

Photonic Integrated Circuits (PICs) and Their Biomedical Applications

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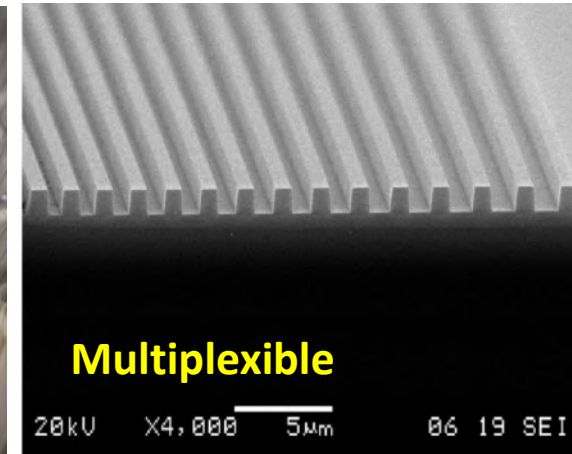
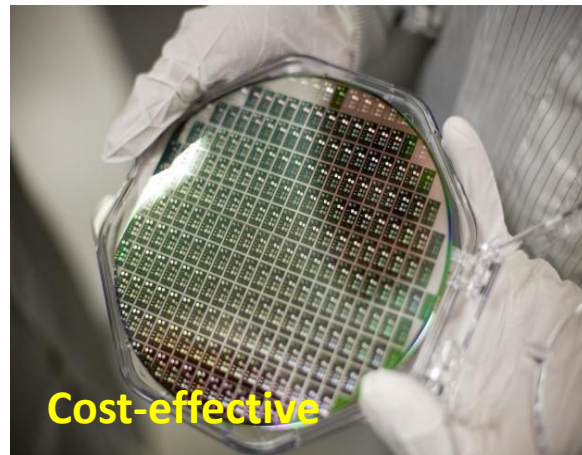
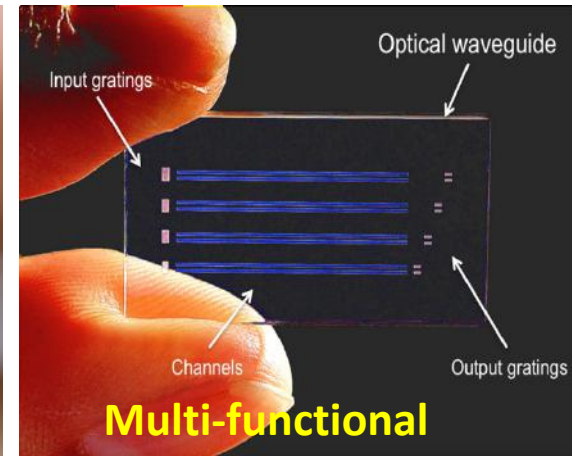
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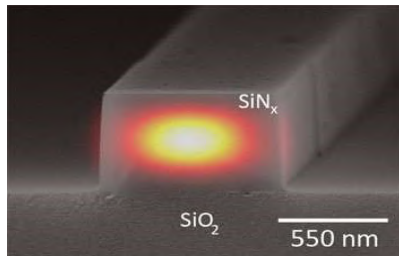
What is a photonic integrated circuit (PIC)?

- A complex integrated circuit
- Analogous to an electronic integrated circuit
- Many optical devices like lasers, amplifiers, couplers, detectors are integrated on to a PIC.
- PIC devices are **compact, multi-functional, cost-effective, multiplexible** and **fast**.

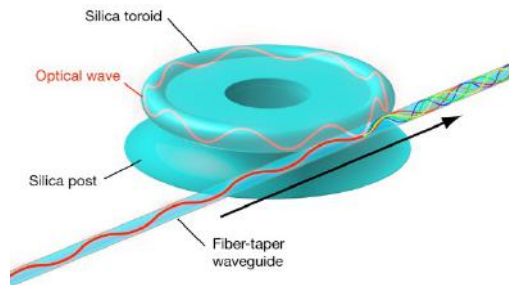


Fundamental Components

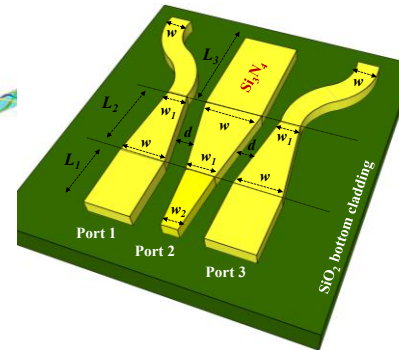
- Optical waveguides



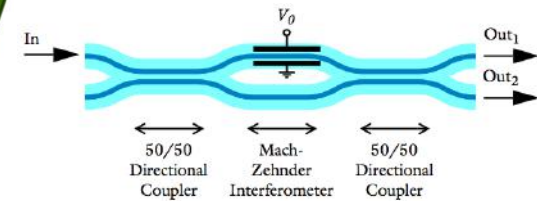
- Lasers



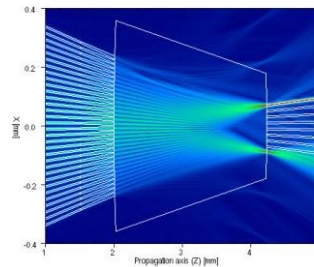
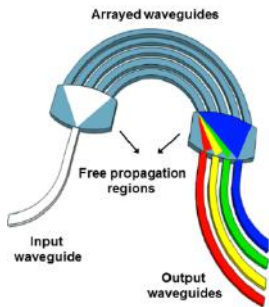
- Splitters



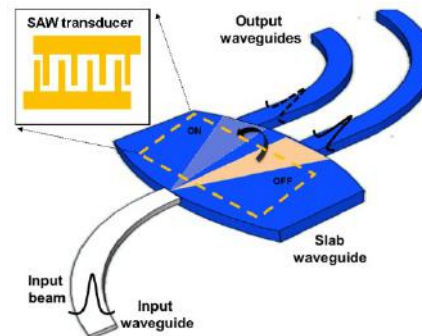
- Interferometers



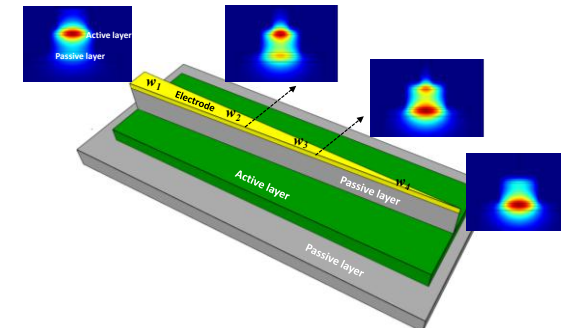
- Spectrometer



- Modulators

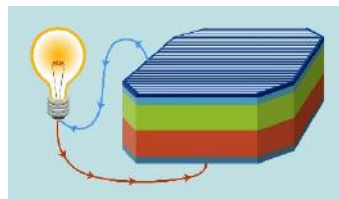


- Photodetectors





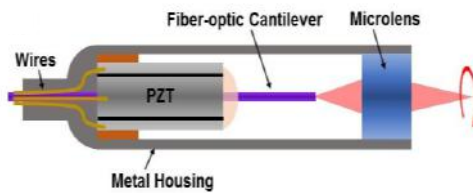
Broad-band splitters & switches



Solar cells



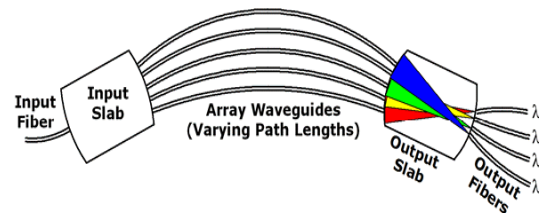
Glucose sensing



Endoscopic probes



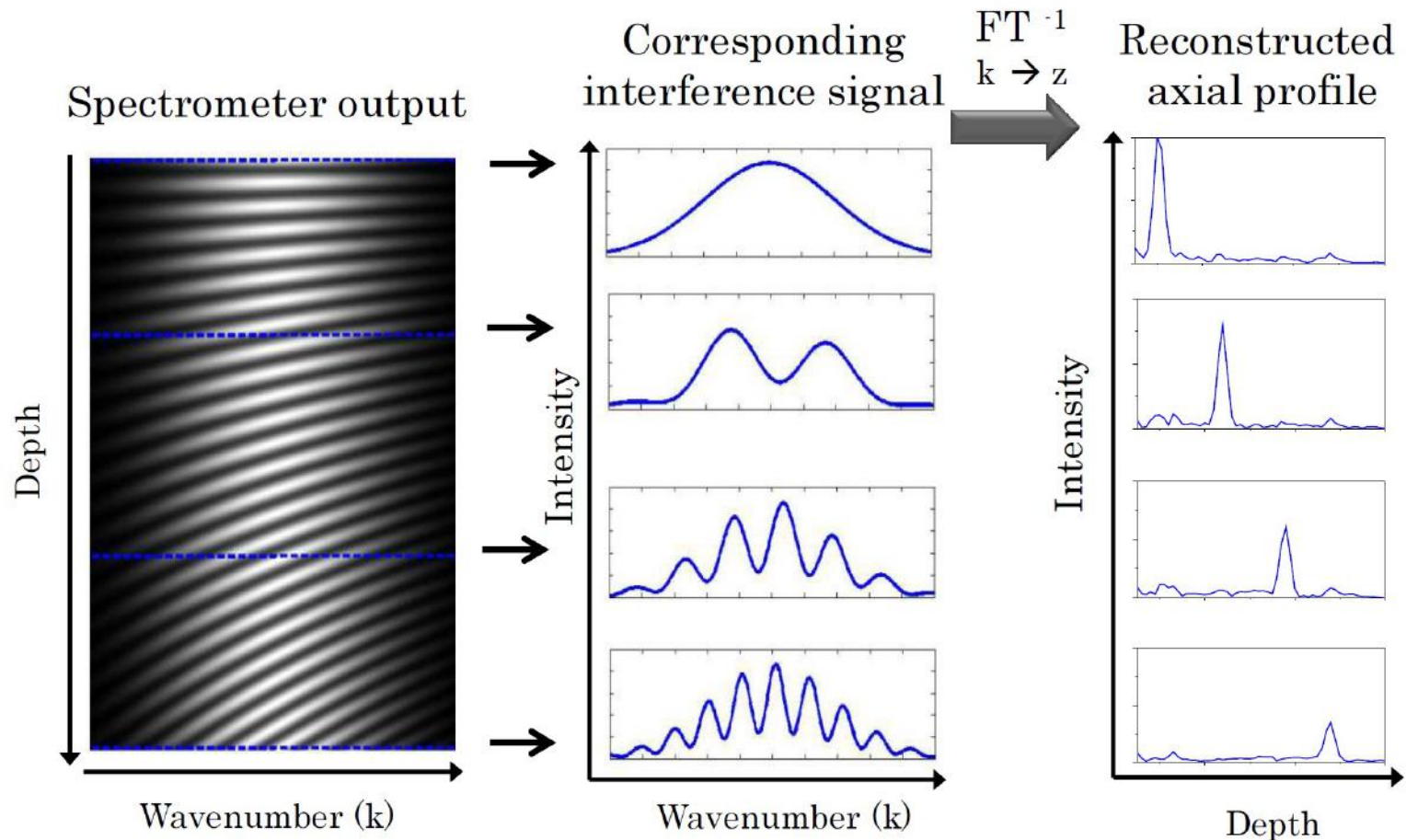
Embryo biomechanics



On-chip spectrometers

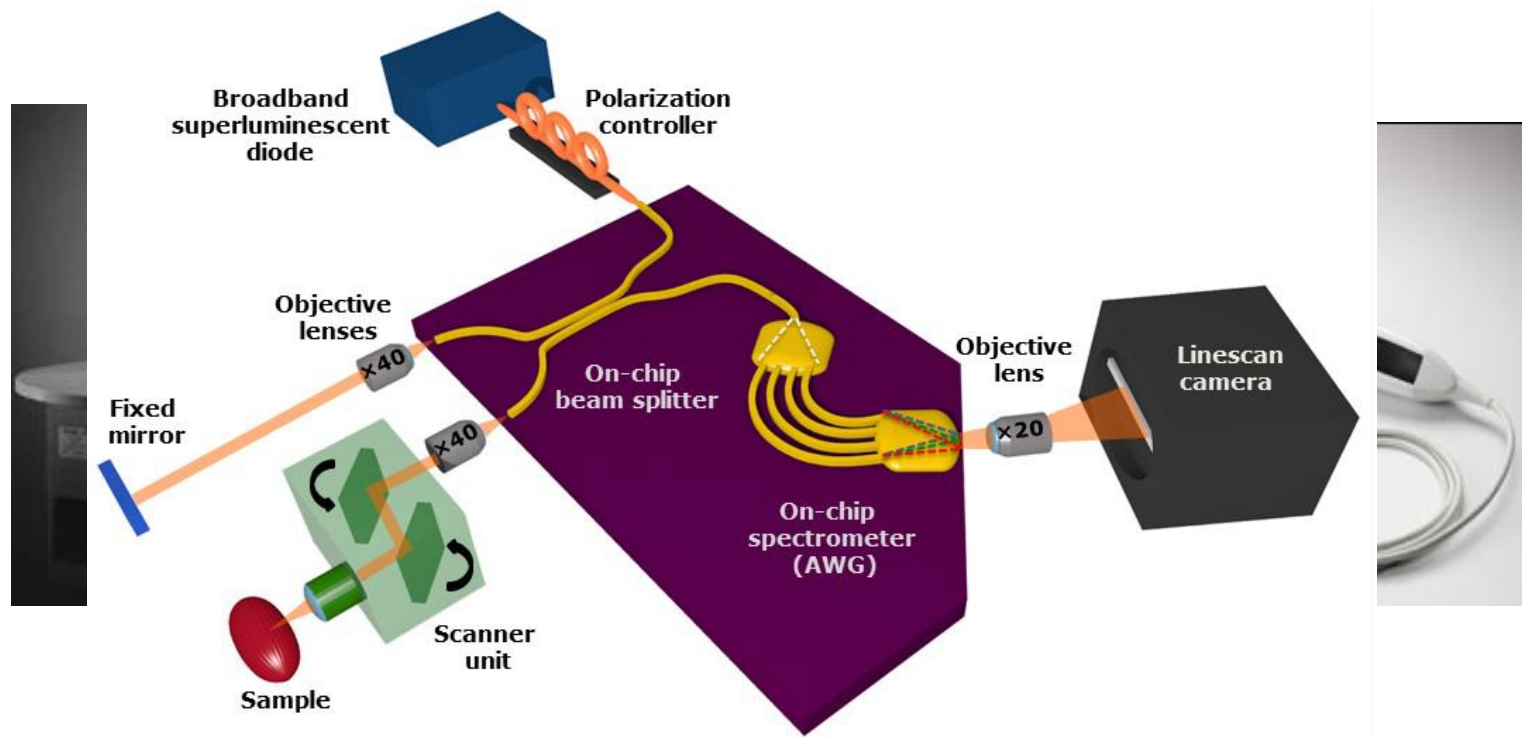
Hand-held OCT systems

Optical Coherence Tomography (OCT)

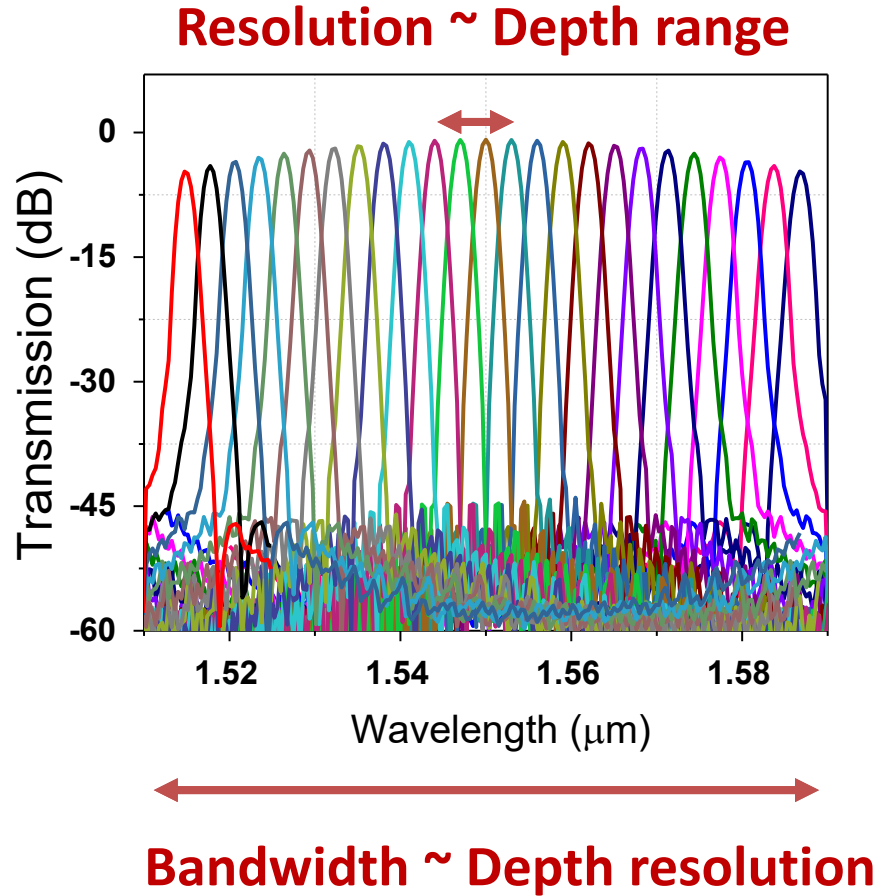
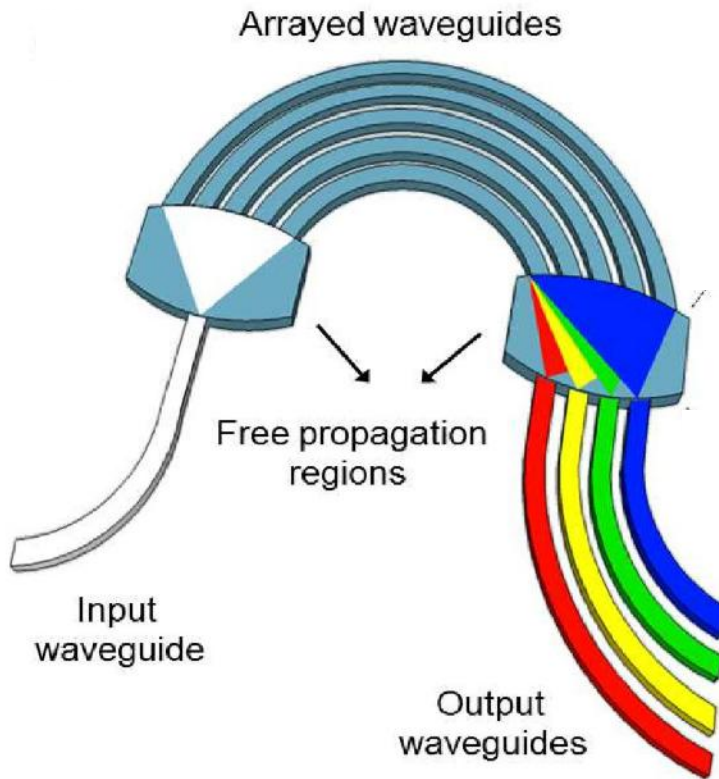


PhD Research

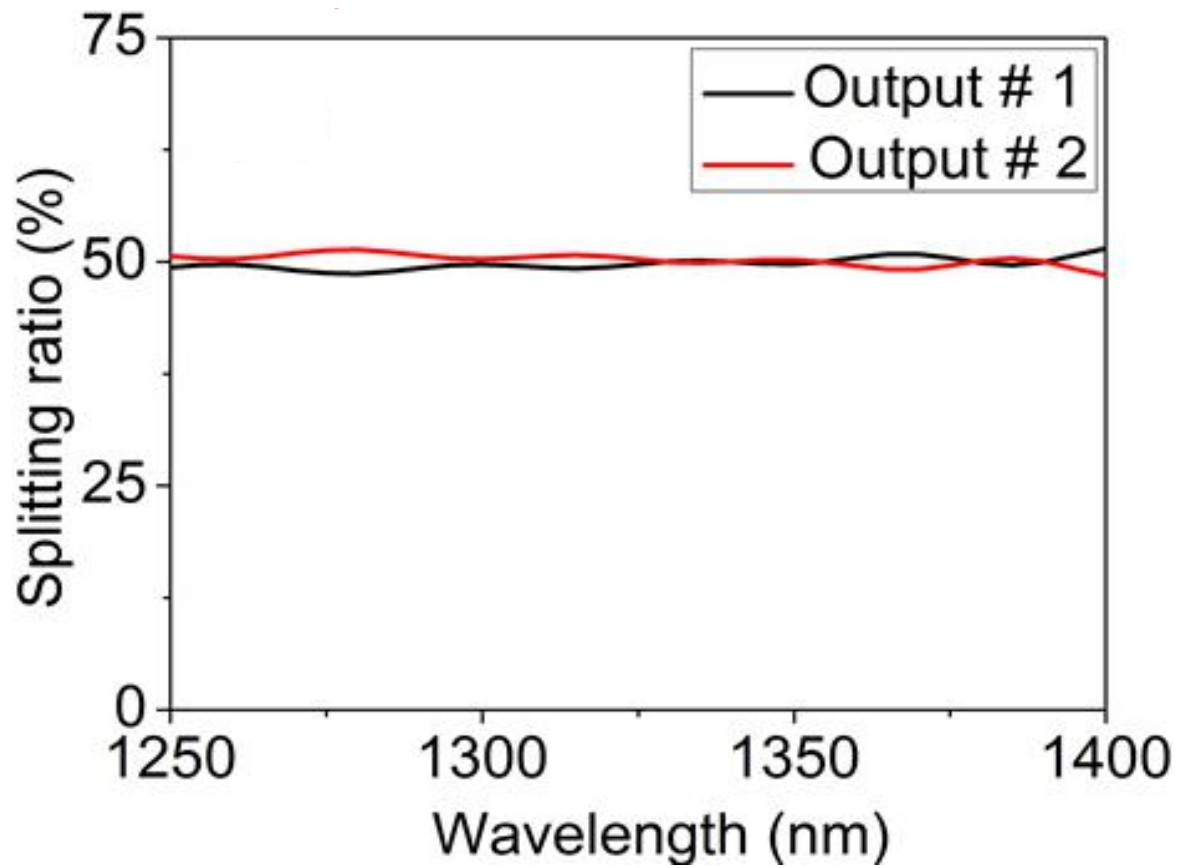
Miniaturization of OCT Systems: “Spectral-domain optical coherence tomography on a silicon chip”



Miniaturized spectrometer



Miniaturized beam splitter

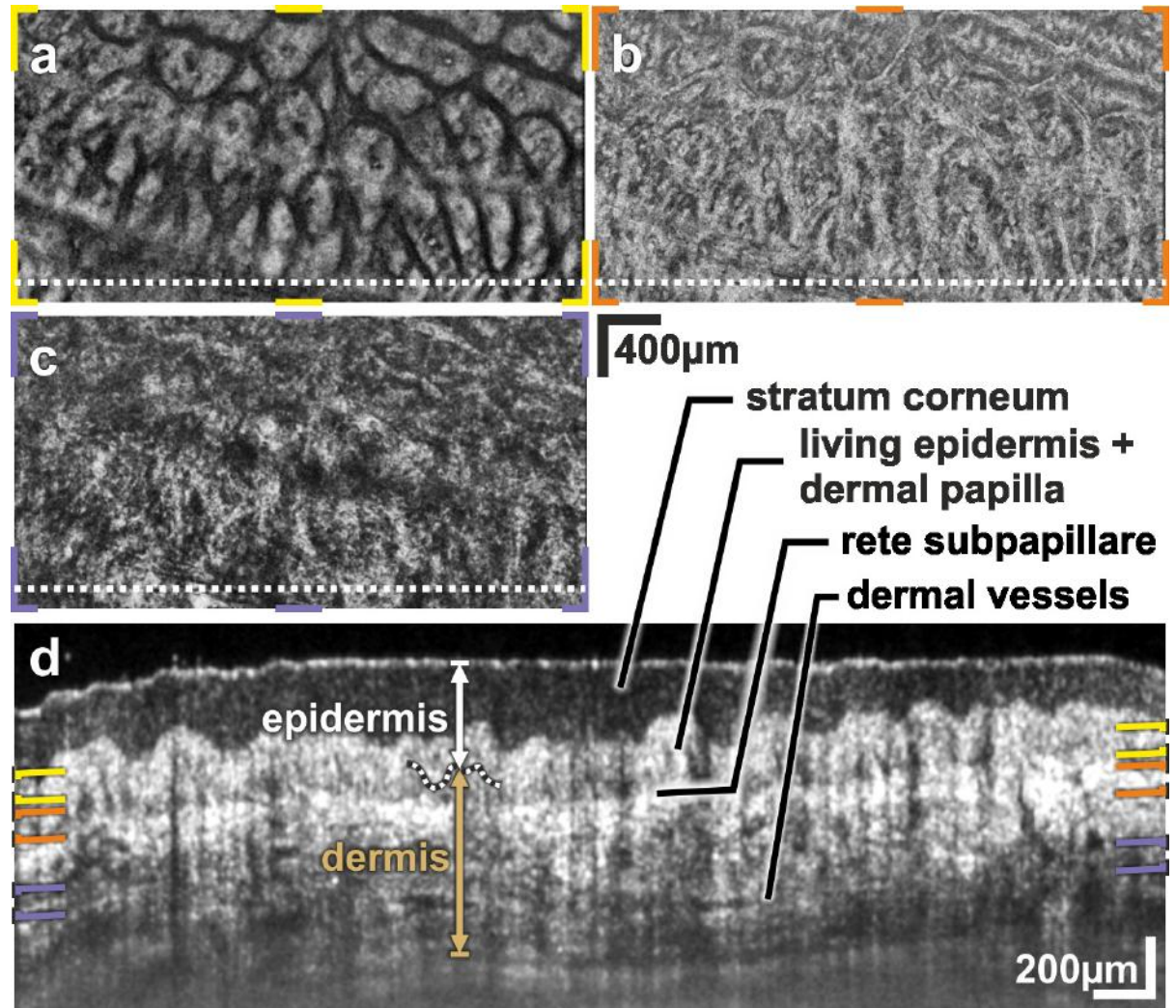


Skin imaging

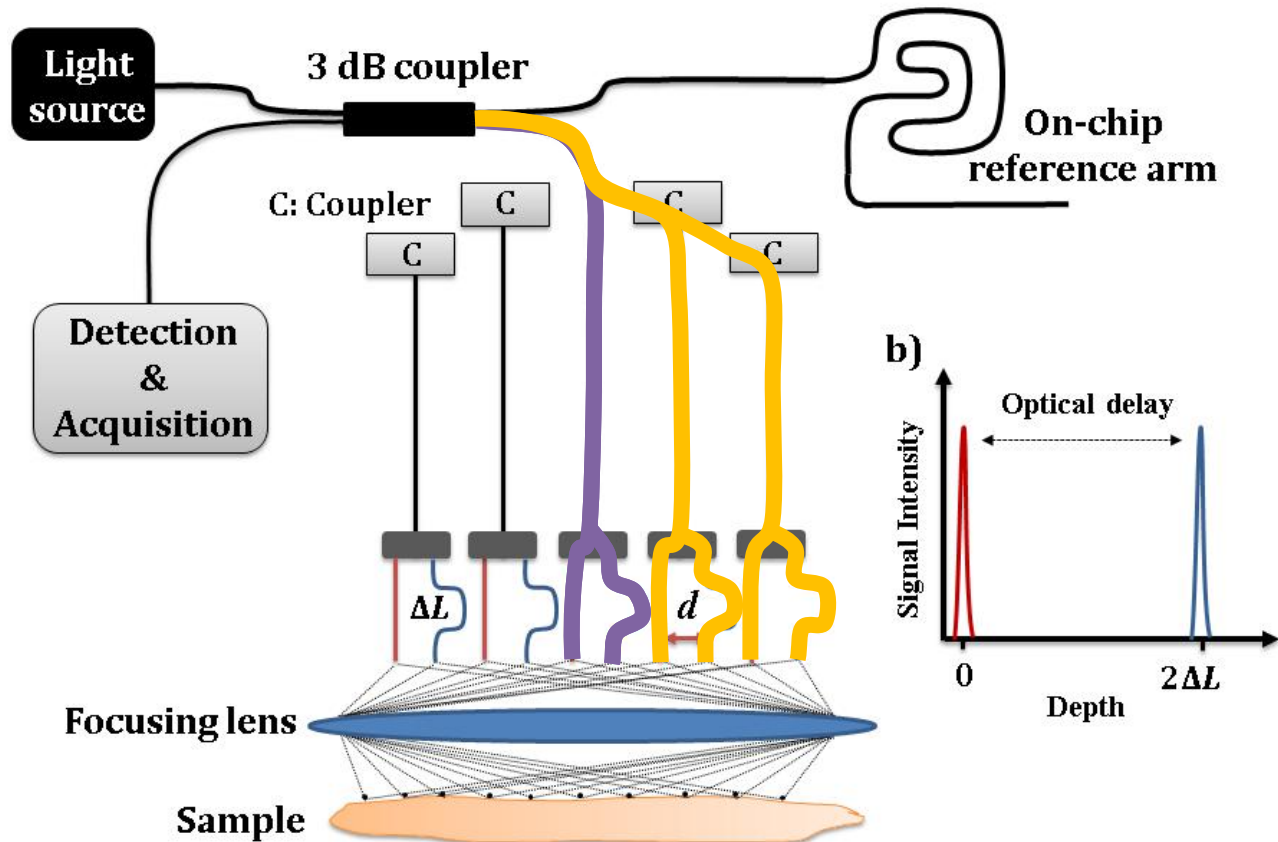
Resolution: 7.5 μm

Depth: 1 mm

SNR: 74 dB

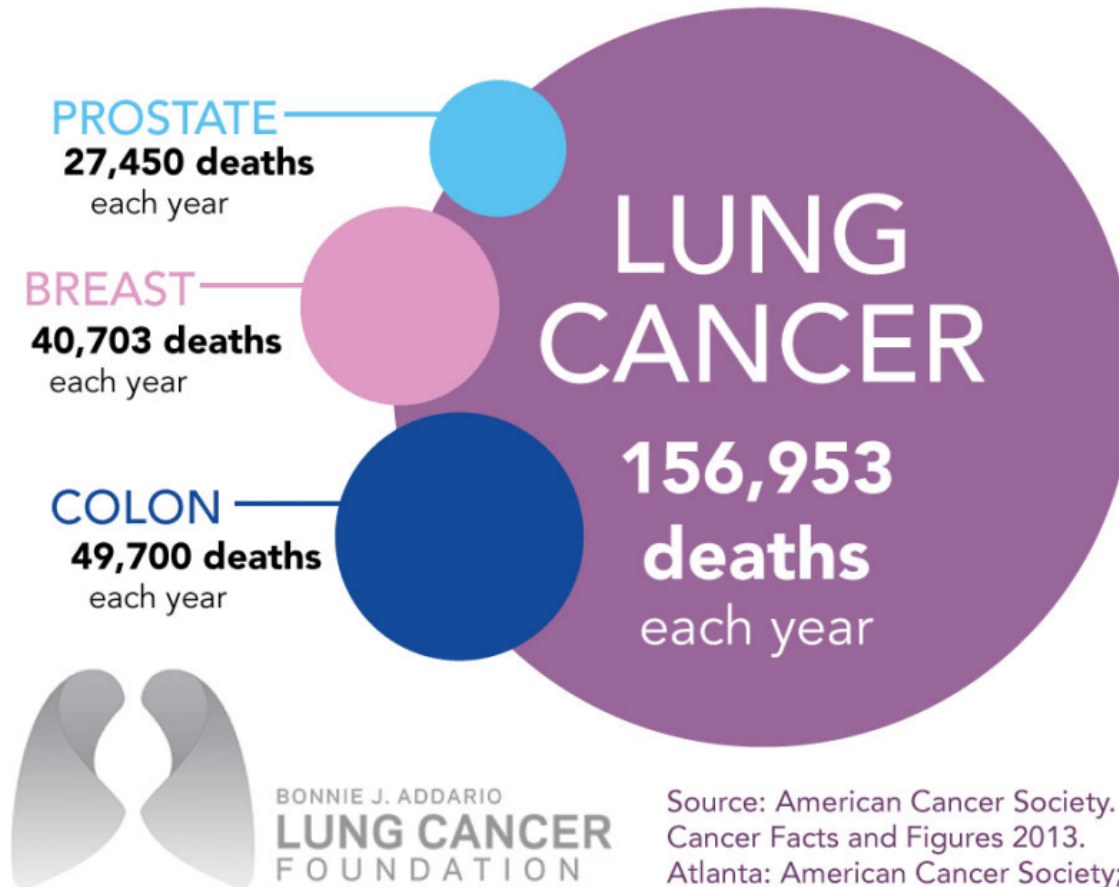


Getting smaller...



Early Lung Cancer Diagnosis

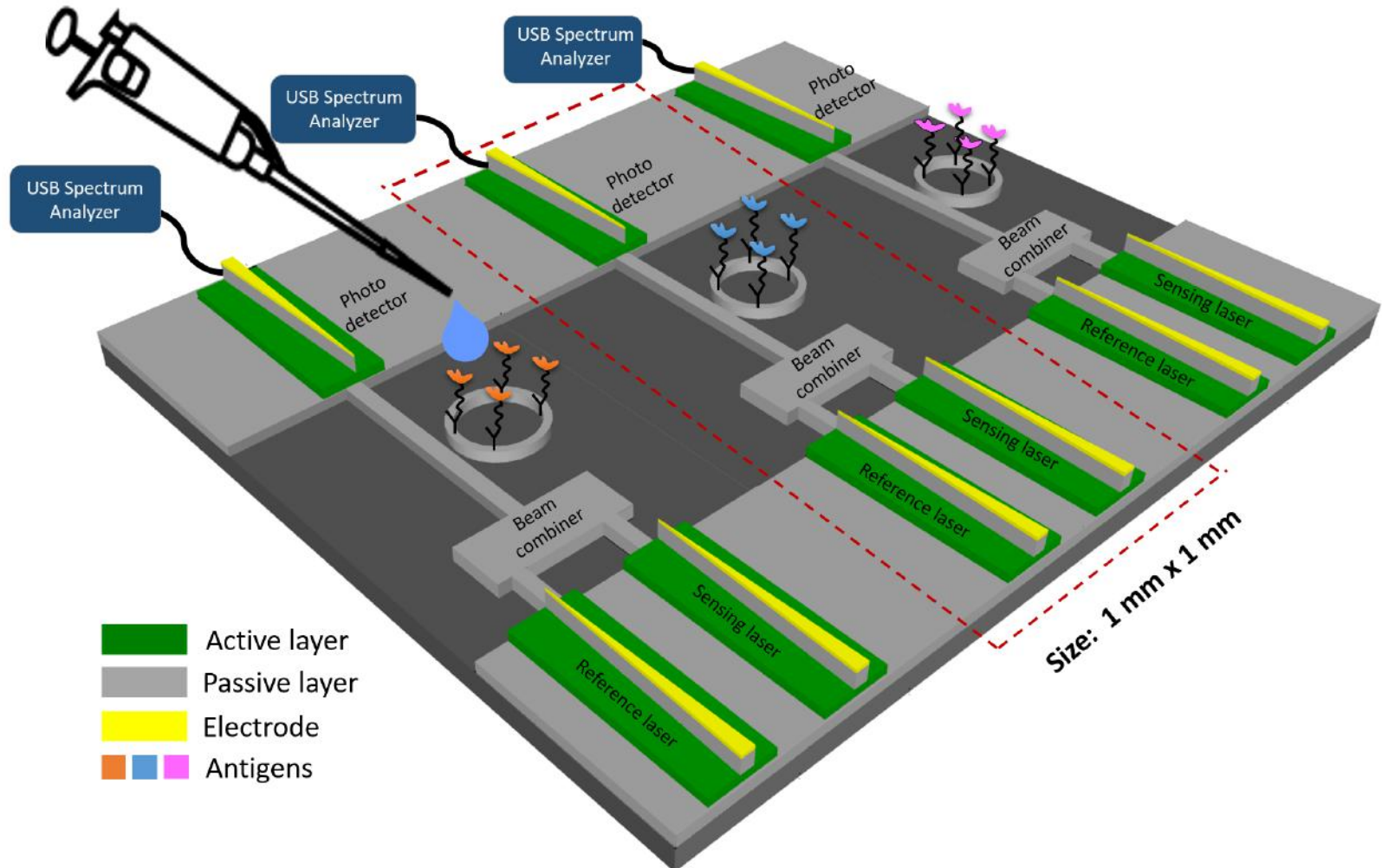
Early lung cancer detection



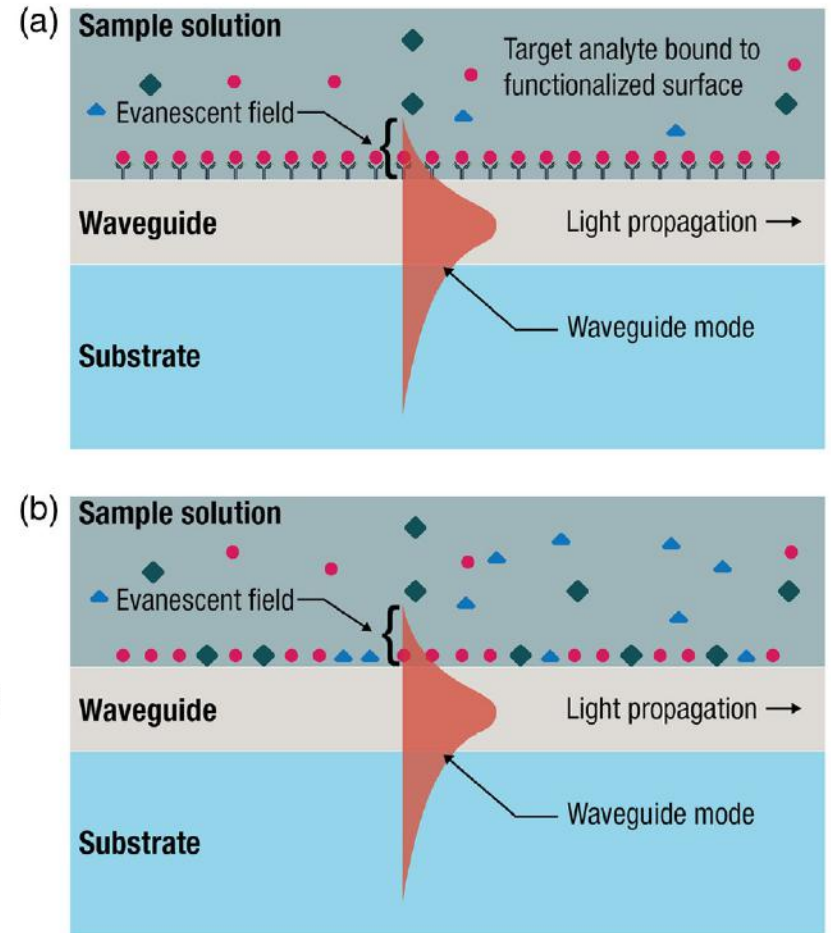
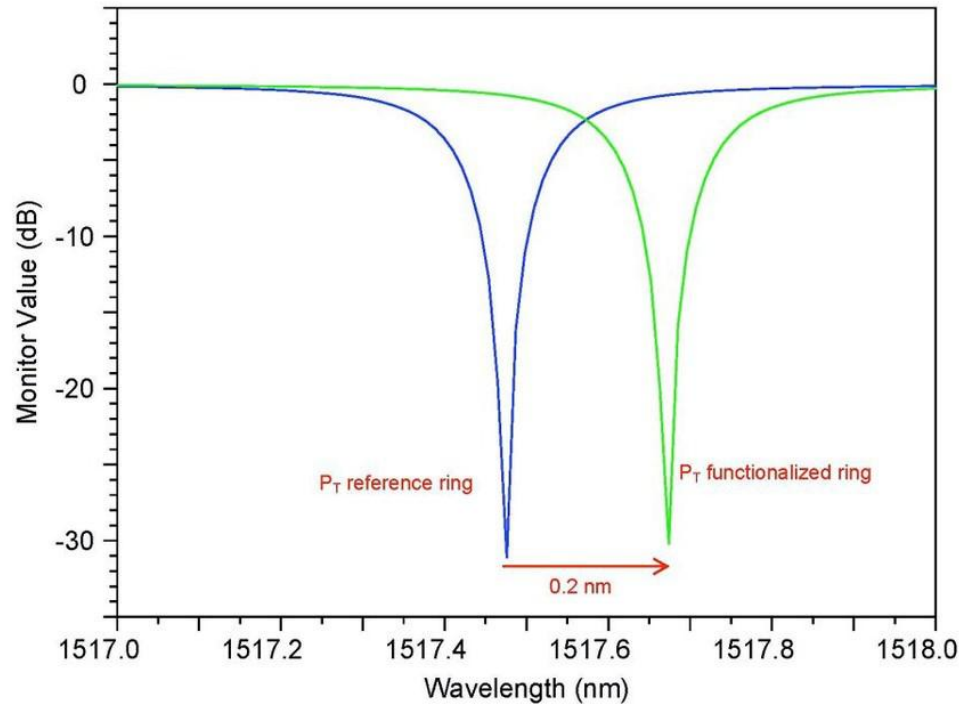
Source: American Cancer Society.
Cancer Facts and Figures 2013.
Atlanta: American Cancer Society; 2013.

Monolithic optical sensor

sengenics
The Functional Proteomics Company



Sensing element: ring resonator



Thanks so much!



Dr. B. van Someren



Dr. A. Alexandrov



MD I. Bahce

