

Nanobiotechnology: Responsible Action on Issues in Society and Ethics

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ABSTRACT

If claims about the major long-term impact of nanotechnologies prove true, then the implications for societies and economies around the globe will be profound. The contrast between expected impact on the one hand, and very low awareness of nanotechnology by the public on the other, has led many to consider nanotechnology, and especially its nanobio- applications, to be the next major public, NGO, media and political issue after nuclear energy and GM food and agriculture.

As yet few researchers have begun to explore seriously the ethical and societal issues in nanobiotechnology. The overall aim of this initiative therefore is, firstly, to anticipate the societal and ethical issues likely to arise as nanobiotechnologies develop and, secondly, to use the lessons from the European GM debate [1] to respond proactively and responsibly to the probable public, media and political concerns.

Keywords: nanobiotechnology, ethics, society, public, media

1 CURRENT STATE OF AFFAIRS

There are many repeated claims about the major long-term impacts of nanotechnologies upon global society: for example, that it will provide radical advances in medical diagnosis and treatment, cheap sustainable energy, environmental remediation, more powerful IT capabilities and improved consumer products. If even only some of these predictions prove true then the implications for global society and the economies of many nations are profound. The general experience with successful new technologies is that the time needed for their development and introduction is optimistically underestimated but that the magnitude of their long-term impact is grossly underestimated too.

Many industries welcome the opportunities which are seen in nanotechnology and this is reflected in the rapid increase in research funding by industry and governments. The European Commission has allocated €1,300 million to nanotechnology as one of the thematic priorities in its 2003-6 Sixth Framework Programme. According to estimates for

2003, public research funding alone totalled \$3 billion worldwide and is still increasing. Sales revenues from products manufactured using nanotechnology have already reached 11-digit figures and are predicted to generate 12-digit \$ sums by 2010.

Following a relatively short phase of research and development a number of new products have already been launched onto the market including cosmetics, sunscreen lotions and water-repellent and self-cleaning coatings. It is possible, but yet unproven, that materials involved, while not normally toxic to humans or the environment, may be so as nano-sized particles. Hence a quite different approach to detection of possible hazard, risk assessment and regulatory control is required. Concerns arise because of the potential nanotoxicity or pollution associated with certain nanomaterials and the likely widespread presence of nanoproducts in the near future across industry sectors, companies and countries throughout the world.

As the UK Royal Society and Royal Academy of Engineering report published in July 2004 states: "*Nanoscience and nanotechnologies are widely seen as having huge potential to bring benefits to many areas of research and application, and are attracting rapidly increasing investments from Governments and from businesses in many parts of the world. At the same time, it is recognised that their application may raise new challenges in the safety, regulatory or ethical domains that will require societal debate.*" [2]

Current awareness of nanotechnology by the public is very low. In the 2002 Eurobarometer survey: "*Europeans and Biotechnology in 2002*" [3], over 50% of the sample answered 'don't know' when asked whether they thought that nanotechnologies would improve or make worse their way of life over the next 20 years. The very low awareness of nanotechnology by the public in Europe and the very high percentage of "don't knows" provides the opportunity for improving public understanding and ensuring effective public communication from the outset. This is clearly necessary to help achieve public acceptance of nanotechnology and not to leave a perception 'vacuum' to be occupied by activist NGOs as happened with GM food and agriculture.

Some already consider nanotechnology, and especially its nanobio- applications, to be the next major public, NGO, media and political issue after nuclear energy and GM food and agriculture. The so-called “grey-goo problem” became a media topic and as “*global ecophagy by biovorous self-replicating nanorobots*” was made the subject of study [4]. Michael Crichton published a best-selling science fiction novel “*Prey*” on the theme.

The majority of the scientists in the academic and industrial nanotechnology communities tend to approach their science with what has been characterised in the epistemology of science as “logical positivism or empiricism, Popperian falsifiability and Kuhnian paradigmatic” views. This is not true of all and for many there has been a discernible, and continuing, shift towards more “relativistic” and “social constructionist” appreciations. Many nanobiotechnologists say that they have considered, or are willing to consider, the ethical and social impacts of their work. Currently, though, many still tend to dismiss the concerns which people have (and probably will have increasingly) about the nanotechnologies in terms of being “just another new technology” and the solution being in the so-called “deficit model” of science communication by “providing the public with information and they will accept it”.

A study by the Joint Centre for Bioethics at the University of Toronto, Canada, “*Mind the Gap: Science and Ethics in Nanotechnology*” [5], published in the journal *Nanotechnology* reportedly said: “*There is a danger of derailing nanotechnology if serious study of its ethical, environmental, economic, legal and social implications does not reach the speed of progress in the science*”. It further said they fear “*a showdown of the type we saw with genetically-modified crops*”. Dr Peter Singer, one of the study’s authors, is quoted as saying: “*I don't want the science to slow down. I want the ethics to catch up.*”

As yet few ethicists have begun to explore seriously the ethical issues in the nanosciences, nanotechnology and nanobiotechnology. Doubtless, as happened for example in the GM agriculture and food, and embryo stem cell research fields, progressively more ethicists will take up such studies as they become aware of the issues involved in these areas and of their importance.

2 NANOBIO-RAISE

It is for these reasons that the Nanobio-RAISE project is being established by the European Commission Research Directorate-General under its “Science and Society” programme. The overall aim of this initiative is both, firstly, to anticipate the societal and ethical issues likely to arise as nanobiotechnologies develop and, secondly, to use the lessons from the European GM debate to respond proactively and responsibly to the probable public, media and political concerns. The project aims to bring ethicists and

nanobiotechnologists together with the aim of helping the former to help the latter, and vice versa, by enabling scientists to better understand and respond to the concerns of the wider society which the nanobiotechnologies will undoubtedly benefit.

The main objectives therefore are to:

- bring together the key relevant players in the field including committed ethicists, European Commission Nano2Life Network of Excellence, European Federation of Biotechnology’s Task Group on Public Perceptions of Biotechnology, EuropaBio, DECHEMA (Fachsektion Nanotechnologie), Royal Institute for Technology in Stockholm (Philosophy Unit), Church of Scotland Society, Religion and Technology Project, SMEs and major companies using nanobiotechnology,
- horizon-scan for the scientific and commercial developments which are likely to cause public and political concern,
- clarify the ethical issues and public concerns involved or as they arise, and recommend and carry out strategies for public communication to address the emerging questions,
- take on board the experiences and lessons learned from the European GM debate of the last decade and apply them with this project to the nanobiotechnology discussions,
- incorporate the recommendations of the European Commission’s Communication “*Towards a European Strategy for Nanotechnology*” [6] and the results of its Nanoforum public consultation which surveys European public opinion on these issues [7],
- prepare for the relevant actions in the European Commission’s Action Plan for Nanotechnology to be published in Spring 2005 and the Technology Platforms on Nanotechnology foreseen in its Seventh Framework Programme commencing in 2006 [8].

3 PROGRAMME

The project will realise these objectives by carrying out the following activities.

3.1 Expert Group

To help explore the potential questions a multi-disciplinary expert working group will be formed which brings together, on the one hand, experts from the relevant areas of scientific research, industry and regulation relating to nanobiotechnology and enhancement, and, on the other, specialists in ethics, social sciences, media and public attitudes. Expert groups have proved immensely valuable in elucidating and exploring issues in a non-aligned context. The group will identify both current and future issues, explore different value perspectives, disciplinary insights and societal contexts.

The expert group meetings will engage scientific practitioners with the ethical and social implications of their research and inform ethical and social science experts in what is and is not realistic in the science.

3.2 Horizon scanning workshops

Two workshops will bring together the key players in the nanobiotechnology scientific and commercial field together with the leading ethicists and public communication experts concerned with it. Their aim will be to forecast the serious societal and ethical issues likely to emerge and to recommend the responses which should be made.

The main conclusions from these workshops will be published as summary reports. These reports will be used in the training courses for nanobiotechnologists and will be widely disseminated to policy makers, scientists, companies, public interest organisations and journalists, and will be made available as PDF files via the project website

3.3 Public opinion focus group discussions

Four focused discussions will be conducted with small groups of lay people led by a professionally-trained ethicist moderator in west, north, south and east Europe for variation in opinions in the different regions.

The main conclusions from these focus group discussions will be published as a summary report which will be used in the training courses and widely disseminated in the same ways as described above for the horizon-scanning workshop reports.

3.4 Ethics & Public Communication Courses for Nanobiotechnologists

Four 5-day residential courses for research and company scientists will be held to increase awareness of the issues, to encourage, support and train the participants in communicating with the public, the media and politicians about the ethically-related topics in their scientific fields and to discuss models for institutionalisation.

The training courses will enable the participants to carry out a wide variety of public communication activities discussing the ethical implications of their work with confidence. From the experience of previous similar courses the participants take what they have learned enthusiastically back to their colleagues and institutions, acting as “amplifiers”, undertaking and organising further outreach and representational activities and working to establish these approaches in the courses and activities of their own institutions.

3.5 Information & Dissemination

A series of activities will be carried out designed to raise awareness, augment skills and enhance attitudes to nanobiotechnology.

Ethics lecturers will make presentations during scientific conferences and will be available for media interviews, discussions with politicians and similar occasions.

Three types of publications designed for their respective audiences will be produced and widely disseminated. These will be in the form of:

- issue papers for government officials and politicians
- briefing papers for consumers, teachers, media, etc.
- ethical briefings for scientists.

A public relations professional will assist with government and media-related activities in order to achieve the maximum possible impact for the project’s activities and publications to EU and national politicians and policy makers, the media, public interest organisations and to the public at large.

A regularly updated and user-friendly website will make all of the project’s quality controlled publications and activities available.

3.6 On-line Forum and Database

An on-line forum linking the members of the main partner organisations and the other participants will enable them to communicate easily and efficiently by email about all of the project’s activities.

An annotated bibliographic database of nanobiotechnology-related ethics research publications, public opinion surveys, researchers, organisations, conferences, reports, “grey literature”, etc. will provide a selected and quality-controlled collection of key reference and resource material for the use of the project’s participants and others interested in the topics covered by the Nanobio-RAISE project.

3.7 Support to EC Nanotechnology Action Plan and FP7 Technology Platform activities

The project has been designed in so far as is possible to anticipate the actions recommended in the European Commission’s Action Plan for Nanotechnology to be published in Spring 2005 and for the Nanotechnology Technology Platform foreseen in the Seventh Framework Programme. Activities not covered in the presently proposed project will be the subjects of (a) further proposal(s) when the Action Plan is published and the Technology Platform is (being) established.

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