

SOFOMECE

Les nouvelles technologies au service de la santé

Jeudi 28 mars 2013

Centre hospitalier de Carcassonne

La révolution de micro-nano technologie/ électronique et la médecine personnalisée

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DG CONNECT, Composantes et Systèmes Electroniques
Commission Européenne, Brussels



European Commission
Information Society and Media

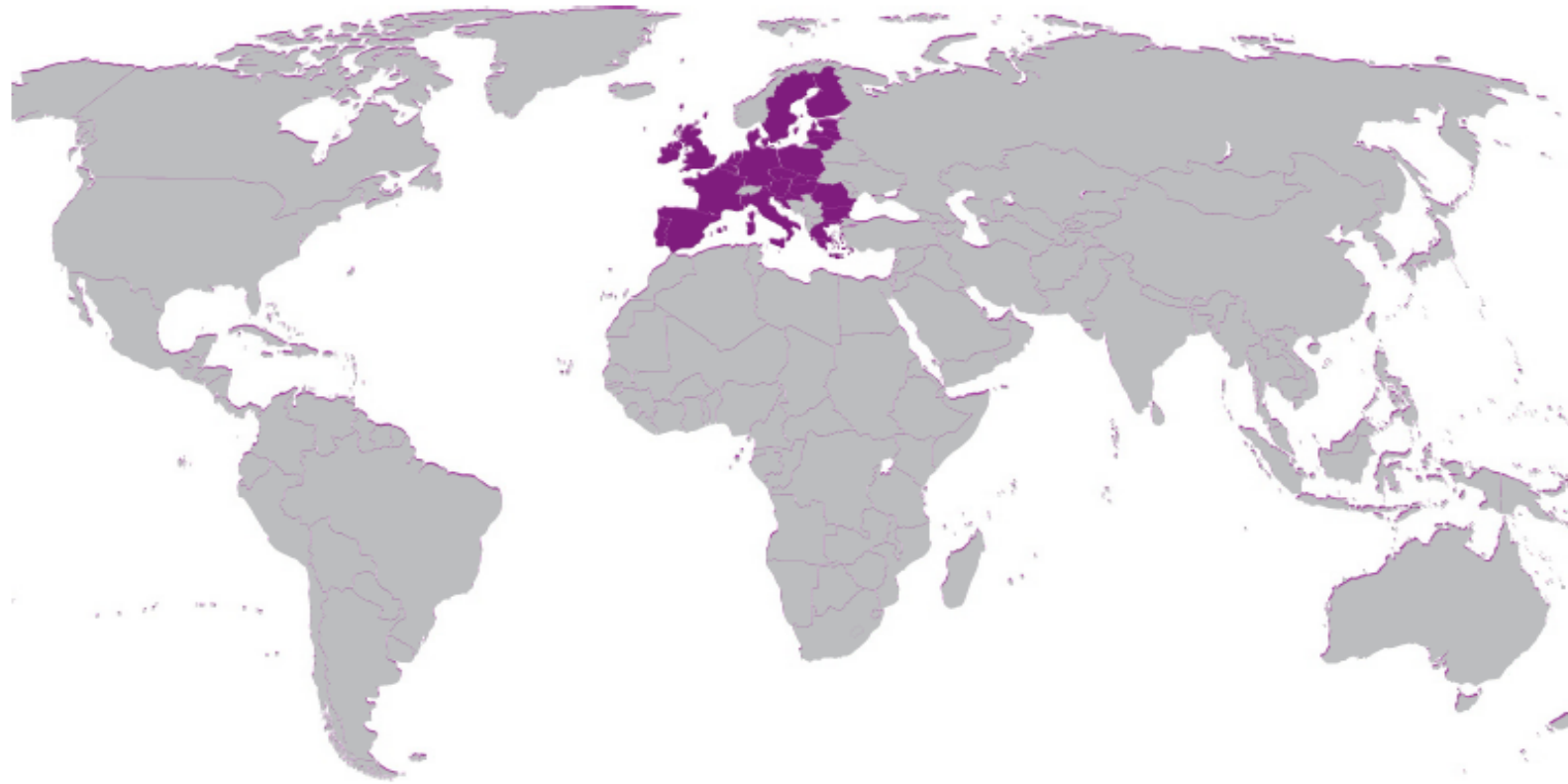


Sujets Principaux

(Micro/Nano) Technologie et Santé en Europe: où en est-on ? Où va-t-on ?

- ❑ Les politiques Européennes de recherche et les défis économiques - sociétaux
- ❑ Micro Nano Tech pour la Santé et la qualité de vie: Etat de l'art en Recherche Développement et Implémentation et Futures Défis
- ❑ e-Santé, p-Santé: Systèmes portables intelligents et Bioélectronique
 - Stratégie
 - Exemples
- ❑ Horizon 2020: Construire l'avenir de l'Europe à travers les Sciences, la Compétitivité et la Société
- ❑ A emporter

The « old » continent Europe



The answer

ONE EUROPE

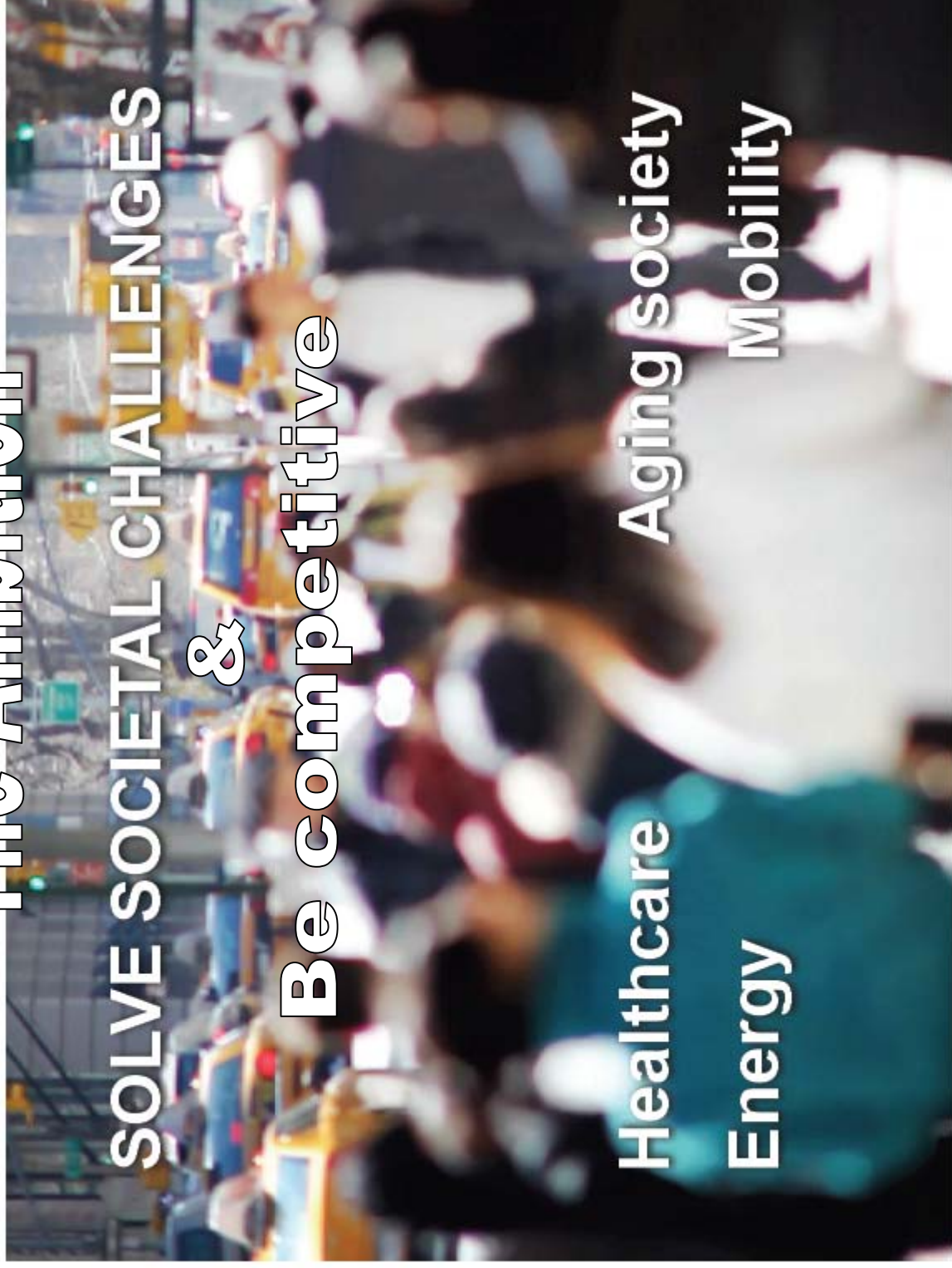
ONE VISION
ONE AMBITION

The Ambition

SOLVE SOCIETAL CHALLENGES

&

Be competitive



Healthcare
Energy

Aging society
Mobility

EU Policies: The renewed Lisbon agenda

- Markets & Competition: Europe - A more attractive place to invest & work
 - Extend & deepen the internal market
 - Improve European and national regulation
 - Ensure open & competitive markets inside & outside Europe
 - Expand & improve European infrastructure

- Knowledge & innovation for growth
 - Increase & improve investment in R&D
 - Facilitate innovation & uptake of ICT & the sustainable use of resources
 - Contribute to a strong European industrial base

- Employment & Skills: Creating more & better jobs
 - Attract more people into employment & modernise social protection systems
 - Improve the adaptability of workers & enterprises & the flexibility of labour markets



Invest more in human capital through better education & skills



Policy Context

ERA: European Research Area

FP6, Eureka, COST, National RTD Programmes

... towards a Single Market for Research

eEurope

Broadband access, e-business, e-government, security, skills, e-health, .



Enlargement

Candidate countries are full partners in FPs

"Lisbon Land"

"EU: Largest knowledge-based economy by 2010"

Other policies

Single Market, Single Currency, Security of Europeans, Sustainable Development

Media

European Commi
Information So



The European Union's Research & Development in HEALTH TELEMATICS

PAST 10 years (1991-2000)

“INFORMATION for HealthCare”

FUTURE 10 years (2001-2011)

“KNOWLEDGE for Health”

1989-1990 1990-1994 1994-1998 1998-2002

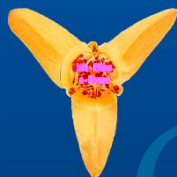
2002-2006 2006-2010 2010-2014

Computers for Doctors

Networks for HealthCare Professionals

User Needs Approach

Societal Demands



Information Technologies

Bioinformatic / Genomics

Neuro and Social Sciences

RESEARCH

IMPLEMENTATION

Budget
20M €

Budget
100M €

Budget
140M €

Budget
200M €

Projects
30

Projects
63

Projects
158

Projects
100+

Results
Feasibility Study

Results
AIM Community

Results
1st batch of products

Results
EU Health Telematics Industry

National and Regional Plans

Inter-cooperation (EMEDIS/MEDA, EU-Canada Telemedicine Group)

eEurope / "Health Online"

eHealth / eCommerce

Ten Telecom



Healthcare and Health Delivery Evolution Underway

Society

- **Increase of aging population and chronic patients**
(3-4 years increase in life expectancy up to 2030 -OECD, persons aged 80+ heaviest users of medical care)
- **“Health Conscious” and “Health Activists” Citizens**
- **Patients becoming “health consumers”**
- **Better health & life style management**
(Better Access, Real time professional consultation, Stay at home, etc)

Brain disorders and Need for solutions

- 21st century will be the century of the brain (devices)
 - 30% of the European cost of illness comes from brain diseases
 - Europe is losing ground to the US
- A conservative estimate* of the total costs of *brain disorders* in Europe (2004) amounts to **€386B**
- Mental disorders: affective disorders (*depression* and *bipolar disorders*)
€106B
 - Neurological diseases: *migraine* (**€27B**), *stroke* (**€22B**), *epilepsy* (**€16B**) and *Parkinson's disease* (**€11B**)
- Comparable or more costly to society than diabetes or cancer, yet only about 15% of direct European health costs are spent in this field

European Brain Counsel, "Cost of Disorders of the Brain in Europe", Eur J Neurol, 2005, 12

Redistribution of resources and reorganisation of Healthcare

“Classical” Healthcare System

Citizen

Patient

Genetics
Biomedics

Personal Risk
Management

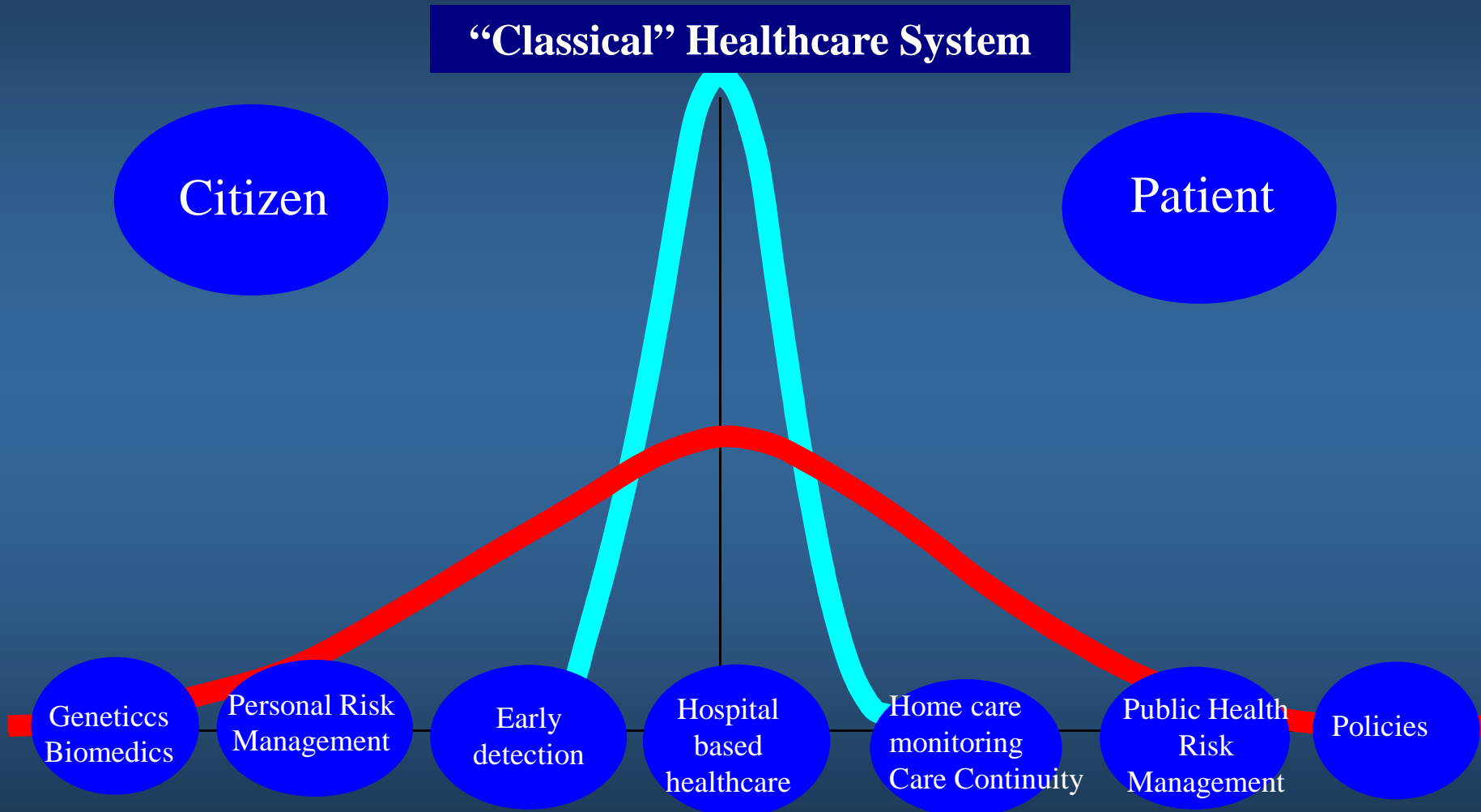
Early
detection

Hospital
based
healthcare

Home care
monitoring
Care Continuity

Public Health
Risk
Management

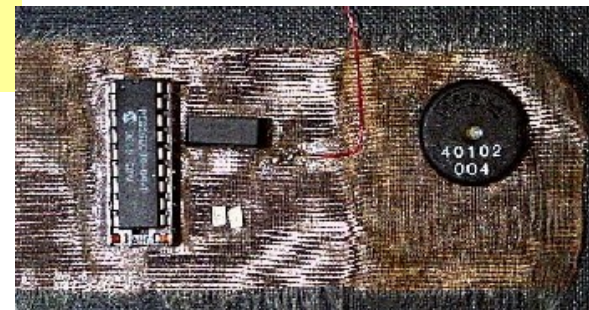
Policies



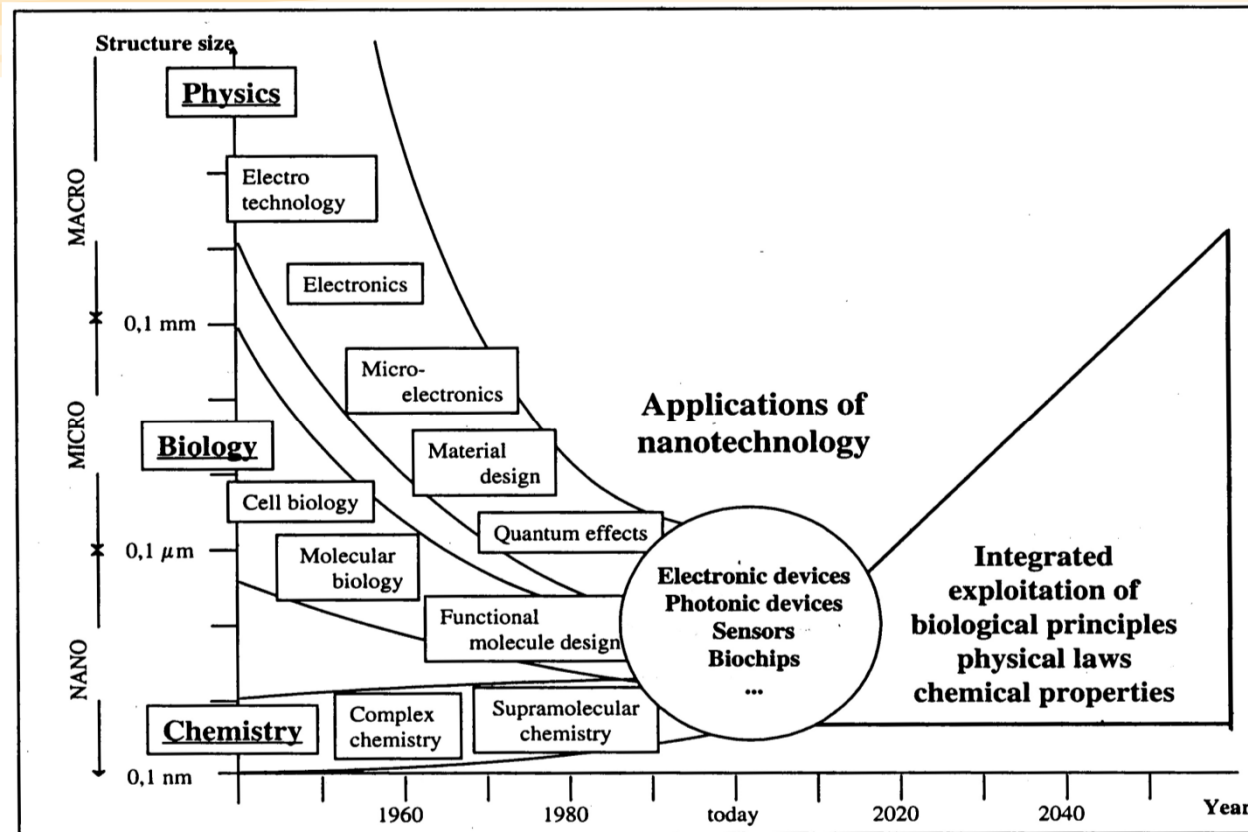
Healthcare and Health Delivery Evolution Underway

Science & Technology

- MNT and Materials
- Computer and Software Engineering
- Artificial Intelligence
- Mobile & Wireless Telecom
- Genomics/Proteomics
- Medical Knowledge



Innovation: Advances in Sciences & Technologies



© Gerd Bachmann, VDI-Technology Centre, Future Technologies



μ -chip



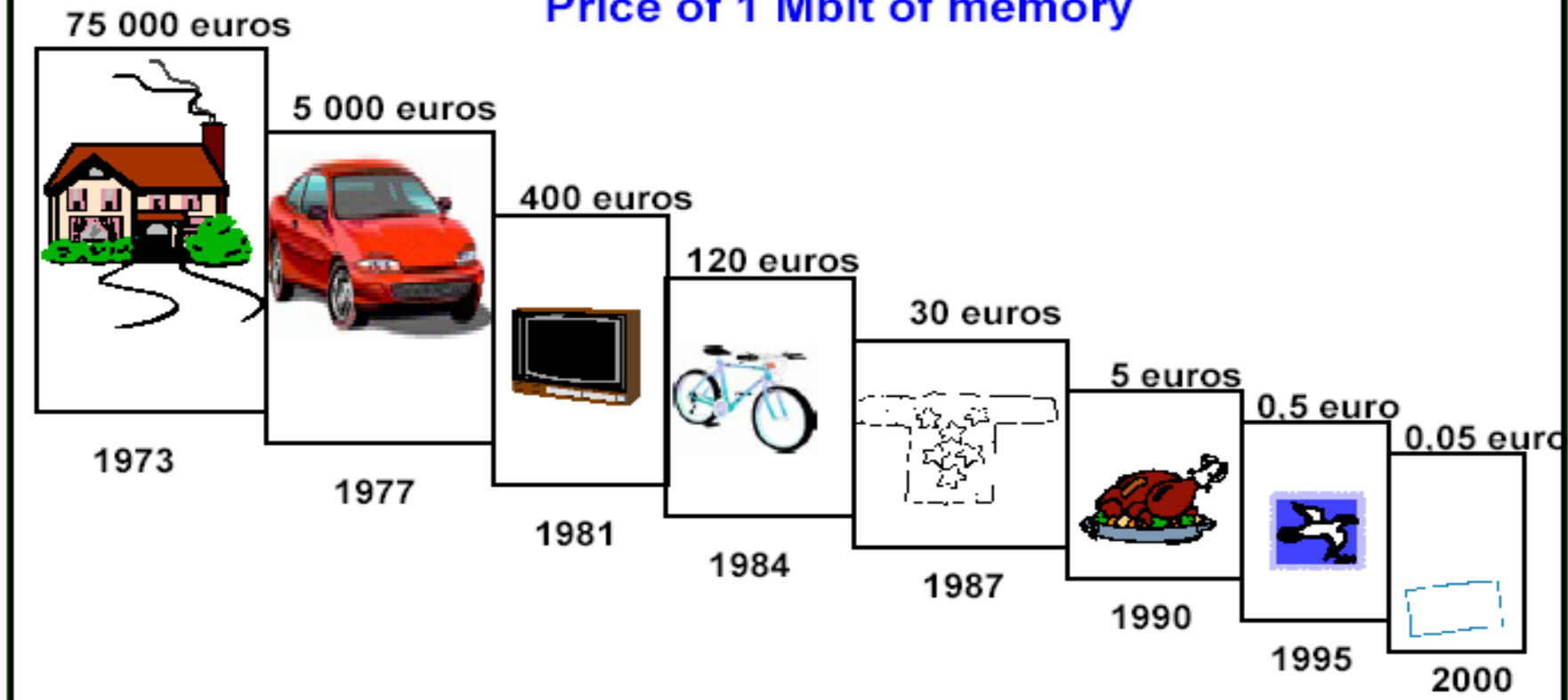
What can Technology offer?



ICT - Miniaturisation

Today's memories are a million times cheaper than in the seventies

Price of 1 Mbit of memory



Wearable remote monitoring devices: HUMAN++

Scenario: enablers for patient centric care

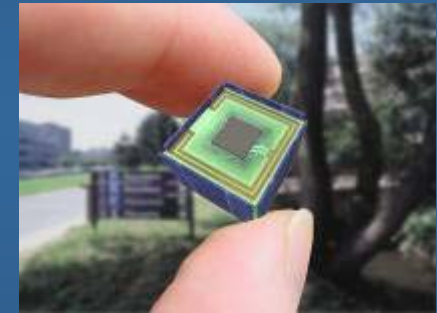
2002



300 cm³

140 mW

< 2010



< 1 cm³

100 μW

Reduce power &
size

Increase
functionality

Courtesy Imec-NI



Information Society
Technologies

Examples of Project Results: From Gadgets to Better Health



European Commission



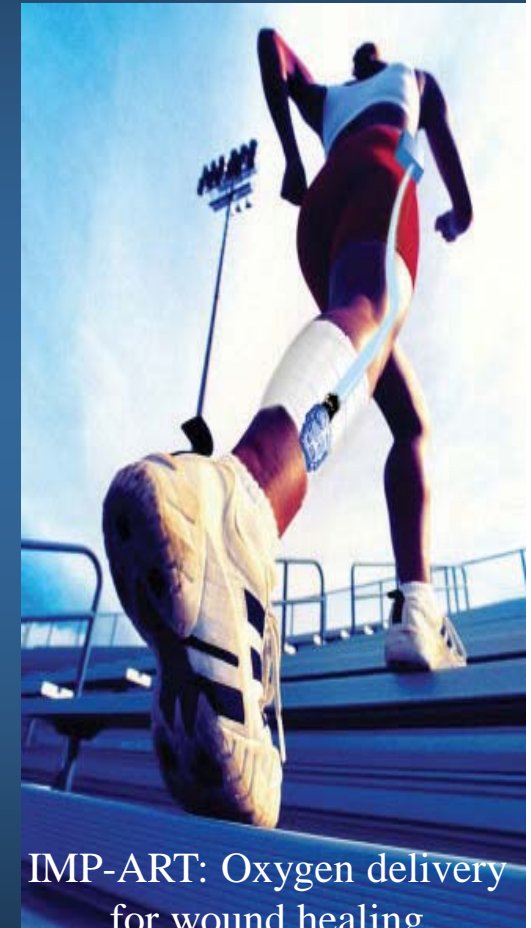
MOBIHEALTH



PARREHA



AMON



IMP-ART: Oxygen delivery
for wound healing

Technology Push: Development & Integration of innovative sensing, MNT, textile and ICT

Micro-communicating:
sensor interface,
processing and
wireless

Microsystems physical sensors
(attitude, fall, health, ...)

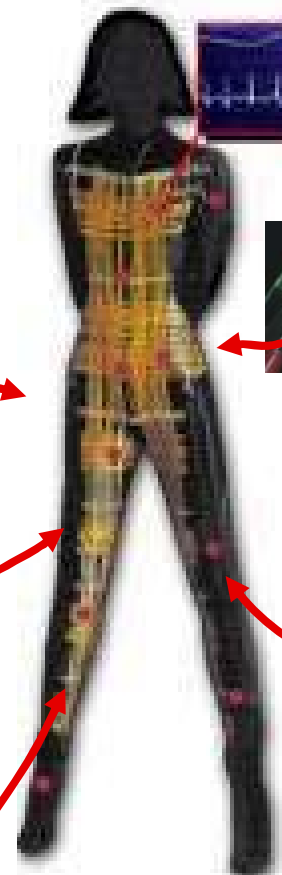
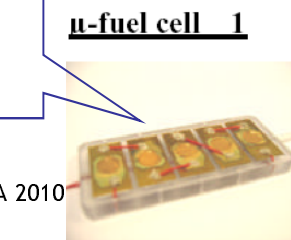
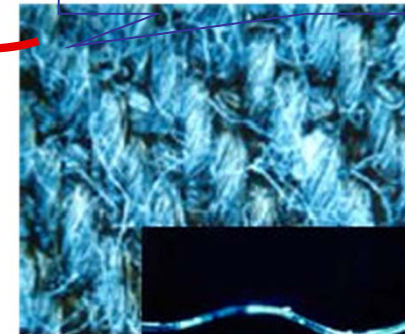
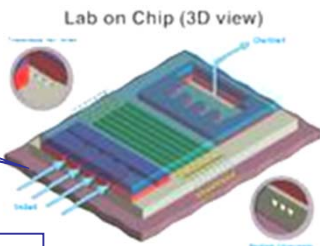
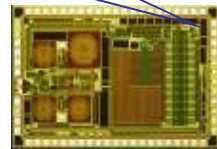
Flexible displays

Nanoengineered
surfaces

- Conductive fabrics
- Micro-interfaces

Point of care

Micro-energy
generators



What can Technology offer? Further R&D



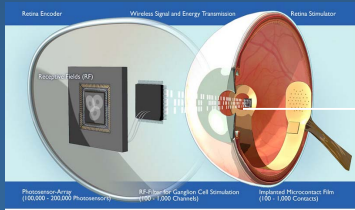
- Intelligent Clothes based wearable solutions for addressing risks of CVD (MyHeart)
- Electrical and electrochemical sensors in textile, using conductive or polymer semiconductive fibres
 - Integration of small/active optoelectronic devices in textile
 - single and multi-parameter analysis of bio-analytes in textile
- Fully Integrated Autonomous Smart Fabric for Personal Safety (physiological and biochemical monitoring, power scavenging and storage)



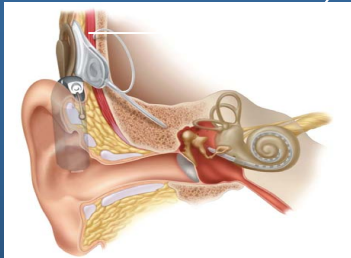
Healthy Aims Nanoscale materials and sensors and microsystems for medical implants improving health & quality of life



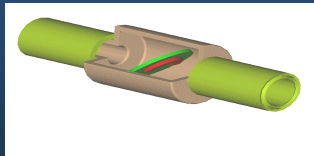
Glaucoma Sensor



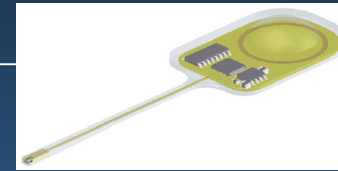
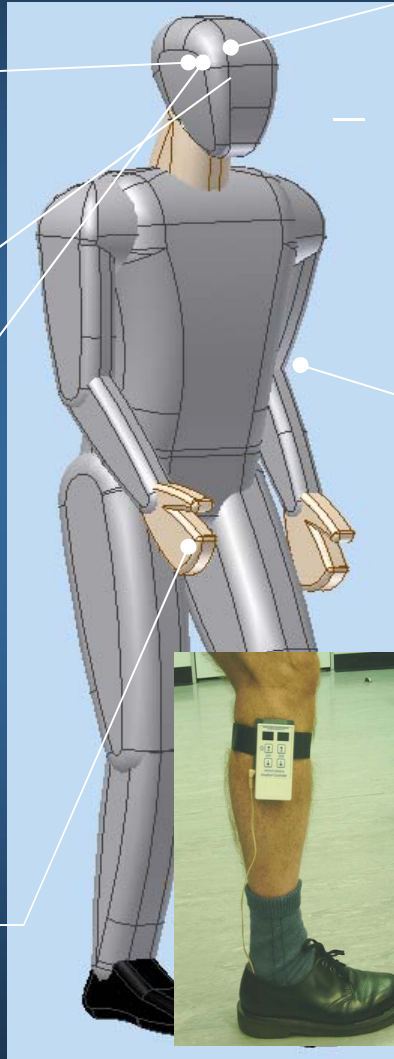
Retina Implant



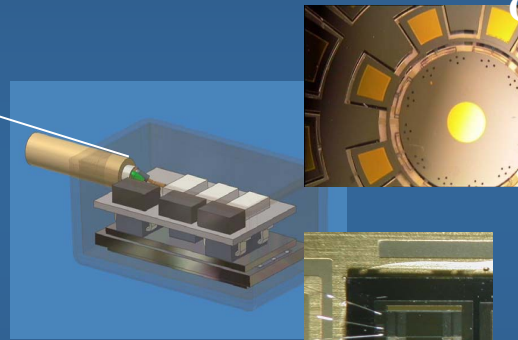
Cochlear Implant



Artificial Intra-Urethral Sphincter



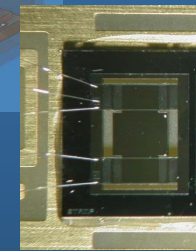
Intracranial Pressure Sensor



IMU for Human Body Motion



Gyro



Accelerometer



Functional Electrical Stimulation

But a lot Remains to be Achieved

- **A successfully treated disease is followed by a more severe one**
 - (Multi-drug) resistant infections
 - Chronic heart failure
 - Many cancers
 - Type II diabetes
 - Alzheimer's disease and vascular dementia
 - Pulmonary diseases
 - Multi organ failure...
- **Shift toward chronic degenerative diseases**

Existing techniques are not optimal

- ***Suboptimal diagnosis***
 - Lack of sensitivity and specificity
 - Overly invasive
- ***Suboptimal implants/devices***
 - Non-biocompatible
 - Poor connectivity with tissues
 - Inadequate durability
 - Clumsy power supply - size - weight...
- ***Suboptimal pharmaceutical treatment***
 - Non-specific action (“carpet bombing” - collateral damage!)
 - Inadequate dosing and kinetics
- ***Suboptimal surgical intervention***
 - Overly invasive - damage to tissues
 - Non-reachable targets, lack of precision, etc

MNBS Vision is also shared by EPoSS, The European Technology Platform on Smart System Integration- Working Group MedTech

Visions

Assisted Health
Checking

Assisted Therapy
& Therapy Control

Full Functional
Substitution &
Rehabilitation

Monitoring & Control
of External Influences

*Solutions & Applications
to visionary topics*

Supporting Key-Technologies

Sensors

Imaging

Data
Fusion / Management

Therapy management

Robotics
Surgery

Prosthesis



www.smart-systems-integration.org



Europe
Inform
and Media



Miniaturization

Integration

Low cost



smaller sample size

Less Reagents

Enables new applications

Faster Diagnosis

Redundancy/Accuracy

FP7 “Co-operation”: Themes

2007-2013
Budget [mn €]

1.	Health	6,000
2.	Food, Agriculture & Biotechnology	1,935
3.	Information & Communication Technologies	9,120
4.	Nanosciences, Nanotechnologies, Materials & New Production Technologies	3,505
5.	Energy	2,300
6.	Environment (including Climate Change)	1,900
7.	Transport (including Aeronautics)	4,195
8.	Socio-Economic Sciences & the Humanities	610
9.	Space	1,430
10.	Security	1,320

Joint Technology Initiatives

32,315

... including

ERA-Nets

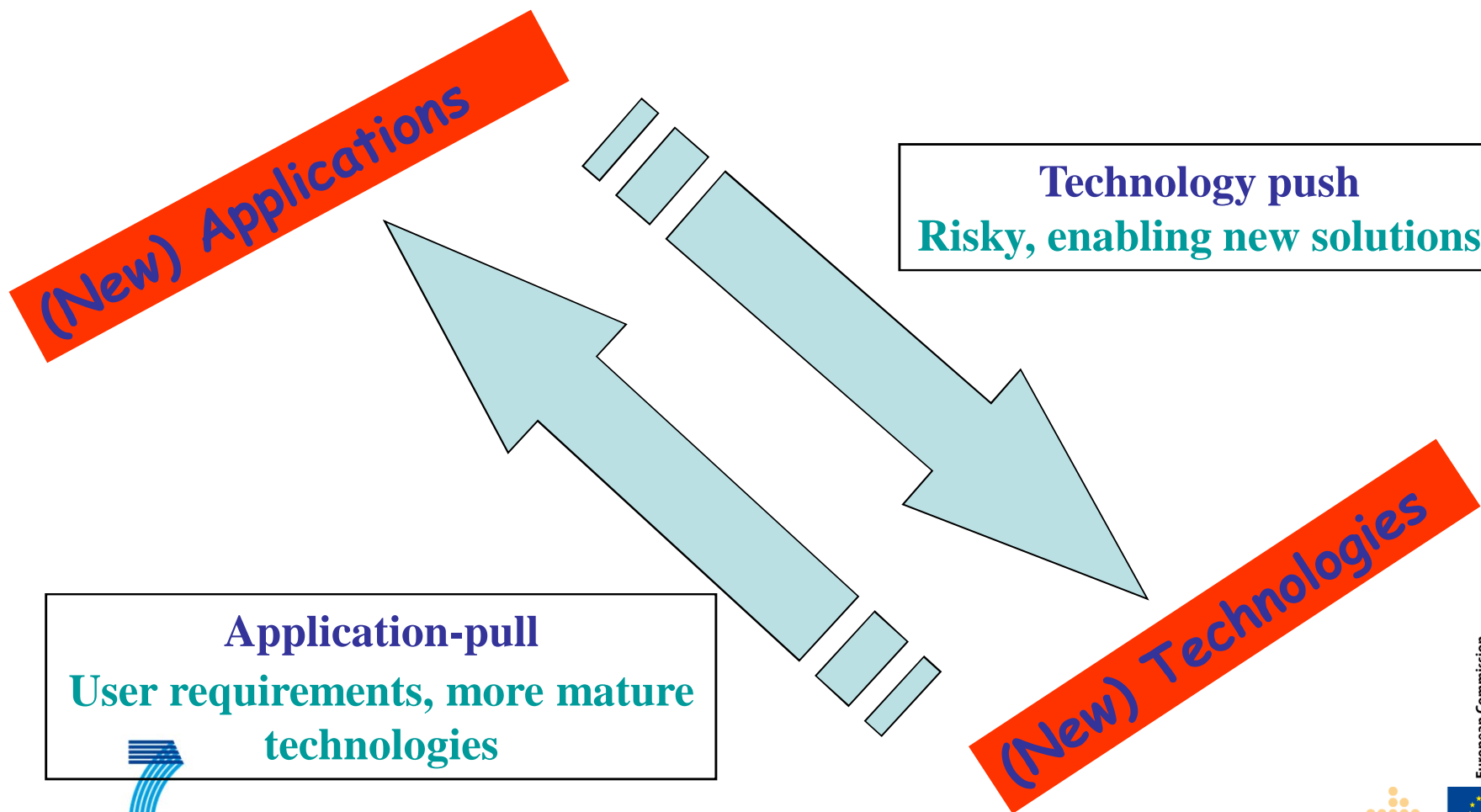
International Co-operation



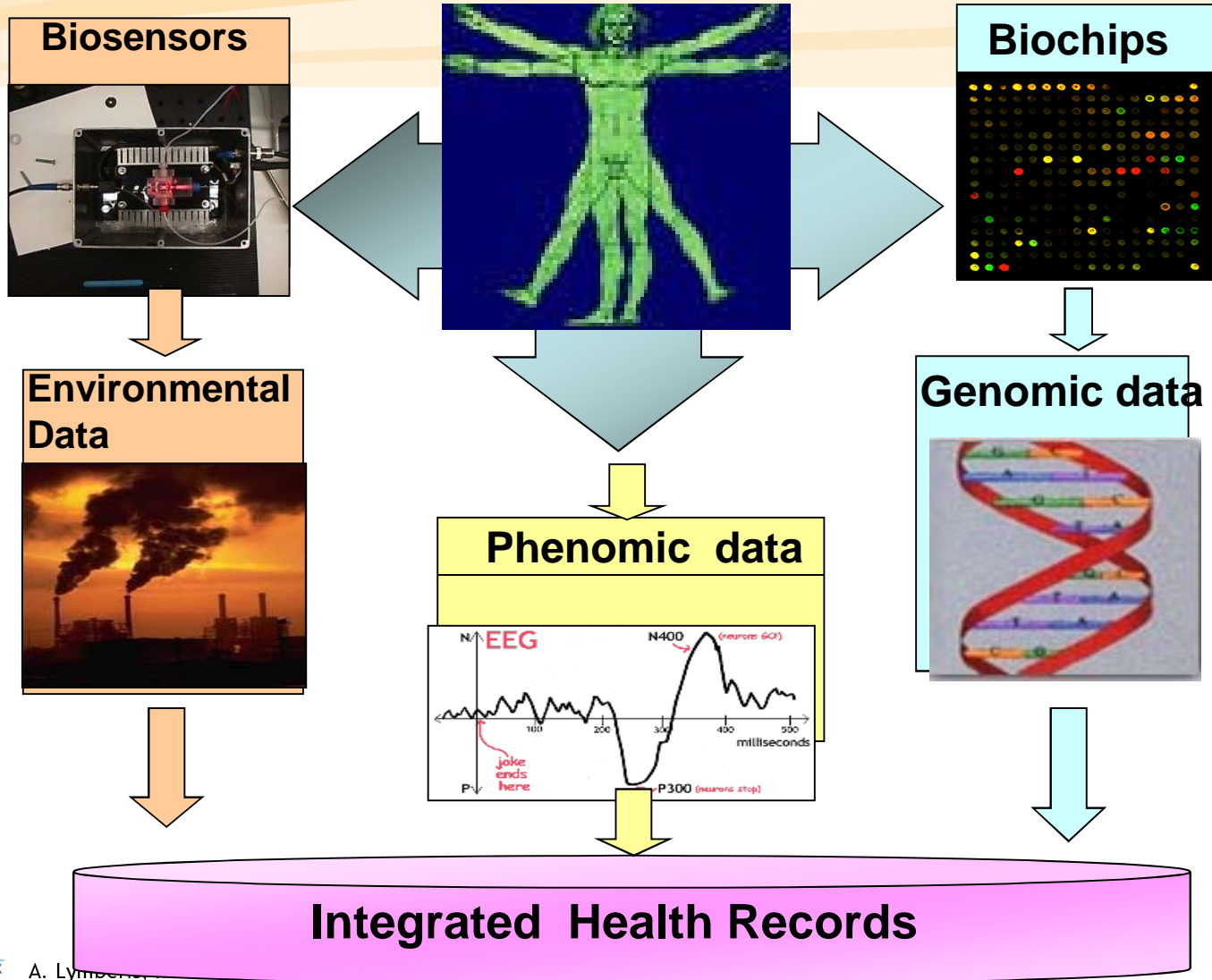
A. Lymberis, Securivet, Paris, 28 Juin



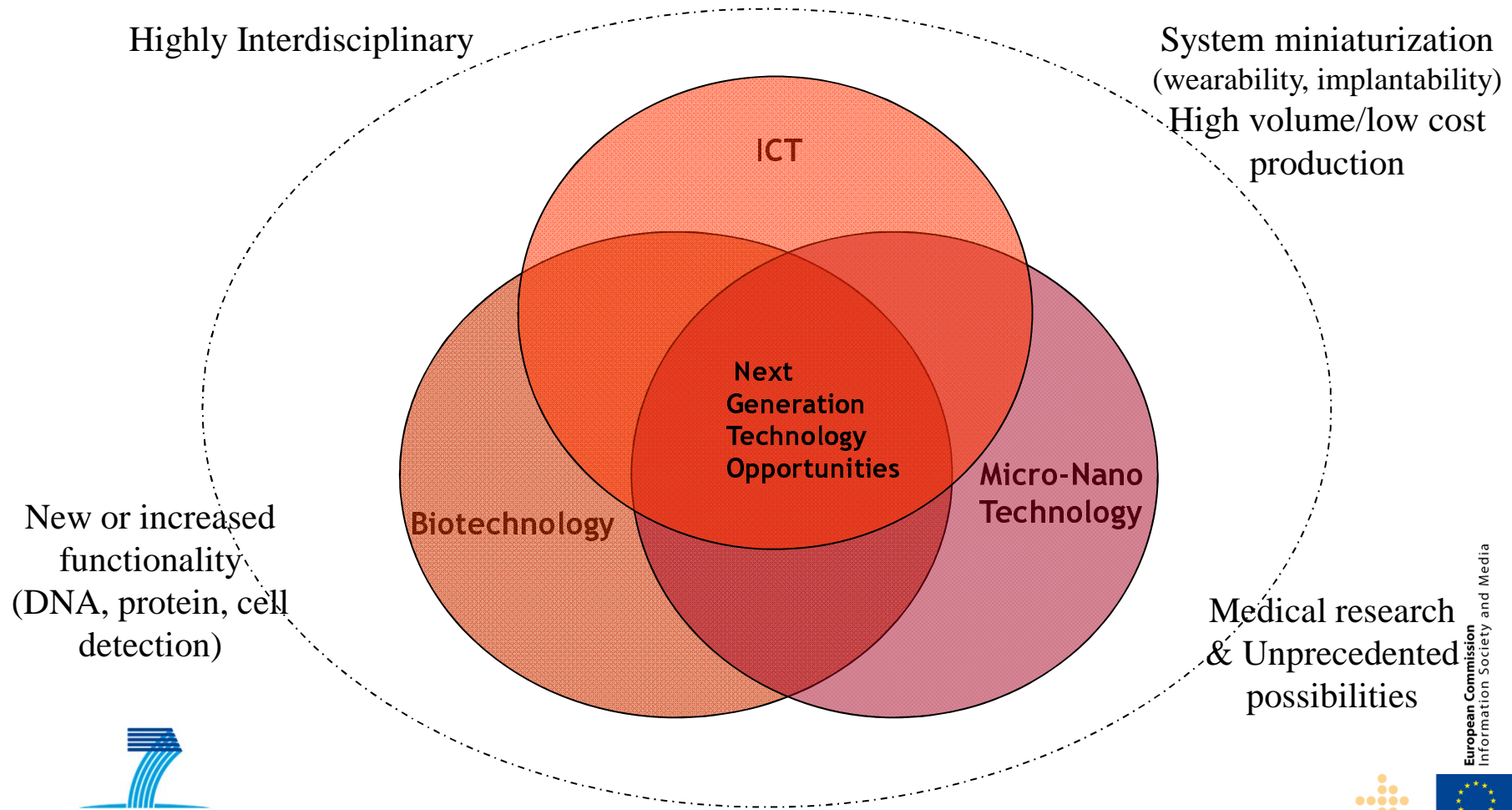
R&D Follows the Dual Approach



Seeing the full picture of individual's health status



New Generation Technology Opportunities at the Convergence of MicroNano- Bio-ICT



MNBS: Technological and Application Areas Focus

Biosensors & Lab on Chip Components and Systems for biomedicine, food & environment, e.g.:

DNA & protein arrays, LoC (e.g. MNT, surface chemistry, biomarkers, microfluidics, modelling, instrumentation, sample preparation, detection, integration/packaging and cost reduction)

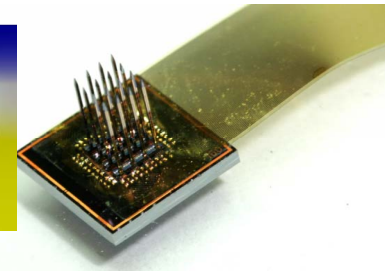
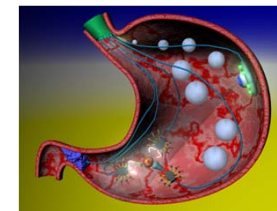
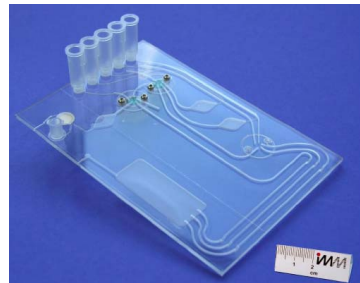
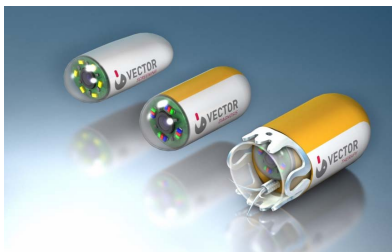
Smart Micro Nano Systems on & inside the body, e.g.:

BioMEMS, BioRobots, Actuator-Sensor (“closed loop” systems), Drug delivery systems, Biochemical Wearable Sensing and Active low power implants

Business and driving forces, e.g.:

Driving applications: Healthcare/biomedicine, food, environment, security, leisure

Mass production (cost), user needs, ethical and societal issues.



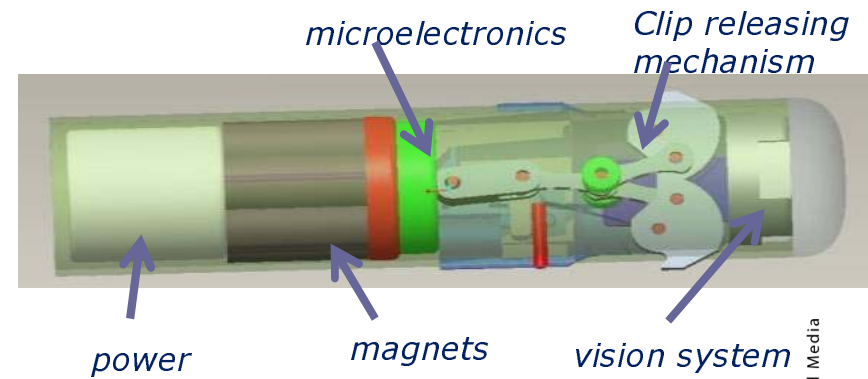
and

Body Sensor-Based Systems for pHealth

**Glaucoma
Sensor**



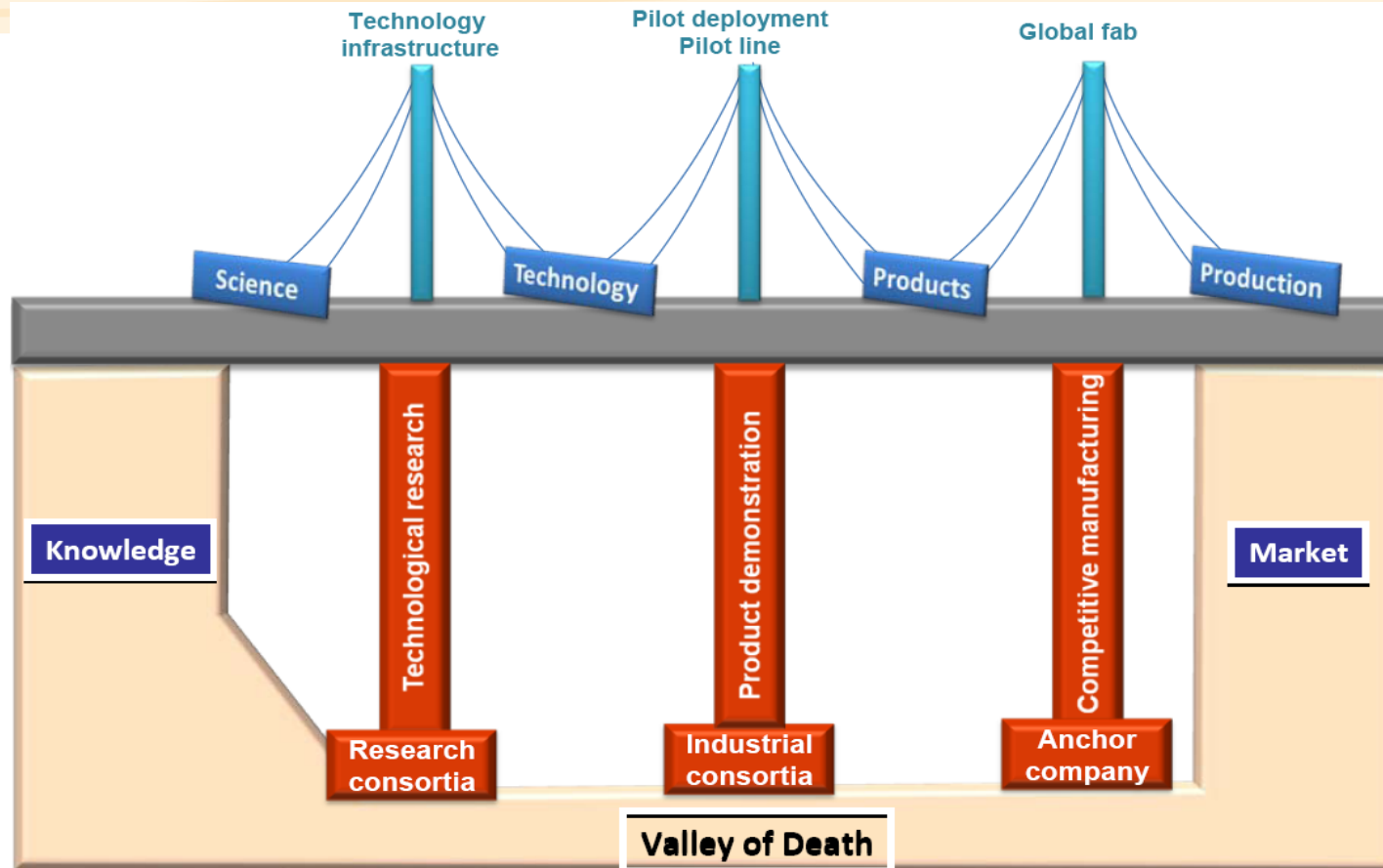
**Functional
Electrical
Stimulation**



Grand Challenge: Overcome current limitations and reach the market

- ✓ Low rate and speed of industrialization; many projects are either never completed or do not survive real world testing.
- ✓ More patents should have been filed and more commercial partners and end-users involved.
- ✓ Inexperience in dealing with regulatory affairs (key factor for successful transition from research to innovation).
- ✓ Expected and unexpected technical key challenges e.g. for smart autonomous MNBS, sample pre-treatment, microfluidics and standardization; lack of adequate sample materials, poor sensitivity, reliability and repeatability. Power management, biocompatibility and interfacing ICT with the human body remain

Turning ideas and R&D Results into Market Products



Horizon 2020

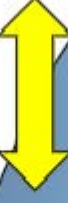
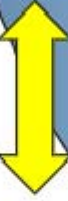


Education and Culture

European Research Area

Europe 2020 priorities

International cooperation



Shared objectives and principles

Tackling Societal Challenges

- Health, demographic change and wellbeing
- Food security and the bio-based economy
- Secure, clean and efficient energy
- Smart, green and integrated transport
- Supply of raw materials
- Resource efficiency and climate action
- Inclusive, innovative and secure societies

EIT and JRC will contribute to addressing these challenges

Creating Industrial Leadership and Competitive Frameworks

- Leadership in enabling and industrial technologies
- Access to risk finance
- Innovation in SMEs

Excellence in the Science Base

- Frontier research (ERC)
- Future and Emerging Technologies (FET)
- Skills and career development (Marie Curie)
- Research infrastructures



Simplified access

Coherent with other EU a

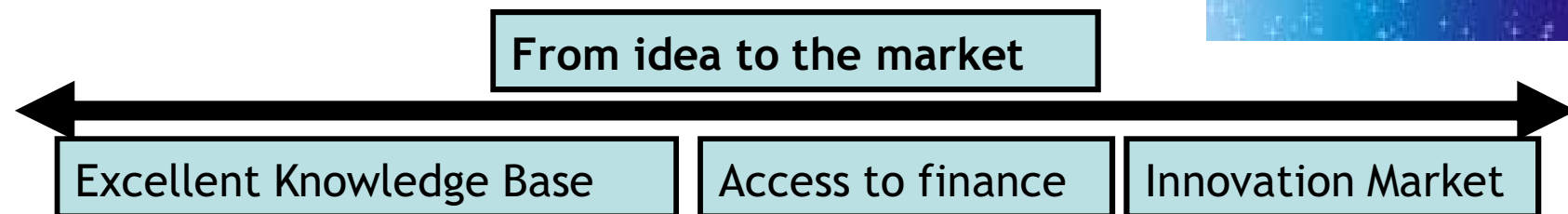
Common rules, toolkit of funding schemes



TOWARDS AN INNOVATION UNION

Communication
COM(2010)546 of 6.10.2010

- Innovation Union will **advance scientific boundaries**, increase European **competitiveness** and help solve **societal challenges** such as climate change, energy and food security, health and an ageing population.



mission
Society and Media

European innovation partnerships & international cooperation

“EIP”’s are an umbrella to guide all activities using all financial instruments

European Innovation Partnership: pilot on Active & Healthy Ageing: Objectives and headline target

Headline target by 2020

- **Increasing the number of healthy life years (HLYs) by 2 in the EU on average**

A triple win for Europe

- Enabling EU citizens to **lead healthy, active and independent lives until old age**
- Improving the sustainability and efficiency of **social and health care systems**
- Developing and deploying **innovative solutions**, thus fostering **competitiveness and market growth**

Innovation in Integrated Care

Innovation in Prevention and Personalised Medicine

Innovation in Active and Independent Living

Communication and Awareness

R&D&I is part of Industrial Policy

Key Enabling Technologies

Communication COM(2009)512 of 30.9.2009

Micro- and nanoelectronics,
including semiconductors

Photonics

Preparing for
our future:
Developing a
common
strategy for
key enabling
technologies
in the EU

Advanced
materials

Biotechnology

Nanotechnology

Advanced manufacturing Systems

http://ec.europa.eu/enterprise/sectors/ict/key_technologies

Challenges in wide implementation of p-Health systems

1. Make ICT meaningful to everyday activities and of apparent practical benefit to the user
2. Build (realistic) National / regional strategies
5. Create framework for Standardisation-interoperability
6. Address Business, Organizational, cultural issues
7. Address confidence and trust issues
8. Educate people about the use of ICTs & medical technology, raise awareness.

Introduction: the Biomedical Device Vision

“In twenty years from now, I would not be surprised to find a book titled ‘physician’s reference to Biomedical Devices’ on the desk of every practitioner”

Steven S. Salterman, MD,
Chief of Medicine Methodist
Hospital, University of Minnesota



Technologists should not forget that advanced (disruptive) (p) Health systems will be fully accepted by the healthcare professionals when they will integrate evidence and knowledge from clinical practice and biomedical research.

10th International Conference on Wearable Micro and Nano Technologies for Personalized Health, Tallinn, June 26 – 28

<http://phealth2013.eu/>





EUROPEAN
COMMISSION

European
Research Area

Merci de votre attention!



Information supplémentaire/documentation

- **MNBS:**
- cordis.europa.eu/fp7/ict/micro-nanosystems/projects-mnbs_en.html
- cordis.europa.eu/fp7/ict/micro-nanosystems/docs/mnbs-projects-portfolio-april-2011_en.pdf
- **MNBS WS, April 2011, Mondragon, ES:**

- cordis.europa.eu/fp7/ict/micro-nanosystems/events-2011-5thmnbs_en.html

EPoSS ETP: www.smart-systems-integration.org/public

Nanomedicine ETP: www.etp-nanomedicine.eu/public



https://twitter.com/#!/Microsystems_eu

The views expressed in this presentation are the personal views of the author and do not necessarily reflect the official view of the European Commission on the subject matter.

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