



# Nanotechnology and health. A difficult relationship?

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nanobüro

## A quote from the IRRST new report



- Research in the nanoparticle (NP) and nanotechnology field is growing at a breathtaking pace. The reason is simple: the unique properties of NP will allow the development of products with unprecedented characteristics and opportunities in every field of human activity, and with tremendous economic impacts. It is currently anticipated that the number of exposed Quebec workers, not only in manufacturing these products but also in using and processing them, will increase over the next few years. Several products are already available commercially and some Quebec companies now have large-scale NP production capacity.

## Outline



1. Some features of the nanodebate
2. Nanomedicine: goals and priorities in tension
3. Whose health? Protection of workers, of environment, of patients
4. Conclusions

## 1. Some features of the nanodebate



### Nanotechnologies as technosciences:

- Primate of application over knowledge
- ability to use instruments rather than the search for objective knowledge and comprehensive theories
- New regime of knowledge production: strict collaboration between public and private research, interdisciplinarity

-- strong orientation toward the application--- **production**

**It fits to the economic context: technological production for increasing competitiveness**

## 1. Some features of the nanodebate



- Great promises, revolutionary potential, *enabling* technologies
- Promises of abundance, sustainable & more efficient production
- Fascination in the promises
- As long as there are production & innovation (“innovative production”) *the benefits are assumed* and the debate concentrate on risks

## 1. Some features of the nanodebate



- “Nanotechnologies may prove beneficial to human health in various ways. The Committee uses the word “may” advisedly because the benefits are mainly concerned with applications that are the subject of - various stages of advanced - research. Only a few products are already on the market or being used in clinical practice. “ (Dutch Health Council, Health significance of nanotechnologies 2006, p. 31).
- The ***framework of risks and benefits*** is very evident in the structure of the report and in the debate in general: the “potential” benefits are listed and taken as positive, the question is only whether and when all promises will happen; the risks have to be discussed.

## 1. Some features of the nanodebate



**Nanomedicine** = application of nanotechnology to the field of medicine (incl. Nanomaterials, nanoelectronic, nanobio)

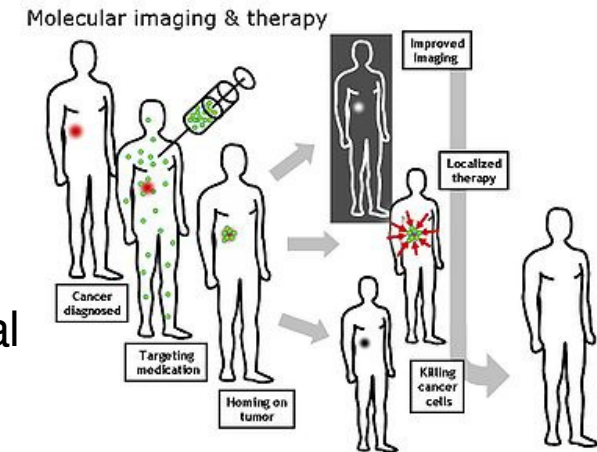
- improved drug-delivery
- Improving diagnostic

(in vivo imaging of drugs, faster & more sensitive Diagnostic through detection of early biomarkers, individual genetic testing, lab-on-a-chip: from hospital

- Cure for cancer
- Improvement of therapy

( especially for neurodegenerative diseases through neuro-electronic interfaces, regenerative medicine)

**Normally health impacts of nanomaterials are not really listed as a problem of nanomedicine**





## The NanoMedicineResearch Agenda

1. NanoDiagnostics: early and accurate diagnosis- Biosensors and miniaturized devices -targeted imaging agents to highlight of disease
2. Targeted Drug Delivery: on the spot- bring the drug to the target site and monitor its impact
3. Regenerative Medicine: stimulated repair- help the body to (re)build organs or systems
4. Meeting ELSA challenges- Ethical, Legal & Social Aspects

## 1. Some features of the nanodebate



- Even a stronger fascination if we talk of medicine
- The benefits of medical research are assumed, not contested, seen as good and fundamental (priorities)

But...

Goals of medicine have to be set

Priorities have to be set

Medical research uses (economical, human, animal, “ethical”) resources

--> Also in medicine it is possible to talk about the benefits, to contest meanings and to question goals & priorities

## 1. Some features of the nanodebate



- Important would be the disentanglement of fundamental concepts of medicine such as HEALTH & DISEASE

### HEALTH:

Traditionally: deviation from “normal functioning” of the body

World Health Assembly (since 1948): Health is a state of complete physical, mental and social *well-being* and not merely the absence of disease or infirmity.

### Critique:

- the reference to the complete well-being is only for less people (young, “rich”, without chronic disease)
- it is not applicable in practice

*Hastings Center (Reports on the Goals of Medicine) (1999):*

Health: state of physical, mental and social well-being

--> Promotion of health, prevention of disease as fundamental

## 2. Nanomedicine: goals and priorities in tension



- For the European Platform on nanomedicine, the key Policy Issues are:
  1. Reimbursement
  2. Risk-sharing healthcare technology assessment
  3. Regulatory: Faster approval methods needed
  4. Accelerating adoption rate of new technologies in Healthcare

## 2. Nanomedicine: goals and priorities in tensions



→ *Discrepancy between diagnostics and therapy* —

Does an improved capacity in diagnostics (without a corresponding in therapy) improve health?

What is the significance of diagnostic tools predicting “genetic dispositions” (and not monogenetic disease) for our well-being?

→ *shift of responsibility to the patient*

Through lab-on-a-chip and increased home diagnostic tools

Does this contribute to the improvement of health?

## 2. Nanomedicine: goals and priorities in tensions



→ *Market of health care*: breaking down of diagnostic monopoly of physicians & business possibilities for test providers

How can be the improvement of health (public health) be realized if everything will left to the market? Who does decide what is worth to be cured? Who does decide who should take the risks? (the workers developing treatments, the patients, the entire population?)

→ *enhancement of the body*

There is a tension between intervention on the (physical) body and broad conceptions of health linked to social, political and economical factors. This can be seen as a partial result on a tension between individual perspective (defended with the argument of free choice) and public interventions in the field of health.

- Who decides what is “maintenance of health” and what is “enhancement”?

## 2. Nanomedicine: goals and priorities in tensions



- *How will nanomedical R&D will be made and organized? The question of patents*
- + support competition & development
- permit concentration of power; no control about the distribution; no consideration for the socio-economic context
- EGE (opinion21 2005, p. 58): There are risks of overly broad patents being granted that may hinder their therapeutic availability

*Questions of distribution* in general affect tremendously the well-being of people, so they are immediately correlate with health policies (otherwise we should not speak of improving public health but rather health of very specific individuals- those who can afford)

## 2. Nanomedicine: goals and priorities in tensions



--> *Questioning the concept of “personalized medicine”*

In nanomedicine, this is linked with the efforts in drug-delivery

- tension with epidemiology and social/economical determinants of health
- Possible discrimination
- Scientific doubts
- Is it possible to make it affordable for everybody?

→ *Medical devices in other fields: implants in the military*

- the problem of “dual use”: does this problem force us to reconsider criteria for setting priorities?
- Nanoparticles: risks and possible double impact in medicine

## 2. Nanomedicine: goals and priorities in tensions



--> *Which criteria guide nanomedicine?*

Research: **which are the most important diseases?** (number of people dying, social relevance, suffering/severity, political-economical priorities, profitability)

“there has been an overemphasis on drugs- The lack of drinking water is a much bigger priority in most countries than antiretroviral treatments”

(Nepal health activist)

--> **importance of the socio-economic and health context in which technologies are introduced**

## 2. Nanomedicine: goals and priorities in tensions



### → *Prolonging life expectancy*

Clear tension with perspectives that stress social, political and economical factors for the growth of population & life expectancy

- Maintenance of a healthy body in a unhealthy environment? (nanoparticles)
- What are we ready to risk in the name of nanomedicine?

### 3. Whose health? Protection of workers, of environment, of patients



- Speaking about nanomedicine, we concentrate on the health of the patients- but when we set the goal of protecting health it is a general one
- It seems to be a **inherent tension between RISKS & POTENTIALS of nanomaterials**
- On the one side we have a growing body of literature about the potential toxic effects of nanoparticles and the needed measures for protecting workers and environment
- On the other side, we face the extraordinary potential applications

### 3. Whose health? Protection of workers, of environment, of patients



#### Risks for the workers:

1. Toxicity of nanoparticles: the appropriate tests are not really available because the mechanisms of toxicity have not been completely understood.
2. Potential of explosion: efficiency of the catalysis is generally a function of the surface area of the catalytic agent. However, nanomaterials have large surface areas; this favors their catalytic activity and may result in rapid – or even violent or explosive – reactions.
3. Risk of asphyxiation is possible in processes using large quantities of inert gases.
4. Risk of electrocution related to the use of high-voltage and strong-current processes.

### 3. Whose health? Protection of workers, of environment, of patients



- It depends very much on the focus we choose to have regarding nanotechnologies:

Society as a whole is divided between

- **Strong fascination** towards the marvellous possibilities of nanomedicine & Need to rapidly applying research results both for saving patients and for return in gain the investments in research
- **Need to consider risks**: the first step of risks is at the level of the workers, the first who have to deal with nanomaterials

### 3. Whose health? Protection of workers, of environment, of patients



- There is another important tension
  - Generally, nanomaterials pose new and different risks (they can potentially harm the environment, and so generally health levels)
  - We apply nanomaterials in the field of medicine, which aims to protect and promote health

3. Whose health? Protection of workers, of environment, of patients



\* *The critique to technological medicine*

T. Mckeown “*The role of medicine: dream, mirage or nemesis?*” (1979)  
growth in population (1700-today): nutrition, environment, behaviour  
Challenge of the ever-increasing demand for technological advance  
from curative medicine and questions the effectiveness of many  
contemporary practices

→ **Are public health ends better served by targeted interventions or by broad-based efforts to redistribute the social, political, and economic resources that determine the health of populations?**

**Example: Nanotechnologies may help reduce malaria (early detection by nano-enabled biosensors; nano-vaccines for malaria). However, in the Henan Province of China, malaria was reduced by 99% between 1965 and 1990 without nanotechnology.**

## To conclude...



- If we want to speak about the impact of nanotechnologies on health we need a **multifaceted approach**: we should not only concentrate on risks for health (for ALL categories, including the workers), but we should consider **the priorities of research** we want to follow in our society.
- The setting of goals and priorities in medicine and in general (since nanotechnologies are enabling) and their promises is a **political choice**. This choice influences the level of risks our society is ready to accept.
- In the model of risks and benefits: the higher the benefits, the higher the risks..
- But, of course, there are limits, set by the political agenda. These are **FUNDAMENTAL RIGHTS** as well as questions of justice and distribution...
- **HEALTH** is of everybody and not only to considered when it is at risk.



Thank you!