

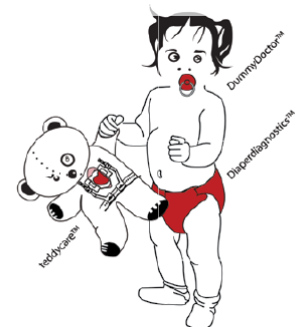
# FOBIS – Foresight Biomedical Sensors

*Tomorrow will arrive!*

September 18th, 2007, Copenhagen

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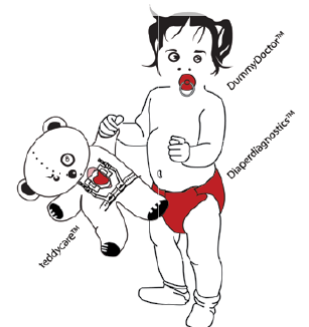
# Outline



- FOBIS project
  - Objectives
  - Perspectives
  - Background
- FOBIS methodology
  - Expert panels
  - Mini-scenarios
- FOBIS business perspectives
- FOBIS ethical dilemmas
- FOBIS findings
- How to follow up FOBIS?

**NRK NYHETER**

(NRK Dagsrevyen 31.10.2006; Biomedical sensors)



# FOBIS – Foresight Biomedical Sensors

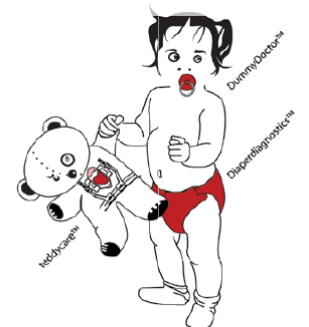
- NICE project 2005-2006
- A Nordic consortium headed by SINTEF (Norway) and with the participants VTT (Finland), FOI (Sweden), S-SENCE (Sweden), STC (Denmark) and MedCoast Scandinavia
- Key questions to be answered:
  - How will biomedical sensors shape the healthcare systems of the future?
  - How can they impact the quality and cost of healthcare
  - What are the business opportunities in the Nordic region?

■ [www.nordic-fobis.net](http://www.nordic-fobis.net)



# Project objectives

- To enable a strategic understanding of the possibilities and implications of the use of biomedical sensors for healthcare purposes by establishing likely scenarios for technology, applications and markets.
- To provide a framework for commercially viable exploitation of biomedical sensor penetration in the Nordic region by enhancing a network of competencies relevant to technology and applications.



# FOBIS perspectives

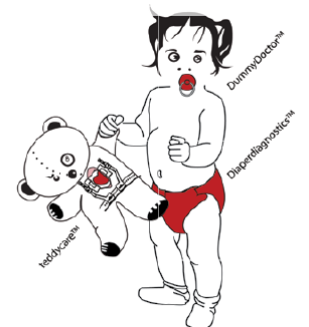
Doctor's office

Hospital

Home care



Defence /  
Public space



# Project background

- The health care systems of the industrialized countries are expected to undergo major changes within the next 10 to 15 years.
  - The number of elderly people will grow considerably
  - So-called welfare diseases are increasing
  - Increasing use of new advanced treatments
  
- This will require a more efficient health care system offering better services.
  
- A number of new health care technologies will emerge and several will be adopted by the health care systems.
  
- The need for biomedical sensors will increase substantially



# Biomedical sensors - a key to our future health!

## Trends:

- Diagnostics will become more predictive
- Therapeutic interventions will become more preventive
- Healthcare will become more personalised and tailored to the individual



# Biomedical sensors - definitions

- *A **sensor** is a device that provides information about the physical, chemical or biological state of a system.*
- *A **medical sensor** is a sensor that in one way or another is incorporated in health care.*
- *A **non-invasive** sensor is a sensor that obtains its information without a physical penetration of the protecting membranes of a living object.*
- *A **biosensor** is a sensor that incorporates at least two processes. One is a biochemical reaction defining the specificity of the sensor; the other is the physical part that – as a consequence of a biomedical reaction – provides for a readout signal. A medical sensor may – or may – not be a biosensor.*

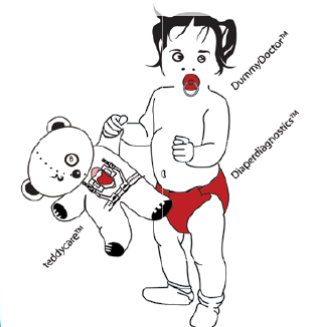




# FOBIS methodology



- Discussions in cross disciplinary expert panels
  - focusing emerging and converging technologies related to biomedical sensors, philosophical and ethical dilemmas, commercial potential and policy implications and addressed major trends and drivers and future uncertainties and challenges
- Facilitated visionary brainstorming, knowledge sharing, analyses of technology trends and identification of major challenges, cultural and social contexts and possible products and services
- How to “see” what you can’t see



# FOBIS expert panels

## ■ The project revolved around a series of workshops

- 1<sup>st</sup> Copenhagen 6-7<sup>th</sup> October 2005
- 2<sup>nd</sup> Oslo, 2<sup>nd</sup> November 2005
- 3<sup>rd</sup> Stockholm, 3<sup>rd</sup> March 2006
- 4<sup>th</sup> Tampere, 7<sup>th</sup> June 2006

*“Where are we?”*

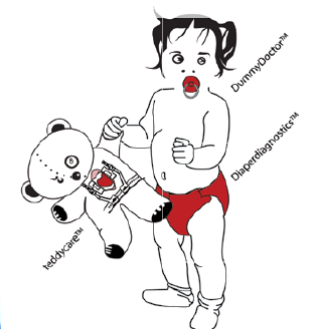
*“Where do we want to go?”*

*“How do we get there?”*

*“What do we do now?”*

- 5<sup>th</sup> Oslo, 31 October 2006

*Project dissemination*



# Workshop I

Copenhagen 6-7<sup>th</sup> October 2005 (40 participants)

Theme: **Where are we?**



FOBIS

*Biophonet*

## Invited speakers from the areas:

Hospital laboratory of the future, Security and Defence, Health technology assessment, Marketing biosensors and Biosensor technology overview

## Some group work conclusions:

### ■ Home care:

- The need will increase drastically, resulting in a large market for medical sensors.
- Preventive health care will be more important

### ■ Doctors office:

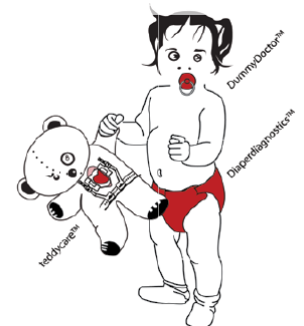
- The patients will be more active and demanding – quicker tests.
- Screening of patients

### ■ Hospitals:

- More service and production oriented.
- More diagnostics must be performed at the point of care

### ■ Defense and security:

- Two areas – personal safety and public safety
- Sensors must be mobile



# Workshop II

Oslo, 2<sup>nd</sup> November 2005 (35 participants)

Theme: **Where do we want to go?**



## Invited speakers from the areas:

Ethical challenges, Potential of biomedical sensors, Biomedical sensor technology, market issues and Biomedical sensors in the pharmaceutical industry



## Some group work conclusions:

### ■ Technology trends:

- Multifunctional and personalized sensors
- Point of care diagnosis
- Long time and high costs to market

### ■ Ethical issues:

- Acceptance of new technology
- Right to privacy
- What kind of deceases can we afford to treat?

### ■ Market scenario for 2020:

- Preventive medicine
- Early detection
- Telemedicine
- Patient self testing



# Workshop III

Stockholm, 3<sup>rd</sup> March 2006 (35 participants)

Theme: **How do we get there?**



## Invited speakers presenting:

Computer screen photo-assisted technique for biomedical sensors, Basic applications of nanoparticle plasmon sensing, Biosensors – a key to our future health



## Panel discussion –some highlight from the discussion:

### ■ What is the worst case scenario in future health care?

- Improvements in diagnostic ability advance more rapidly than the therapeutic ability to cure
- E-care: Wrong diagnosis due to wrongly configured computers
- Fear that with our focus on technology we might forget mental health
- Healthcare is too technical – patients need a human contact
- Epidemics like the bird flu or terrorist attacks



### ■ Ethical issues

- Could the idea of prevention instead of diagnostics lead to difficult choices and new ethical problems?
- Who to treat - those who have looked after themselves rather than those who have abused their health?
- Deciding whether to keep people alive or not. Cost and quality of life?



# Workshop IV

Tampere, 7<sup>th</sup> June 2006 (40 participants)

Theme: **What do we do now?**



## Invited speakers presenting:

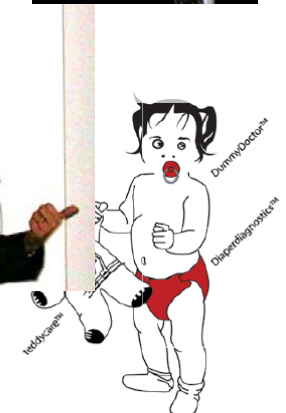
Clinical Biosensors, Future in-vitro diagnostic (IVD) products, Why innovations of distributed ICT applications for health tend to fail?, Towards Integrated Molecular Diagnostics, Wireless Biomedical Sensing

## Panel discussion –some highlight from the discussion:

### ■ Where can biomedical sensors make the greatest contribution to future health care?

- Improve our ability to diagnose infectious diseases and to allay peoples' fear of being infected,
- Individual monitoring of the whole person based on physical measurements, In the case of long term vascular diseases, like diabetics, continuous monitoring might make real treatment possible in comparison with today's "treatment" of diabetics with insulin which does not of course cure the patient.

*Technologically there is a tremendous potential, especially related to converging technologies, however technology alone does not create business.*



# FOBIS Dissemination seminar and plenary meeting

## Better life, longer life?

How will biomedical sensors shape the healthcare systems of the future?

Rikshospitalet, Oslo

Tuesday 31 October 14.00 – 21.00

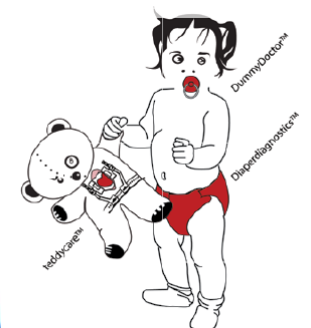
### Program

14.00 – 15.00: "Live" heart surgery implanting a biomedical sensor monitoring the first critical hours

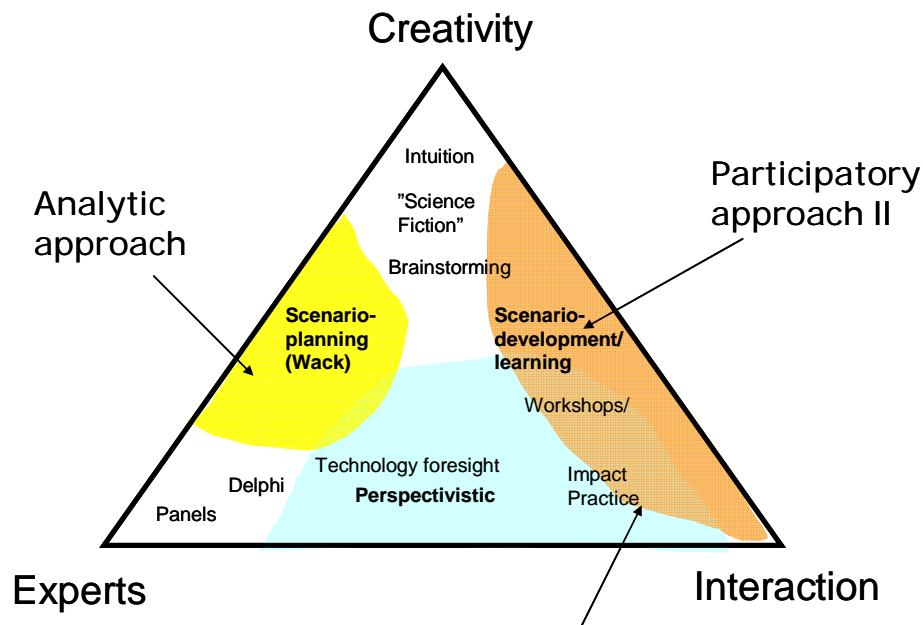
15.30 – 18.00: Parallel seminars:

1. Bio-terrorism and bio-defence
2. Innovation based on biomedical sensors

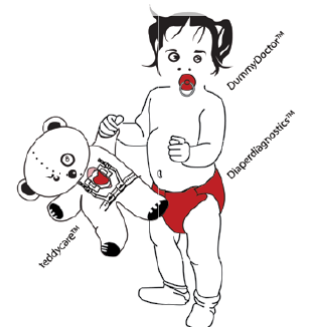
19.00 – 21.00: Plenary meeting



# FOBIS mini-scenarios



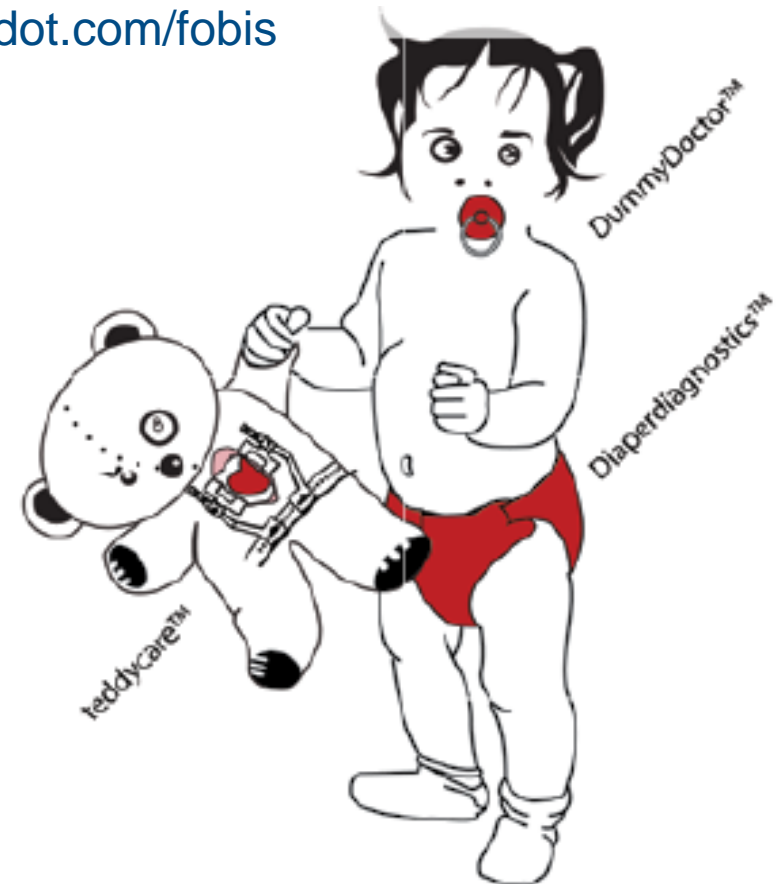
- The scenario approach used by FOBIS has been based on existing research and product development projects, the sharing of ideas and information between people of different backgrounds and interests, generation of ideas on future uses of technology, discussions of possible consequences of new technologies and future challenges of further development.





# Small pictures of the future

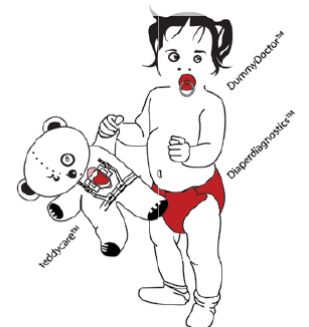
- Osteoporosis
  - Diabetes
  - Prostate
  - Cervix cancer
  
  - Future hospital
  - Home care
  - Personalized water
  - New services
- Pictures and visions also presented in the FOBIS "web-toolbox"
    - [www.orgdot.com/fobis](http://www.orgdot.com/fobis)



# Business perspectives

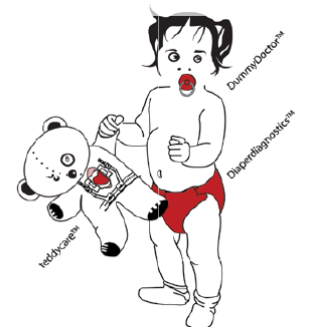


- Nordic perspective
- Future market
- SWOT – Nordic exploitation of biomedical sensors
- Main opportunities and barriers



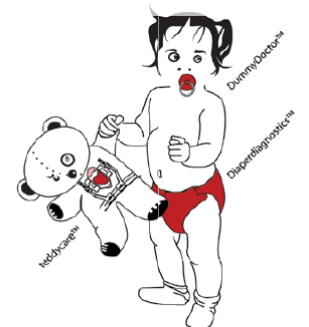
# Nordic perspective

- The Nordic countries all have well-developed and extensive health care systems.
- There are strong industries within pharmaceutical development, production and marketing as well as in medical diagnostics.
- Micro-and nanotechnology and telemedicine are also areas where the Nordic countries have strong competence.



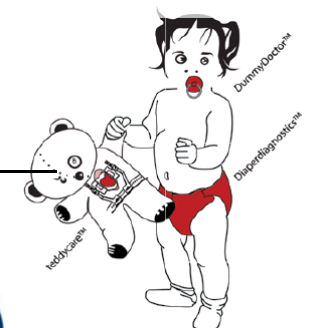
# Nordic perspective...

- In order to take advantage of the needed symbioses of these technology fields, Nordic industry need to create collaborative networks and strategic alliances.
- The region is in an excellent position to exploit potential benefits of biomedical sensors both as users and as vendors of sensors and systems.



# Future market for biomedical sensors

Who	Need
Hospital	Clinical routine tests Monitoring critically ill patients during e.g. surgery Monitoring of critically ill patients during intensive care Monitoring of (critically ill) patients at point of care
Medical centers/practitioners	Routine tests More advanced tests (cell counting)
Diseased individuals at home	Testing for development of non-critical disease while at home in order to be in a non-hospital milieu. Testing for chronic disease (diabetes) Testing for infectious disease
Healthy individuals (home care)	Sensing of device function/function of device (implant) Self testing (blood pressure, pregnancy, testing of children)
Soldier biosensing	Medical care testing as stated above Remote and self testing in the (battle) field (infectious agents, explosives)
Legal authorities	Doping (sport) Drugs



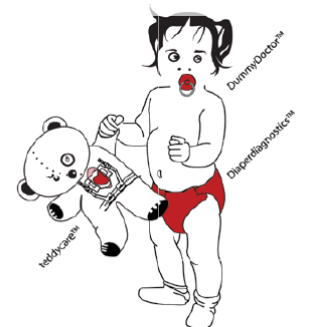
## SWOT – Nordic exploitation of biomedical sensors

<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>• A competitive and well established research environment</li> <li>• A strong health care industry in general with several world leading companies</li> <li>• A health care system that can provide very good statistics in relation to needs and effects of measures</li> <li>• A good record with respect to companies working with sensors</li> <li>• Educational skills</li> </ul>	<p><b>Weaknesses:</b></p> <ul style="list-style-type: none"> <li>• Inadequate seed and venture capital</li> <li>• Inadequate market access (Test markets are small)</li> <li>• Regulatory conditions that limits the use of medical sensors – especially in Europe</li> <li>• High overall costs</li> </ul>
<p><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>• A very good potential for improvements of health care systems</li> <li>• An ageing population and increase in lifestyle diseases requires increased point-of-care and at home diagnostics</li> <li>• Access to novel technologies due to a strong research environment</li> <li>• A non-bureaucratic business environment</li> </ul>	<p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>• The US and the Far East continues to demonstrate a larger agility to innovate (transform knowledge to business)</li> <li>• A slow and complicated decision-making within health-care systems</li> <li>• A consumer basis that is less adaptive to new health care technology than encountered in the US and the Far East</li> <li>• Shortage of adequately qualified personnel</li> <li>• A world market that does not develop as predicted</li> </ul>



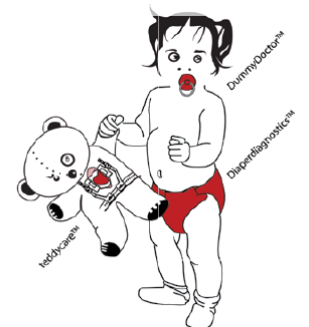
# Main opportunities and barriers

- Nordic industries are major vendors of medical sensors.
- The growth of Nordic companies in the field is considerably larger than the world average.
- The Nordic countries are leading in relation to the use of medical sensors for the benefit of health care and well being.
- Regulatory conditions that seriously limits the use of sensors particularly in hospitals.
- Shortage of venture capital especially to finance the stage between the research stage and the development phase



# Ethical dilemmas

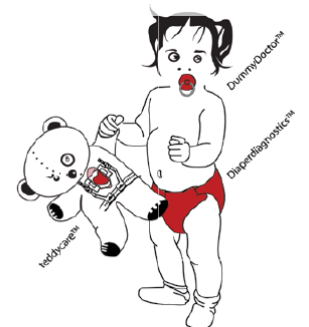
- Evaluate the foreseeable consequences of the biosensor technology
- A public debate regarding biosensors will facilitate the acceptance and even accelerate the rollout of this new technology
- The right to know and the right not to know
- There is no sense in sensing something you can not do anything about
- Who should make decisions?





# Findings

- The health care system will face an enormous challenge in the near future due to e.g. ageing population, well-fare diseases and new technology. Thus, development of biomedical sensors technology will be crucial.
- Biomedical sensors will be a central unit embedded in several health related applications and scenarios. By using micro- and nanotechnology it will be possible to design small, smart, robust and cost effective sensors with a wide functionality.



# Findings...

- Biomedical sensors will monitor important body functions and status (i.e. blood sugar level, heartbeat rate, presence of toxic agents), and advanced algorithms adapted to each individual may trigger alarms when non-normal values are encountered.
- Technologically there is a tremendous potential, especially related to converging technologies, however technology alone does not create business.
- Nordic industries are major vendors of medical sensors, and the region is leading in relation to the use of medical sensors for the benefit of health care and well being. This creates great opportunities for Nordic companies to find international markets for biomedical sensors and take leading positions.



# How to follow up FOBIS?

- Create "winning teams" of companies and innovation actors
- Stimulate and strengthen cross-disciplinary networks of experts
  - Nordic conference "Personalized health systems" (2008)
- *"Home care hospital" / "Personalized healthcare" / "Future Nordic Healthcare system"*
  - future Nordic programs?

