

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

The screenshot shows the homepage of the NTUMAPs website. At the top, there is a logo for 'MAPs NTU' with the text 'National Taiwan University Microarray Analysis Platform and System'. Below the logo are several logos of partner institutions: Academia Sinica, NTU, IBM, and the Ministry of Science and Technology. The main visual is a stylized globe divided into colored segments (yellow, green, blue) representing different data analysis tools. Labels include 'Classification', 'Clustering', 'PCA', 'Scatter plot', 'Multiple array viewer', 'Genotype plot', and 'Ontology'. To the right of the globe, there is descriptive text about the system, its features, and the conference details. A list of 5 features is provided at the bottom.

台大基因晶片線上分析系統  
NTUMAPs

一個完整的微陣列晶片分析平臺，藉由  
人性化網路介面，讓使用者可以有效率  
地對各種基因晶片進行表現分析，進而  
獲得極為完整的各項數據。

網址：<http://ntumaps.com.ntu.edu.tw>

NTUMAPs 發表會

地點：台灣大學第二行政大樓（重化新館）五樓  
台灣大學第四會議室

時間：星期三（Wednesday） 2106-09-20 AM10:00

全面的系統架構及分析技術

- 擁有強大資料庫管理系統 (DB2) 及共享平台等。
- 具備兩基因變異及分析基因表現之功能。如Outlier detection、ZAM、Scatter plot、Multiple array viewer等。
- 能協助資料統計及對比兩基因，適用如t-test、Wilcoxon檢定方法。
- 提供判斷基因交互作用處理的階層型基因變化圖譜，不含樹狀圖 (A Clustering Hierarchical - Principal Component Analysis (PCA)法)。
- 具有統整各基因資訊並獨立檢視每個基因之基因資料庫，如資料庫(Gene Ontology: GO)、KEGG、BioCarta等。

TEL : 022362409 ext. 8000 FAX : 022362479  
台灣大學基因晶片分析研究中心 生物醫學基因分析組

# 即時疾病偵測及通報技術新突破

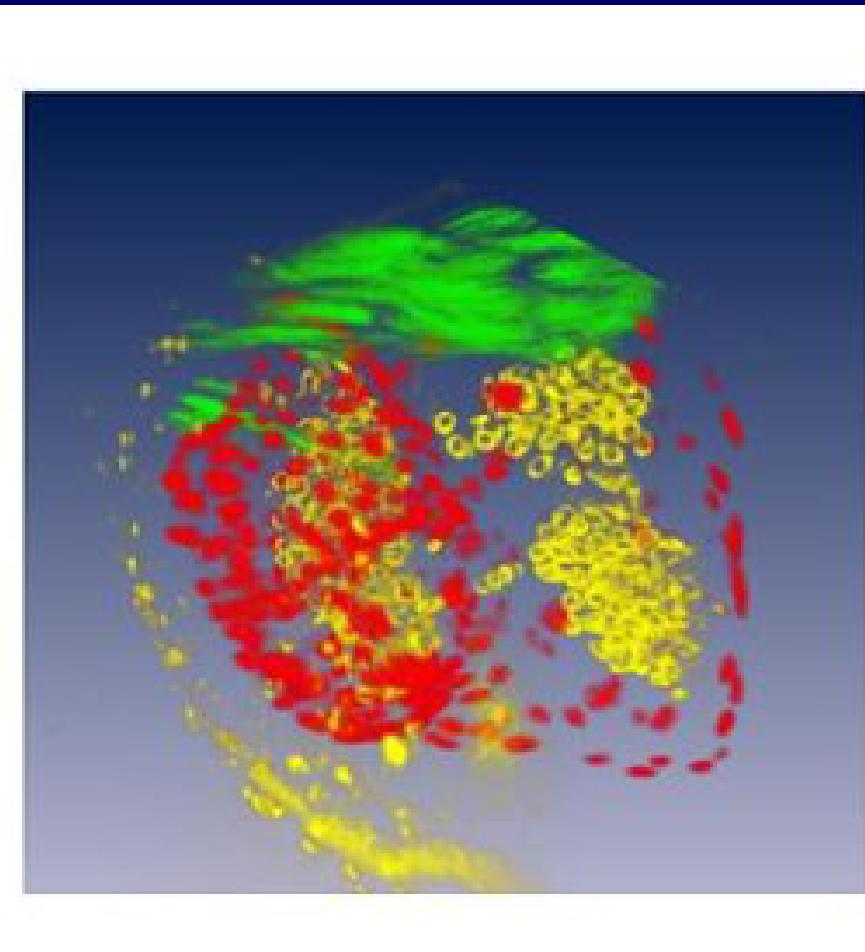
- 9/4/2006
- 台灣大學成果發表會：半導體和生醫技術的新結合--即時疾病偵測及通報技術新突破-開啟簡便可攜式/穿戴式健康監控的應用
- 發表人：呂學士教授



# 雷射、倍頻、新顯微術 胞的創新研究

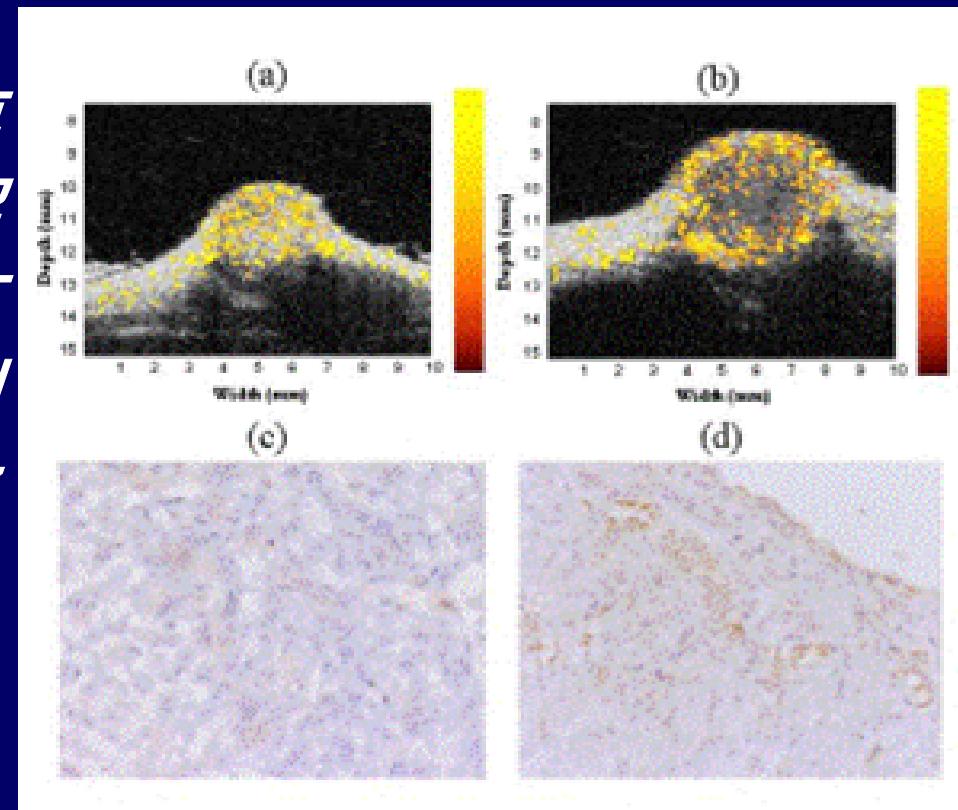
直接觀察活體內細

- 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



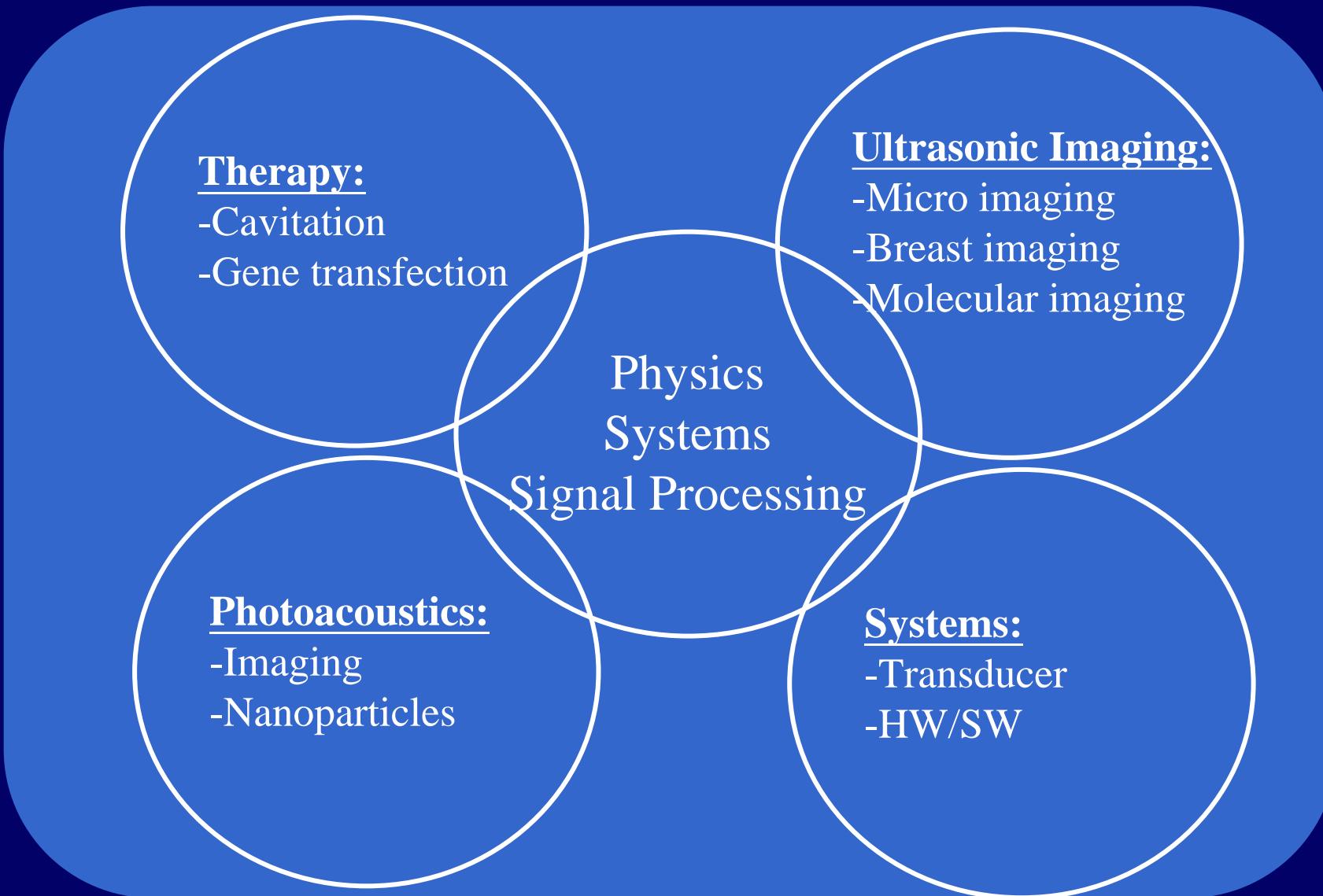
結合生物醫學與電子資訊科  
技已是前瞻研究趨勢！

# 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.

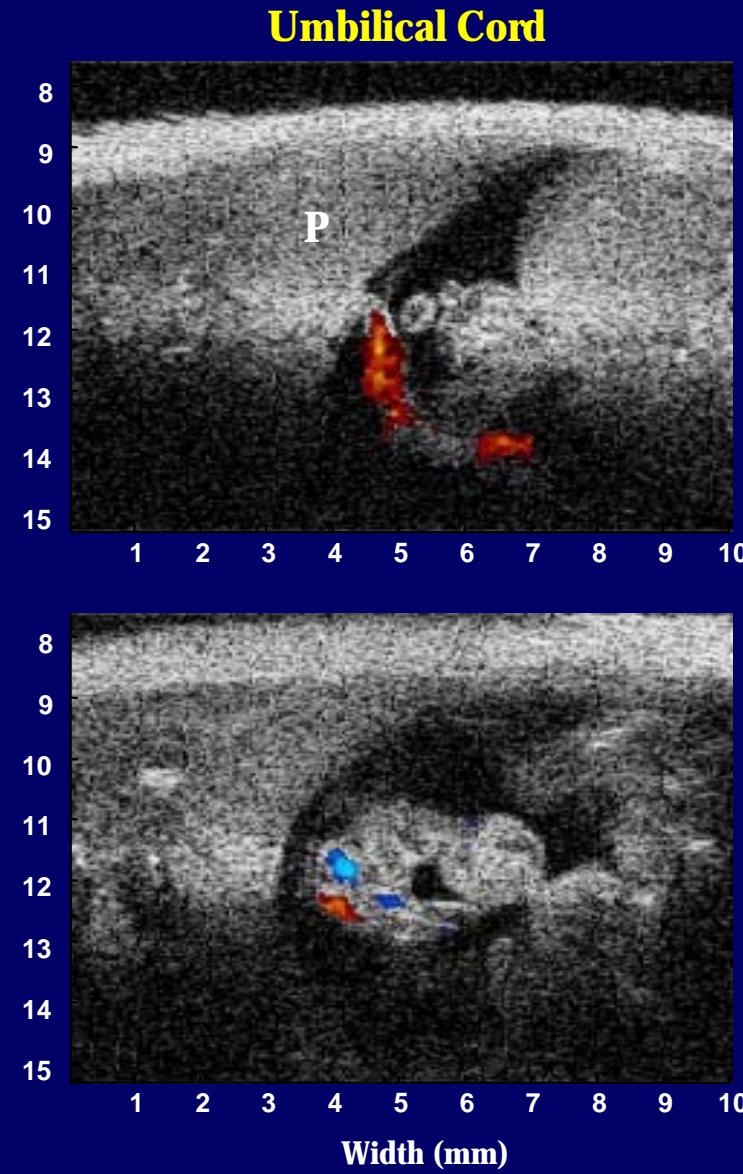
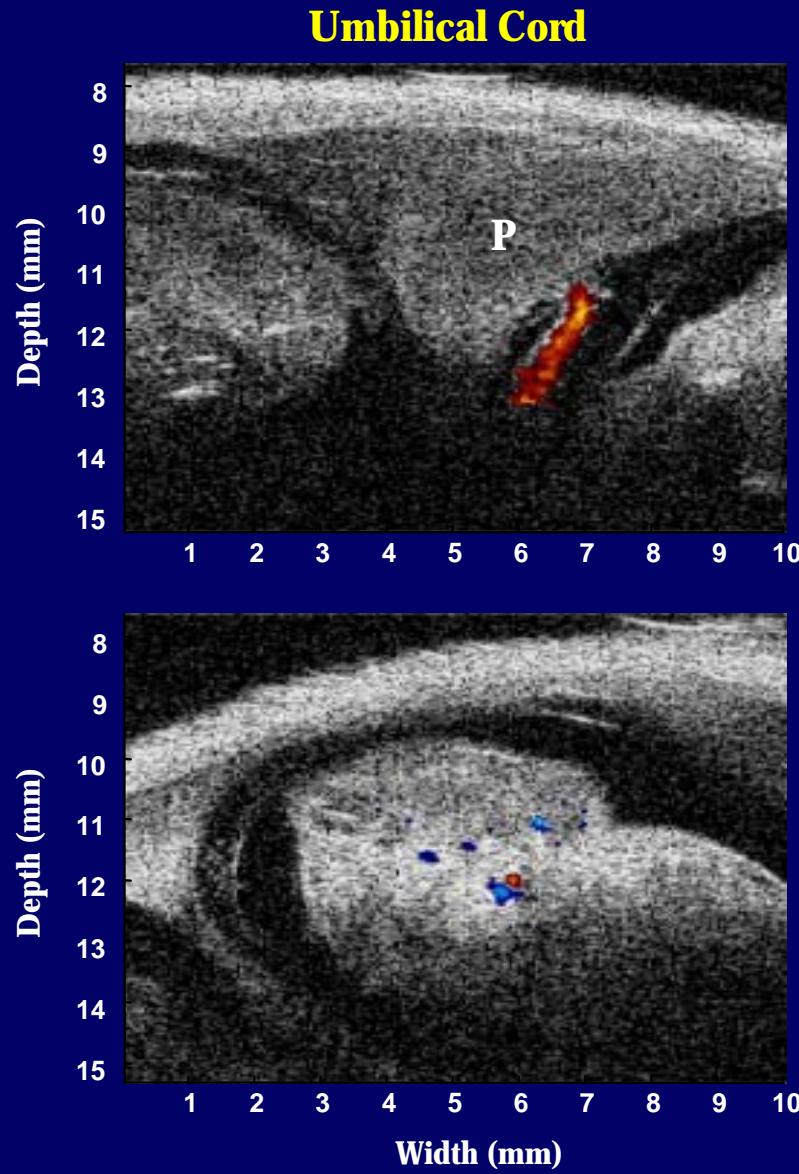


合作團隊：臺大醫學院、生命科學院、基因體中心、奈米中心、國家衛生院、成大、師大、中正、暨南，等單位。

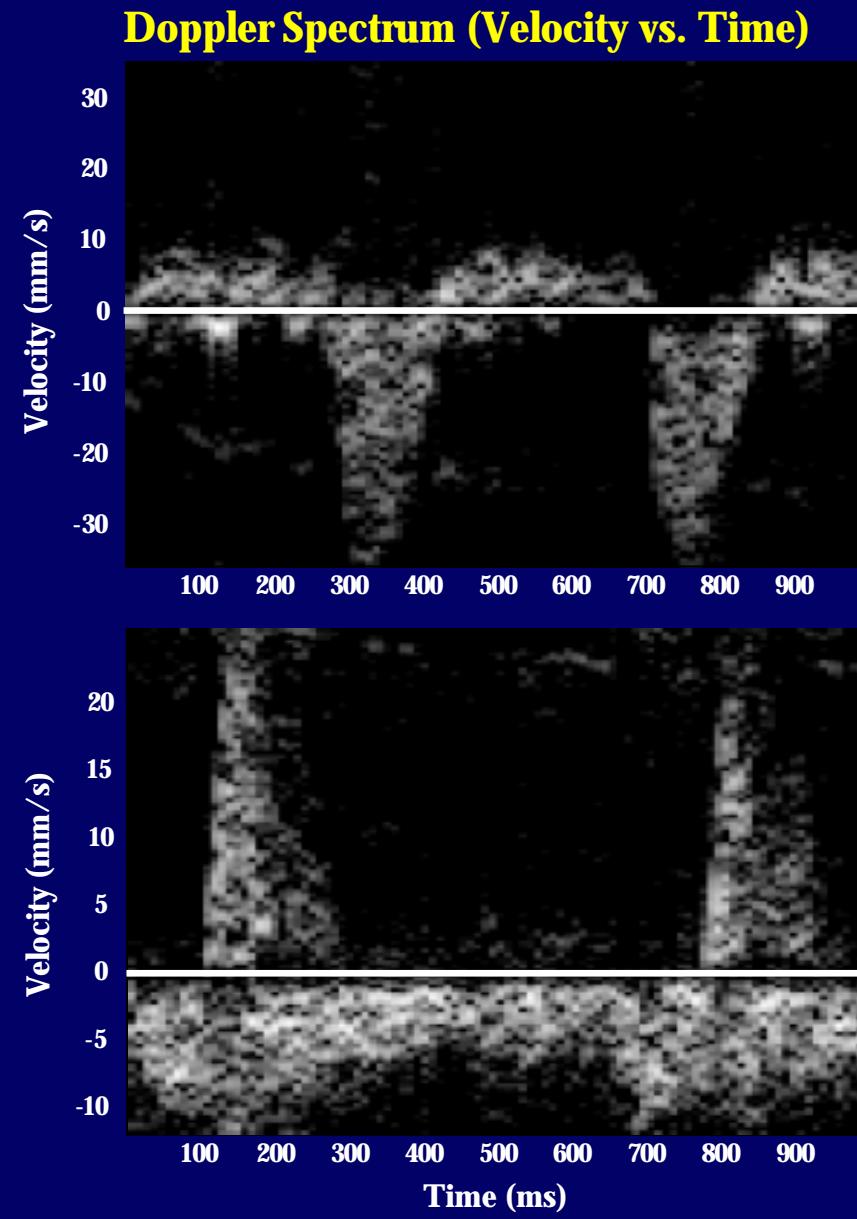
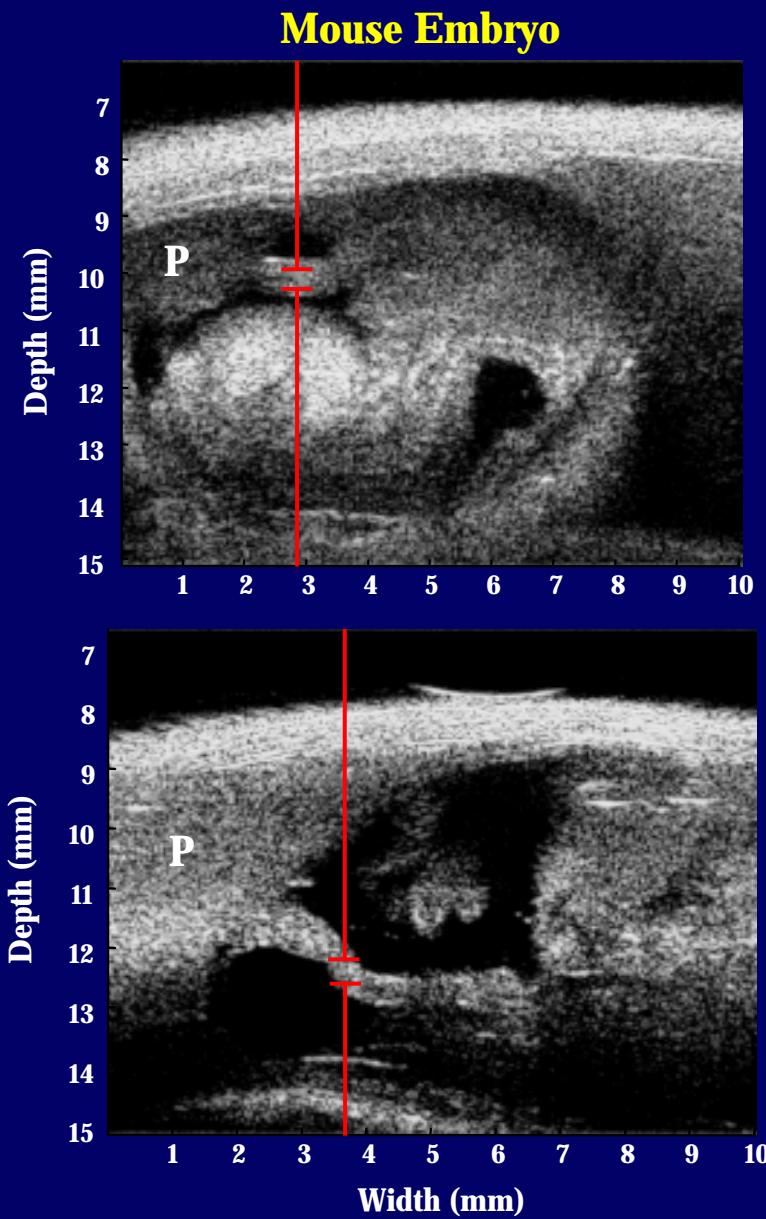
跨領域研究：電子、物理、醫學、生命科學、化學、奈米材料。

# Ultrasonic Micro-Imaging

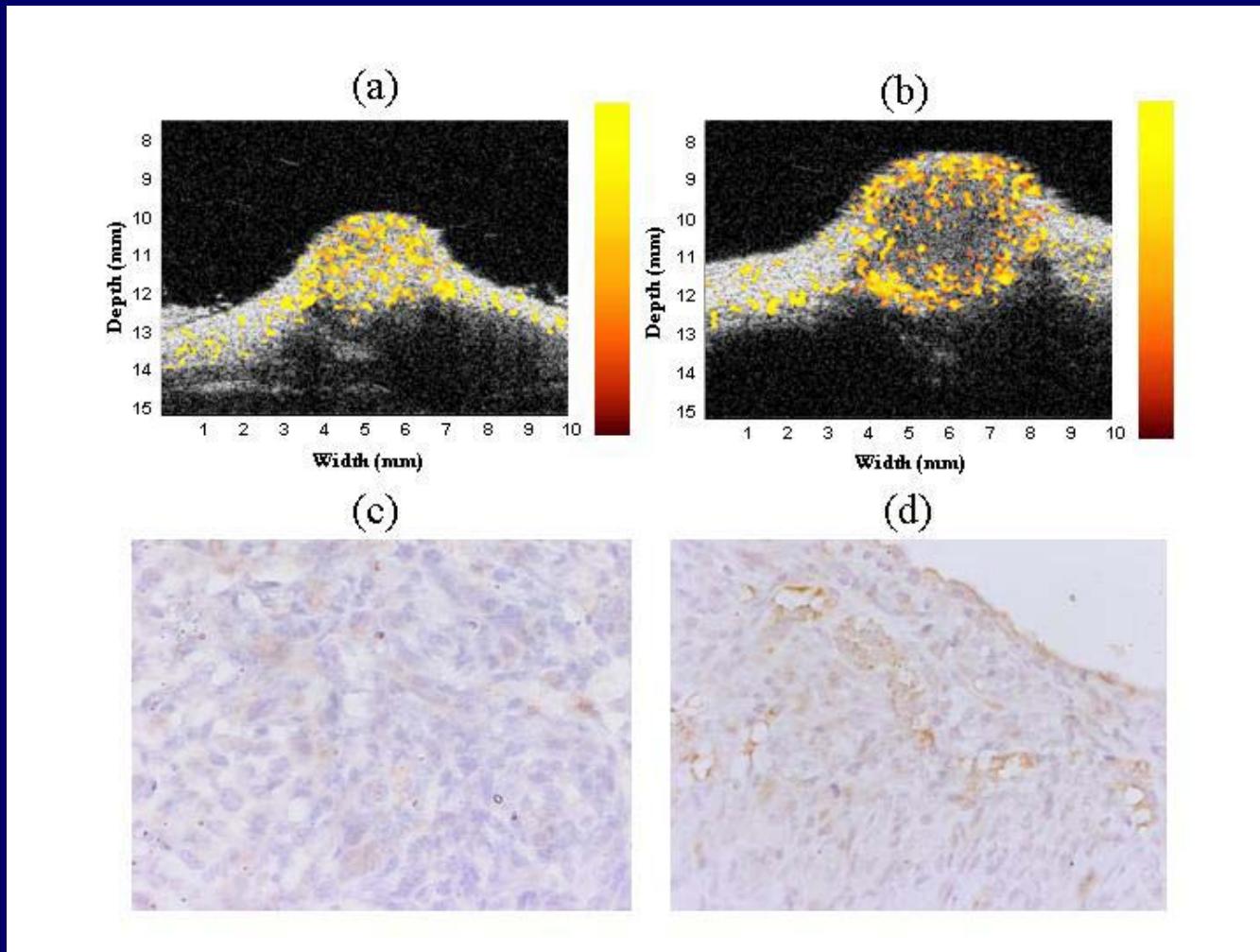
# Mouse Embryo Micro-Imaging



# Mouse Embryo Micro-Imaging



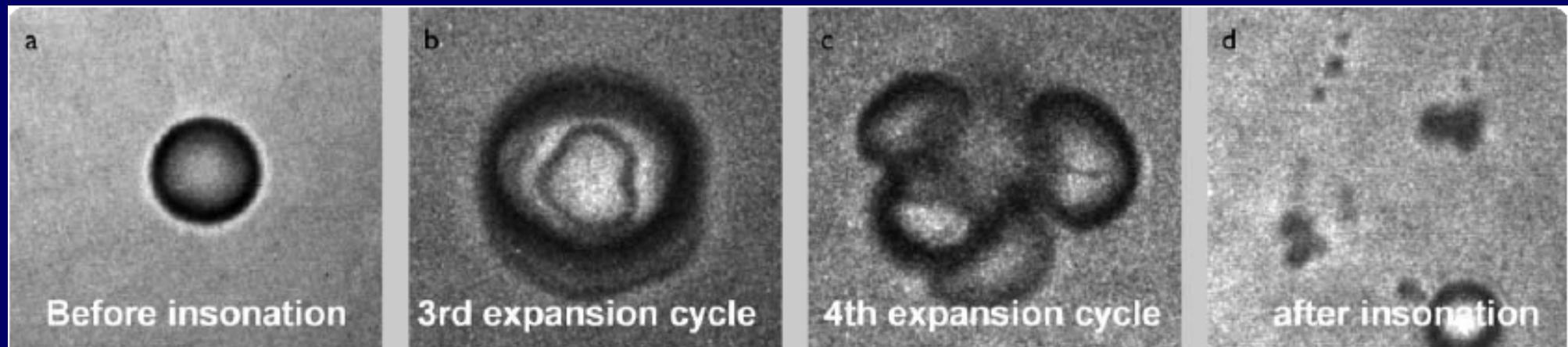
# Mouse Tumor Micro-Imaging



*Cover of IEEE Trans. on UFFC, Jan. 2004*

# Ultrasound Assisted Therapy

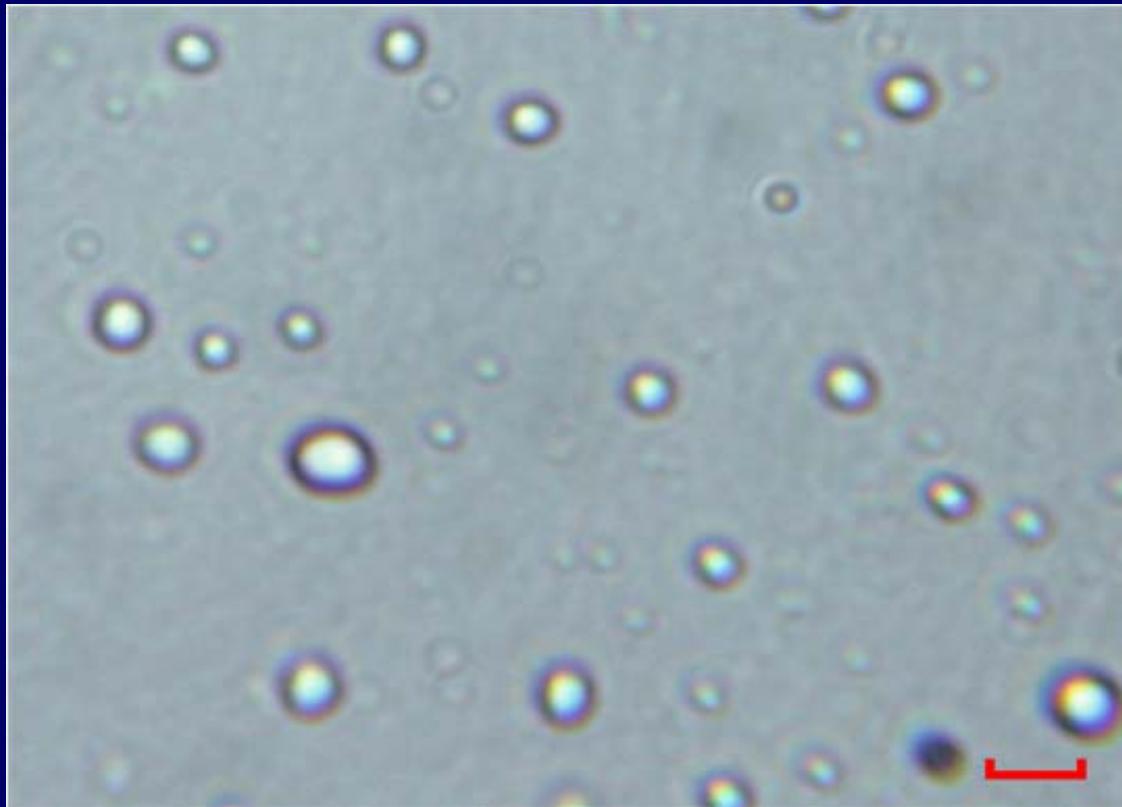
# Microbubbles and Cavitation



From UC Davis

# Liposome Microbubbles

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

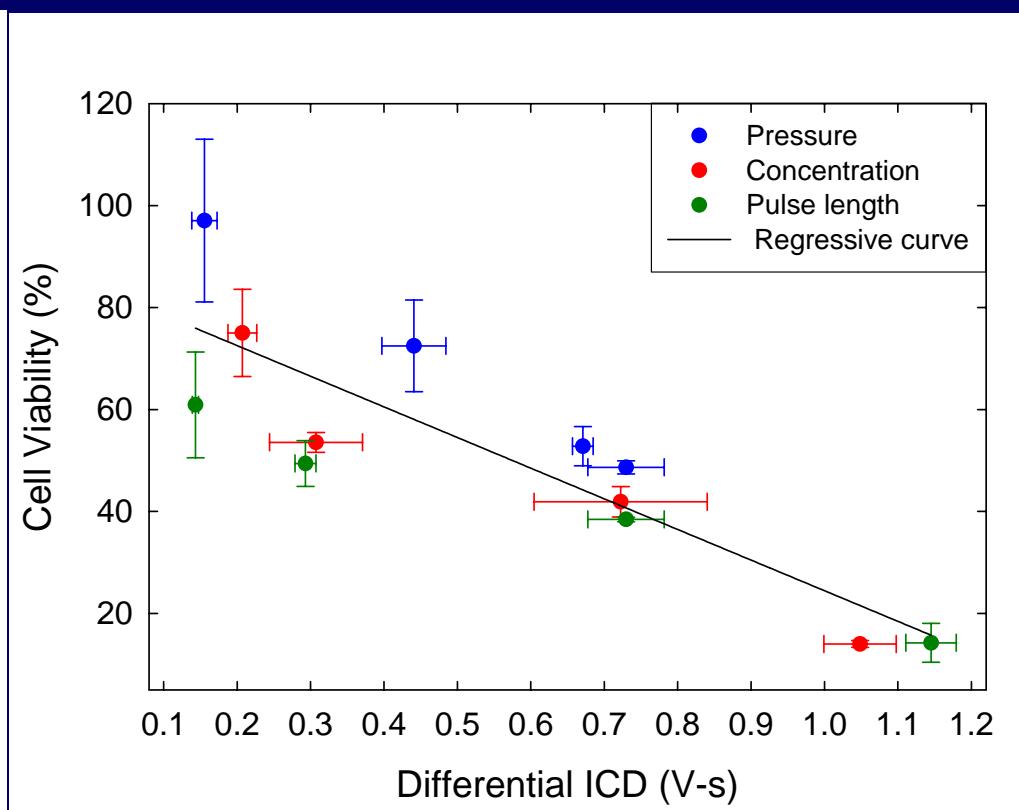
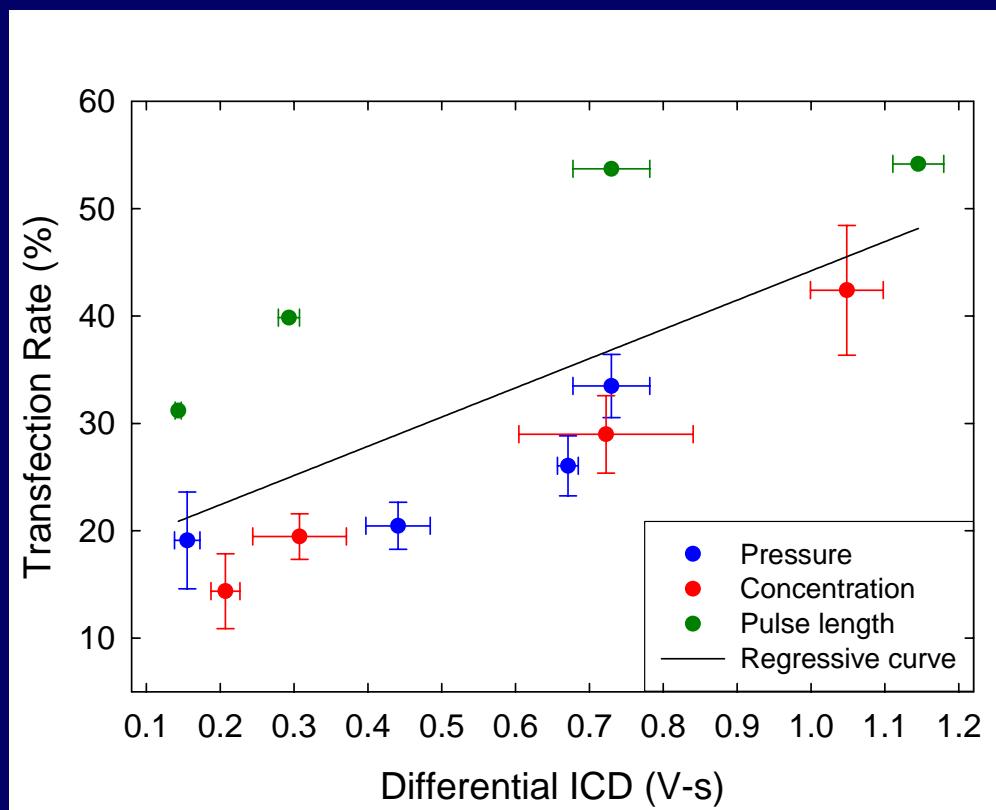


bar = 5 $\mu$ m

- B-mode image

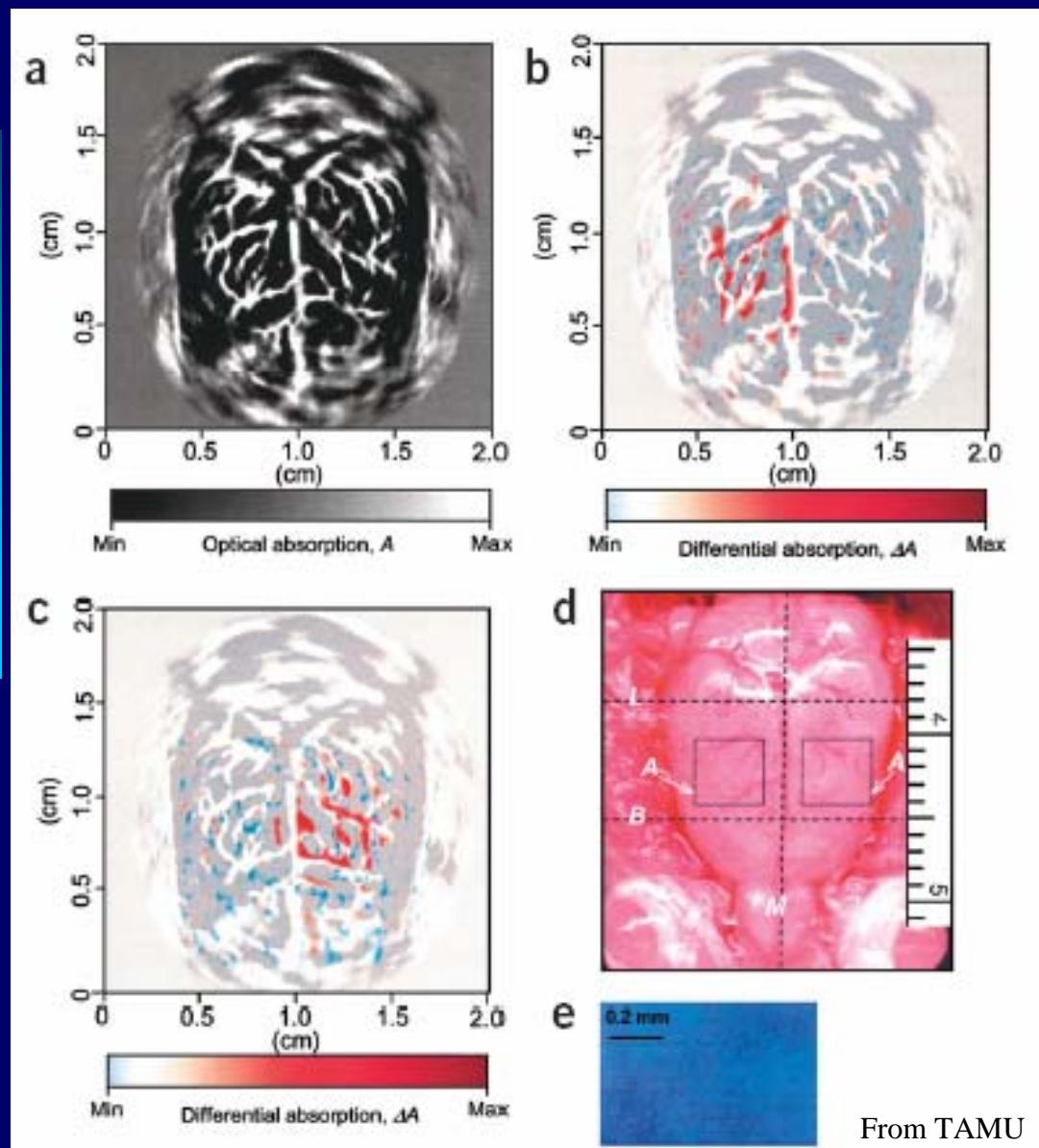
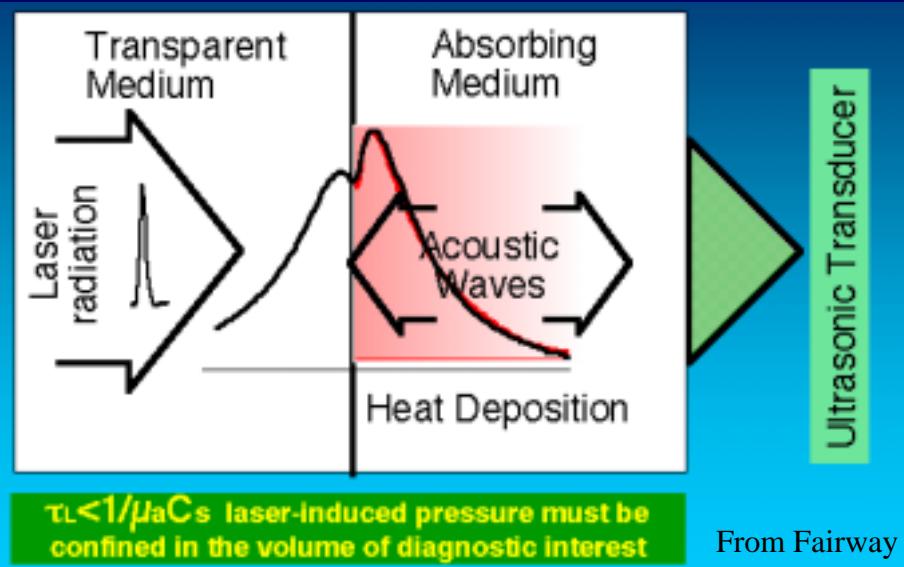


# Cavitation vs. Gene Transfection/Cell Viability



# Photoacoustic Imaging and Gold Nanoparticles

# Optoacoustic (Photoacoustic) Imaging

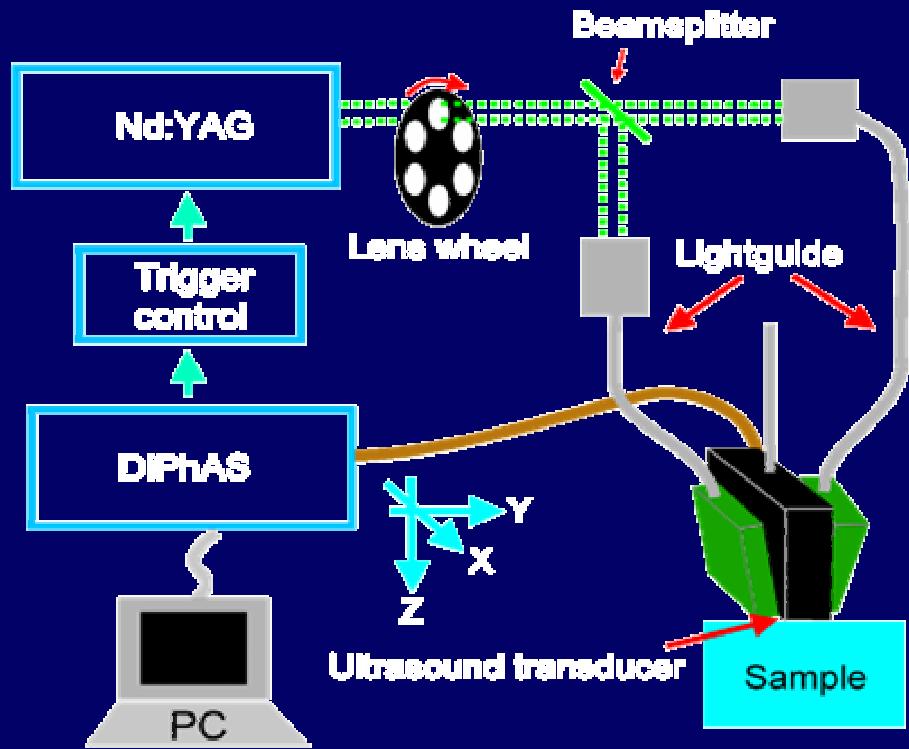


# Digital Phased Array System

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



# High frame rate photoacoustic imaging system



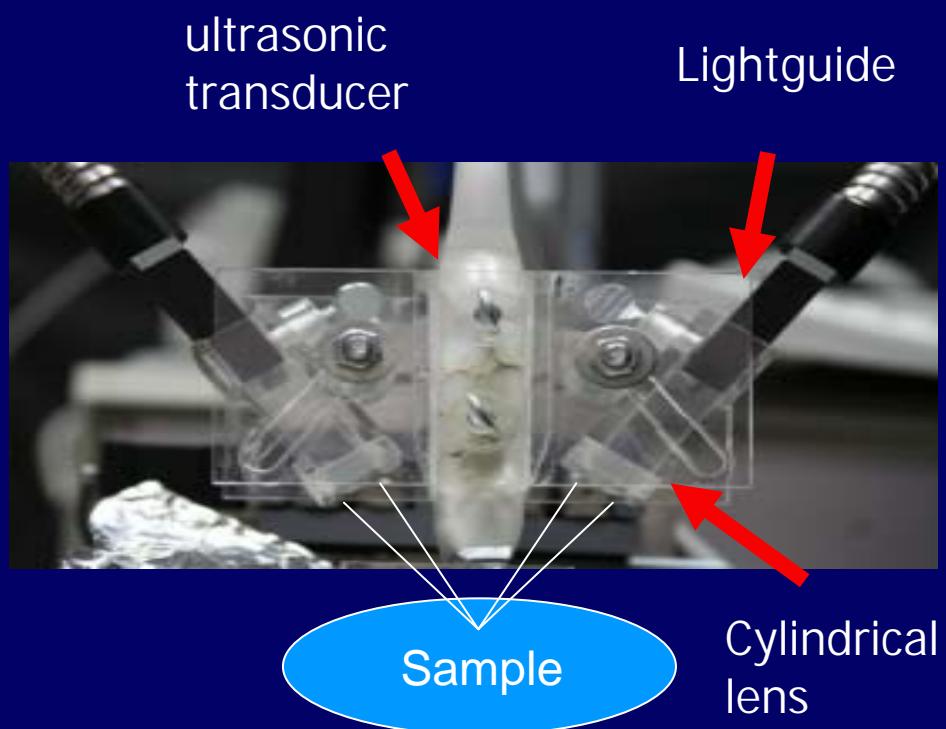
Laser system: Q-switched Nd:YAG

(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:

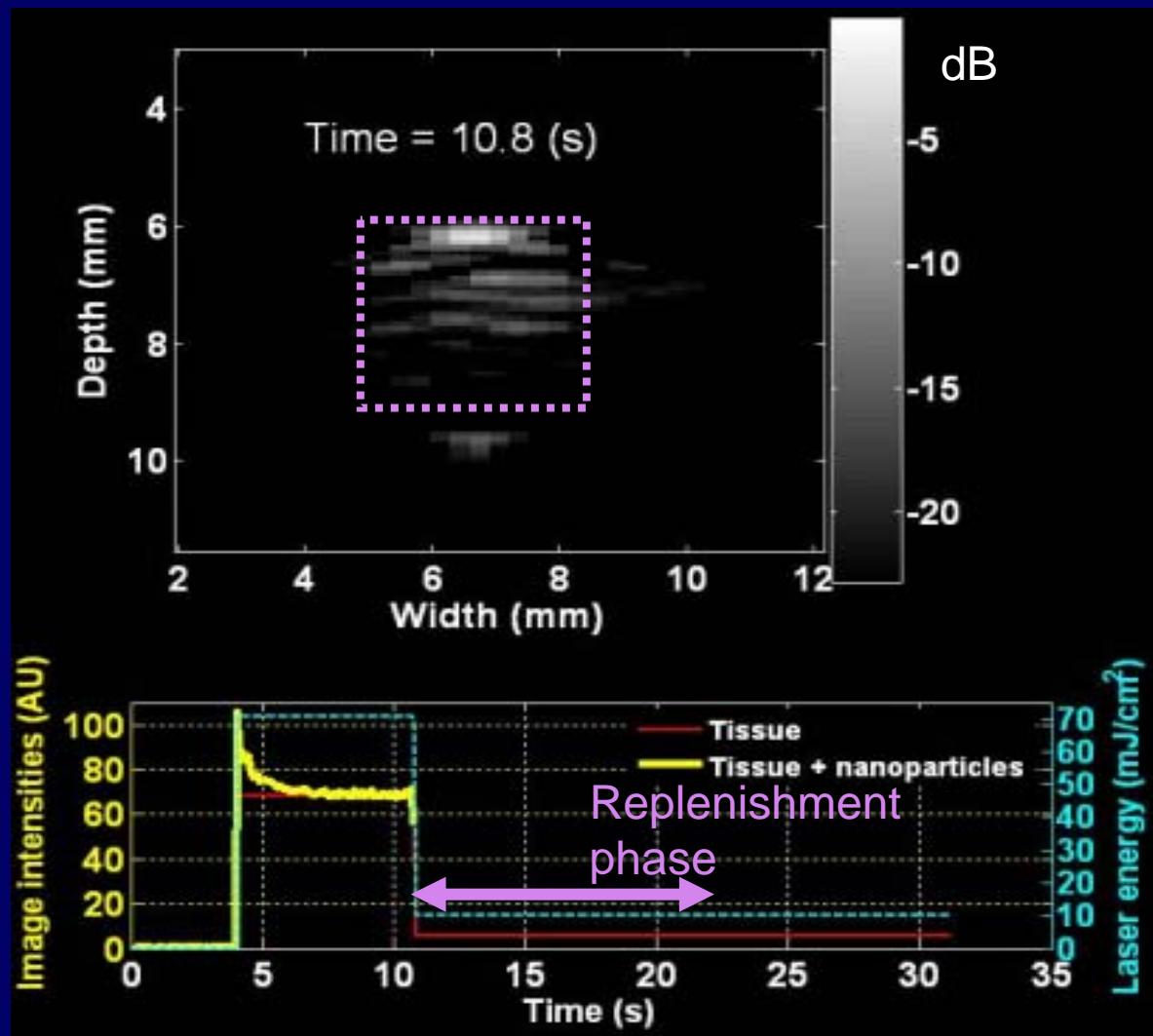
Optical: Light guide with cylindrical lens

Acoustic: Linear array with 128 channels

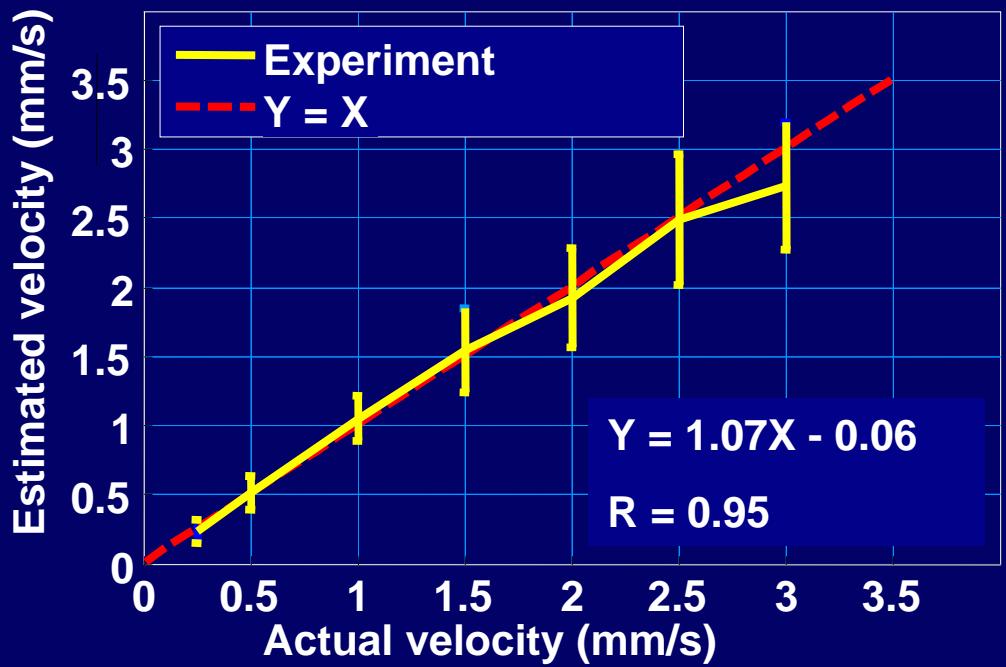
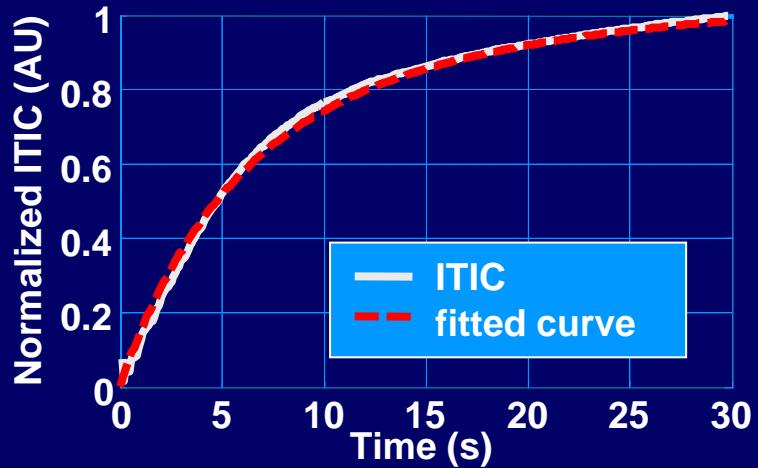
(pitch : **0.3 mm**,  $f_c = 5 \text{ MHz}$ )

Reflecting foil: **9  $\mu\text{m}$**

# Perfusion time-intensity measurements



# Results



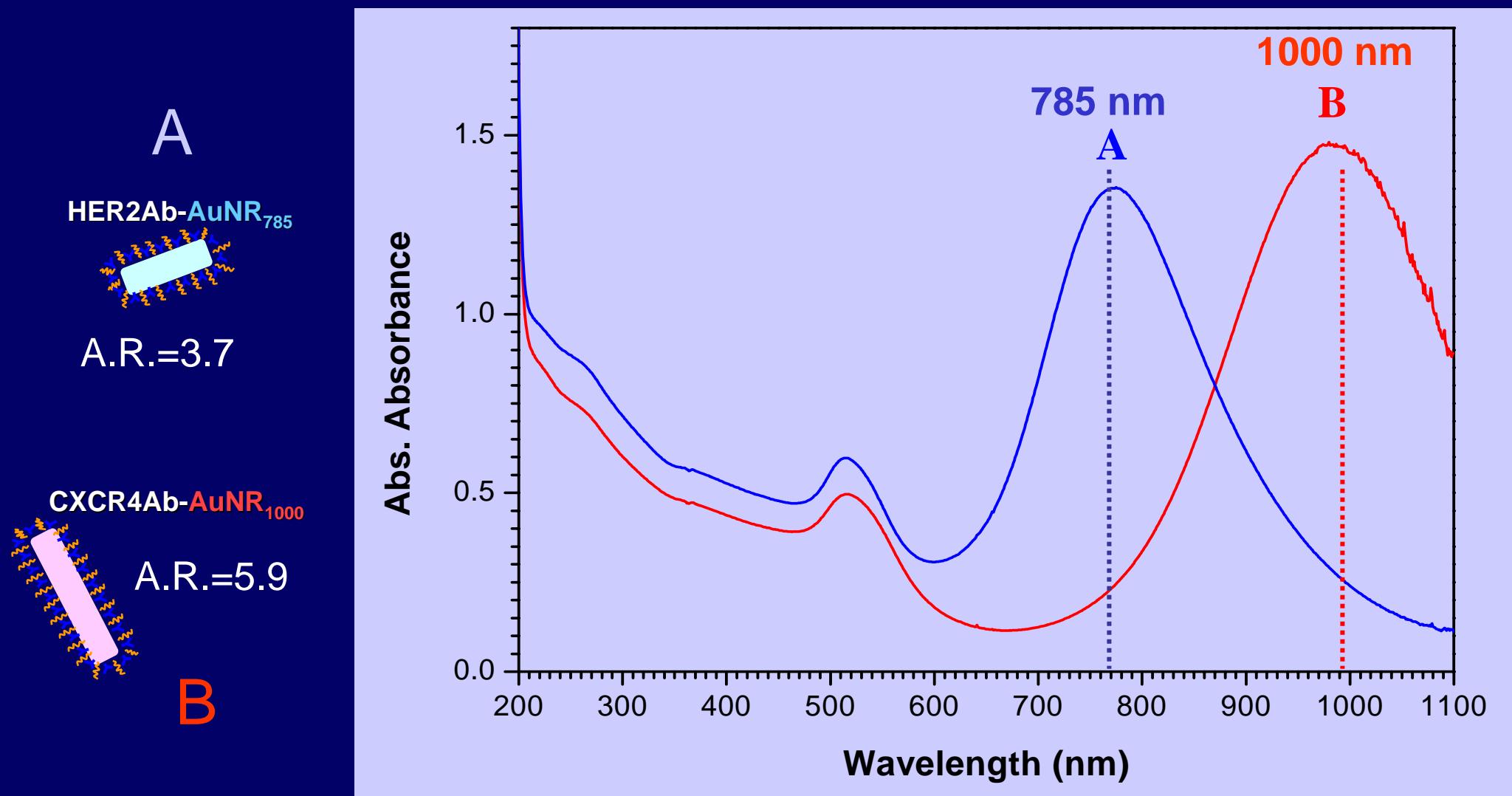
Flow velocities were calculated from the fitted curves.

Six measurements were performed at each flow velocity.

Estimated results show a high correlation with the actual velocities.

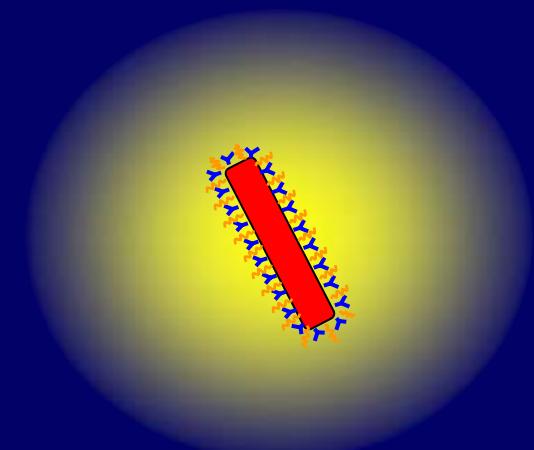
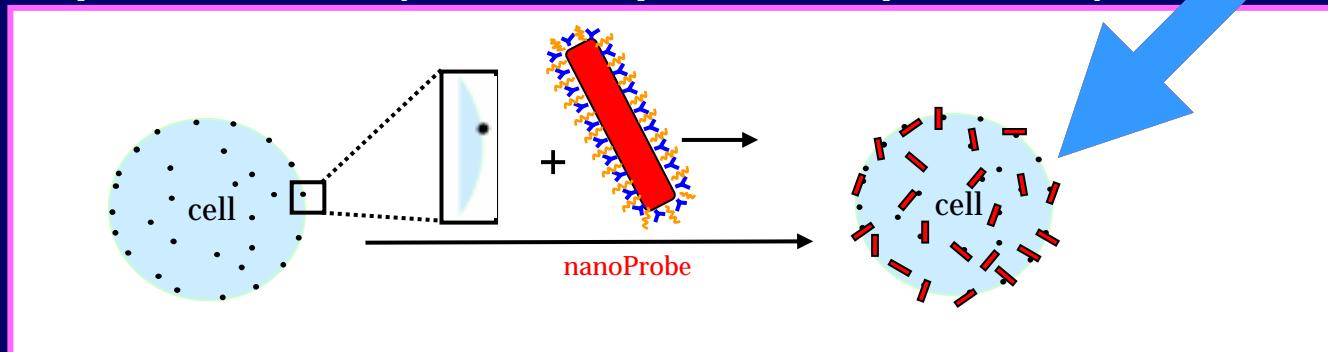
The correlation coefficient between the measured flow velocities and their linear regression fit is 0.95.

# Nanoprobe Designs (I)



# Multiple Selective Targeting for Both Imaging and Therapy

HepG2-WT cells (human hepatoma HepG2 cells)

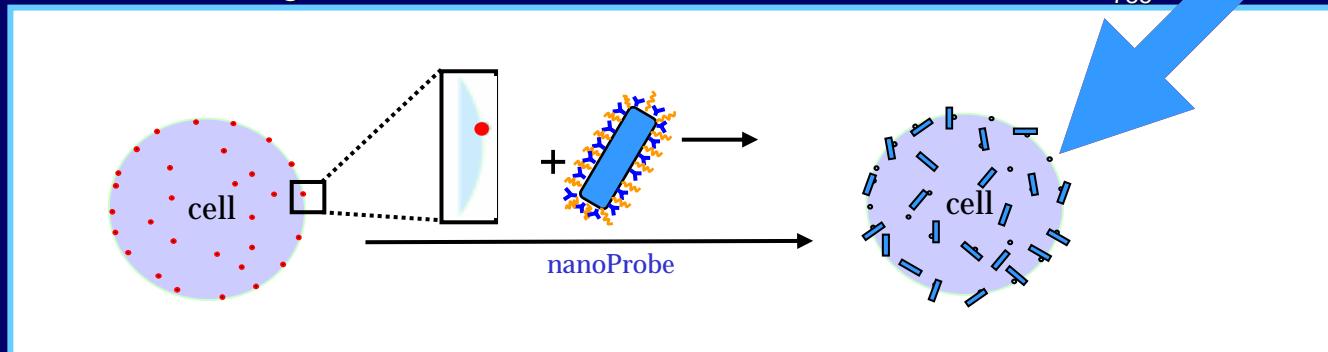


HepG2-CXCR4Ag

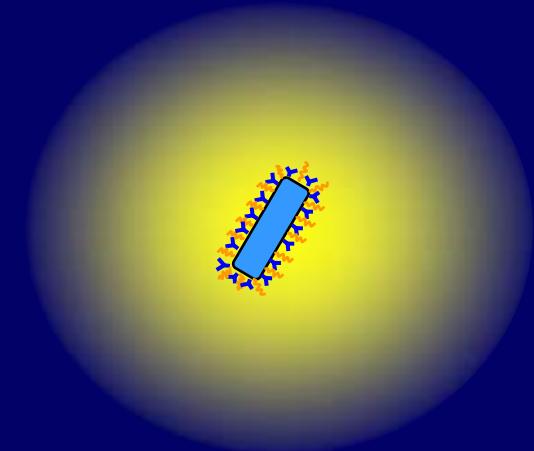
HepG2-CXCR4Ab-AnNR<sub>1000</sub>

MBT-Her2Ag

MBT-HER2Ab-AnNR<sub>785</sub>

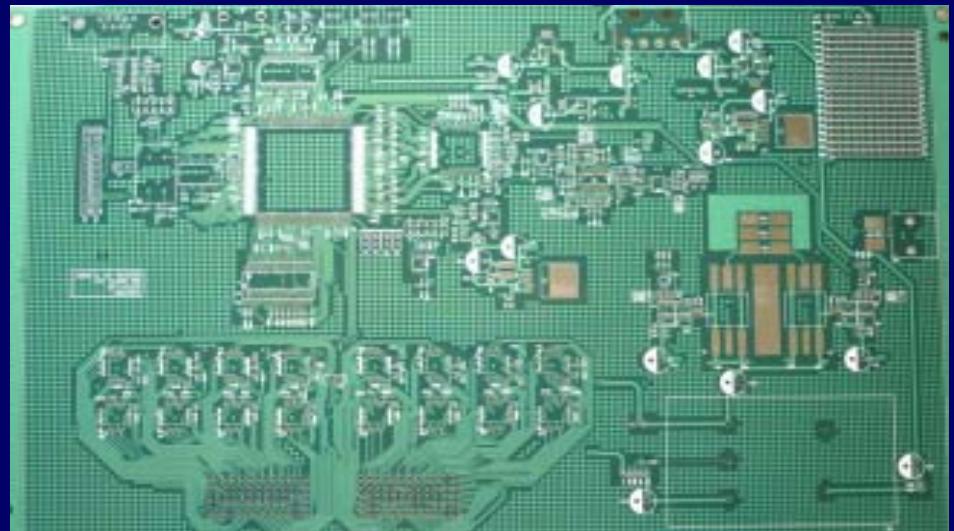
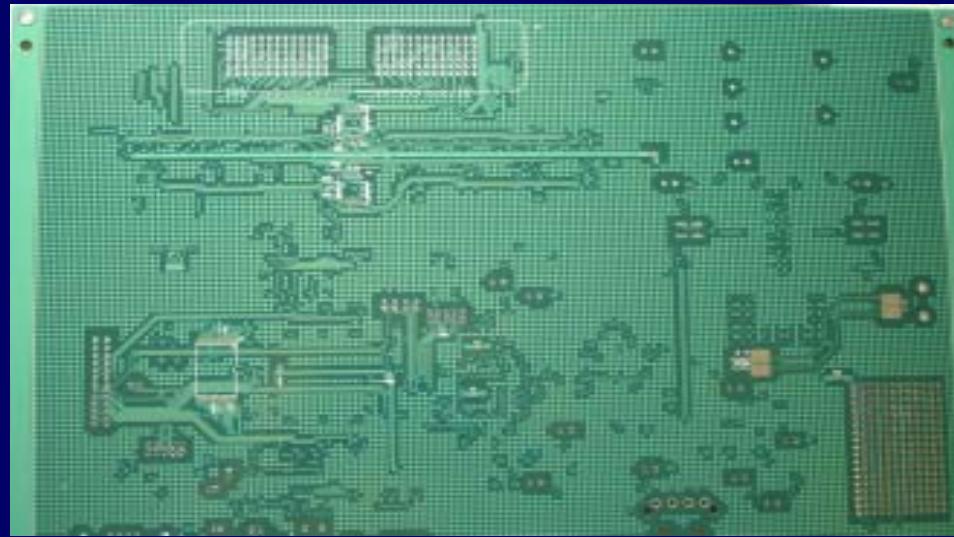


MBT-WT cells (murine bladder cancer cells)

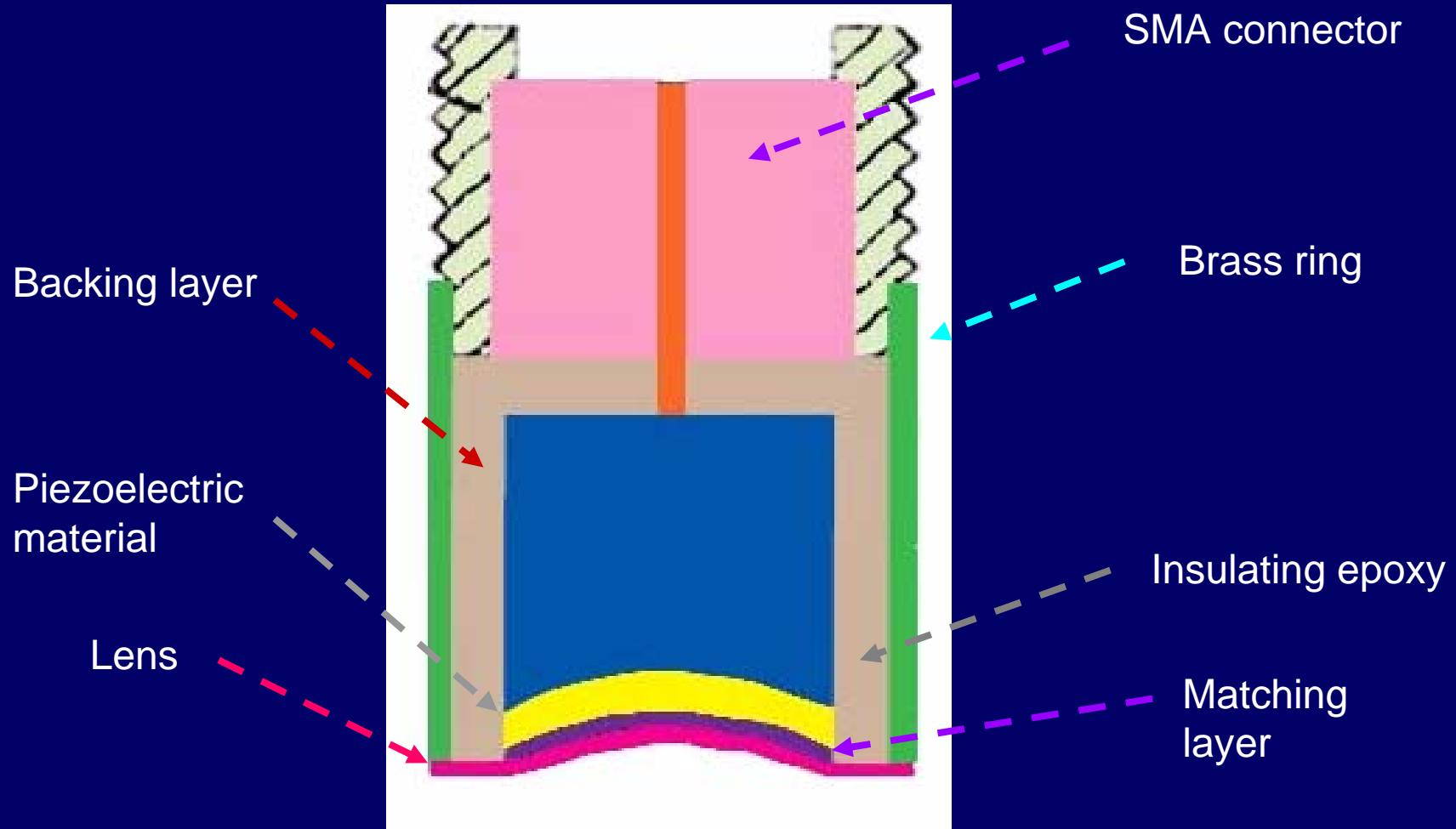


# Systems and Probes

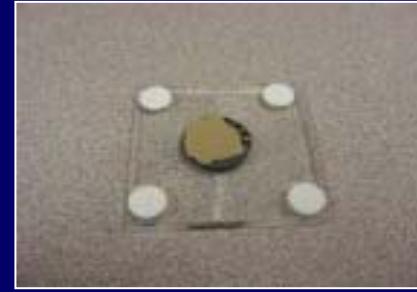
# System Development



# High Frequency Transducer



# High Frequency Transducer



# 跨領域研究

- 很有趣
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電機系的同學，在跨領域的環境中，發揮自己的專長

- nVIDIA for Medical Imaging
- 血管內的影像世界
- ,

# 聯絡方式

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- 02-33663551
- paichi@cc.ee.ntu.edu.tw
- <http://ultrasound.ee.ntu.edu.tw>
- 生物醫學超音波影像實驗室：電二303室、博理館529室、慶齡中心、展書樓、奈米中心、基因體中心