

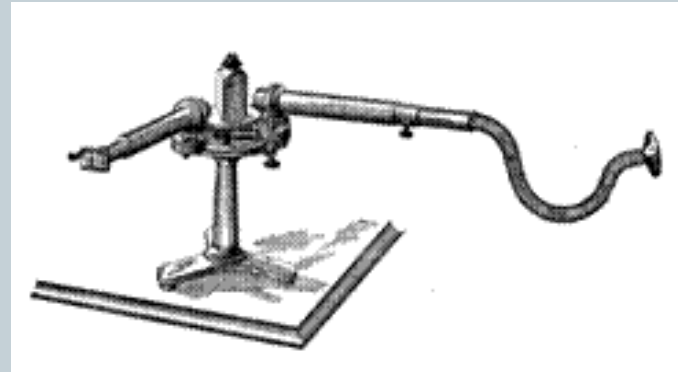
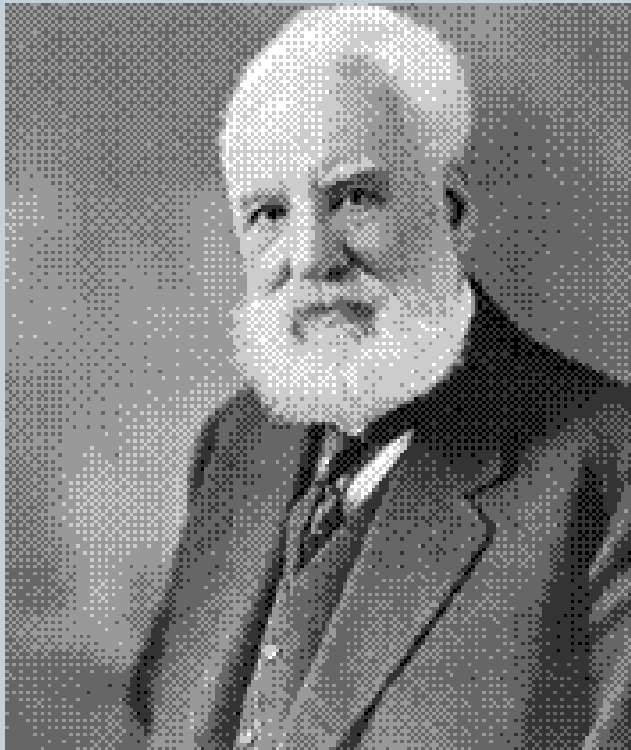
Multi-modality Photoacoustic/Ultrasonic Micro-Imaging: from Scientific Research to Product Development

1

PAI-CHI LI
NATIONAL TAIWAN UNIVERSITY

“Photophone”: Scientific Discovery

2

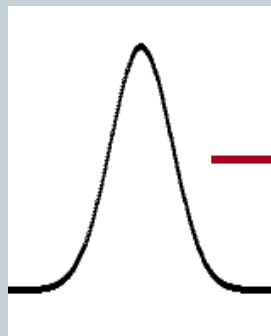


“Photophone”
Alexander Graham Bell, 1881

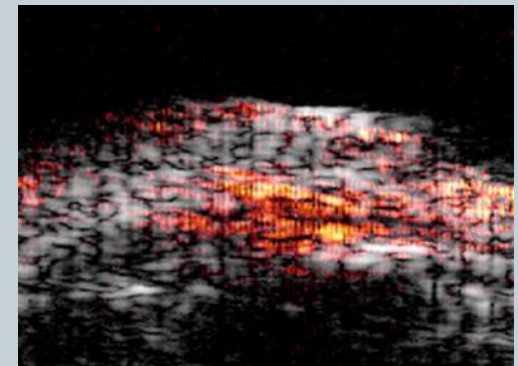
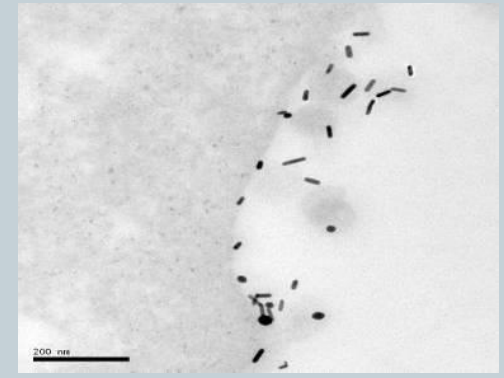
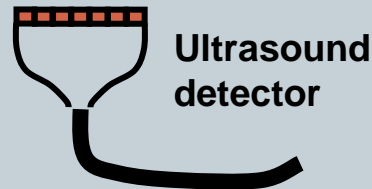
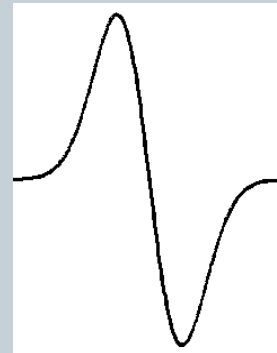
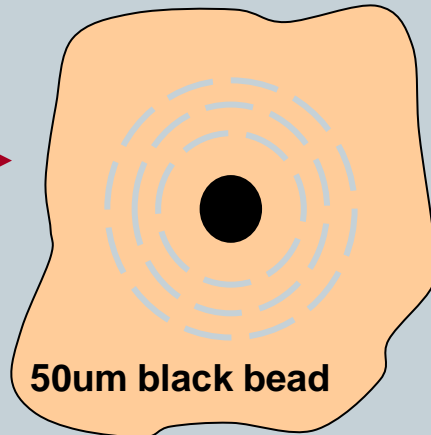
Light can be used to generate sound!

“Photoacoustics”: Biomedical Applications

3



Pulsed
Laser

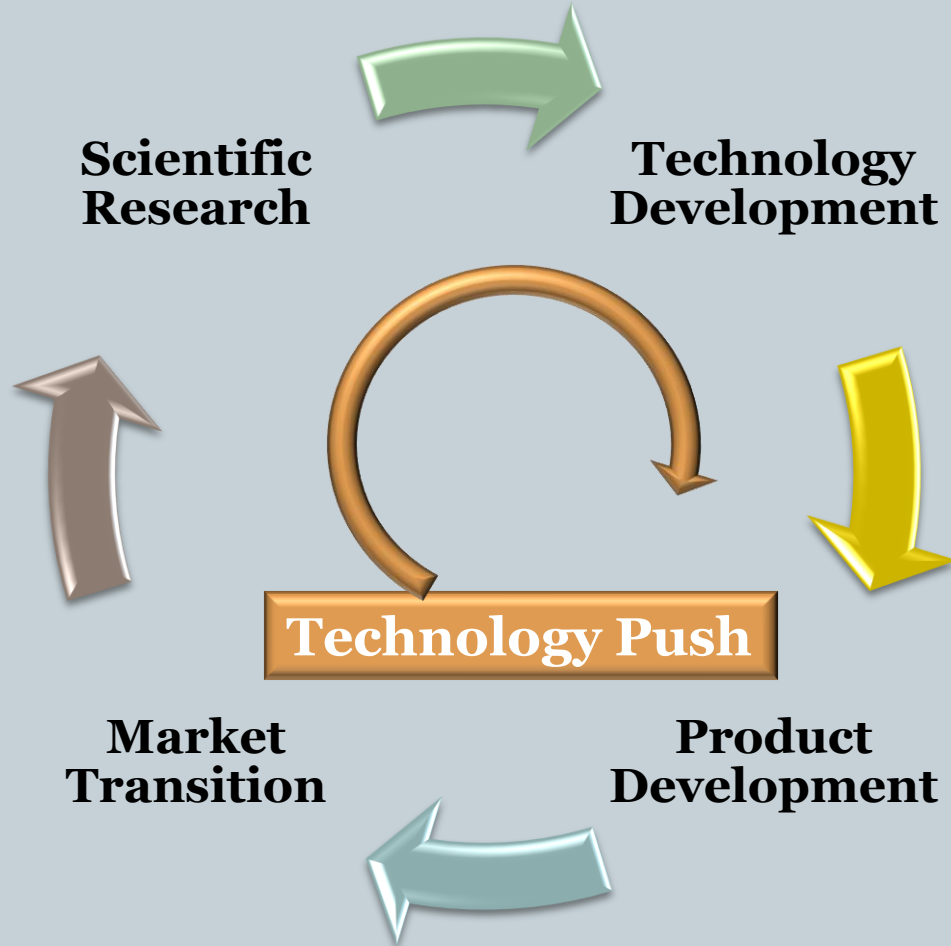


Molecular Imaging and Therapy

S. Emelianov, P.-C. Li and M. O'Donnell, *Physics Today*, pp. 34-39, May 2009.

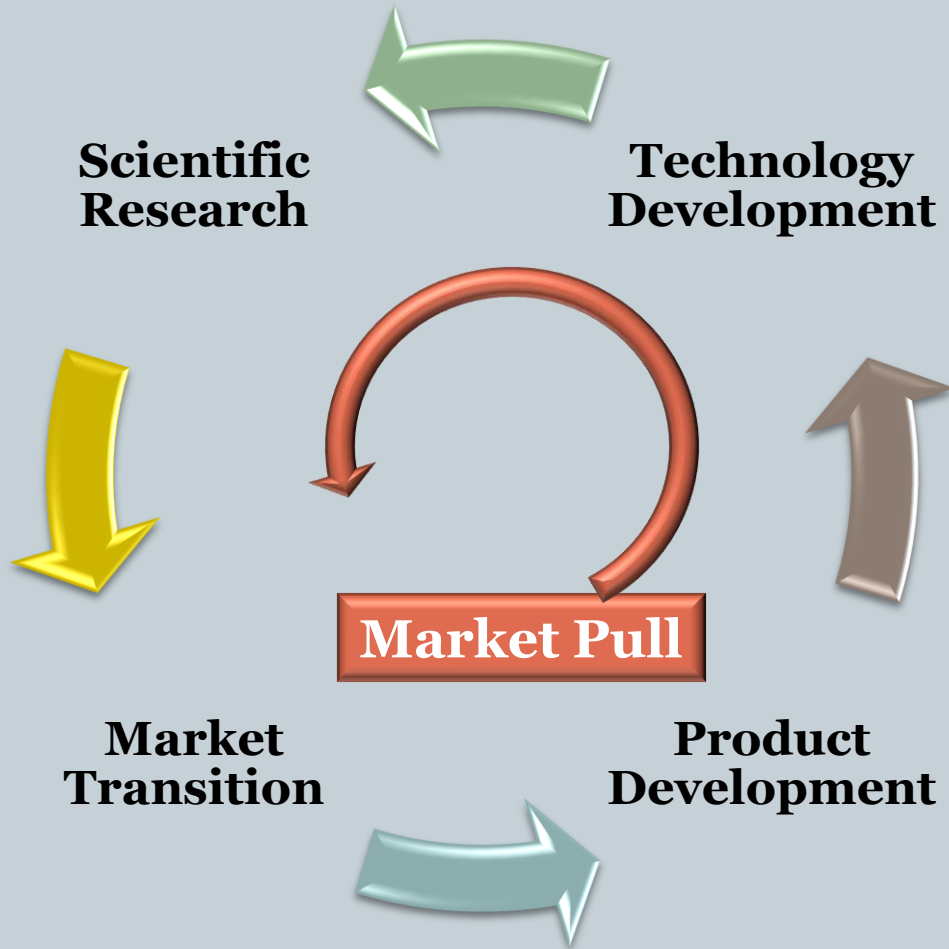
Scientific Discovery → Biomedical Applications

4



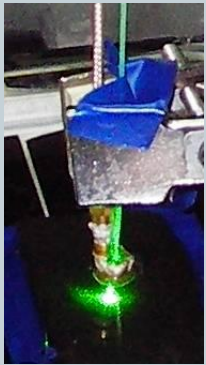
Scientific Discovery ← Biomedical Applications

5



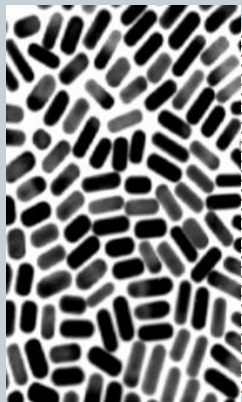
Technology Push

6



Pulsed laser for
stress/thermal
confinement

Ultrasound
array
technologies



Gold
nanoparticles

Powerful
computers



PCI
EXPRESS™

Foresight Taiwan-Phase 1

7

Common
technologies

Application
specific
technologies

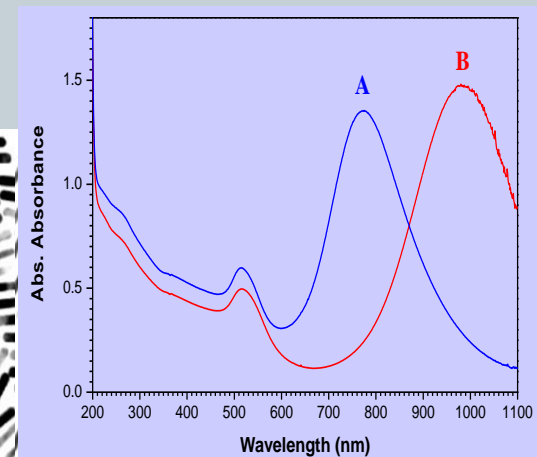
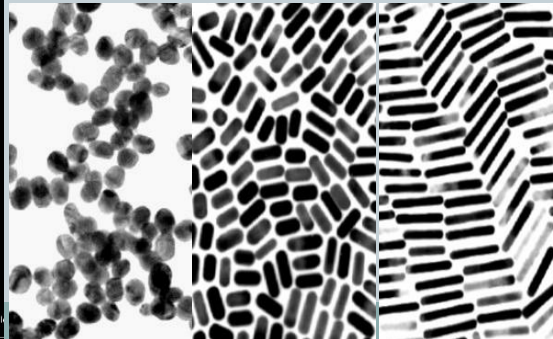
Theragnostics



Market Pull: Better Imaging Tools

8

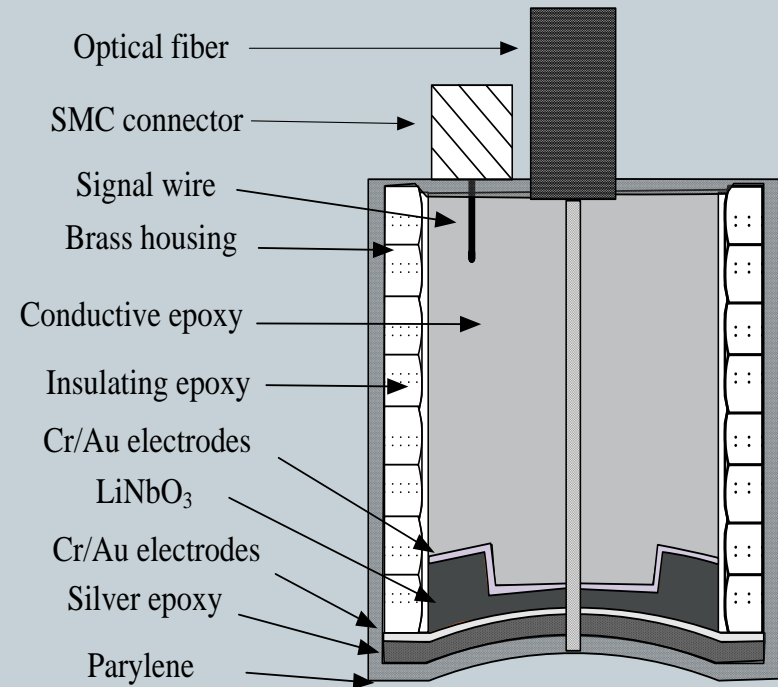
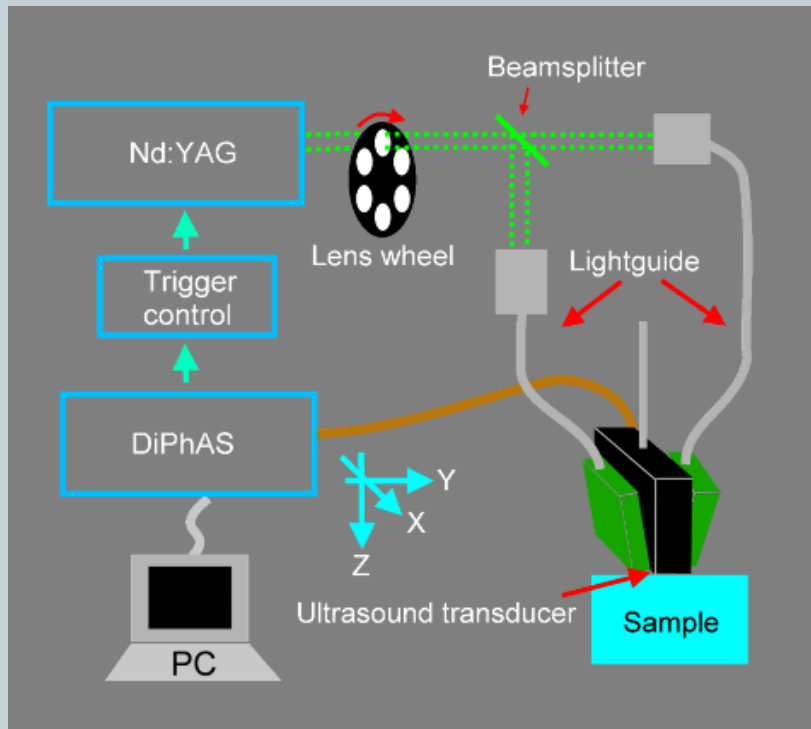
- Molecular imaging:
 - Imaging of molecular process
 - Early detection of disease
- Molecular imaging with multiple targets
 - For better diagnosis



Market Pull: Multimodality Imaging

9

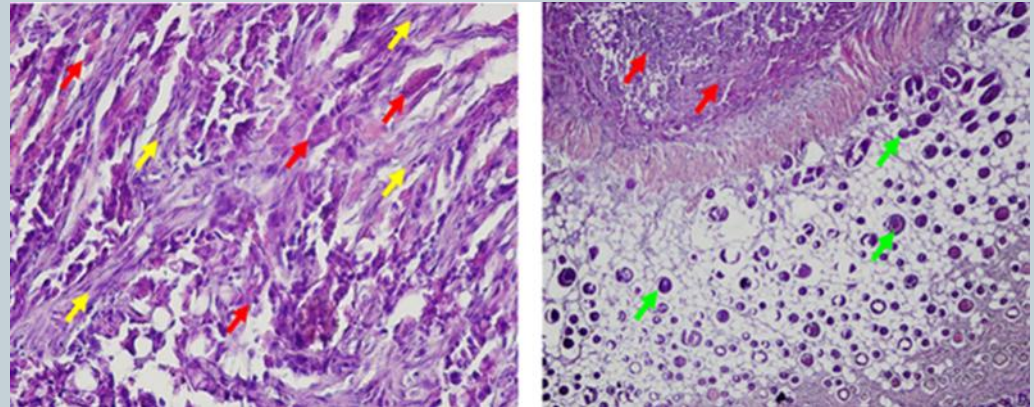
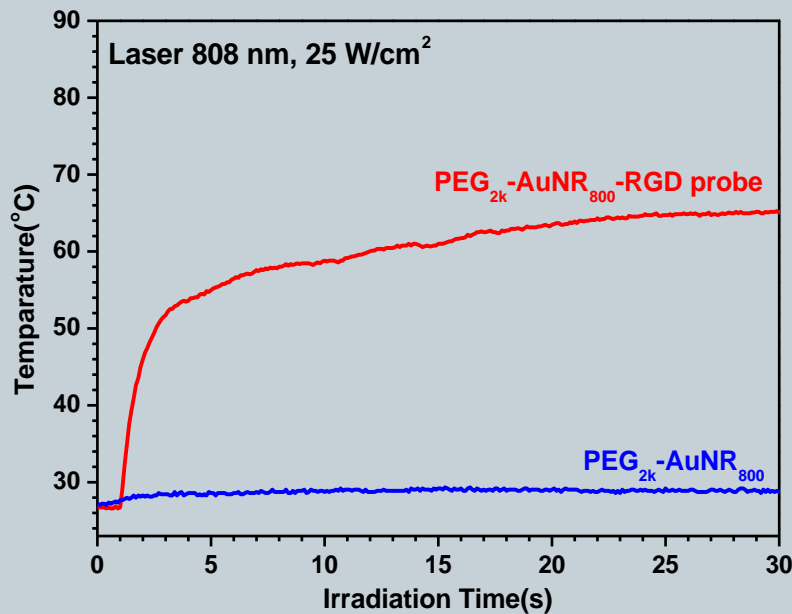
- Combine different imaging modalities.
 - Acquiring complementary information simultaneously.
 - Example: PET+CT, US+PA.



Market Pull: Targeted Therapy

10

- Targeted photothermal therapy was achieved simultaneously by irradiating nanorods attached to the surface of cancer cells.



Foresight Taiwan-Phase 2

11

Common
technologies

Application
specific
technologies

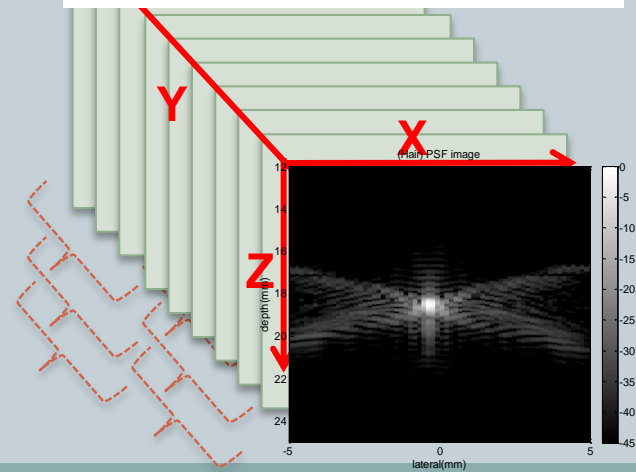
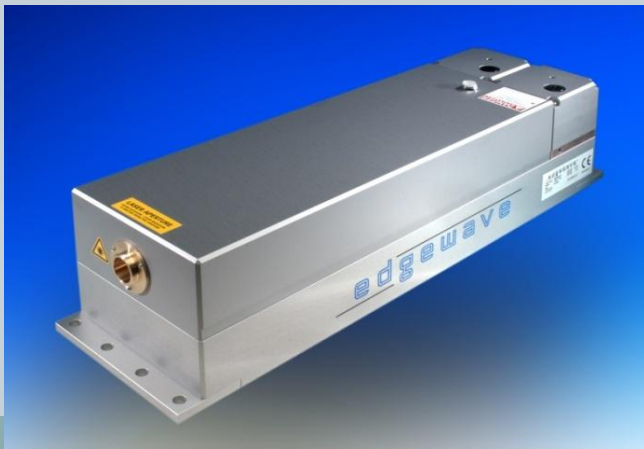
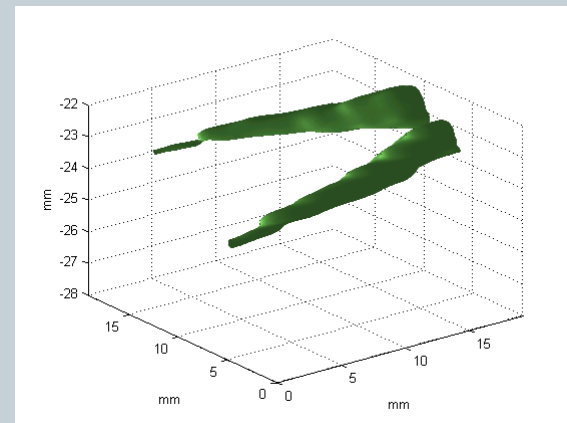
Theragnostics



Product Development Innovations

12

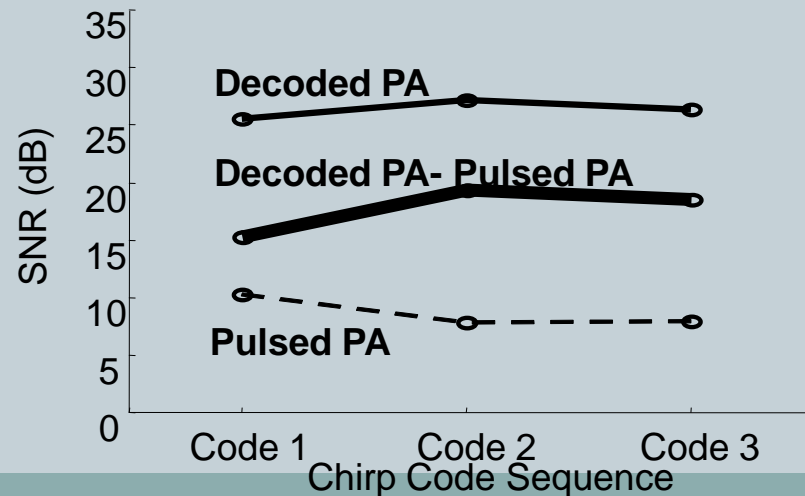
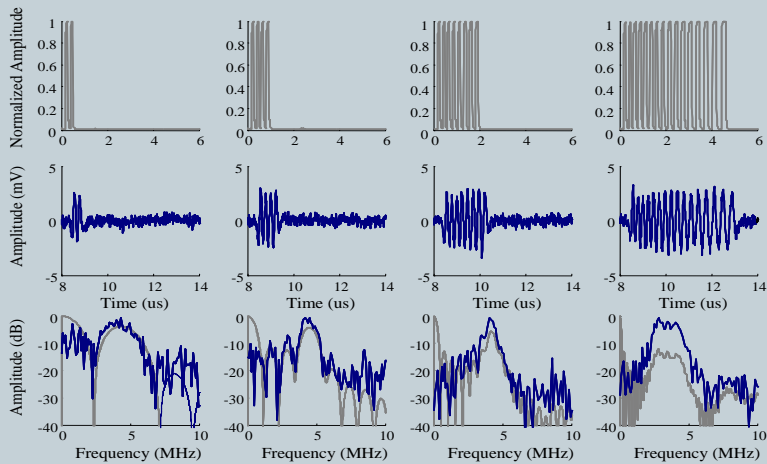
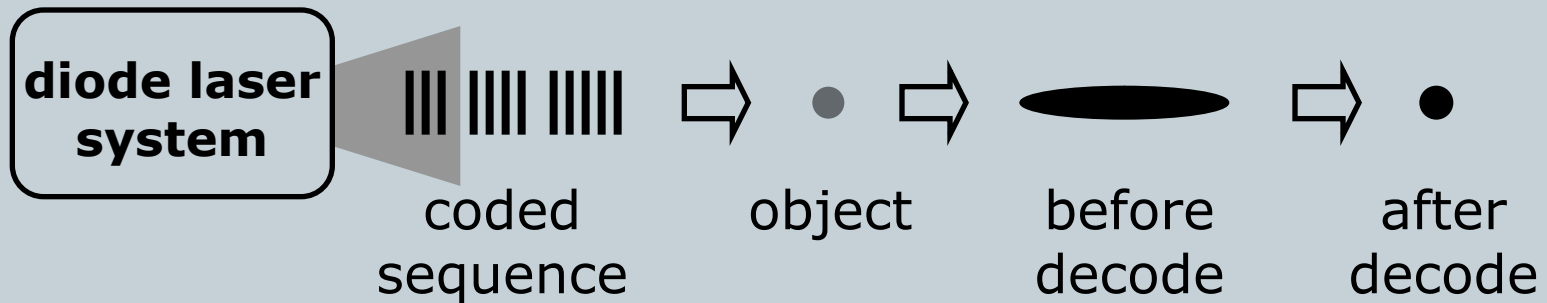
- Real-time 3D photoacoustic imaging



Product Development Innovations

13

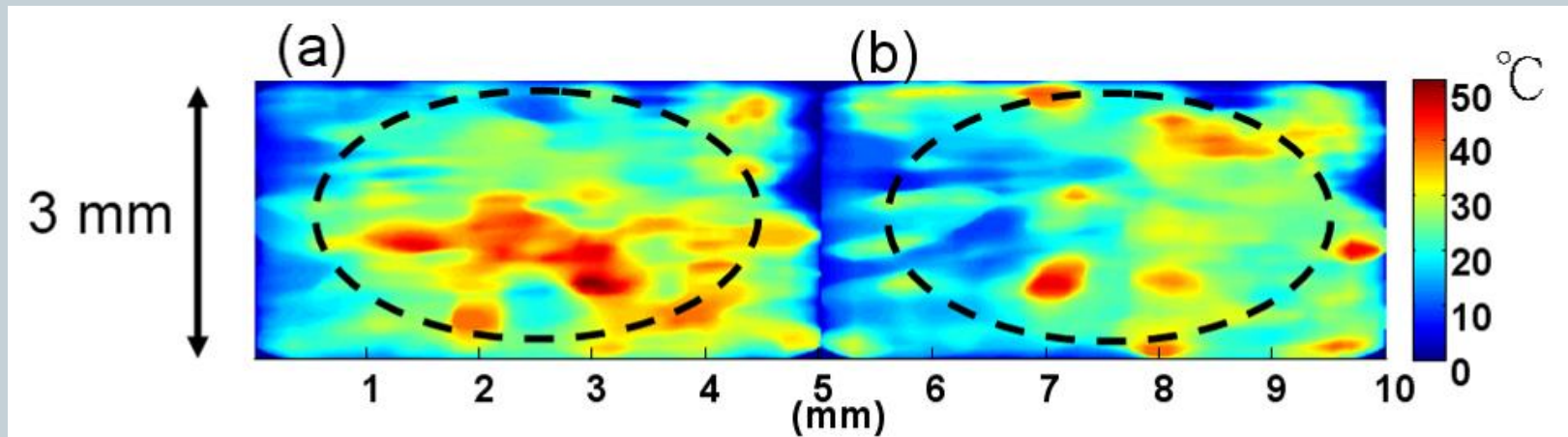
- Cheap diode laser to replace expensive solid state laser:
 - Coded excitation



Product Development Innovations

14

- Real-time temperature monitoring for thermal therapy



Key Success Factors

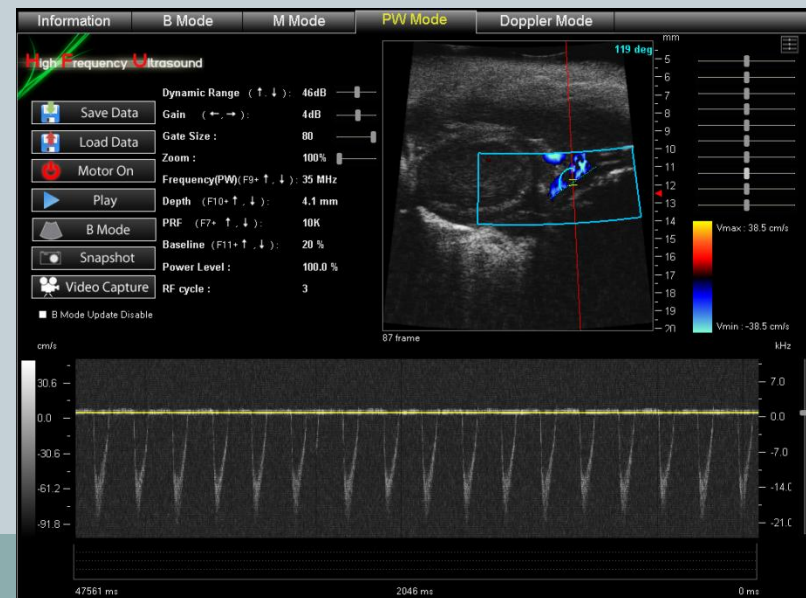
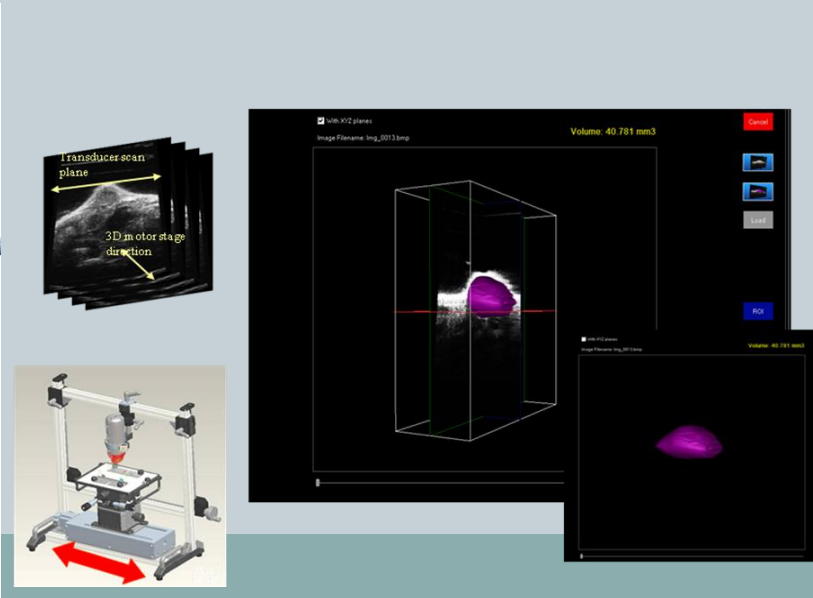
15

- **Integration**
 - Multi-disciplines
 - Technologies
- **Innovations with applications in mind**
 - Un-met needs
 - For people who do not have to understand the technologies
- **Infrastructure**
 - Foresight Taiwan
 - Entrepreneurship

Entrepreneurship: Personal Experiences

16

- Mission: To provide a high performance imaging system for pre-clinical research.
- Technology transfer → Team build → “brand labeling” for world-class brand company.
- An entry to high-end biomedical devices for Taiwan.



Conclusions: A Professor's Perspectives



- If you build the infrastructure, innovations will come.

Scientific
Research

Engineering

Technology
Transfer

Business
Development

Innovation

Integration

Infrastructure



Thank you!