

**INTERDISCIPLINARY WORKSHOP
LASER IMAGING FOR SKIN CANCER DETECTION**

Review of optical techniques applied to skin cancer detection

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Academic Medical Centre, Amsterdam 9/10/2014

Centre for Sensors, Instruments and Systems Development (CD6)

UPC-BarcelonaTech

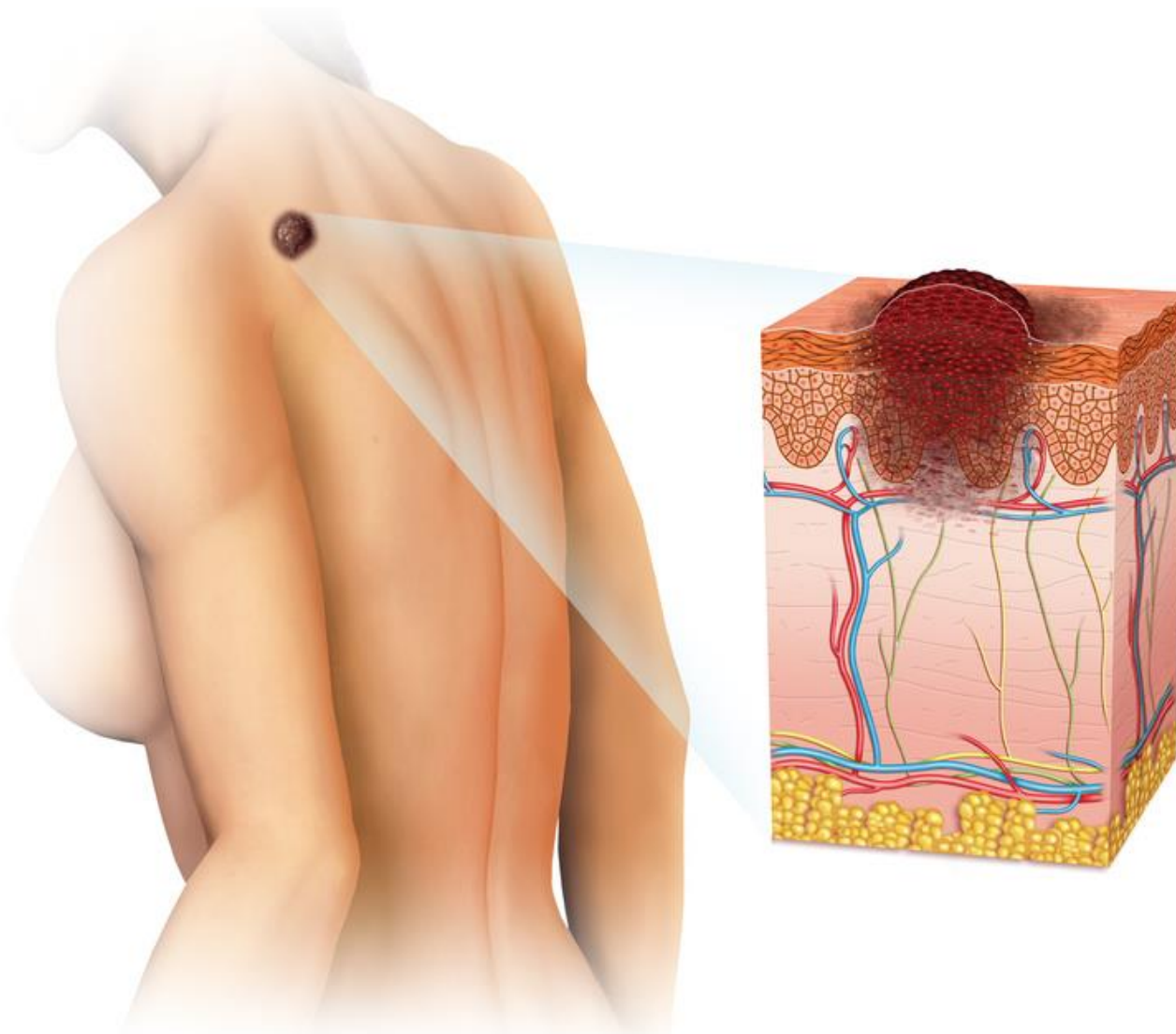
Purpose



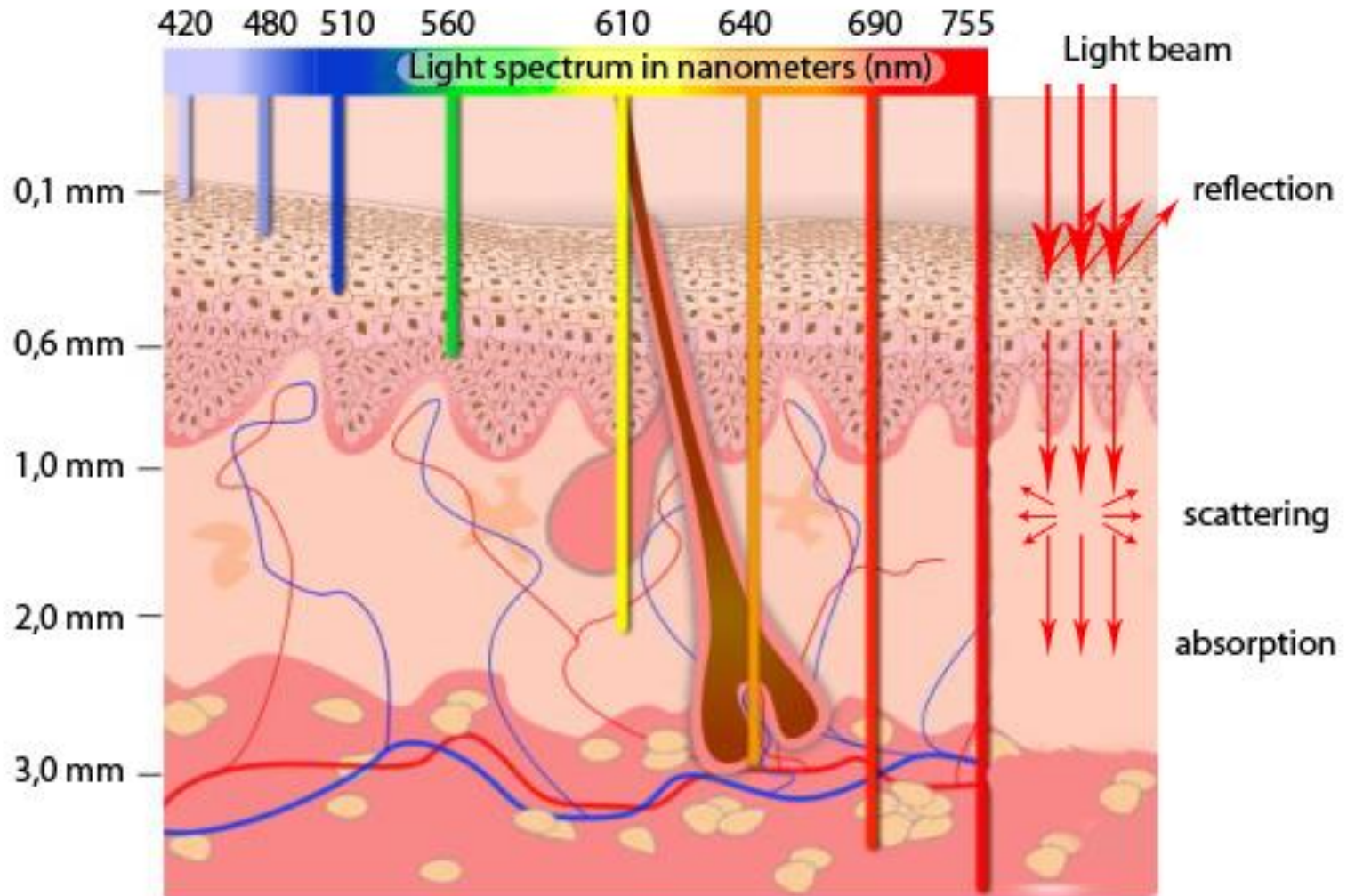
Purpose



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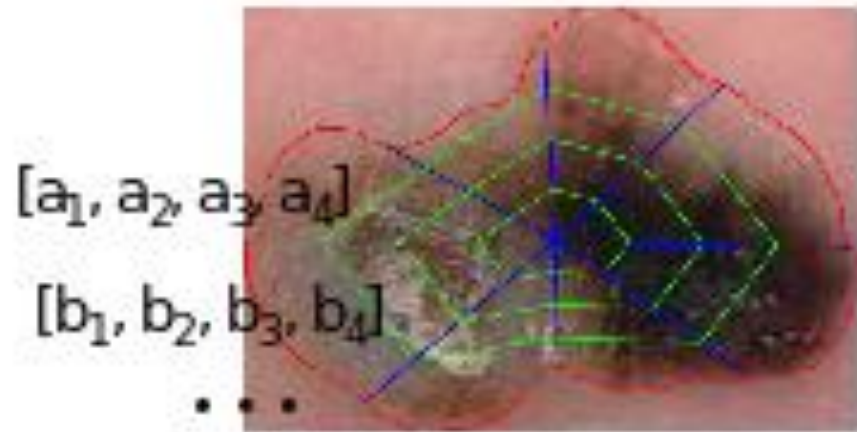
Purpose



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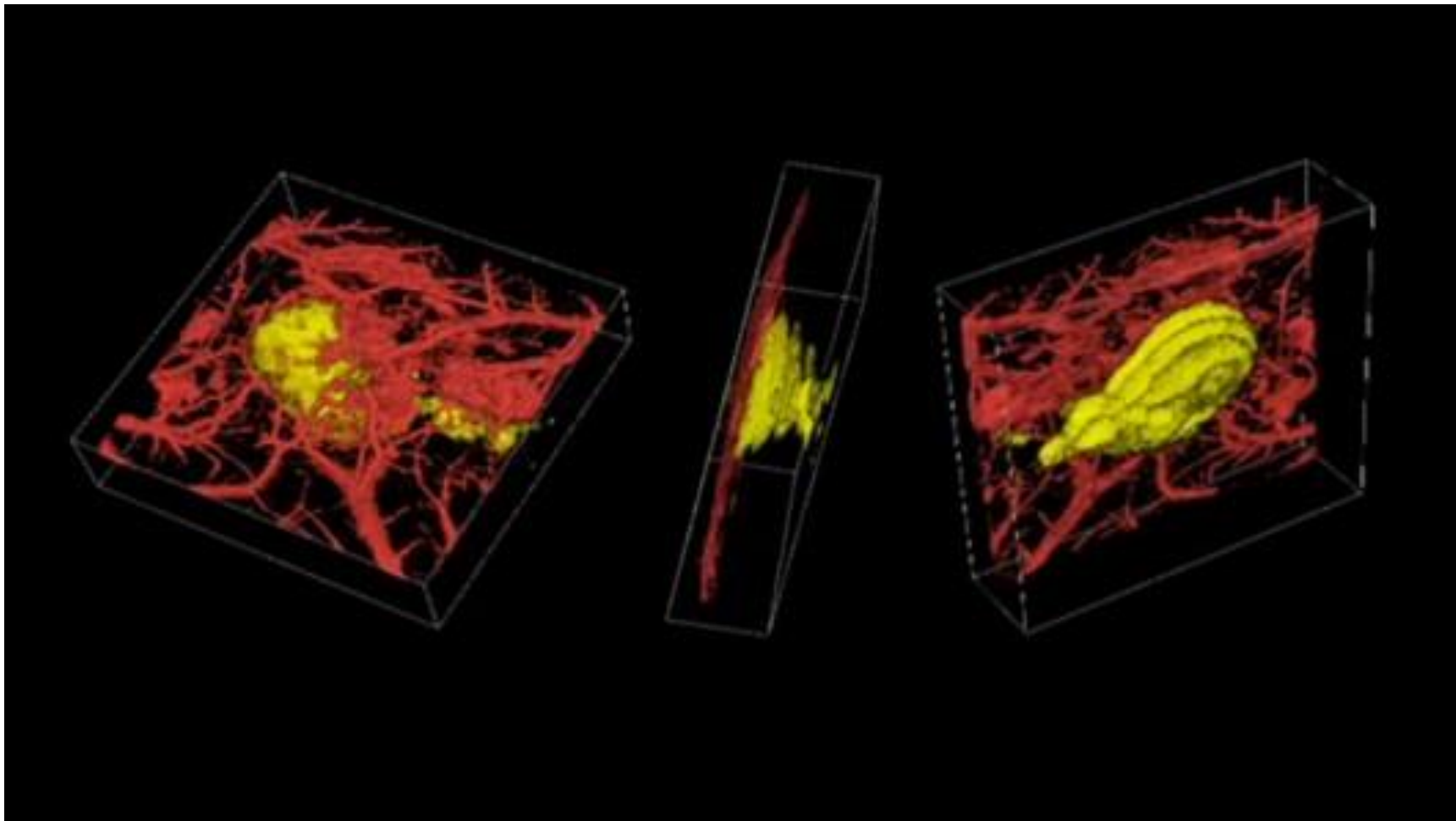


(a)

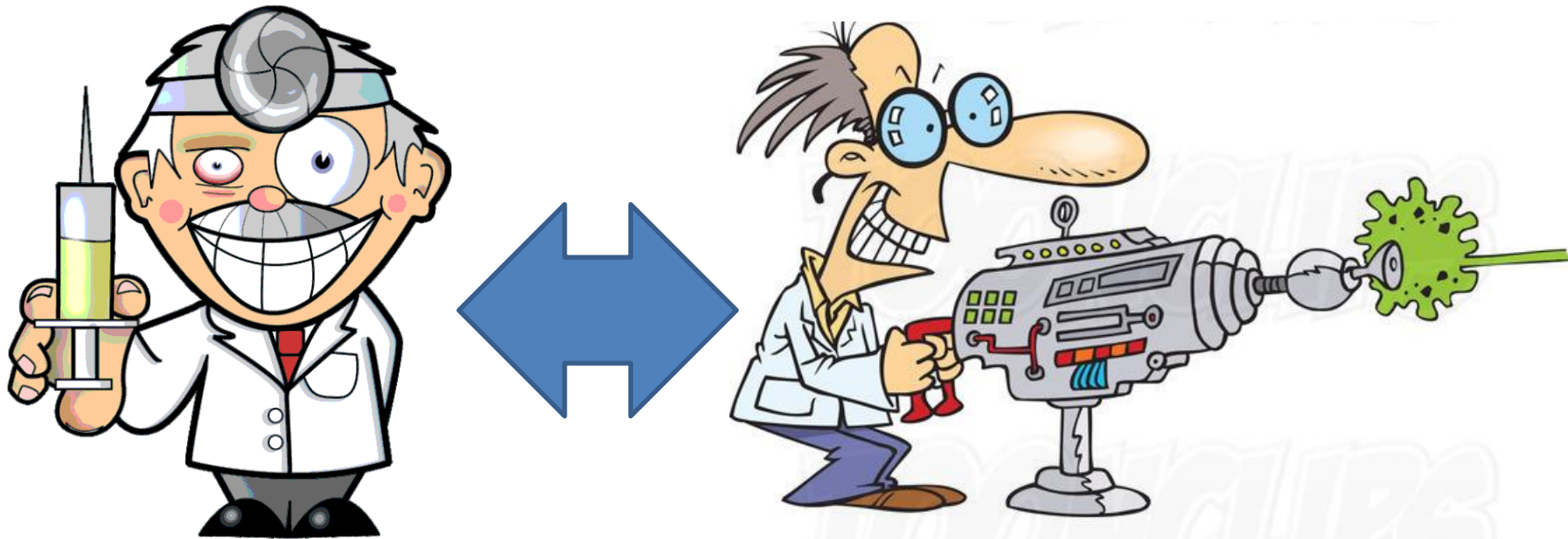


(b)

Purpose

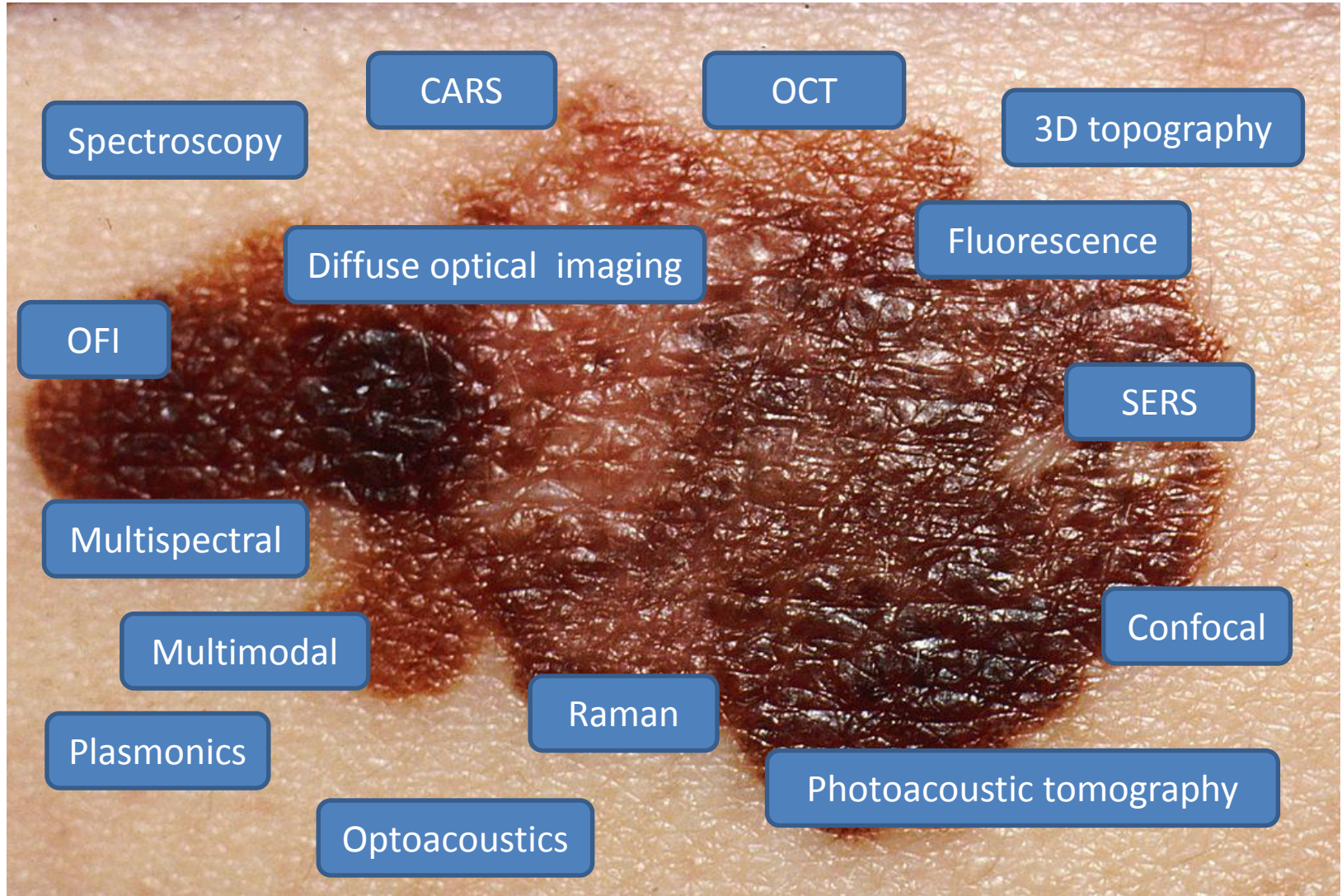


Purpose

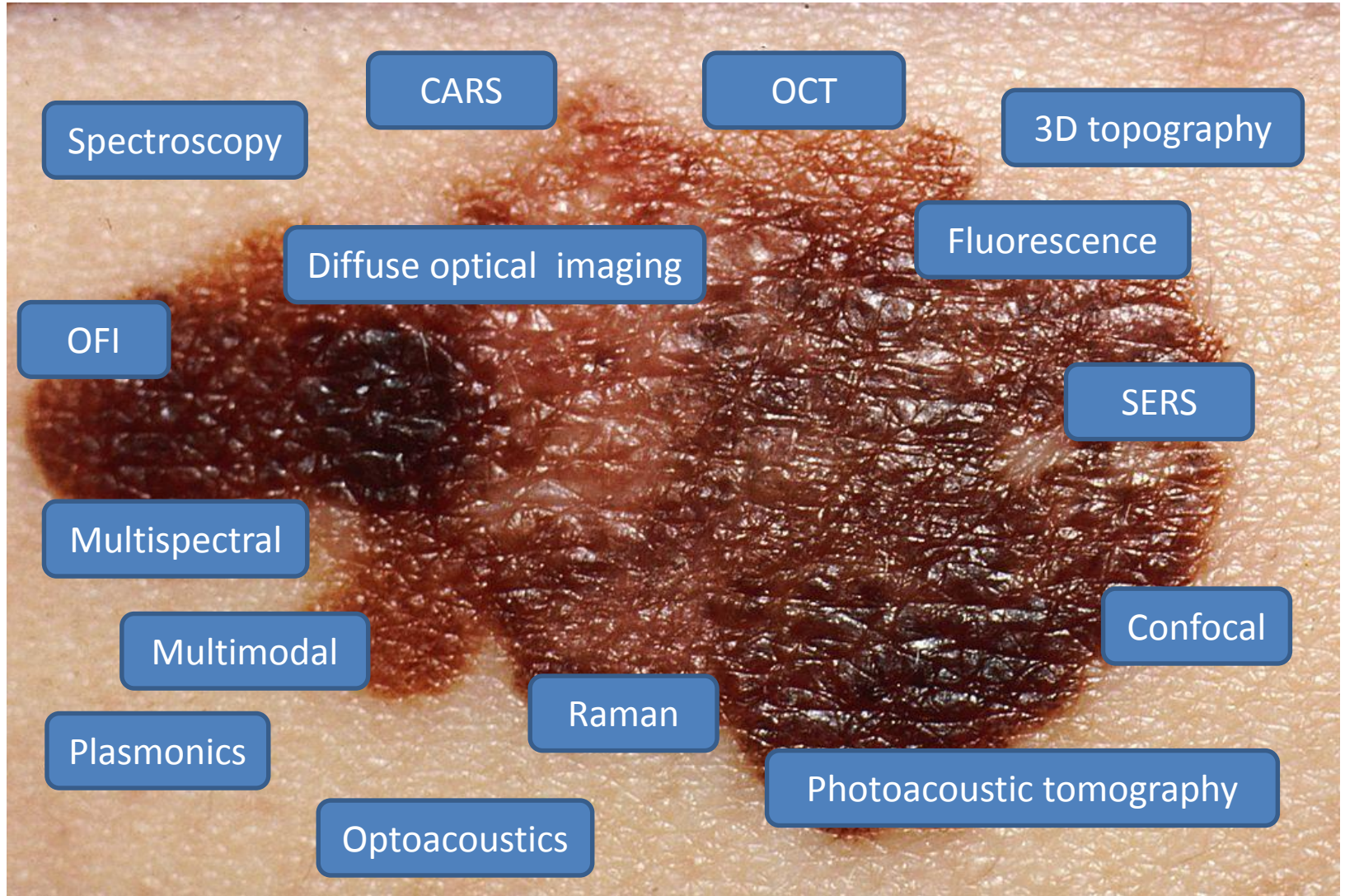


INTERDISCIPLINARY WORKSHOP ON LASER IMAGING FOR SKIN CANCER DETECTION

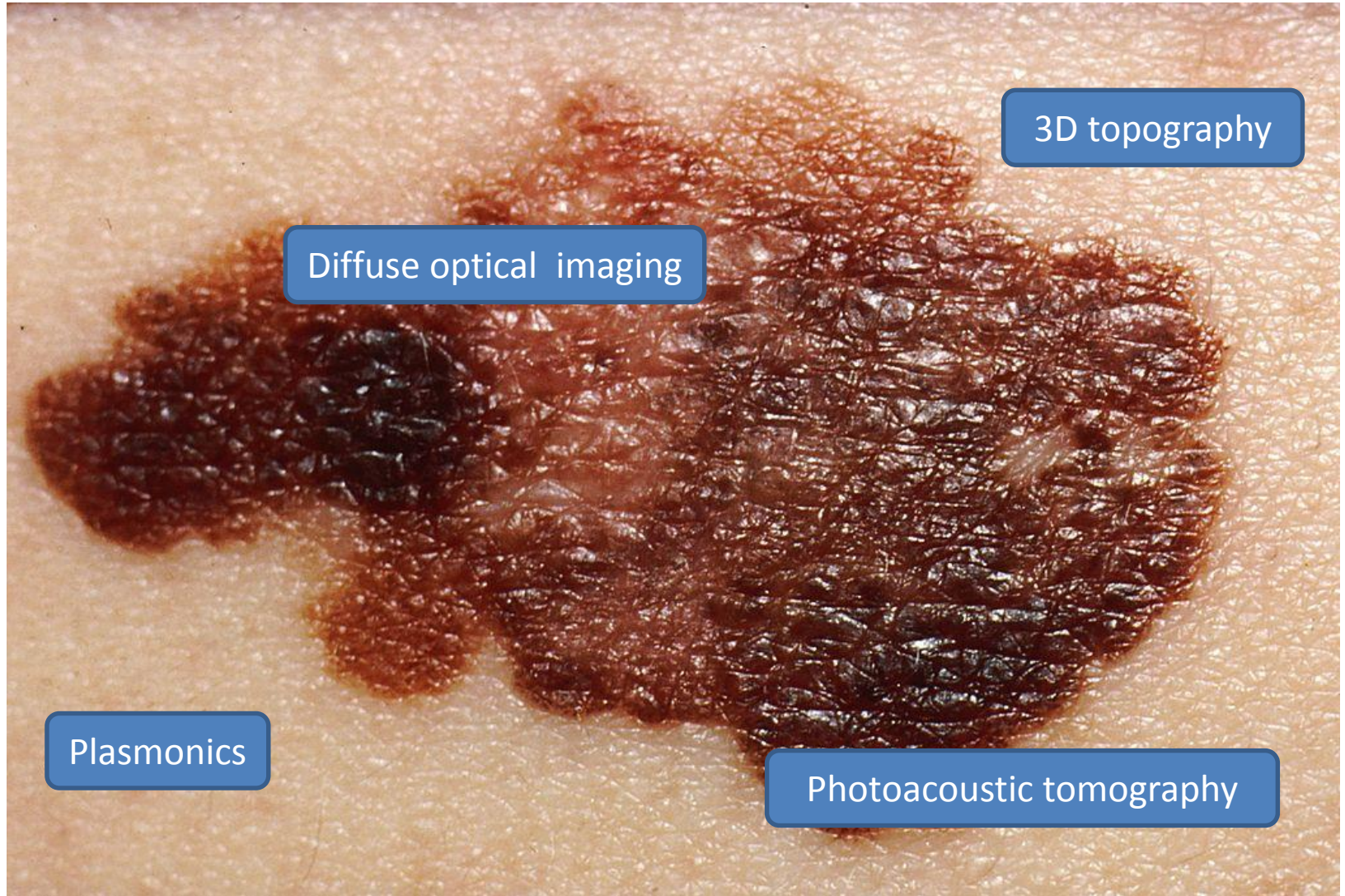
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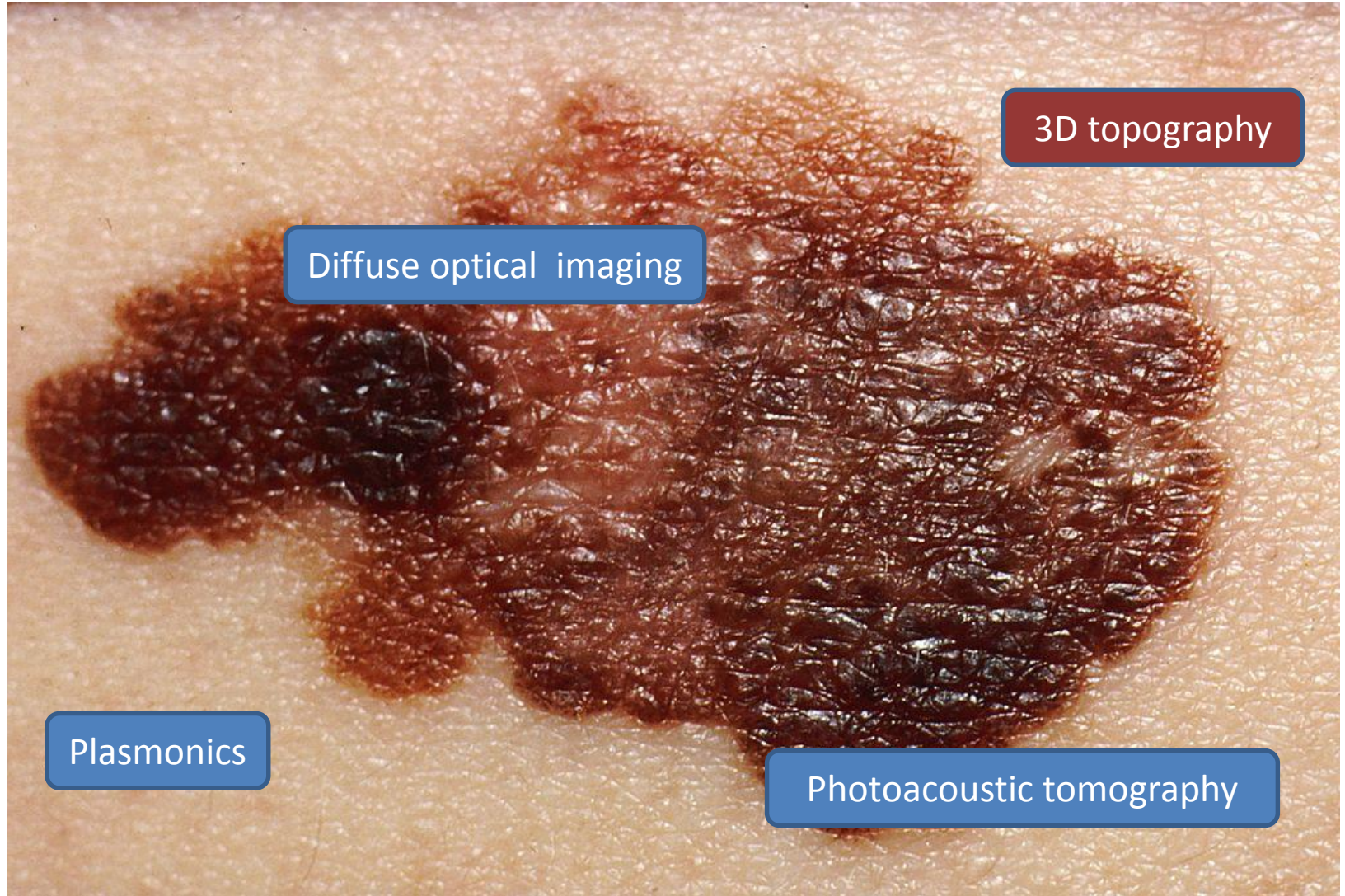
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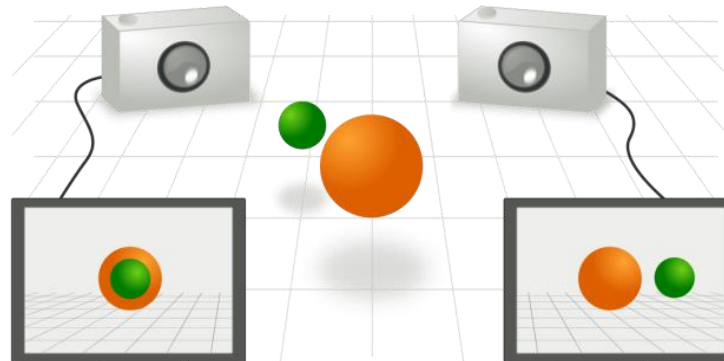
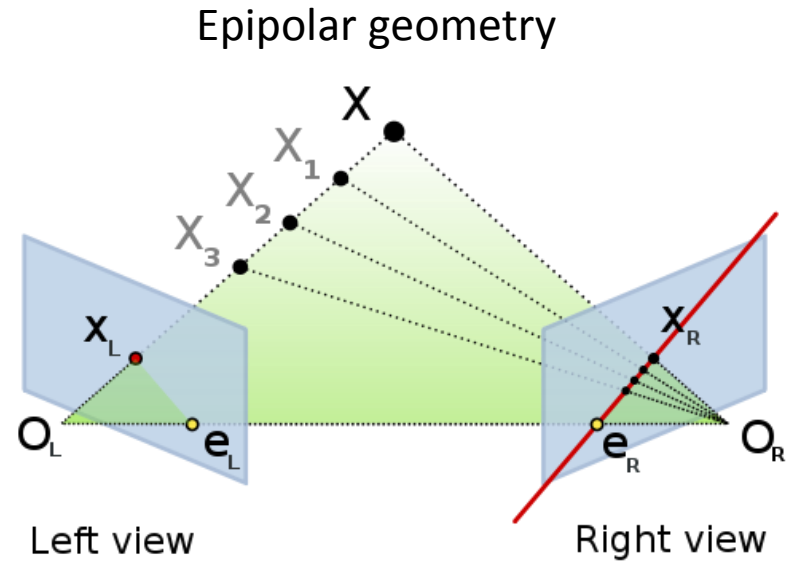
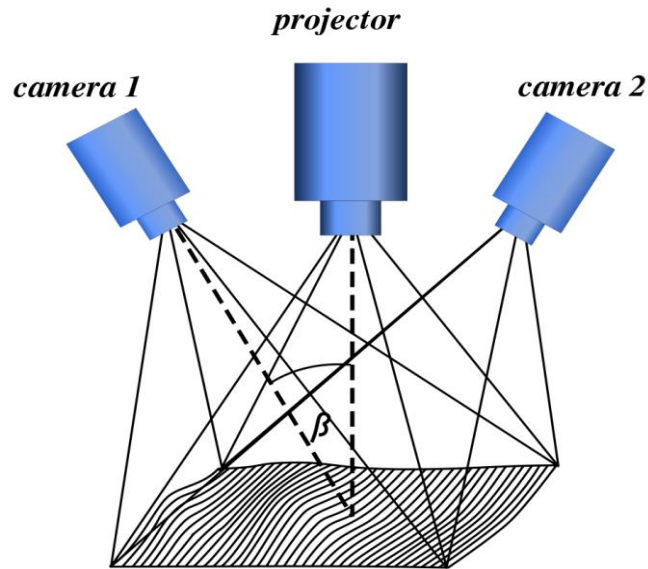
Guide



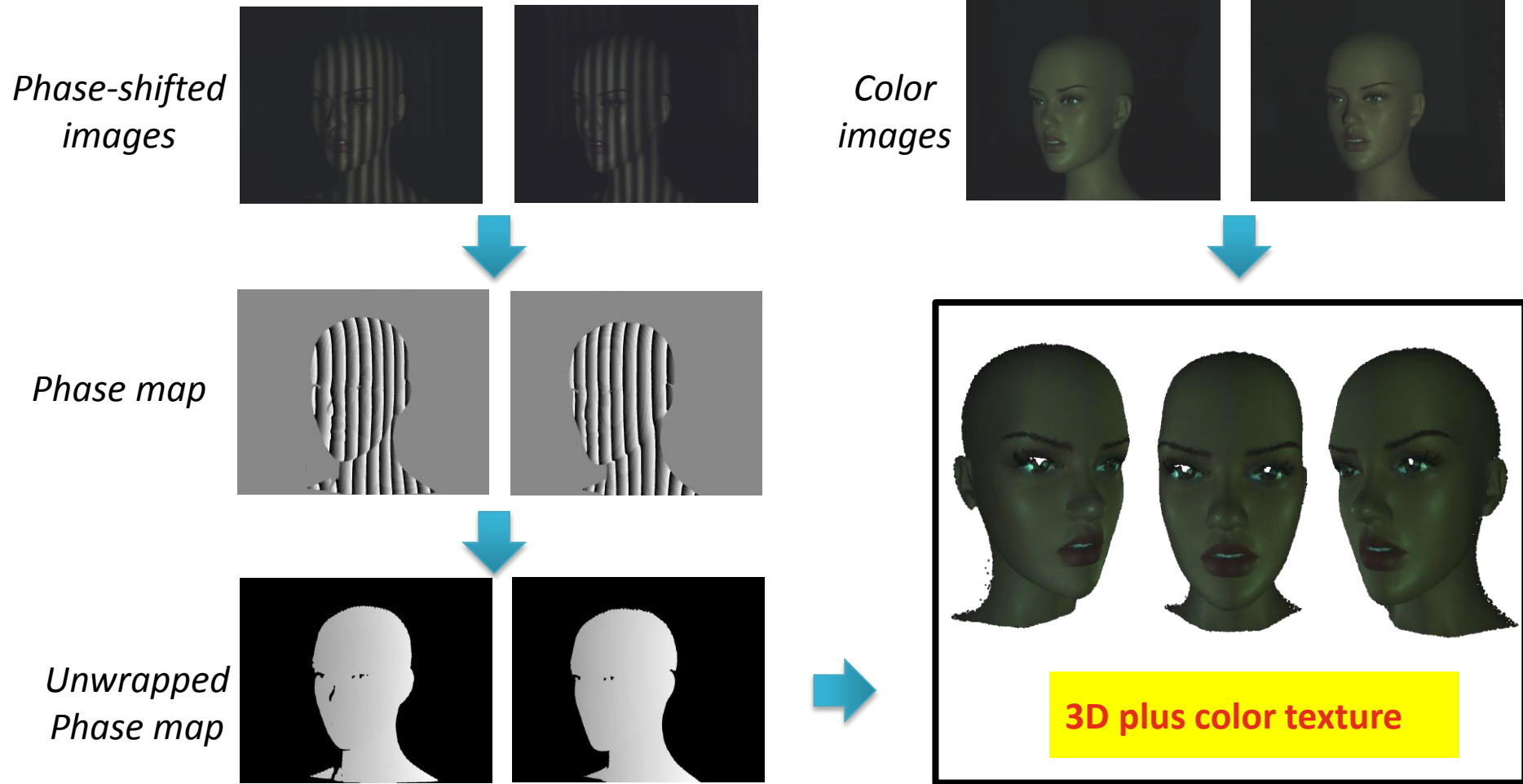
Guide



3D topography: Stereo fringe projection (1)

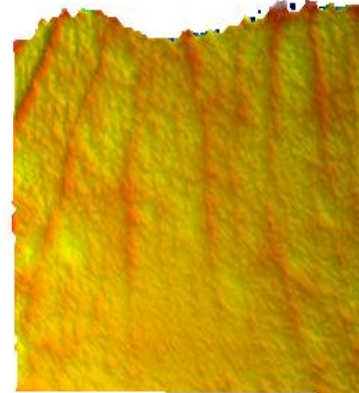
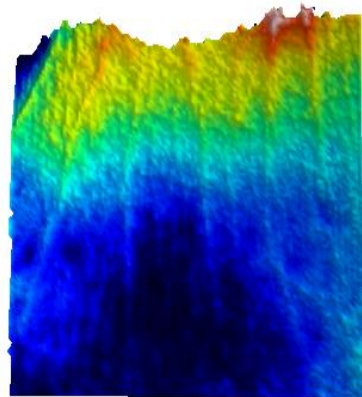
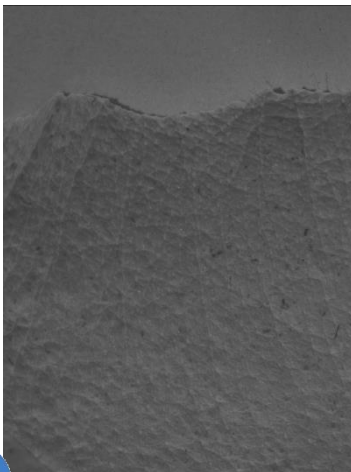
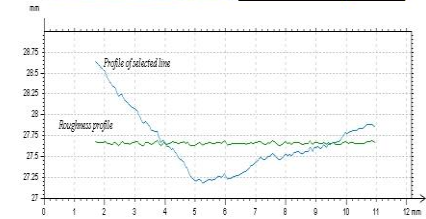
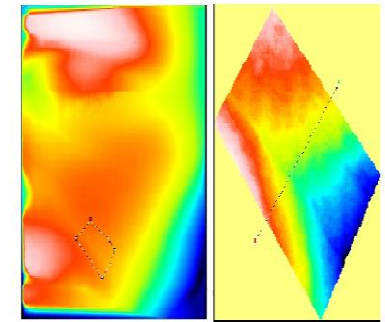
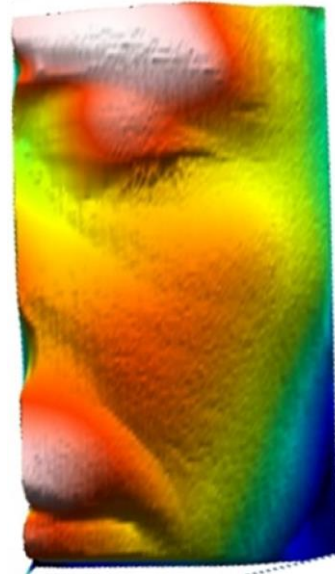


3D topography: Stereo fringe projection (2)

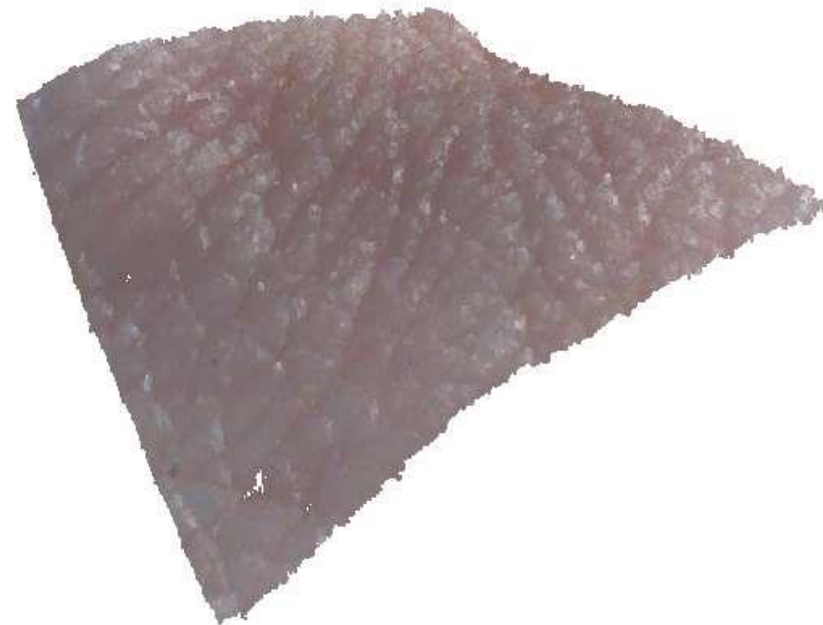
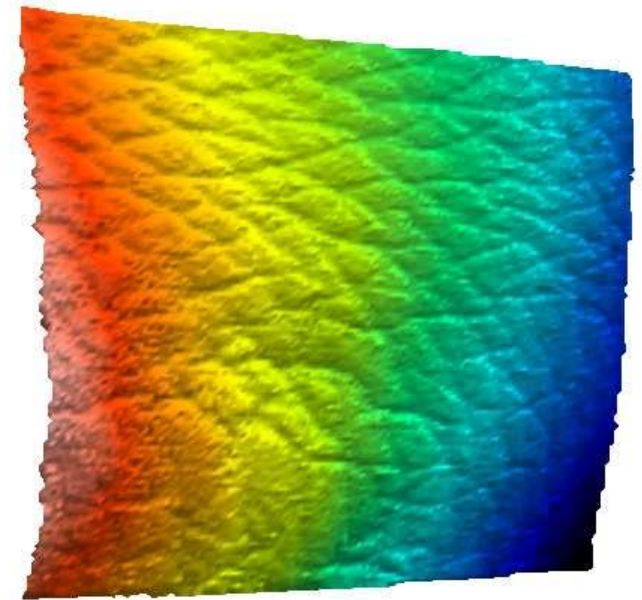
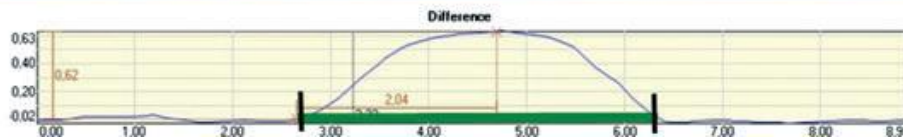
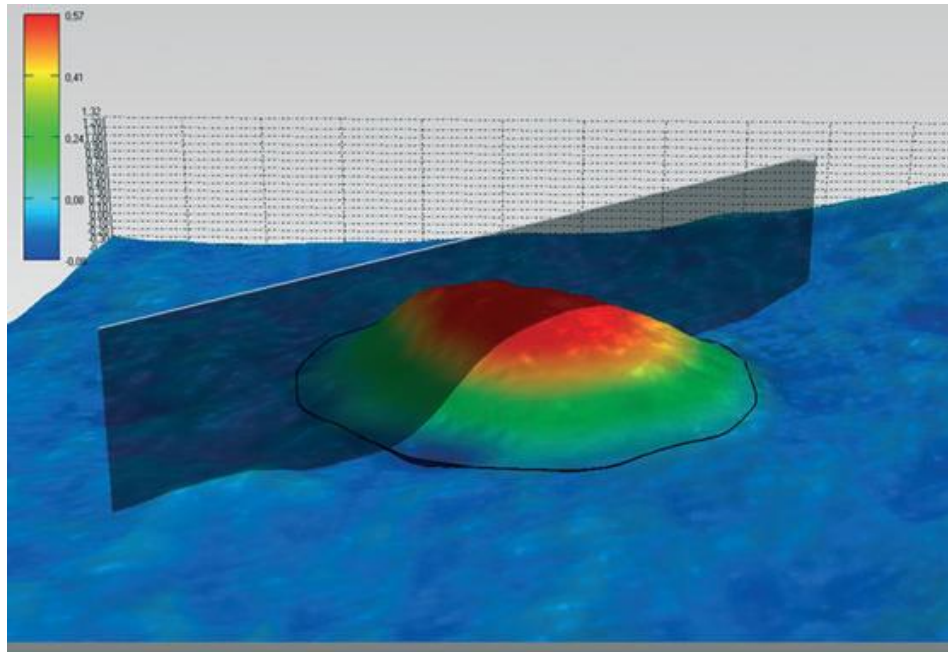


Epipolar triangulation

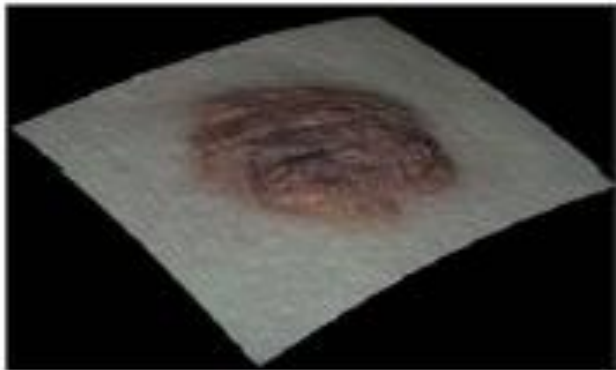
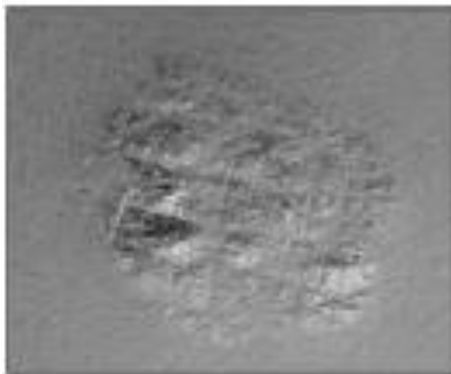
High resolution skin imaging



3D and skin cancer

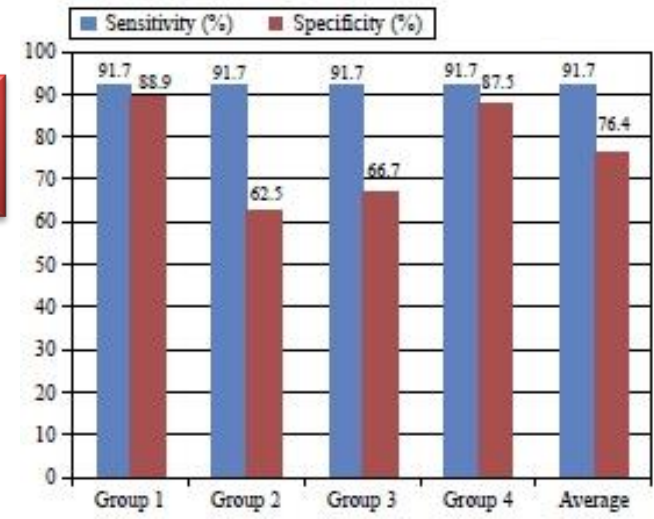
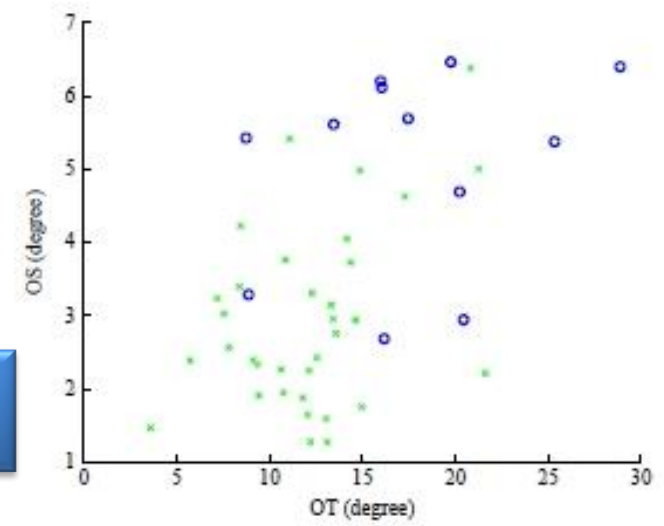


3D and skin cancer

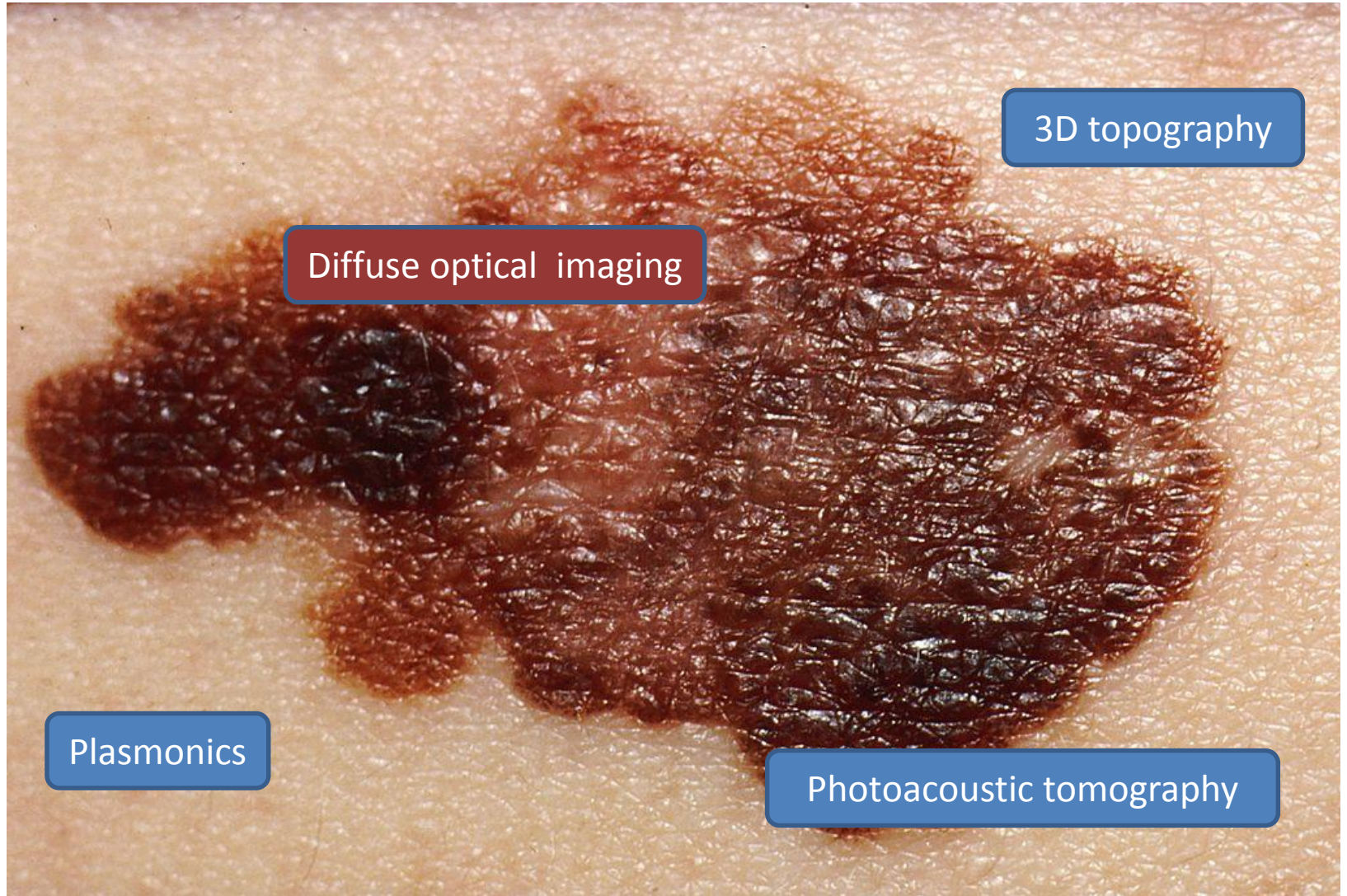


O melanoma
X benign

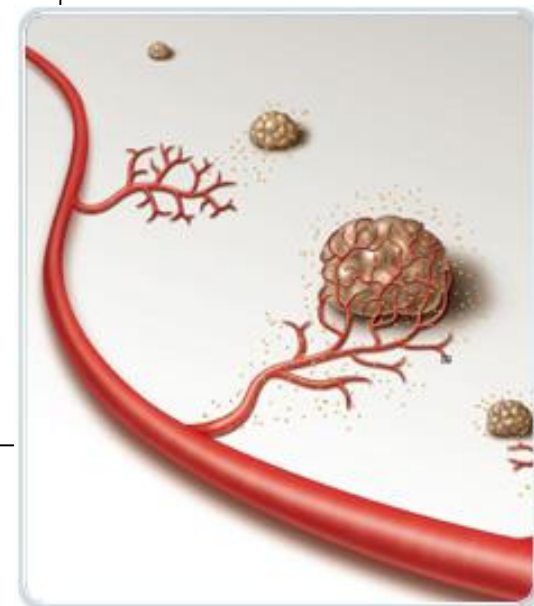
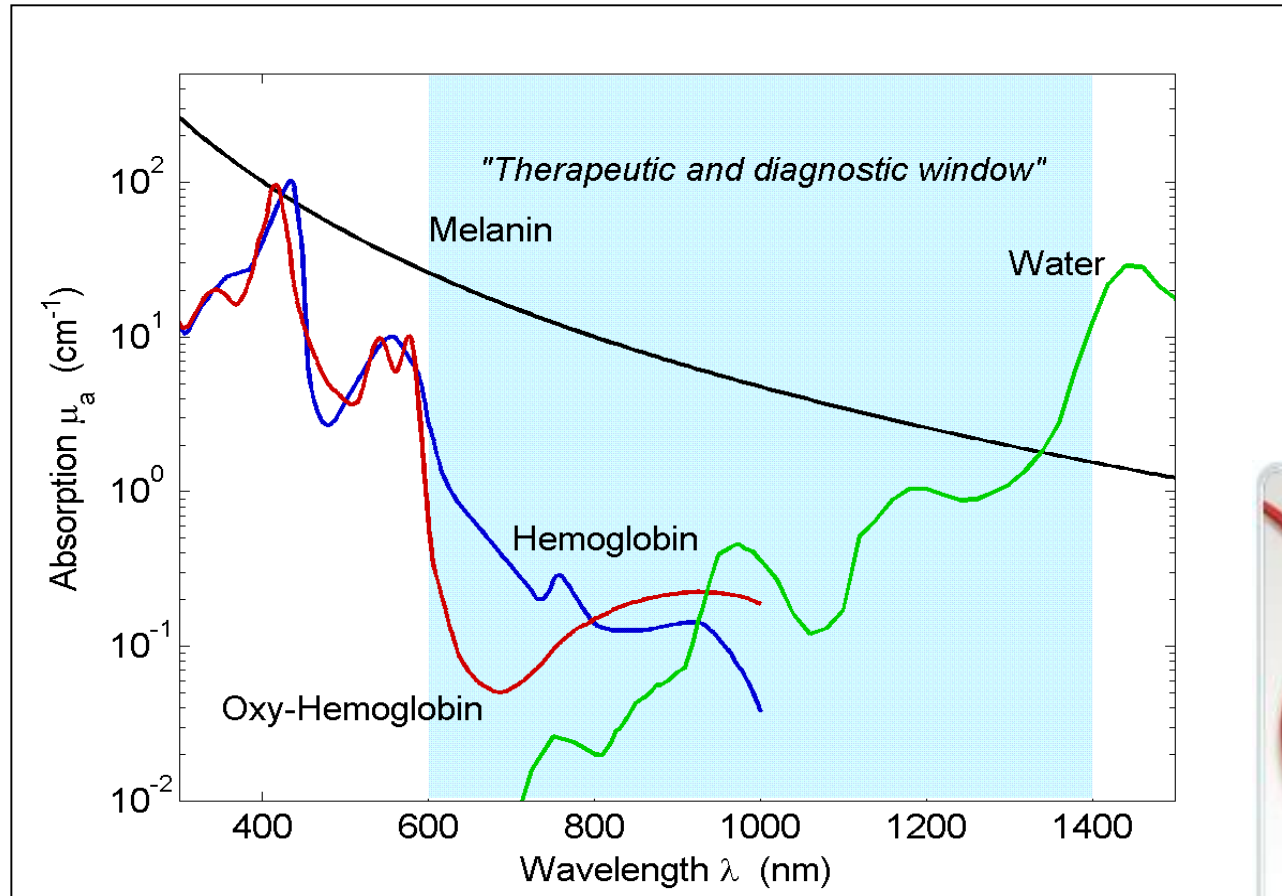
O 12 patients
X 34 patients



Guide

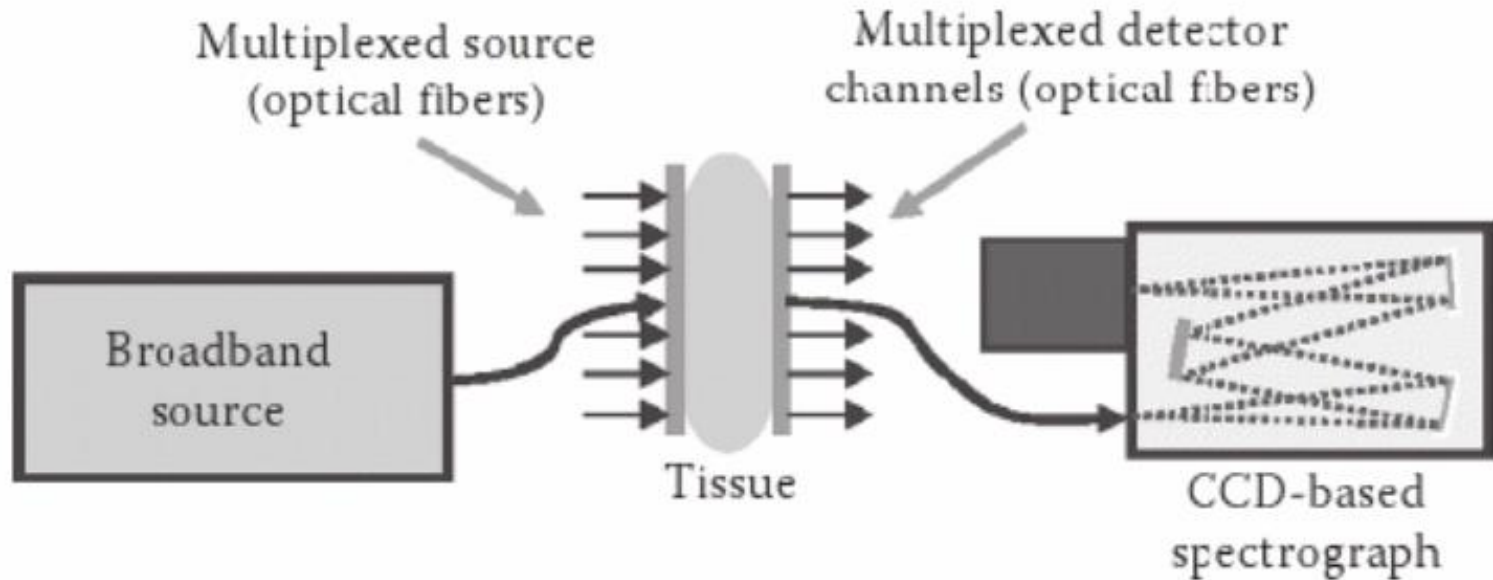


DOT basics



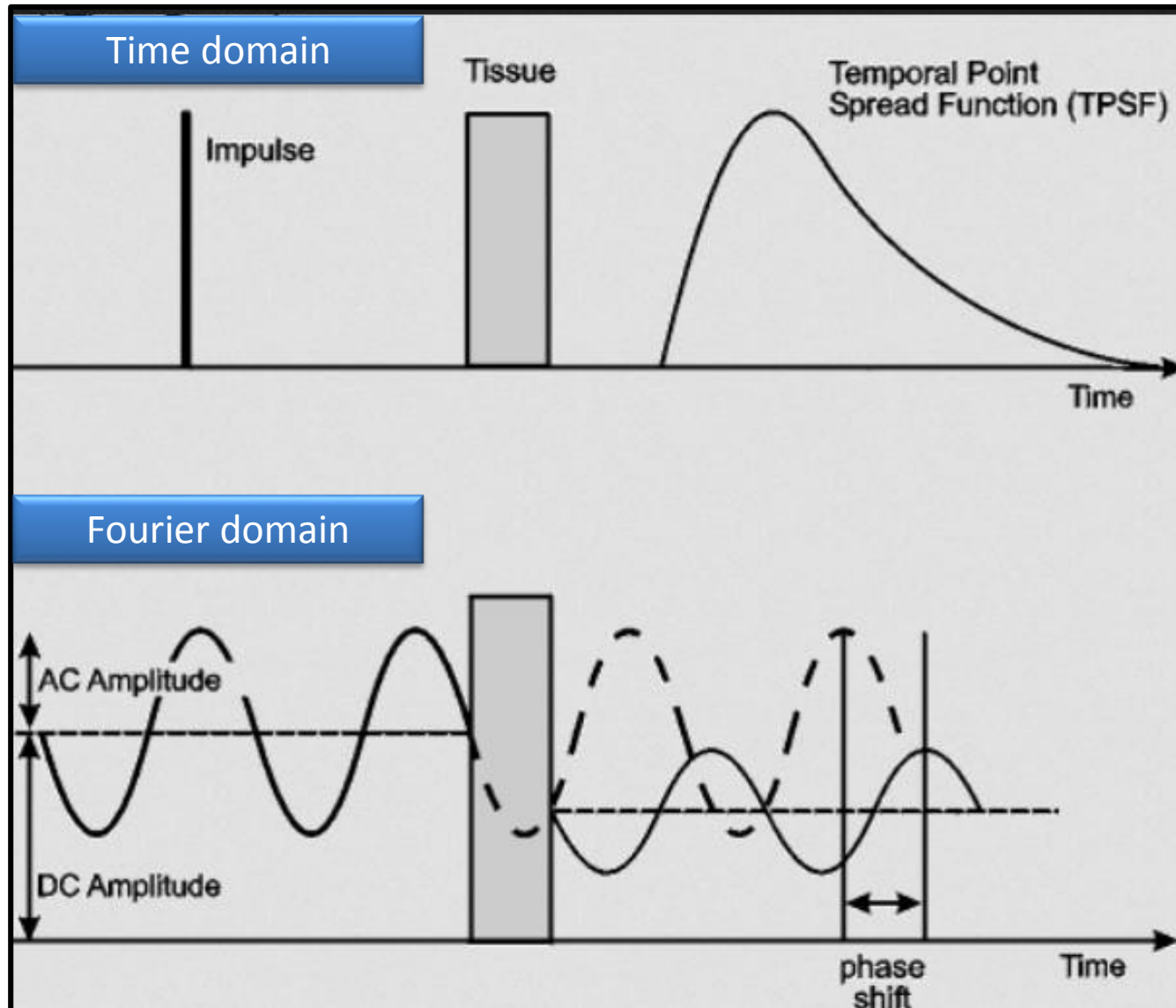
DOT basics

Continuous wave

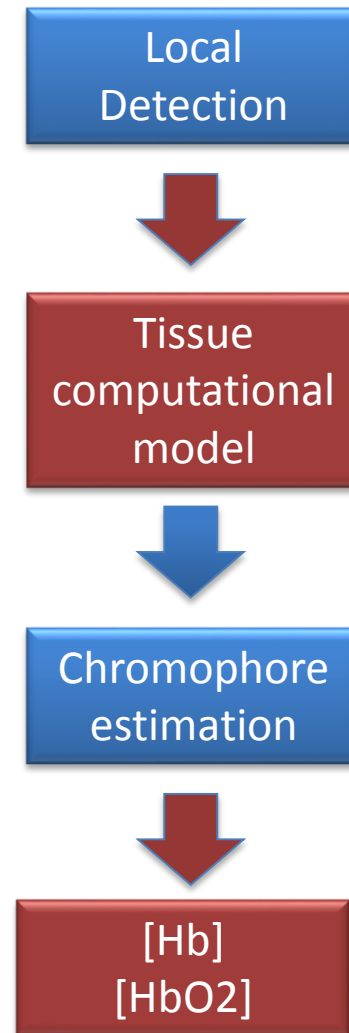
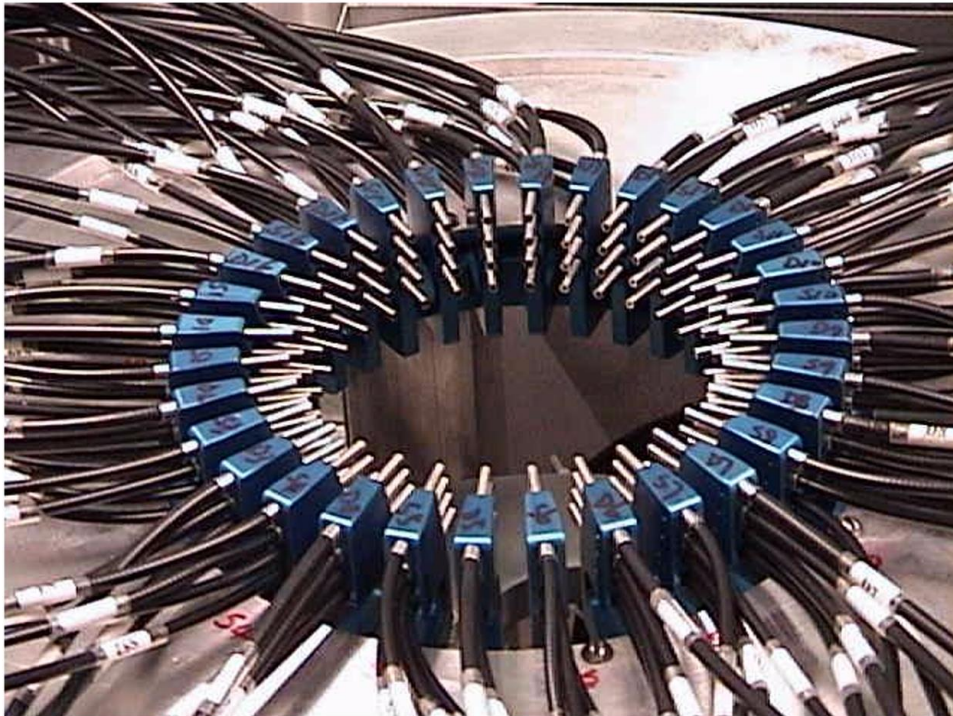


Local changes in the optical properties of tissue are detected as changes in how light propagates in tissue

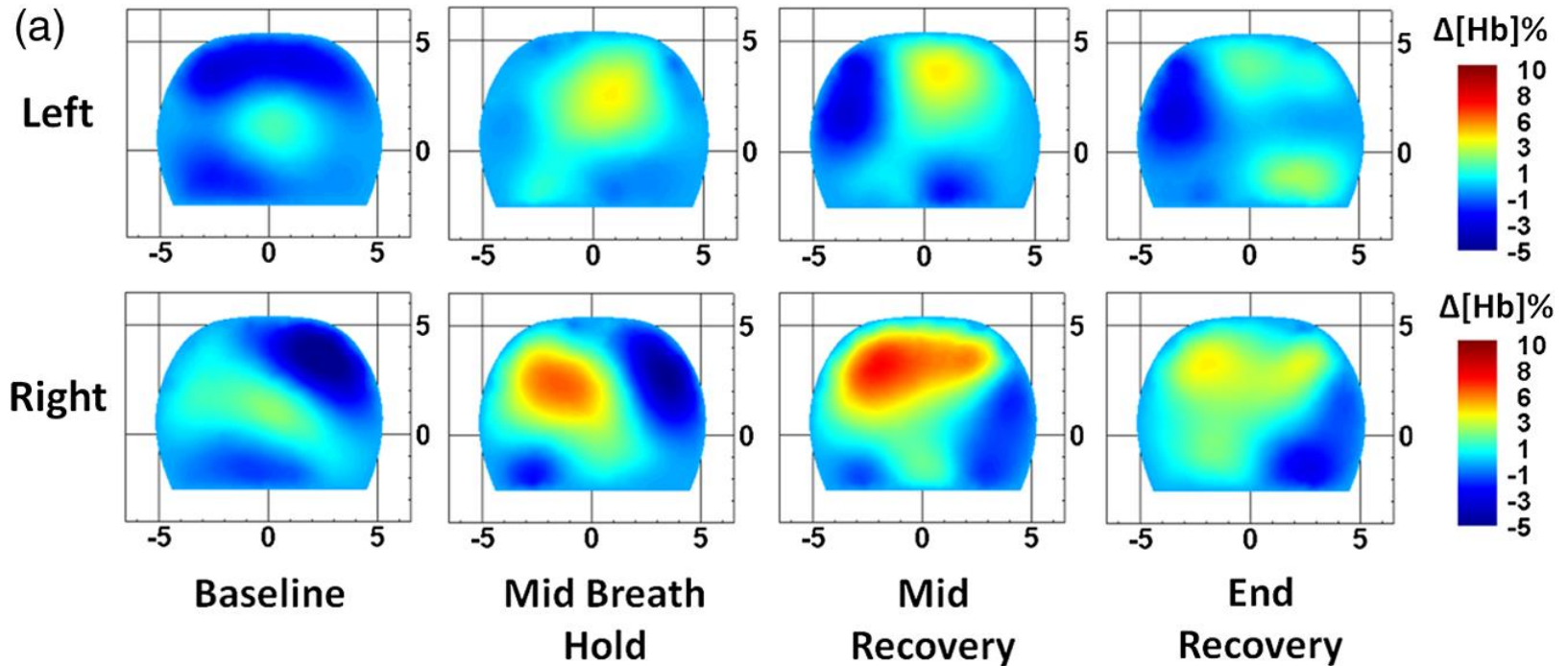
DOT basics



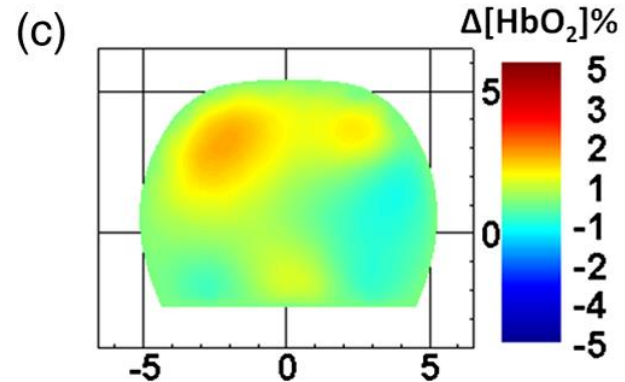
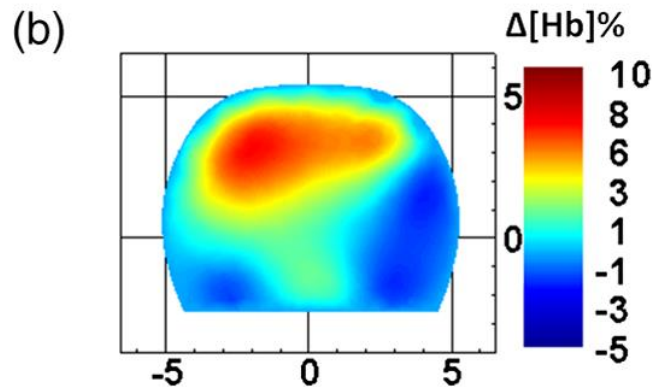
DOT Basics



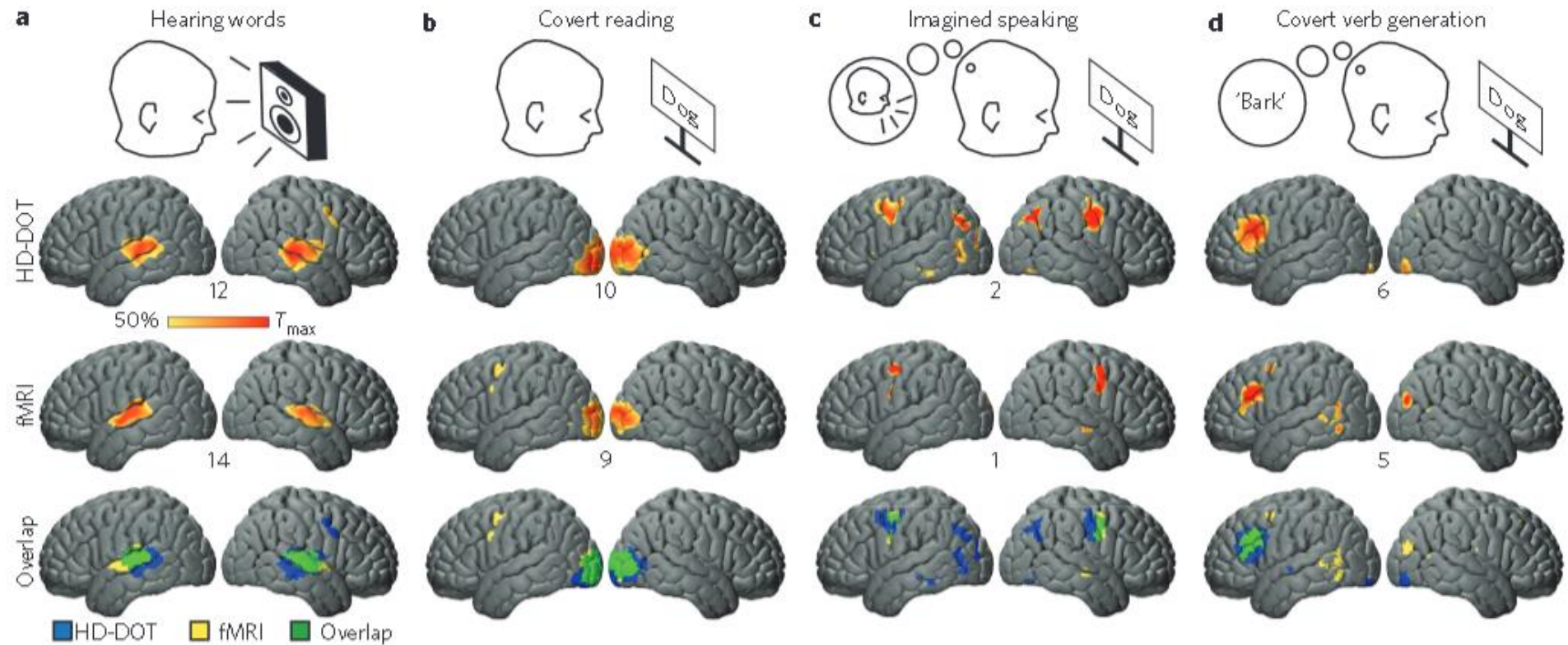
Applications: Breast cancer



32 sources
64 detectors
4 λ

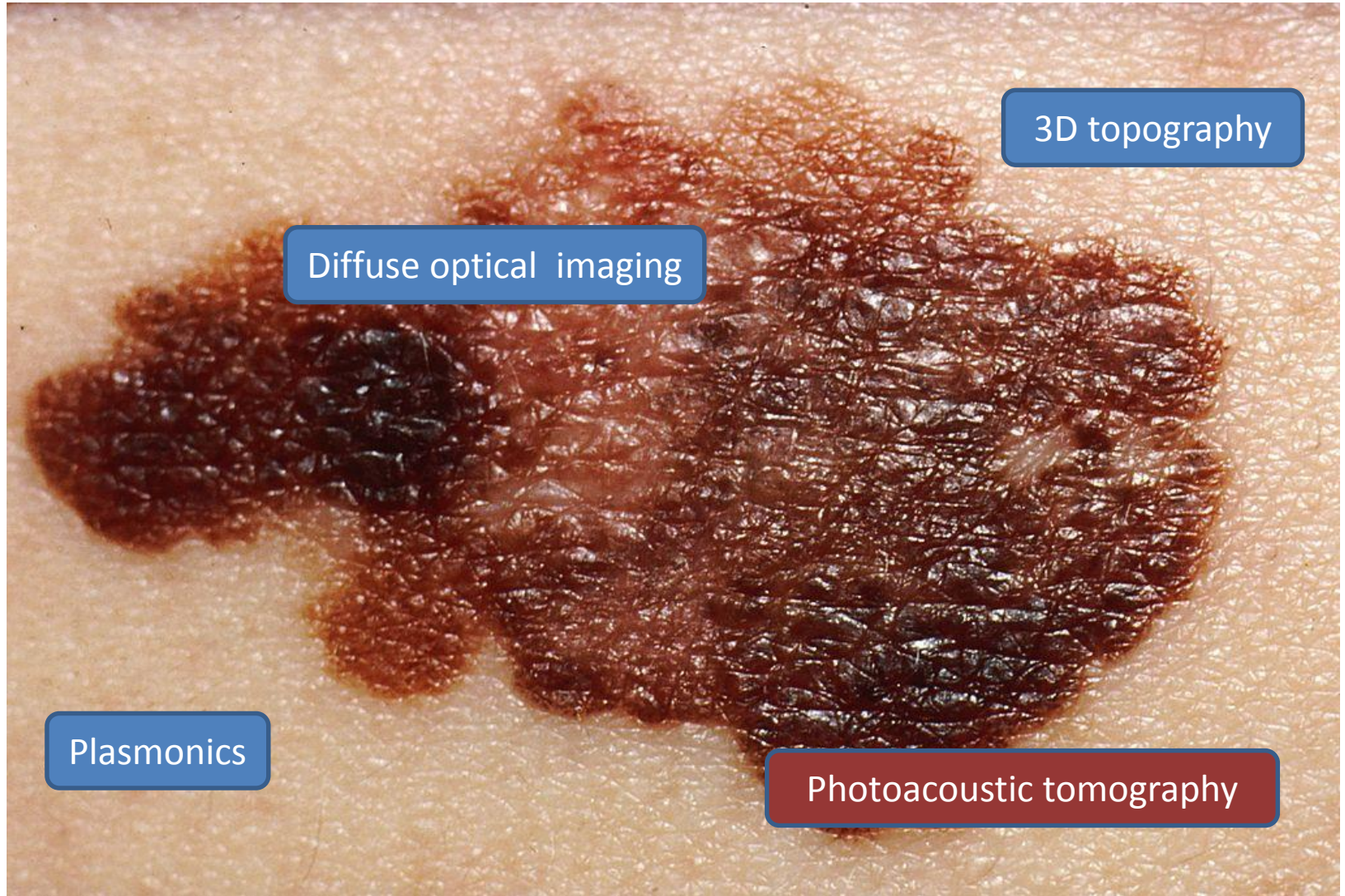


Applications: functional imaging

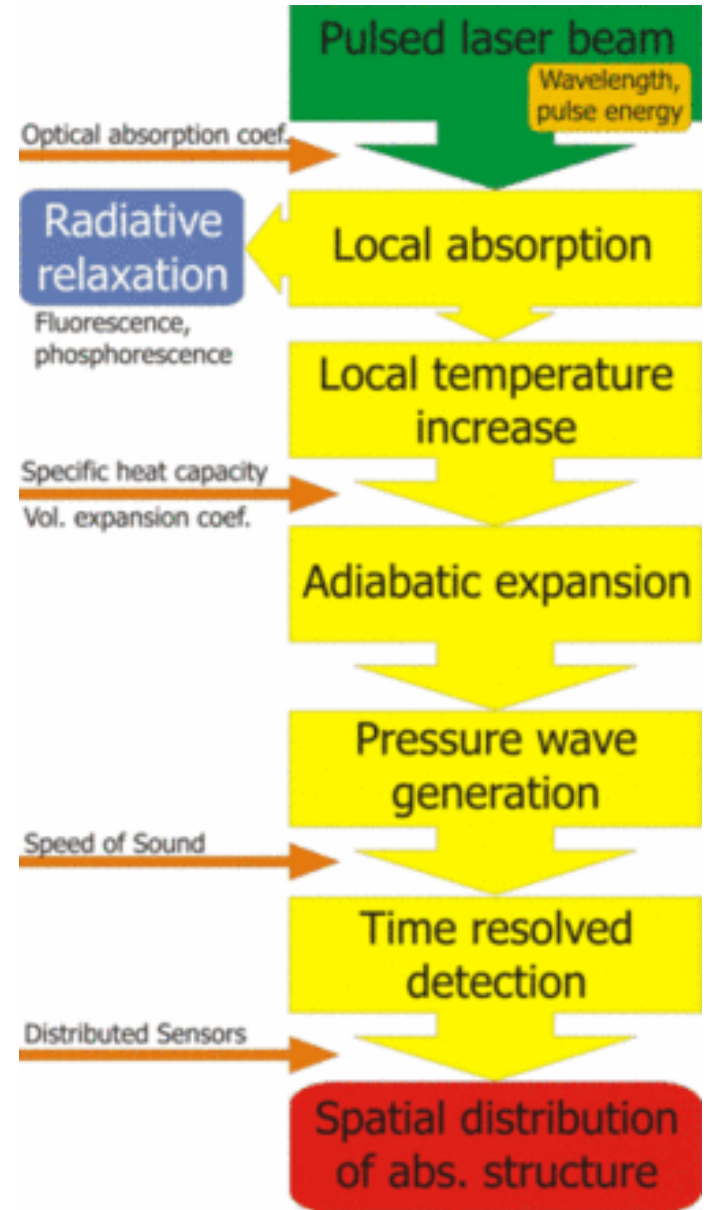
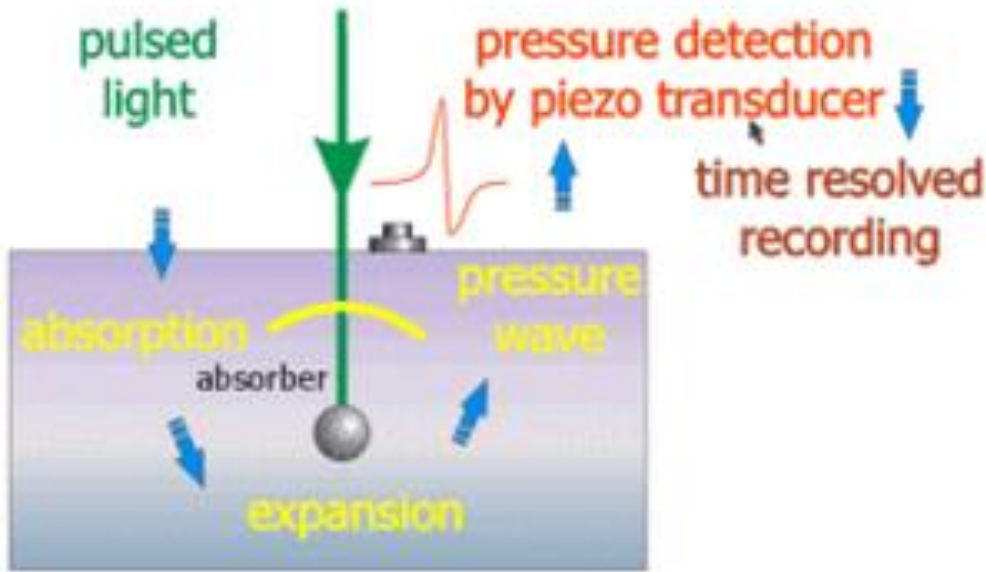


96 sources
 92 detectors

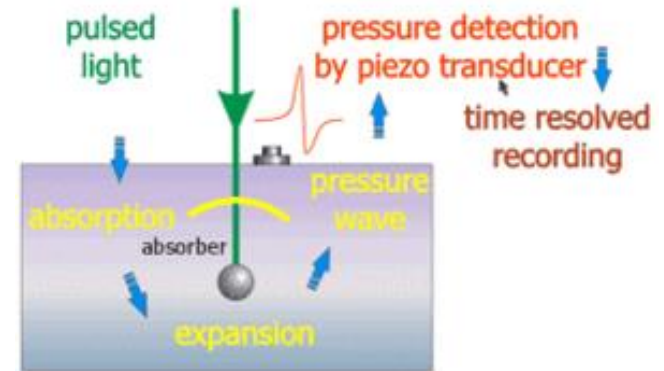
Guide



PAT basics



Why PAT?



Optical excitation

Ultrasound propagation

Piezoelectric detection

Optical focusing

Smaller scattering
(100 cm^{-1} to 0.3 cm^{-1})

Contact+gel

Easy scanning

Time-resolved

HF repetition rate

Larger speckle

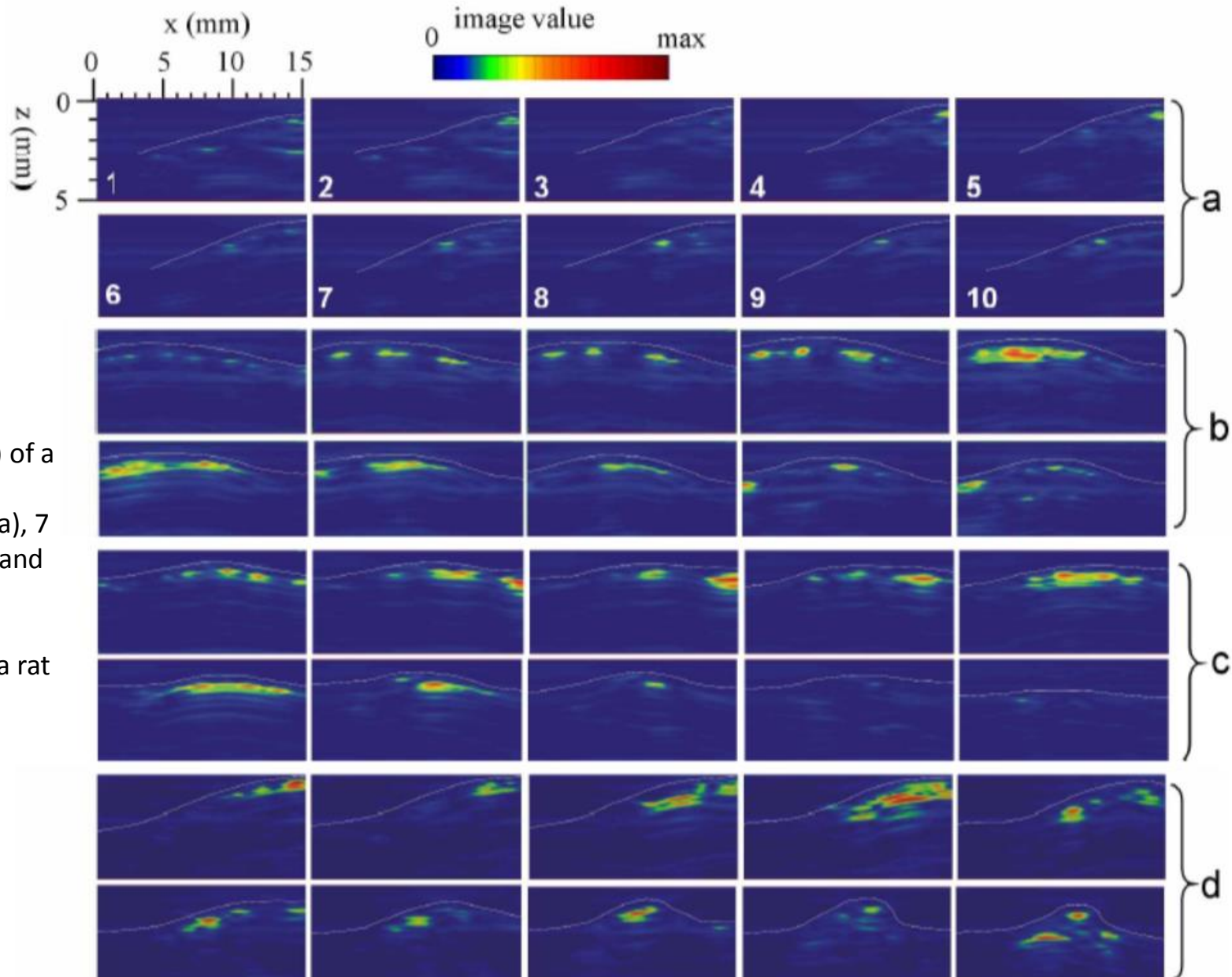
High bandwidth

Optical contrast

Larger depths

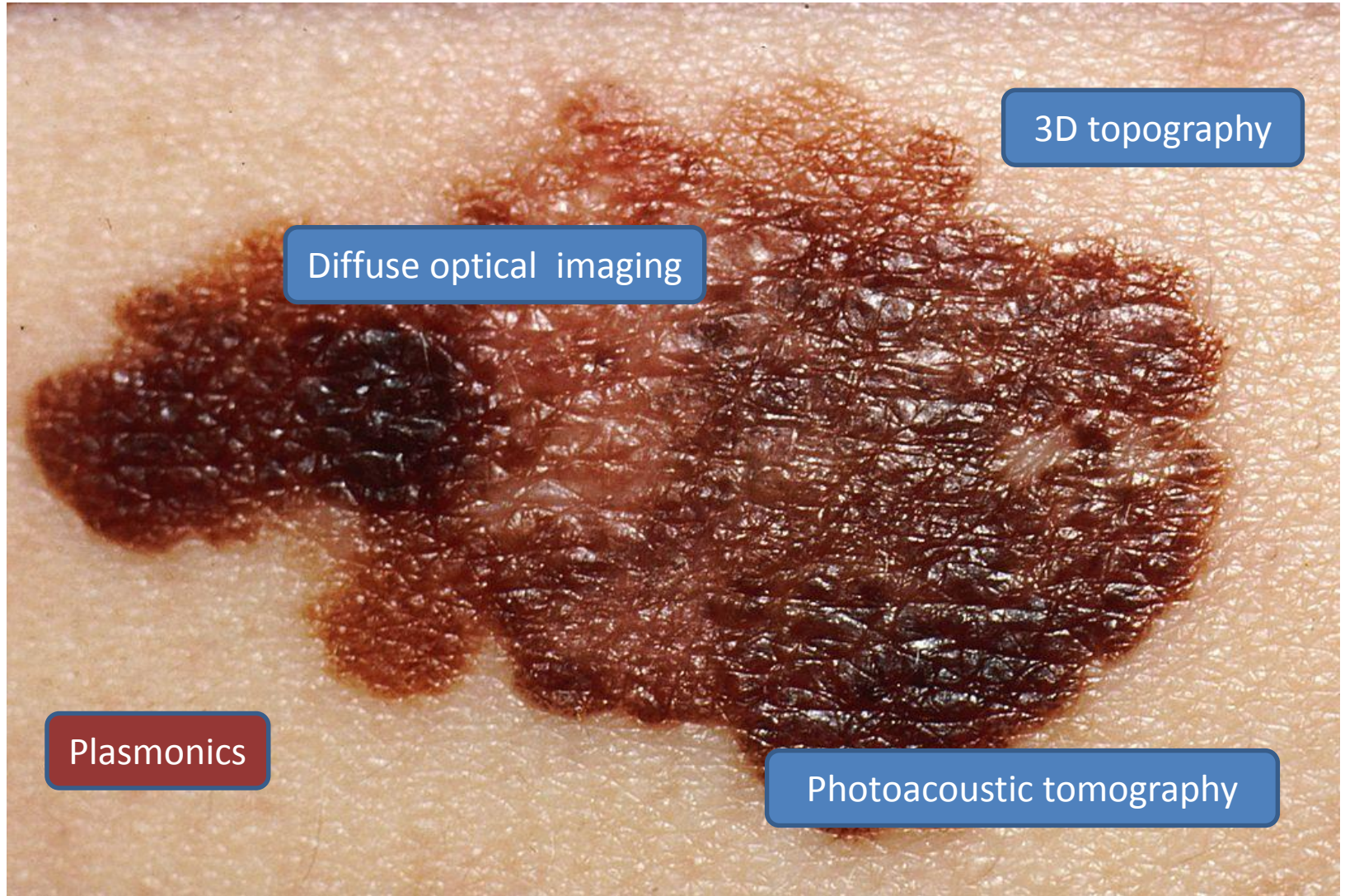
Well-known detectors

Detection of cancer

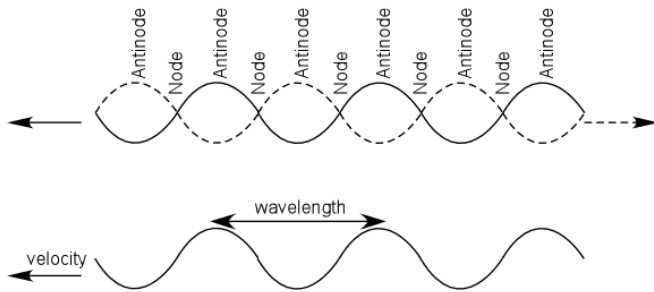
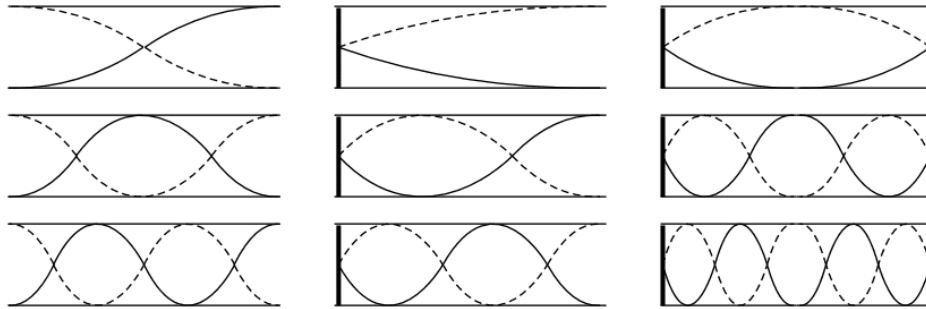


Thin slices (150 μ m) of a 3D volume (1-10) performed 3 days (a), 7 days (b), 8 days (c) and 10 days (d) after inoculation of cancerous cells on a rat

Guide

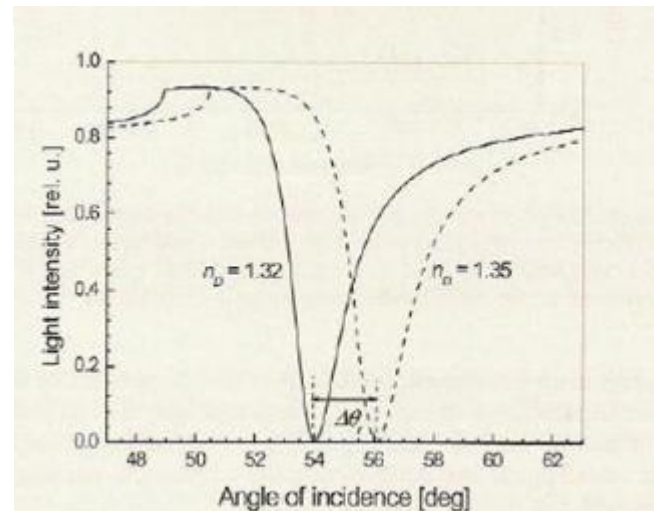
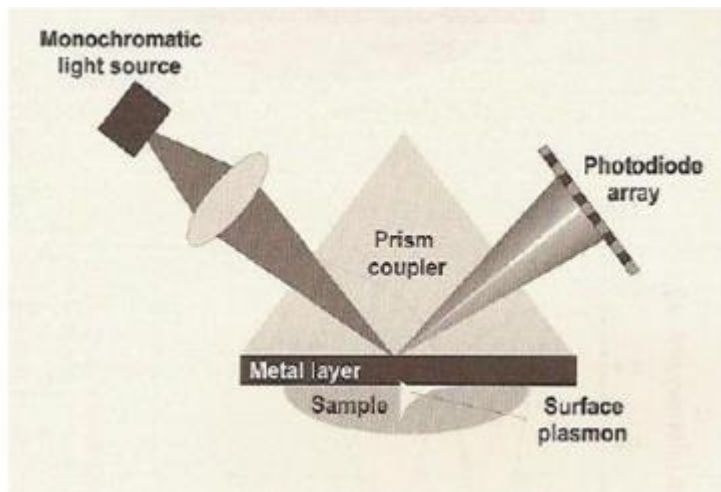
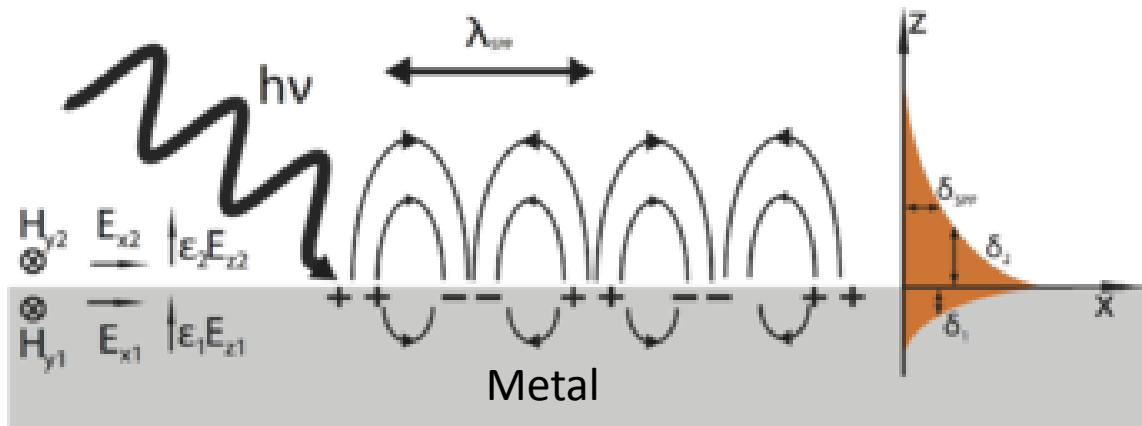


Plasmon basics: waves

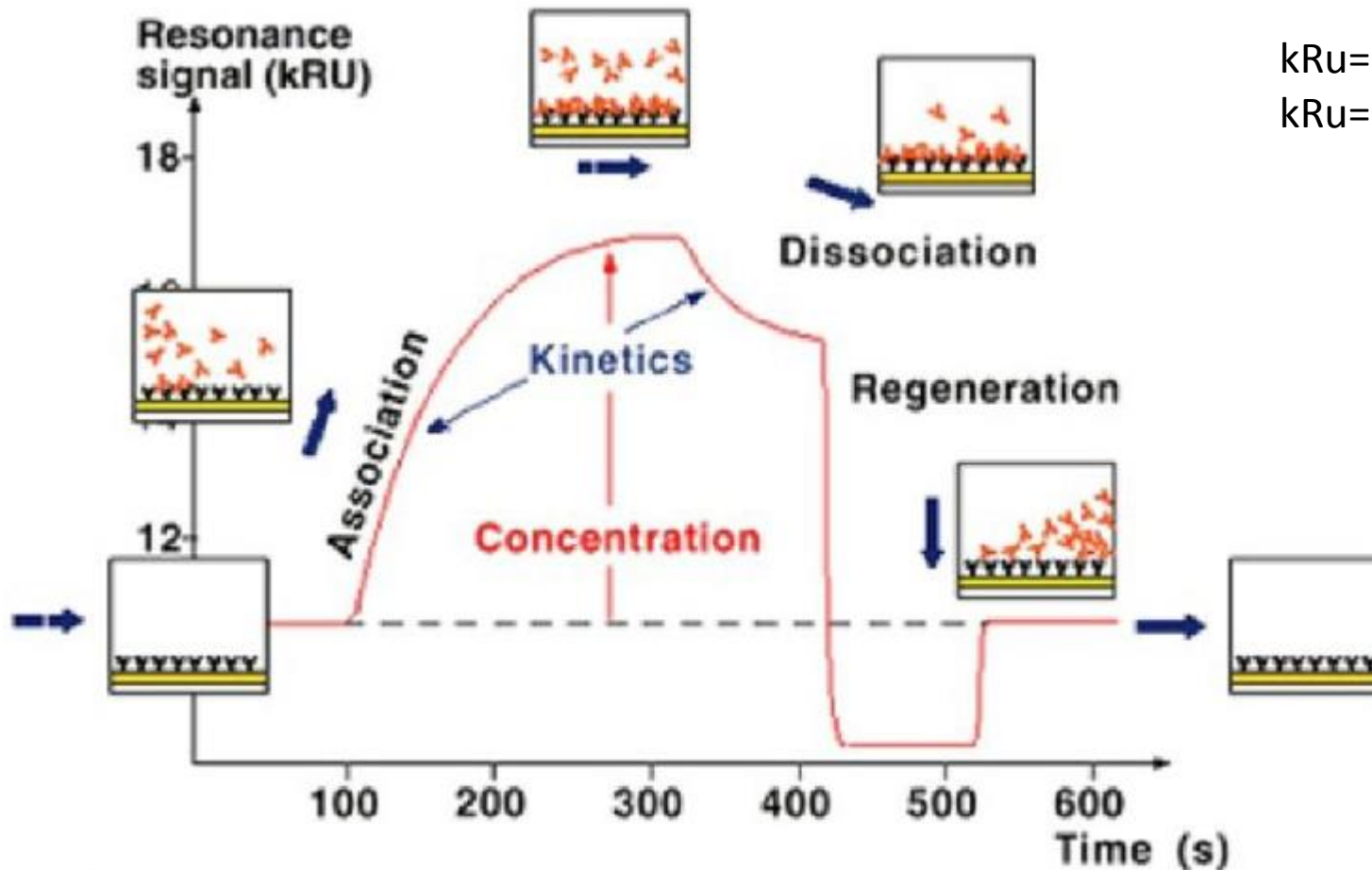


To physicists, all waves may be seen as particles.
Light waves are photons
Waves in crystals are phonons
...and waves in plasmas are plasmons

Plasmon basics: waves in plasma

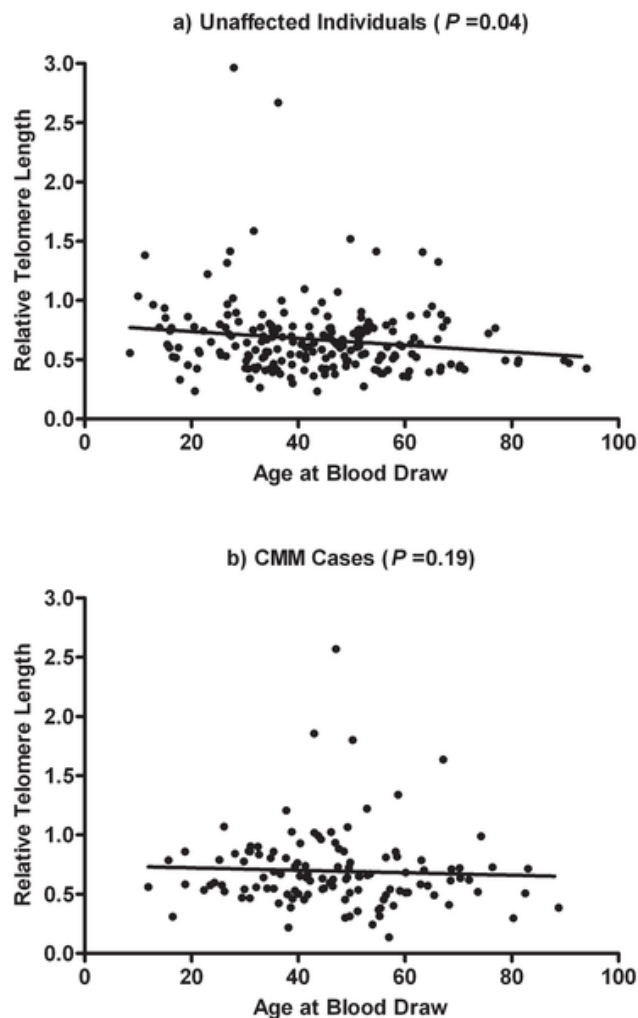


Plasmon basics: waves in plasma



$kRu=0.0001\text{deg}$
 $kRu=0.28\text{arcsec}$

Figure 1. Correlations between relative telomere length and age at blood draw in unaffected individuals and CMM cases.



Burke LS, Hyland PL, Pfeiffer RM, Prescott J, et al. (2013) Telomere Length and the Risk of Cutaneous Malignant Melanoma in Melanoma-Prone Families with and without CDKN2A Mutations. *PLoS ONE* 8(8): e71121. doi:10.1371/journal.pone.0071121
<http://www.plosone.org/article/info:doi/10.1371/journal.pone.0071121>

Guide



Multimodality



Novel tools for fast and reliable skin cancer diagnosis and prognosis

Design, build and test pilot services in hospitals for early & specific skin cancer detection

Multimodal
in-vivo platform
with four
different
photonic
technologies

Ex-vivo platform
for optimized
surgery
procedures

Piloted in ESP and ITA at two hospitals



Coordinators



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH



CLÍNIC
BARCELONA
Hospital Universitari

IDIBAPS^R
Institut
D'Investigacions
Biomèdiques
August Pi i Sunyer



MAVIG
VivaScope

carril
instruments



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<http://www.diagnoptics.eu>



- Staff: 40 people
 - 11 researchers
 - 17 R+D Engineers
 - 8 PhD Students
 - 4 Management
- Multidisciplinary:
 - Optics
 - Mechanics
 - Electronics
 - Software
- Site:
 - 1800 m2
 - Research labs
 - Mechanic & Electronic Workshops



Open PhD Position

Open Posdoc Position



Thanks!



UNIVERSITAT POLITÈCNICA DE CATALUNYA
Centre de Desenvolupament de Sensors, Instrumentació i Sistemes (CD6)

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<http://www.cd6.upc.edu>



Project DPI2011-25525



Actions BM1205 / MP1204

