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Setting-up the Scene

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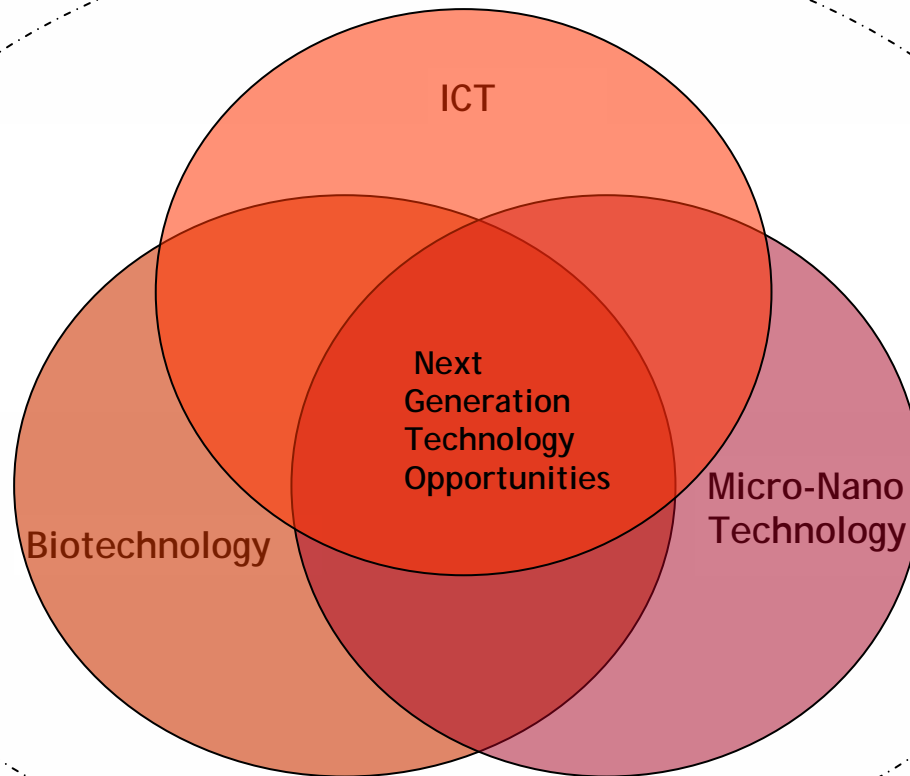
*Information Society Technologies and Media, Micro-systems
European Commission, Brussels*



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

Highly Interdisciplinary

System miniaturization
(wearability, implantability)
High volume/low cost
production



New or increased
functionality
(DNA, protein, cell
detection)

Medical research
& Unprecedented
possibilities

New concepts and integrated approaches and systems.

- Integration of diagnosis, treatment and monitoring
- Computer-assisted, image based intervention
- Drug-device combinations and targeted delivery of drugs and genes
- Sensor-activated (closed loop) drug delivery systems
- Integrated neuronal interfaces and muscular stimulators (epilepsy, appetite suppression, hemi- and quadriplegia, blind- and deafness...)
- Fast information about the patient's response to the treatment is essential for its success (complex combination of IVD, imaging and information technologies).

□ Micro- nano systems are potent facilitators of integration.

Dual Approach is necessary

(New) Applications

Technology push
Risky, enabling new solutions

Application-pull
User requirements, more mature technologies

(New) Technologies

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

Components, Systems, Engineering: **Microsystems**

An enabling technology, bringing together separate technologies and sciences

- **Inter-disciplinarity**

Mechanics, electronics, fluidics, biology, magnetism, optics, photonics, chemistry,

- **Convergence of heterogeneous technologies**

Micro/nanotechnologies, ICT, bioengineering

- **Heterogeneous Materials**

Semiconductors, ceramic, glass, organics and polymers, metals

- **Multiple functionalities**

Sensing, processing, actuating, energy harvesting and storage, communication, memory, logic

Total budget in FP6
[2002-2006]
301M€

Applications

- **Biomedical**
- **Transport**
- **Telecommunications**
- **Automotive**
- **Safety**
- **Environment**
- **Smart textiles, ...**



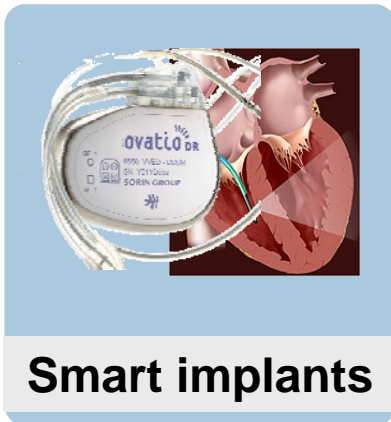
What are Smart Systems?

Smart Systems ...intelligent miniaturised technical subsystems evolving from microsystems technology with ≥ 1 additional functionalities:

- ➔ are able to diagnose a situation, describe it and qualify it,
- ➔ mutually address and identify each other,
- ➔ are predictive,
- ➔ are able to decide and help to decide,
- ➔ enable the product to interact with the environment.

They are networked, energy autonomous and highly reliable.

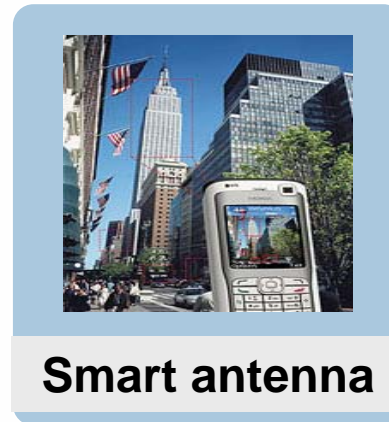
R&D in advanced microsystems driven by application



Smart implants



Smart RFID

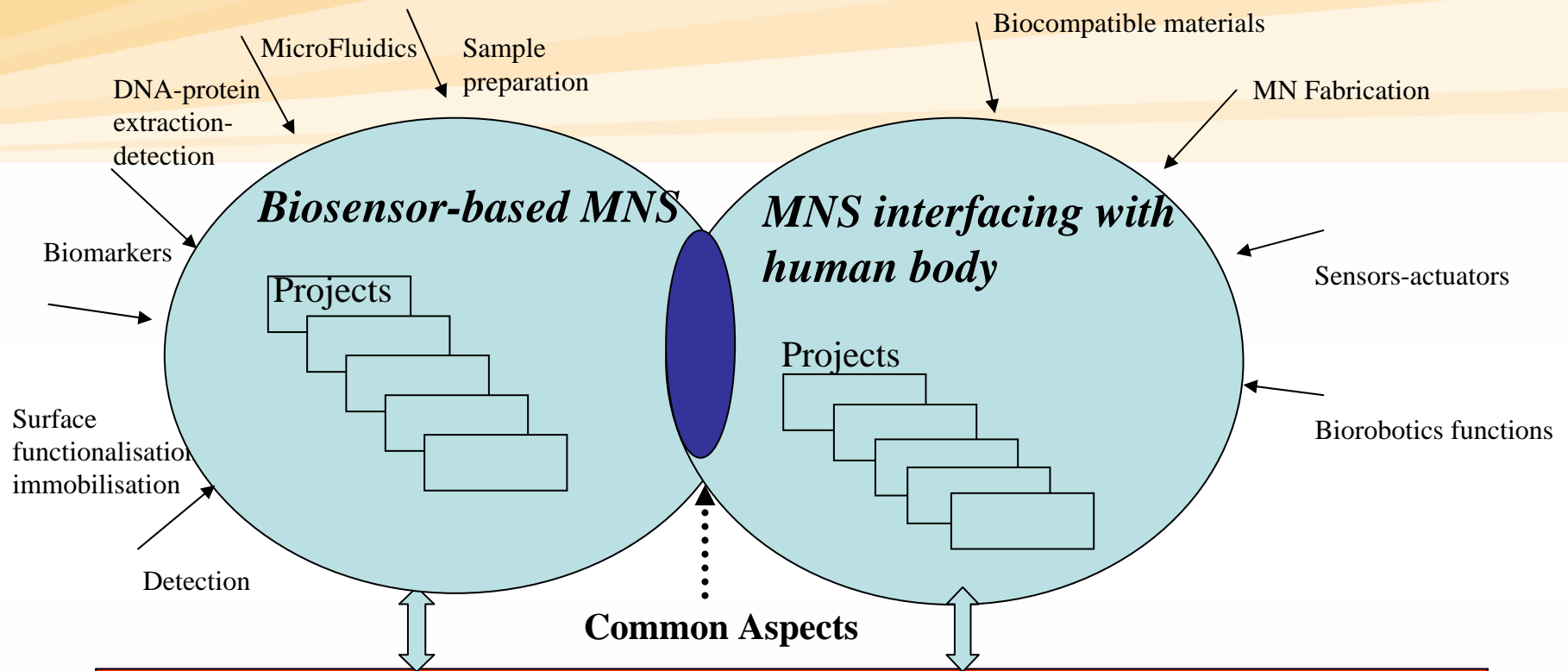


Smart antenna



Smart tire

MNBS group Projects: Structure, links and content



Power, Signal Processing, Telecoms, Packaging, Manufacturing, Standardization, Ethics, Testing-Validation, Business, IPR, Certification, Dissemination, Awareness, Education.

- 36 Projects, 2 Service Actions
- 145 M€, 390 Organisations, 27 MS & AS + China, Australia, USA, Korea, Mexico
- 80 Universities, 60 R&D Centers & Institutes, 85 companies (Research & product development)

Technological and Application Areas Focus

Biosensors & Lab on Chip Components and Systems, 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.

Nanobiotechnology Markets: Europe should become more competitive

- World total \$1 trillion market for nanotechnologies in 2015
- 350-500 \$billion is allocated to healthcare and pharmaceutical applications
- Nanobiotechnology market: \$4b (2002), \$8b (2005), \$20b (2010), \$70b (2015)
- Gap between USA and EU: In 2005, \$8b (5.1 USA, 1.5 EU); in 2010, \$20b (12 USA, 4 EU); in 2010, \$ 70b (35 USA, 21 EU)
- US government recognised the future potential of nanotechnology and academia/research centers move ahead but industrial segment still relies on venture capital (estimates of potential markets of technologies and applications)

HOW IS THE EU DOING?

Region	1997	1998	1999	2000	2001	2002	2003	2004	2005
EU	126	151	179	200	~ 225	~ 400	~ 650	~ 950	~ 1,050
Japan	120	135	157	245	~ 465	~ 720	~ 800	~ 900	~ 950
U.S.	116	190	255	270	465	697	862	989	1,081
Others	70	83	96	110	~ 380	~ 550	~ 800	~ 900	~ 1,000
Total (% of 1997)	432 (100%)	559 (129%)	687 (159%)	825 (191%)	~ 1,535 (355%)	~ 2,350 (547%)	~ 3,100 (720%)	~ 3,700 (866%)	~ 4,100 (945%)

- **VERY WELL IN TERMS OF FUNDING (figures in M\$), BUT ...**

... could do better in publications, patents, uptake

- **About 20% of ISI publications (the US produces about 40%)**
- **Less than 20% of *Nature* and *Science* publications (the US produces 50%)**
- **Delay in commercialisation of technologies**

Market Questions

- Why doesn't nano-bio-micro-it take off?
- There is a clear difference between the consumer market (POC, last chains in food distribution system, etc.) and the large players (Universities, Pharma, Hospitals, Clinical Chemistry labs).
 - “Successful” Biotech companies do not sell for a consumer market (yet? - except perhaps the diabetes sensors) !
- Who is a customer?
Who makes the money?
 - The health care structure differences within EU
 - How about the regulations (food quality control, water quality, etc.)
- How large investment in R&D is needed?
- The role of EU
 - Better differentiation between Research vs. Development!
 - Scientific focus is important
 - Company involvement

Factors that hinder or Delay execution (worldwide)

- *Knowledge gaps* (e.g. biochemical pathways)
- *Technology gaps* (MNB at early stage, integration of building blocks, prostheses/implants, actuators, etc)
- *Reliability* (complex and emotive)
- *Liability issues* (much beyond technology development and application)
- *Cost and affordability!*
- *User issues-ethics*

Challenge 3 - Components, systems, engineering Call 5 objectives and budget

- 3.1 Nanoelectronics Technology (35M€)
- 3.5 Engineering of Networked Monitoring and Control Systems (32M€)
- 3.7 Photonics (50M€)
- 3.9 Microsystems and Smart Miniaturised Systems (80M€)

Objective 3.9: Microsystems and Smart Miniaturised Systems Analysis

Funding scheme	#received	# above threshold	# retained / reserve
IP	28	15 (54%)	6 (21%) / 1
STREP	120	68 (57%)	11 (9%) / 2
CSA	6	5 (83%)	2 (33%) / 0
Total	154	88 (57%)	19 (12%) / 3

- Success rate: 1:8 / 1:7 (in terms of number of proposals & budget)
- Funding of retained proposals: 34% industry (21% SMEs)
- Participation in retained proposals: 45% from industry (29% SMEs)

Objective 3.9: Microsystems and Smart Miniaturised Systems

Coverage of retained proposals

Application-specific Microsystems (50 M€)

Microsystems and Smart Systems Technologies: (Heterogeneous Integration and Autonomous Systems) (27 M€)

Telecommunications:

1 project

Food/Beverage:

1 project

Smart Fabrics & Intractive textile:

1 project

Bio-med and bio-tech:

7 Projects

7 projects

Coordinated Actions (3 M€)

2 projects

TOTAL 80M€

The final goal

Starting from the cluster

- Building common understanding of R&D and market challenges
- Gaining visibility and critical mass of activities

Expanding to a broader EU sustainable and competitive initiative world-wide

- Creation of a body/forum/joint venture with main public and private stakeholders to:
 - Increase & improve investment in R&D
 - Facilitate innovation & uptake of MNB Convergence
 - Facilitate the sustainable use of resources, identifying strategic drivers and leveraging effects, and forecasting innovation pathways to bring R&D into practice
 - Contribute to a strong European industrial base
- Collaborate with CIP (*to ensure uptake and best use*), National Programs, Regional Policies, EUREKA

THANK YOU

- European research on the web:

- http://cordis.europa.eu/fp7/home_en.html
- <http://ec.europa.eu/comm/research/future/>

- Information Society and Media:

- http://cordis.europa.eu/fp7/ict/programme/home_en.html

- Challenge ICT-2007.3.9:

Microsystems and Smart Miniaturised Systems :

<http://cordis.europa.eu/fp7/ict/micro-nanosystems>



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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.