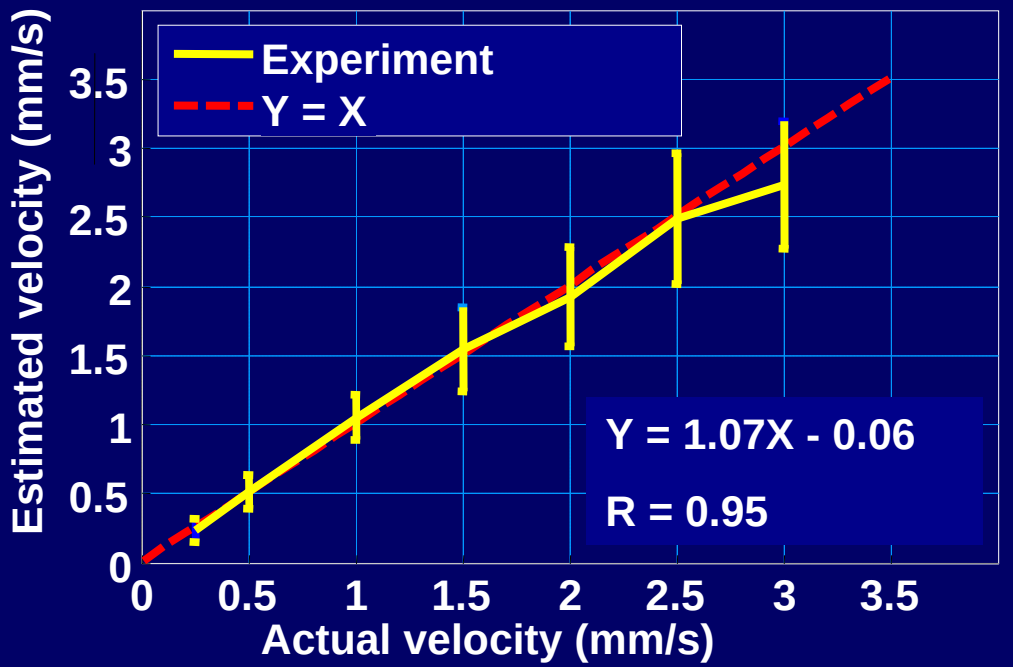
Reflecting foil: 9 μm

Perfusion time-intensity measurements



Results





Flow velocities were calculated from the fitted curves.

Six measurements were performed at each flow velocity.

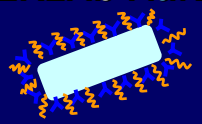
Estimated results show a high correlation with the actual velocities.

The correlation coefficient between the measured flow velocities and their linear regression fit is 0.95.

Nanoprobe Designs (I)

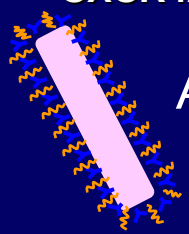
A

HER2Ab-AuNR$_{785}$



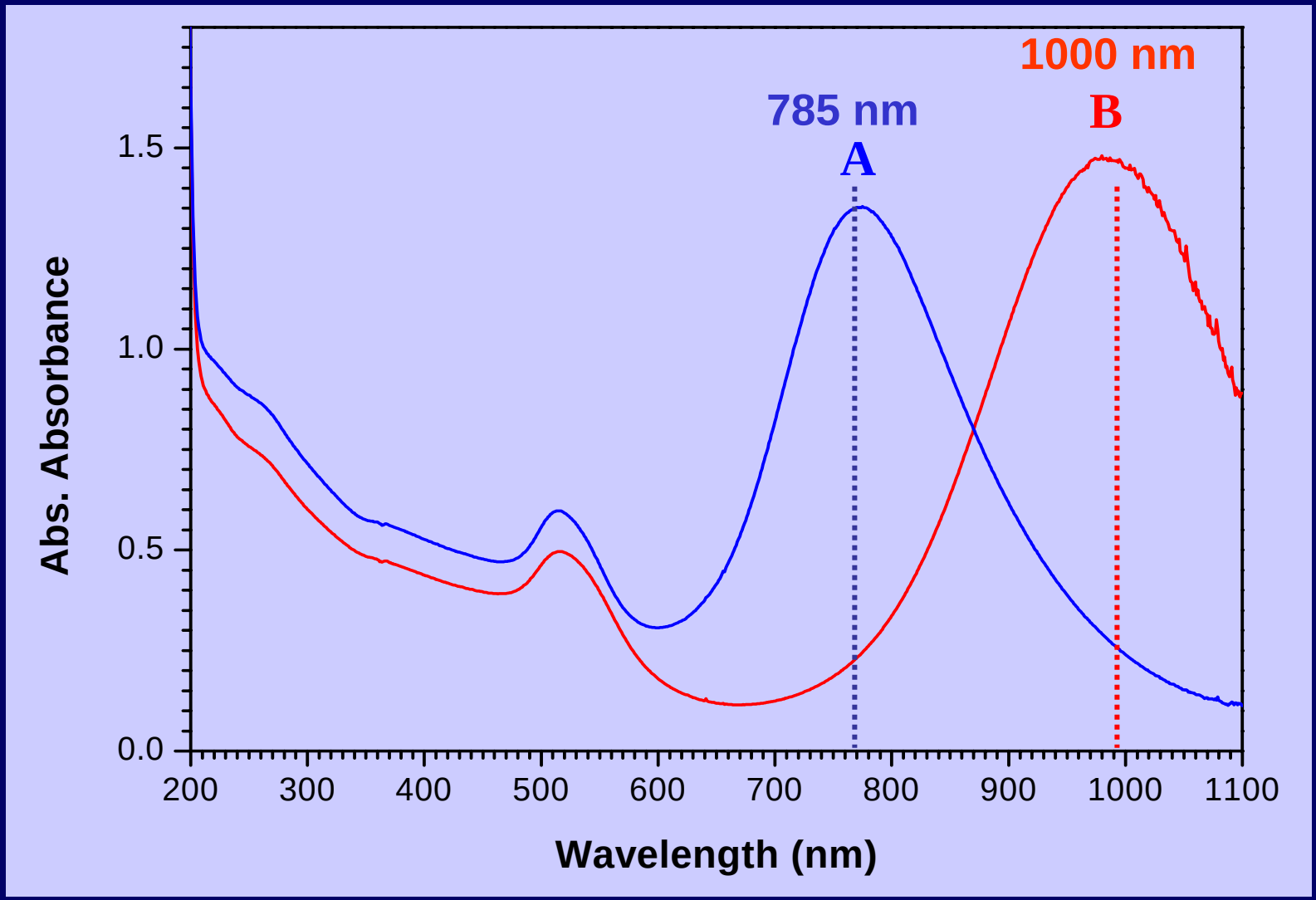
A.R.=3.7

CXCR4Ab-AuNR$_{1000}$



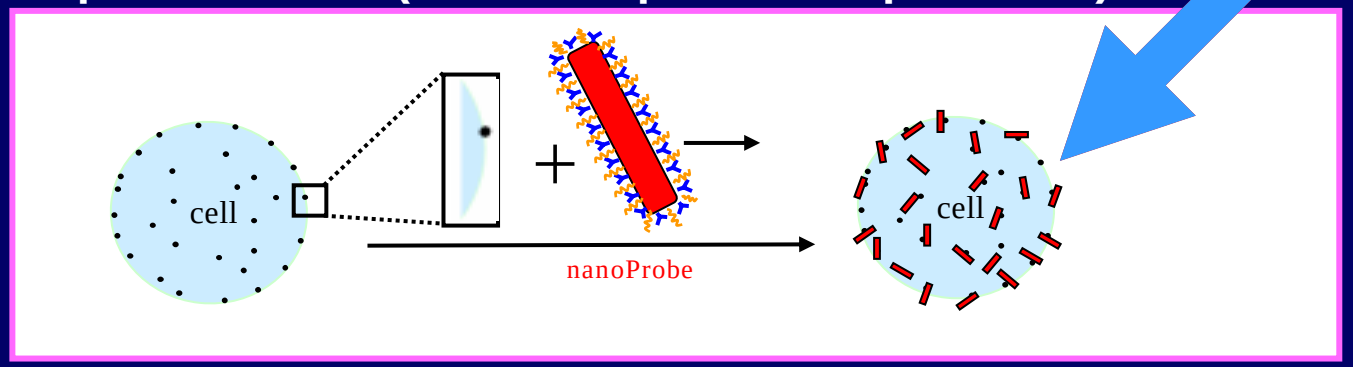
A.R.=5.9

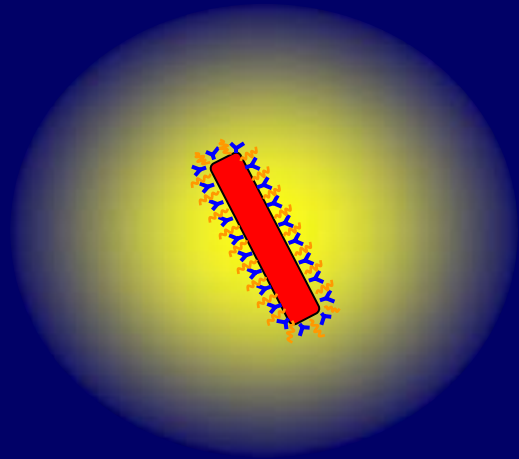
B



Multiple Selective Targeting for Both Imaging and Therapy

HepG2-WT cells (human hepatoma HepG2 cells)



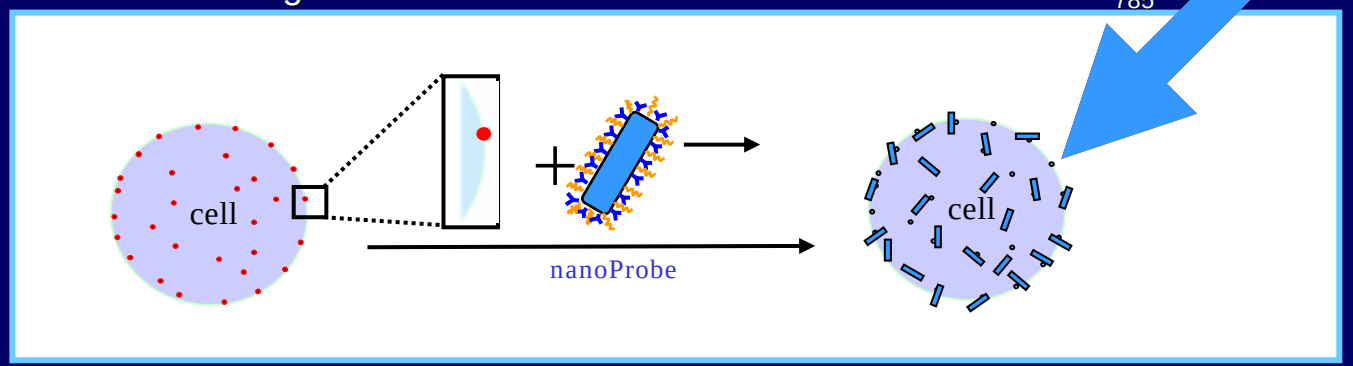


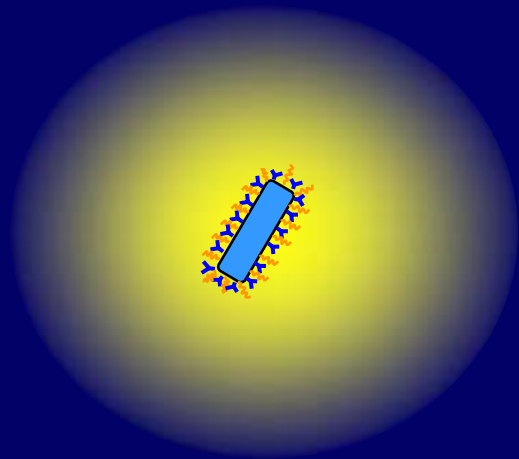
HepG2-CXCR4Ag

HepG2-CXCR4Ab-AnNR$_{1000}$

MBT-Her2Ag

MBT-HER2Ab-AnNR$_{785}$

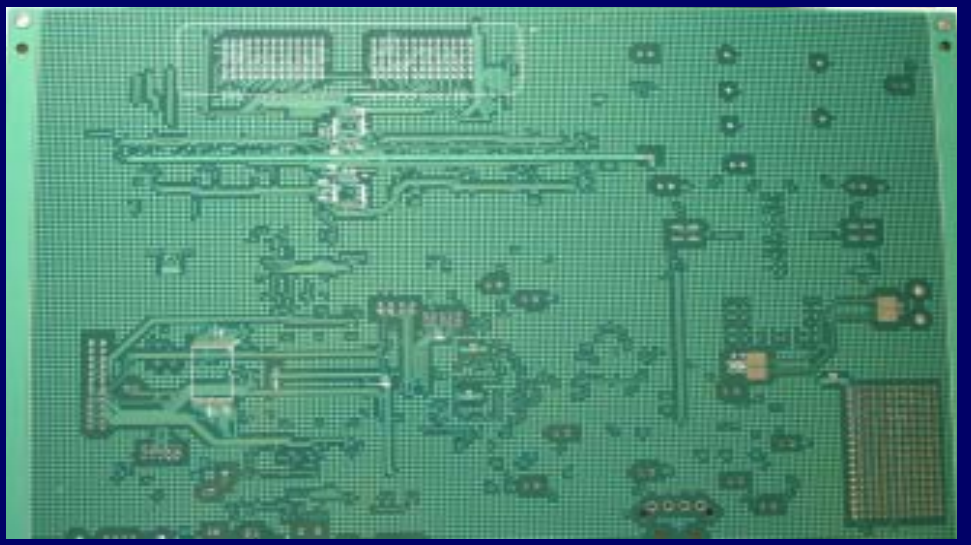


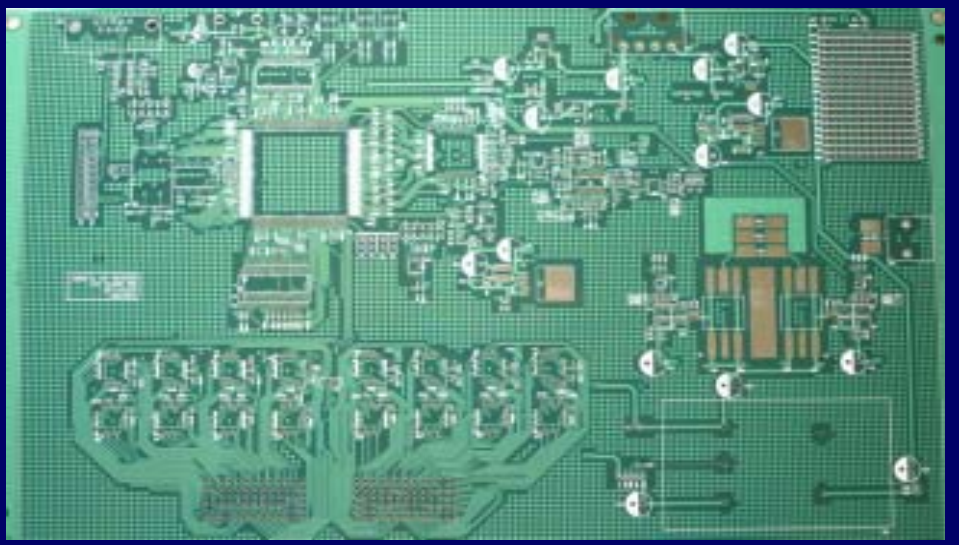


MBT-WT cells (murine bladder cancer cells)

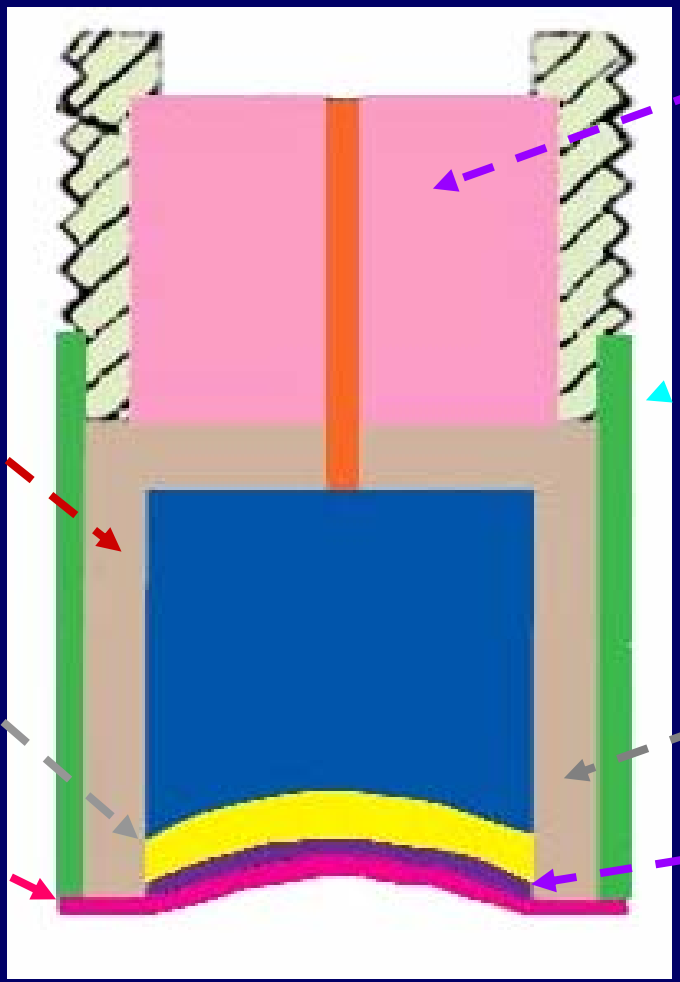
Systems and Probes

System Development





High Frequency Transducer



High Frequency Transducer









- 跨領域研究
  - 很有趣
  - 很有意義
  - 很有挑戰性
- 電機系的同學，在跨領域的環境中，發揮自己的專長
  - *n*VIDIA for Medical Imaging
  - 血管內的影像世界
  - ,…

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