Report of the ethics session in the EMBO fellows meeting, 23 June 2007, EMBL Heidelberg, Germany

Audience: n=67, type=molecular life sciences (age group 25 – 35), countries represented, n=15

A bit of bioethics

Speaker: Matthias Kaiser, Director of the Norwegian Ethics Commission, Oslo, Norway

Scientists should not stay away from troublesome topics. But they should recognise that there can be a number of different perspectives on a topic. Looking from the outside in is completely different from looking from the inside out. Scientists shouldn't assume that others see things the same way as they.

Knowledge, although some argue otherwise, can be said to have a value, and so it is legitimate to ask "where does that lead us?" The "technology fix" is a symptom of our era, and with respect to distant "catastrophes" we have time to develop solutions via science and technology.

The Marquis de Condorcet, French philosopher, mathematician and early political scientist, argued that scientific and technological progress is unthinkable without the parallel development of morals. Three societal entities interact to generate the values that give rise to morals: politics, science & industry and the general public.

It should never be claimed that ethics and values have nothing to do with science. People who deny the connection risk being perceived as naïve or, worse, considered to be playing a power game and belittling democracy.

The social framing of an issue is the hottest issue in itself. But what is ethics of science, exactly? Sometimes it sets limits of what can and what can't be done. Sometimes it gives visions of "good" knowledge (and by inference "bad" knowledge). My claim is that you can still meet Wernher von Braun types in science today; people who would say "I'll go where the money is." Society, however, expects (and deserves) socially responsible researchers.

The narrative that scientists themselves have of science (progress, improvement, Nobel prizes) is *not* the narrative that much of the public entertains (which is often a negative perception). With regard to modern biotechnology, for example, many people pose the question "aren't these boundaries that we shouldn't cross?" The assertion that a tangible benefit will arise from a particular application of science simply does not convince many people that it is right to develop the application. Scientists mostly do not see this. Why? Partly because the definition of what *is*, and what *is not* a problem that "needs" to be addressed by science differs greatly across societal groups. For instance, do we need more research in order to produce pigs with less fat, or do we need to change our diet? When a particular route of scientific research or application is considered, it is reasonable to ask immediately "what are the alternatives?" "what are the uncertainties and possible risks?" "what are the possible undesirable effects, and do they justify the desirable outcomes?"

Ethics should not be reserved for philosophers and theologians. Scientists *should* get involved. There are some concrete rules of engagement. Firstly, concealing parts of the science in question is not acceptable. In the case of growth-enhanced salmon that were being developed in Norway scientists tried to conceal the fact that it was a human growth factor gene that had been introduced. This led to serious public distrust of scientists. Lesson: be completely honest, and do not try to manipulate perceptions. Some questions of ethics can be addressed using a kind of logic based on a

matrix to assess the probable impact of a technology. This can help define "good" ethical values. Unfortunately, the perception that uncertainties eventually disappear – often proclaimed or wished for by politicians – is a fallacy. Uncertainty in a particular case is – and probably always will be – given a different value by different societal groups. The "uncertainty trough" refers to the lower uncertainty that politicians are keen to reflect compared with scientist, on the one end, and members of the public with little knowledge, on the other end (see presentation slide).

The negative effects of uncertainties can be managed (or completely obviated) by application of the precautionary principle (PP). The PP applies to situations in which the degree of risk is not known (or not completely known), but in which the result of that risk becoming reality is serious. In its simplest form the PP states that the development of such technology should be proceeded with applying great caution. The rate of progress should be subsidiary to increasing knowledge of the possible risks and their quantification, which means that it is a priority to research these risks as an end in itself. In its most extreme interpretation, the PP precludes further progress in applying/developing a particular technology because its possible negative outcomes are deemed too serious to risk their happening. If the risks of a particular technology are completely known, we do not need to apply the PP to it, but rather control it appropriately and provide appropriate public information (if applicable).

Exercise in considering the ethical concerns connected with the public application of an emerging technology

Andrew Moore, Programme Manager for Science & Society, EMBO

The following scenario, questions and exercises were originally developed by contractor No. 12 for use by contractor No. 7 in an ethics workshop held in Porto in February 2007. They were used in the current setting in an adapted form. The whole audience of scientists was involved in considering the scenario and then developing opinions and discussing/arguing their points of view in a plenary session.

Summary outcome: The exercises demonstrated that within this relatively homogenous group (all molecular life scientists between 25 and 35 yrs old, almost all from Europe) very different points of view were expressed and defended with great conviction. Many of the scientists managed to be convinced and convincing defenders of all of the role-play types: scientist (naturally), environmental organisation representative, company representative, journalist. This anecdotal observation suggests that scientists can, indeed, with relative ease, see scientific and technological topics and concerns from different societal points of view – when directed to do so. This effect was also witnessed at the Porto workshop mentioned before. The logical extension of the exercises would be to ask the scientists to role-play different societal groups when considering their own research and its application. This is predicted to be harder, but never the less achievable. Unfortunately there was not time in the session to accomplish this. It remains an interesting activity to perform at another occasion.

Scenario and exercises:

Trouble in Mawatubiki – Nanotech to the rescue of tropical island state?

Author: Andrew Moore, Manager, EMBO Science & Society Programme

As a result of climate change, the tropical island state of Mawatubiki has in 2006 suffered a greater number and greater intensity of tropical storms than ever before in its recorded history. The agricultural economy is dependent on at least two annual harvests of the fast-growing bio-diesel producing variety of Tappi-tappi plant. Mawatubiki farmers have to deal with mountainous terrain, much of which is laid out as fragile terraces. Traditionally these are planted with a variety of crops, some of which are harvested only once a year. Twice-yearly harvesting of the shallow-rooted Tappi-tappi plants makes the soil especially vulnerable to erosion by heavy rain-fall. Much agricultural land has recently been destroyed – literally washed down the hillside in tropical storms.

The Mawatubiki government called on international advisory agencies including the FAO (Food and Agriculture Organisation), but while the FAO was preparing a study of the situation, a US company "Agrosol" came forward with a possible solution. This involves a new, as yet untested, nanotechnology product that claims to be able to bind the surface of fragile soil into a semi-solid crust. SurfaceSave is a nanoparticulate combination of an organic moiety that binds to humus (decaying organic matter) and silicate particles in the soil. It thus forms an amorphous structure that is relatively water insoluble but easily broken up by physical means (such as ploughing or tilling the earth). Sprayed onto the surface of the soil as a mildly alkaline emulsion, SurfaceSave penetrates to a depth of only 1 cm, and upon moistening with rainwater catalytically binds the surface into a crust, hence reducing erosion. It has since emerged also that the Mawatubiki application of SurfaceSave might act as a pilot project for a larger scale use in California, USA, where hillsides are regularly made vulnerable to erosion as a result of deforestation by fires.

Environmental protection agencies, notably NGOs Greepeace and Friends of the Earth, have reacted with horror at the news of the experimental use of a nanotechnology product in Mawatubiki. Residents of California are also "concerned" to say the least, after hearing of the "secret" plan to use their neighbourhood as a beta-testing ground for the product. Mawatubiki farmers are desperate to save their land, and are keen to try any solution, but as the NGOs point out, a short-term gain could be accompanied by a long-term environmental disaster. "If this is some kind of catalyst, that means that it can carry on reacting with the soil for as long as it survives, and we don't know how long that is, or where it might end up over that time span" said Nicola Alvares of Friends of the Earth, continuing "We don't even know much about its toxicity to humans and other organisms, especially in the Mawatubiki ecosystem. This is yet another example of unnatural interference with the environment – we have to stop the cycle somewhere and say 'enough is enough'." The Mawatubiki government says it is prepared to discuss the "aid" from Agrosol, which would be provided free of charge according to a company spokesman. Mawatubiki's minister for agriculture said "Agriculture ***is*** our economy on Mawatubiki's. If we do not act soon, we may not be able to grow anything, let alone Tappi-tappi. That said, we do not want to become slaves to western technology, and must try to find long-term solutions to the problem ourselves."

Whatever the situation in Mawatubiki, a public challenge is growing (mainly in the developed world) to the use of SurfaceSave, and even to nanotechnology itself. Basic researchers and technologists alike are becoming concerned at what this could mean for the public image and hence funding of their work at a time when it already arouses fear and mistrust. Indeed, Agrosol funds certain research projects that are ongoing at the University of California San Francisco – academic laboratories that rely on such funding to keep their heads above water.

Choose a role to become. Imagine yourself with one of the following mind-sets:
1. Current affairs correspondent of a major international newspaper
2. NGO representative (pro-environment etc.)
3. Chief Scientific Officer of Agrosol
4. Eminent independent scientist (academic professor, whose research is totally publicly funded) working in area of nanoscience

Tasks:

1. Playing your role above, consider some of the issues:

A. The new crop (responding to western needs, and provided by a western biotech company) has inadvertently caused a problem in Mawatubiki – in combination with western-driven global warming. Are we justified in using one western technology to solve the problems caused by other western technologies? Some would say we have a duty, but the argument against is that we simply wind ourselves and others up in a dependency upon new technologies, the consequences of which are never predictable.

B. What is more important? The immediate needs of the Mawatubiki farmers, or the concerns of developed-world observers that something wrong and even "unnatural" is being done?

C. Can any situation, however severe, justify the environmental use of a product that has not yet been tested in the intended scenario? This refers to the precautionary principle or "PP". How much do you know about the PP? How could it be applied in the Mawatubiki scenario?

D. The situation with Mawatubiki is similar to a patient who is bound to die of a hitherto untreatable disease, but who has the chance to participate in a trial of a new potentially life-saving treatment (not cure, note!). If the medicine works, what are the responsibilities to the patient after the trial is over? What if the patient can't afford the new medicine, or regulatory agencies decide against its registration?

E. Would the perception of Agrosol's product be different if it were simply labelled as a product of "modern chemistry", and not a nanotechnology solution? The company was keen to use the "nano" cachet in its marketing and description of the product. What do you think about the re-labelling of science to follow fashionable trends?

F. Should the researchers working in the Agrosol-funded USCF laboratories have a say in how their research is marketed and to whom?

G. Mawatubiki's environment minister said she didn't want to become slaves to western technology. How can scientists help to work towards a future in which the distribution of knowledge and technical ability is more diffuse, and not just concentrated in rich developed countries?

H. How can the scientists working on nanotechnology protect fundamental research from the generalised bad perception that invariably occurs when one example hits the headlines?

Are there any other points on which you have an opinion, apart from the above?

After considering and discussing these stimulatory points, you might like to move on to the second part of the exercise:

2. Now, imagine that the Mawatubiki situation has just tipped the balance enough against nanotechnology to precipitate top-level discussions on an internationally agreed moratorium on nanotechnology applications. Public referenda will be held in the near future in many countries. Though the moratorium will not include basic (fundamental) research, the implications for basic research are obviously disastrous. Basic researchers rally to the cause, and organise public appearances in defence of their science. Some write to large newspapers offering articles setting the record straight. Most editors, wishing to be in control of what is reported to the public(!) prefer to get their correspondents to interview several sources, and write the article themselves. Participants in this exercise now have to play their roles as indicated above. The scenario starts with the independent scientist calling the newspaper correspondent and offering an article. The correspondent says that he will write the article, and that he will interview others as well. The interview proceeds (allow 2 minutes), then the correspondent interviews the others in the role-play (also each for around 2 minutes). In the following 10 minutes each role-player separately makes a draft of how he/she thinks the article should read. After that, they all compare their versions with the one that the role-play correspondent has made. This should show that even among scientists, different slants and opinions can emerge when a topic is seen through different spectacles, so to speak.