
ULL C.Telemedicina
I Jornadas INNOVACION SANITARIA con las TICs
29 Septiembre 2010
Cátedras Telefónica
Prof.Dr.O.Ferrer-Roca
Cátedra UNESCO Telemedicina
Cátedra Telefónica de Telemedicina
UNITWIN/UNESCO Chairs Programme
Twinning networks and university networking
Cátedra Unesco de Telemedicina


Evolución computadoras
electronic comic by Ted Goff
El viaje fantastico
THE HISTORY OF PORTABLE COMPUTING
1980
PORTABLE COMPUTER
1990
LAPTOP COMPUTER
2000
FINGERTOP COMPUTER
2010
CONTACT LENS COMPUTER
2020
MICROCHIP INHALANTS
UMPC= Ultramobile Personal computer
SPOT= Smart Personal object technology
Nanosensor sprays
2010
Hitachi μ-chips 1.5μ
TinyOS
Smartdust 2003
Ley de Moore→ 2a.
Corolario de Bell nuevas clases de computadoras→10a.
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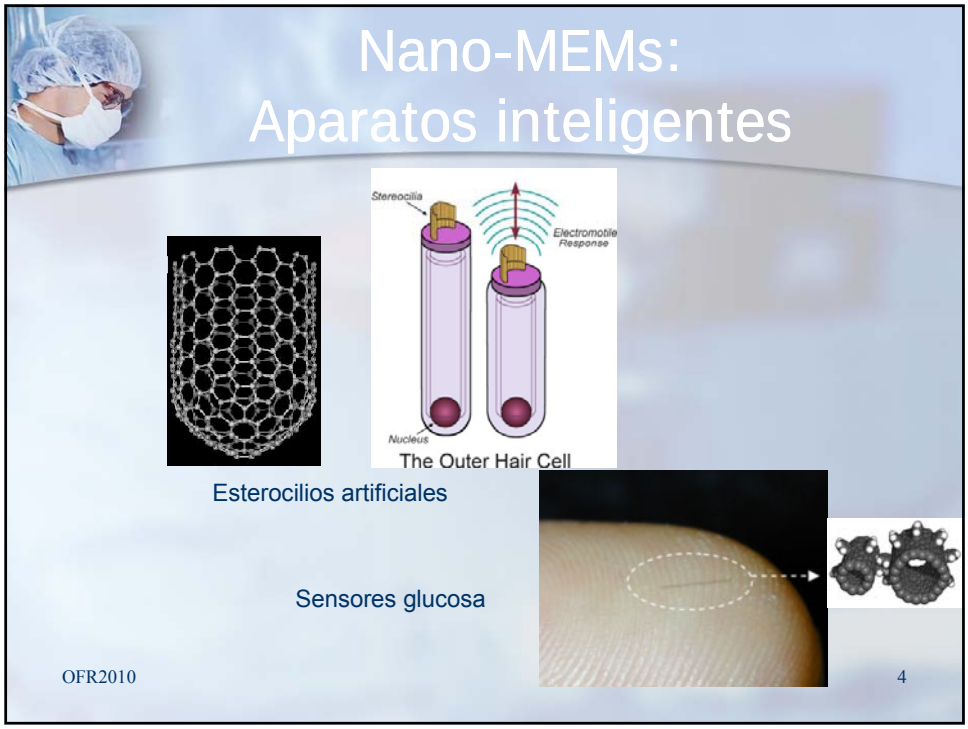
Glucosa en las Lágrimas
PHOTONIC CRYSTAL TECHNOLOGY
Photonic Crystal Tear Glucose Sensing
SENSORES LENTES CONTACTO-LC (2004) → COMPUTADORAS EN LC (2010)
OFR2010
Clin Chem 2004; 50:2353
3


Nano-MEMs:
Aparatos inteligentes
Stereocilia
Electromotile Response
Nucleus
The Outer Hair Cell
Esterocilios artificiales
Sensores glucosa
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# Vestidos inteligentes

INHALAMBRICOS



- Sensores camisetas
- → ECG
- → Pulso
- → Temperatura
- → Posición del cuerpo
- → Geo-localización (GPS )

Cálculo de magnitudes como:

- → Nº pasos
- → Distancia recorrida
- → Detector eventos (shock, caidas...)

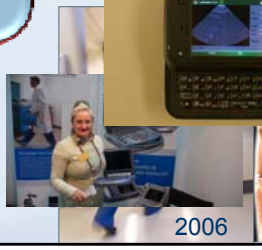

iBGStar glucometro

**TGManager** is included in the TG developers Kit
**TGSport** –geolocalizacion: aplicacion de Symbian S60.



- Nuevas clases de computadoras requieren plataformas, redes y un ciberespacio nuevo.
- Nuevas plataformas computación →dependen de la evolución densidad chips (Ley Moore).
- Hay apps y contenidos nuevos para cada clase
- Cada clase se disintegra en 5-10 AÑOS para una industria que está basada en **estándares de HW y SW.**

Ley de Bell para el Ciberespacio

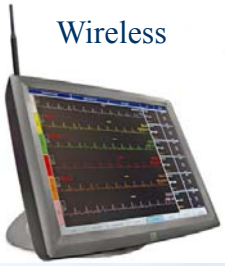






# Imagen medica

- Fonendo

Wireless





COW

VOW

- Ultrasonógrafo portátil (con TM.)



# Siemens- ACUSON P10

- 2007

# VSCAN- GE

- 2009



Mobile
Pocket
US

OFR2010 **CEO of General Electric Jeffrey R. Immelt** 9

# VSCAN
# General Electrics

PoC imaging

- 400 gr peso
- Doppler color
- 2D
- 60 min

- TM off line
  usando equipo sobremesa
- Sonda fija
- Grabación voz
- Estación USB

- Enero-2010 – Se testea en 3 hospitales UE: Francia, Alemania y el Hospital Clínico de Madrid. En Madrid hay 4 unidades: 2 Hospital Clínico y 2 centros de **atención primaria**. El objetivo: utilizar el ecógrafo como sistema de screening e identificar pacientes que requieren un examen más exhaustivo.
- **Validation: 12 leading clinical sites throughout the world** to help determine how the technology will impact patient workflow and focused exams in **primary care**, **critical care** and the **cardiology** practices. The ultimate goal is to develop **a structural protocol** for Vscan exams.

FDA,CE Mark, MD-License Health Canada.

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Impacto tecnológico
Escáner-US de mano
Home care → TM
Tele-ictus → TM + 3D + Dpp
Emb. riesgo * pac. →TM + 3D + Dpp
Consulta experto → TM //+ 3D
Total Vascular Ultrasound Exams Per 1,000 Medicare Beneficiaries
1998 2003 PERCENTAGE INCREASE
116 156.9 35 %
Who's Performing Vascular Ultrasound Exams?
Radiologists 42.1%
Surgeons 26.4%
Cardiologists 12.7%
Primary Care Physicians 8.1%
All Other Physicians 5.6%
IDTFs 5.0%
Doppler color
Sonografía virtual → 3D + TM on line.
Trabajo colaborativo
PoC standard ISO/IEEE-11073
OFR2010
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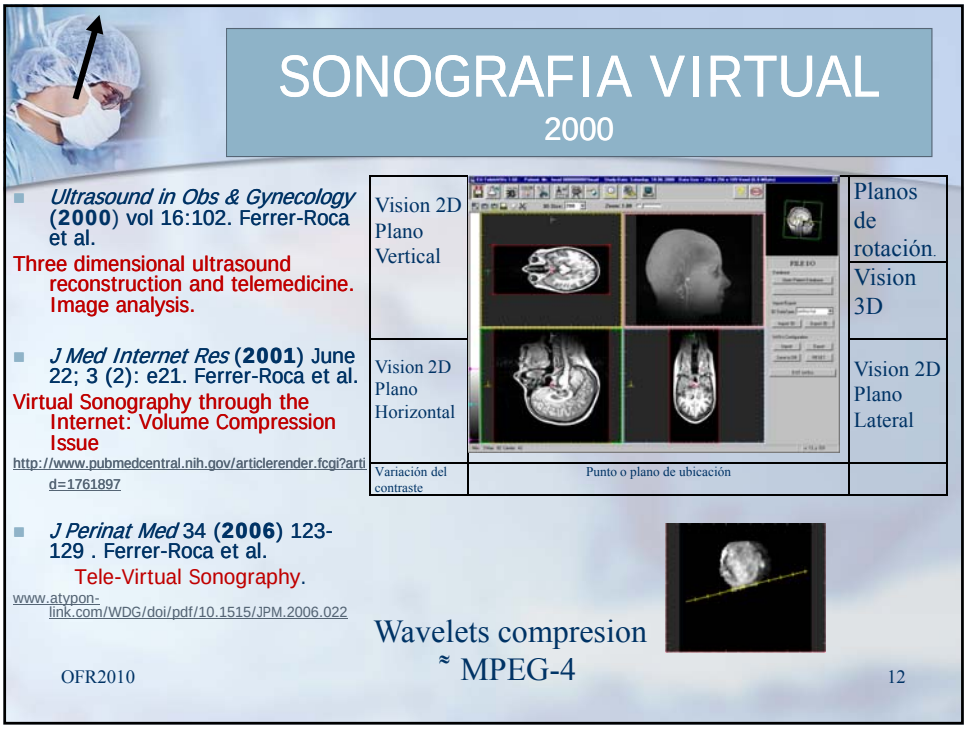
SONOGRAFIA VIRTUAL
2000
Ultrasound in Obs & Gynecology (2000) vol 16:102. Ferrer-Roca et al.
Three dimensional ultrasound reconstruction and telemedicine. Image analysis.
J Med Internet Res (2001) June 22; 3 (2): e21. Ferrer-Roca et al.
Virtual Sonography through the Internet: Volume Compression Issue
http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1761897
J Perinat Med 34 (2006) 123-129 . Ferrer-Roca et al.
Tele-Virtual Sonography.
www.atypon-link.com/WDG/doi/pdf/10.1515/JPM.2006.022
Vision 2D Plano Vertical
Planos de rotación
Vision 3D
Vision 2D Plano Horizontal
Vision 2D Plano Lateral
Variación del contraste
Punto o plano de ubicación
Wavelets compresion
≈ MPEG-4
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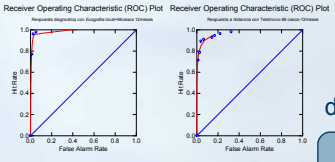
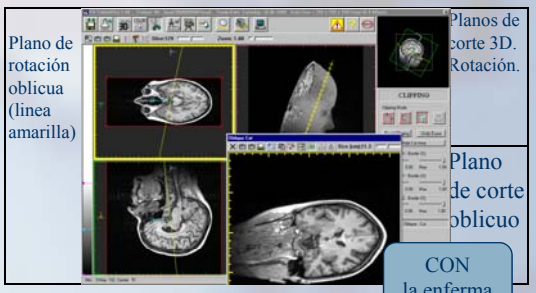
# SONOGRAFIA VIRTUAL

*J Perinat Med* 34 (**2006**) 123-129 . Ferrer-Roca et al.

- Permite encontrar la ventana 2D óptima para el diagnóstico




CON la enferma

La Variabilidad Intraobservador, local versus a distancia, fue baja con una kappa muy alta (k=0.7);

SIN la enferma



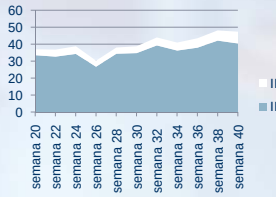
# Sonografía virtual:1. Tele-ictus

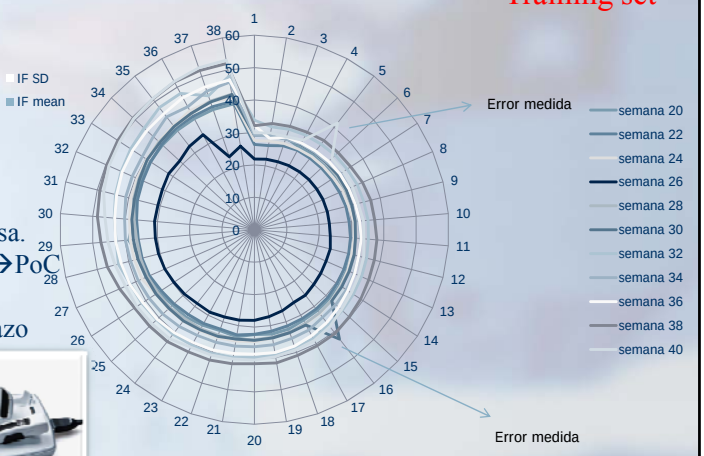
1. Sonografía por un “no experto”
2. Sonda 3D + Doppler.
3. Envío de la volumetría → TM
4. Programa de análisis de la imagen y sonografía virtual → encontrar la “ventana diagnóstica”.
5. Diagnóstico
6. Tratamiento → <2h.

# Sonografia virtual: 2. OB-G

JM Troyano Luque & O. Ferrer-Roca 2010

**Indice Flujo: 37 Pacientes** Training set




1. US no experto+ casa.
2. 3D+Doppler+TM→PoC
3. Calculo IF
4. Evaluación embarazo

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# HEALTH-GRID (2011)

- GRID TECHNOLOGY IN TELEPATHOLOGY AND PERSONALIZED TREATMENT

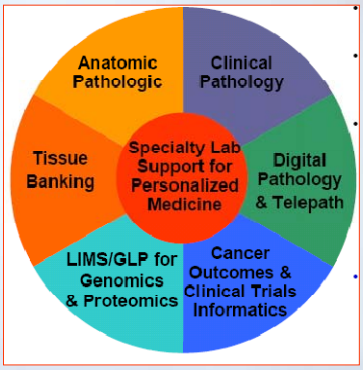
**Ferrer-Roca O.** et al (2011)

In: Grid Technologies for eHealth: Applications for Telemedicine Services & Delivery

Editor: Dr. Ekaterina Kldiashvili. IGI Global Publ. Philadelphia. USA

http://www.igi-global.com/Bookstore/Chapter.aspx?TitleId=45561

ISBN13: 9781616920104




*Text Mining*

**Literature Based Discovery** (LBD) technique that use annotations and data in existing biomedical sources to discover associations.

*Image Mining*

**ISO 19115/19139** standard on image metadata ontologies,
MPEG-7 (MPEG Query Format-MPQF **ISO/IEC 15938-12** ),
MPEG-21 or **ISO 21000-14**,
**ISO 24800-3** for JPEG query search
**ISO/IEC 15444-2** for JPX metadata set
**DICOM** (Q/R SCP query-retrieve service class )

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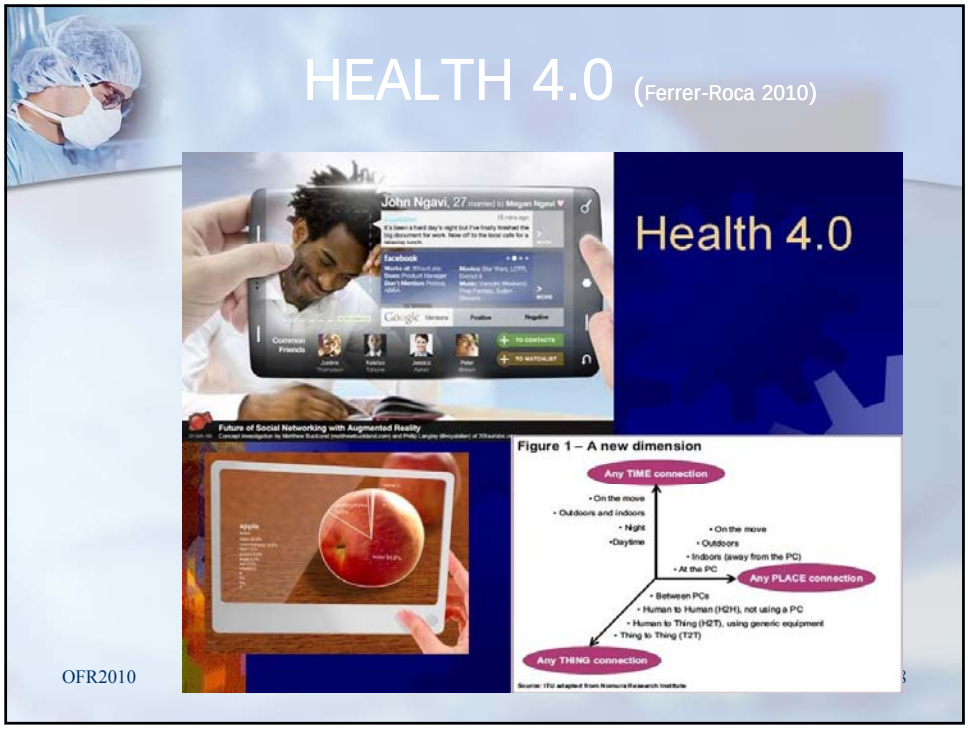
HEALTH 4.0 (Ferrer-Roca 2010)
Health Care Quality
Health 2.0
Web 2.0
Health 3.0
Web 3.0
Social, Semantic, Service
WEB 3.0
taking your webapps offline
CLOUD
HCQ
HCQ
ISO 13485
ISO27k
Segurida
HCQ 2009 is poised to address the
five key pillars supporting quality improvement:
Performance Measurement and Payment Reform
Patient Safety and Error Reduction
Care Management and Coordination
Public Reporting and Transparency
Efficiency and Resource Utilization
Health 4.0
Web 4.0
HCQ
KBL
Q byEx
OFR2


HEALTH 4.0 (Ferrer-Roca 2010)
Health 4.0
Future of Social Networking with Augmented Reality
Figure 1 – A new dimension
Any TIME connection
• On the move
• Outdoors and indoors
• Night
•Daytime
• On the move
• Outdoors
• Indoors (away from the PC)
• At the PC
Any PLACE connection
• Between PCs
• Human to Human (H2H), not using a PC
• Human to Thing (H2T), using generic equipment
• Thing to Thing (T2T)
Any THING connection
OFR2010

# Solo-Medicina

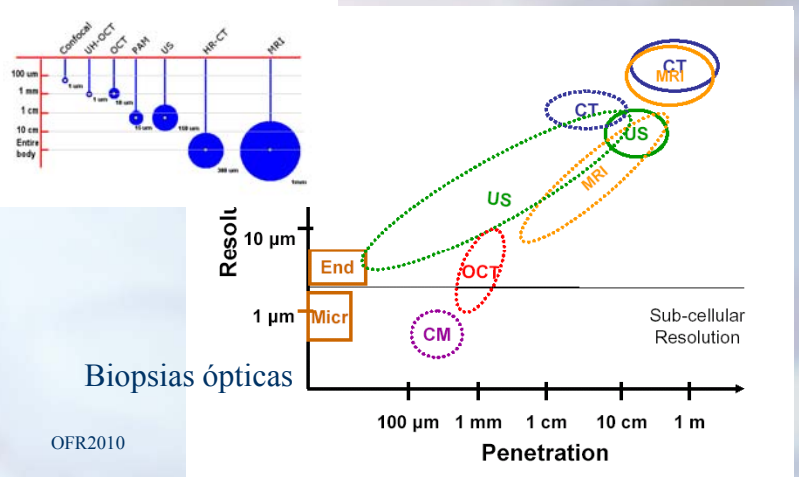
- Inhalámbrico
- Hand-held portable.
- LBD-Image search → “solo-perinatología”
- TM con sonografia virtual.
- pMedicine o medicina personalizada.

## Solo- Perinatología



# Nuevas Modalidades Imágenes

- Basadas en su mayoría en US
- Excepto la Microscopia Confocal




Biopsias ópticas

# Fusión de Imágenes

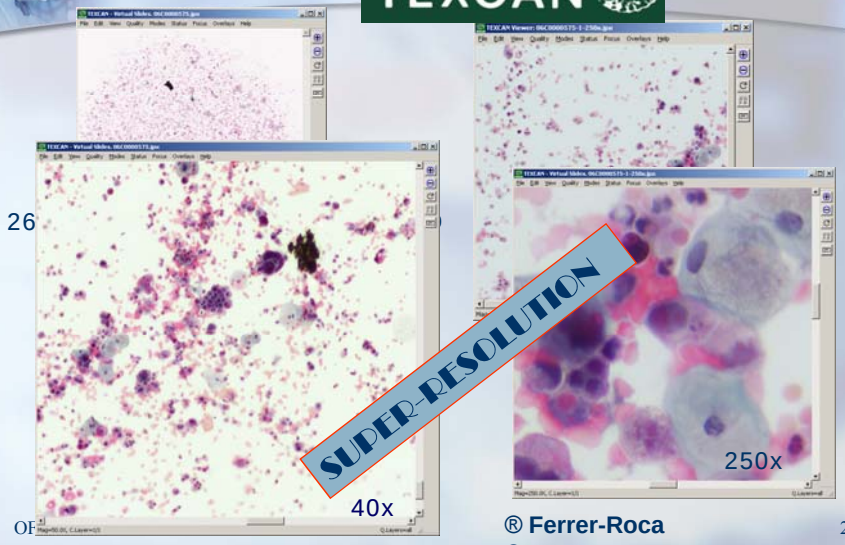
- "Para aplicaciones de radiologia vascular" en otras palabras para un sistema de US general.
- Lo impresionante de LOGIQ® E9 es su NUEVA TECNOLOGIA DE IMÁGENES y su capacidad en tiempo-real de fusionar un examen de US que se esta realizando en ese momento con imágenes previamente adquiridad de CT, MR or otras de US.



# TEXCAN-II®- SSVS 2005 ©

Areas identified by pathologist / technician

TEXCAN

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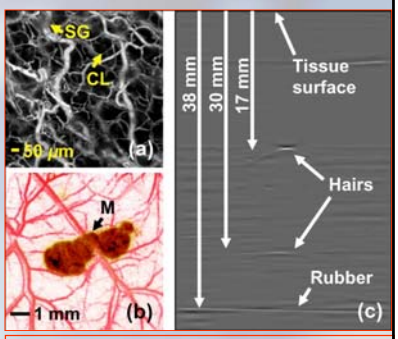
© Ferrer-Roca

# Microscopia fotoacústica Super-resolucion

## 3D tomographic photoacoustic microscopy (PAM)

PAM → optical irradiation, ultrasonic detection, and image formation

• **Light & ultrasound** in a single hybrid technology enables multiscale, HIGH RESOLUTION IMAGING deep into biological tissue (SUPER-DEPTH).
•Tissue is irradiated by a short-pulsed laser, and the light absorbed by the material causes an increase in pressure via thermoelastic expansion. The increased pressure propagates through the tissue as an ultrasonic wave, known as a photoacoustic wave, which is detected by an ultrasonic transducer that produces electrical signals. The signals are then amplified, digitized, and transferred to a computer, where an image is formed.



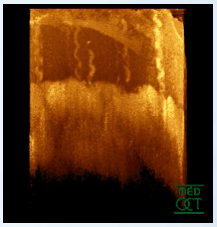

**5MHz US & 804 nm light → 3cm depth**



# OCT & Microscopy

Limited to imaging 1 to 2 mm below the surface in biological tissue

- OCT echo technique similar to UltraSound image



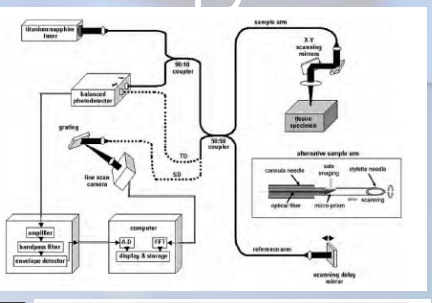
Depending on the use of high-brightness and wide-spectrum light sources such as superluminescent diodes or ultrashort pulse lasers, OCT has achieved sub-micrometre resolution (with very wide-spectrum sources emitting over a ~100 nm wavelength range).

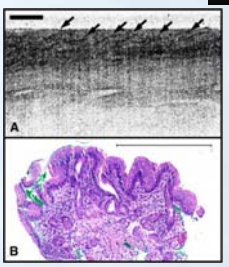
OCT', is a technique for obtaining sub-surface images of translucent or opaque materials at a resolution equivalent to a low-power microscope. It is effectively 'optical ultrasound', imaging reflections from within tissue to provide cross-sectional images

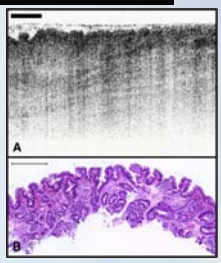
OCT delivers high resolution because it is based on light, rather than sound or radio frequency.

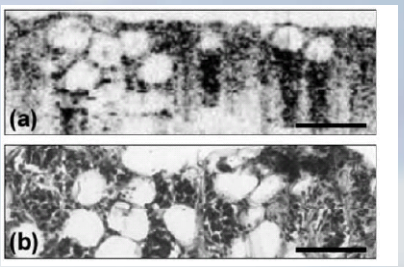
# OCT & Microscopy

- Fiberoptic OCT system





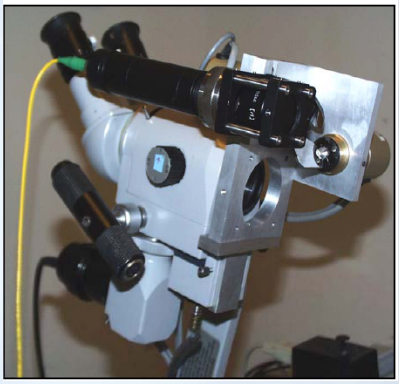



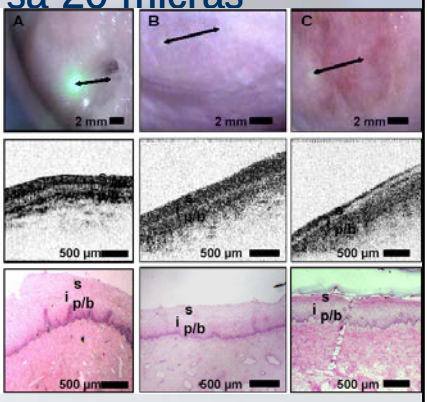



# Colposcopio-OCT

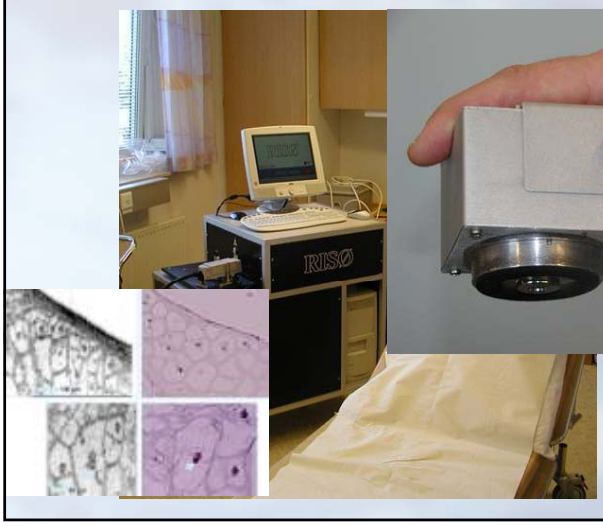
- Resolucion transversa 20 micras

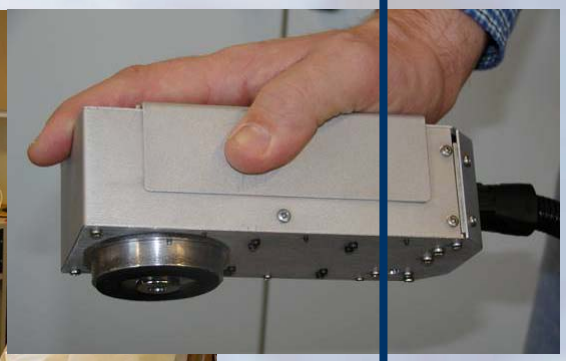


Zeiss



# Ultra-High resolution OCT





CITOLOGICA



# PoC imaging

Inhalámbrico

Hand-held

Miniaturizado

mHealth

Ley Bell limite

Trabajo colaborativo
Sonografía virtual

PoC imaging

Ubicuo
Estandarizado

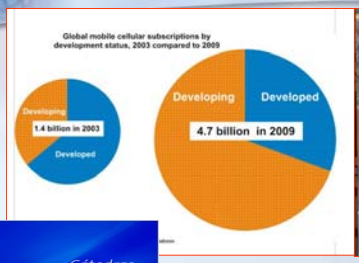
TM

Health 4.0

Biopsia óptica

Nuevas modalidades imágenes

# INNOVACION ES FUENTE DE INSPIRACION Y DESARROLLO





Cátedras Telefónica

UNITWIN/UNESCO Chairs Programme
Twinning networks and university networking
Cátedra Unesco de Telemedicina

CATAI

*"Initiate–Build–Operate–Transfer"*
*(IBOT)*

Prof.Dr.O.Ferrer-Roca
UNESCO Chair Telemedicine
catai@teide.net
htttp://www.teide.net/catai ; http://www.catai.net/blog