Submission to the **Nuffield Council on Bioethics** inquiry into **Emerging Biotechnologies**

Memorandum by Professor Nick Pidgeon of the ***Understanding Risk Group*** *Cardiff University.*

BACKGROUND

I direct the *Understanding Risk* research group, a major research initiative funded by independent Charity (Leverhulme Trust) and domestic and international Research Councils (ESRC. NERC, EPSRC, USNSF) and which is based at Cardiff University. The group brings together a team of interdisciplinary researchers in the investigation of the nature of risk attitudes, risk governance and public engagement in contemporary Britain[1]. For work on emerging nanotechnologies in particular we are collaborating partners in the Centre for Nanotechnology in Society at the University of California at Santa Barbara[2].

My own research over the years has led me to study public reactions, controversies and public engagement processes around emerging issues such as agricultural biotechnology, human genetics, nanotechnologies and (latterly) climate geoengineering. In 2003/4 I was a full member of the Royal Society study group on Nanotechnologies.

I confine comments to questions asked in the call for evidence.

Questions 1 and 2 – Defining Emerging Technologies

Such technologies are sometimes also described as 'upstream' in nature. They involve novel applications – or perhaps more crucially often *visions* of applications that have been posed by scientists and entrepreneurs – in advance of full scientific knowledge or commercial application. Crucially, they arise at a point where public knowledge of the issue is typically low, setting very particular challenges for public engagement. They can range from the relatively mundane (e.g. nano-wound dressings) to the controversial (e.g. nano-cognitive enhancement).

We do know that application matters a lot to how emerging technologies will be received, and how they could be governed. In comparative deliberative work on emerging nanotechnologies conducted in 2007 in parallel in the US and UK, and published in the journal *Nature Nanotechnology*[3], we found that people responded very differently to nano-energy applications as compared to nano-health/enhancement . The former were seen as raising few ethical issues and capable of governance through the traditional mechanism of markets, safety assessment and consumer choice. By contrast the latter were felt to raise more nuanced ethical questions requiring governance and scrutiny on behalf of society through independent 'ethics panels' or other such bodies.

More generally as the work of Demos[4] and others have pointed out, emerging technologies bring into sharp relief the competing, often profoundly different visions that stakeholders hold for the world, the environment and humanity, and the place of scientific progress within those public spheres.

In all of this there is a very real difficulty in separating the 'hype and hope' that cutting edge scientists tend to profess, from the more credible future developments – a lesson from the Royal Society Nanotechnology inquiry[5]. There seems little point in instigating extended effort on proactive governance for a field or application which may never fully mature. This raises the principal regulatory dilemma of emerging technology risk governance – sometimes referred to as the Collingridge Paradox. When a technology is very early in its development cycle and potentially open to steering the outcomes may be so uncertain as to prevent appropriate decisions, while later on when outcomes become clearer it may be 'locked in' and difficult to change.

Questions 3 – Which Emerging Biotechnologies?

Clearly synthetic biology and agricultural biotechnology are key issues, as are human health applications of nanotechnologies. Hearing synthetic biology enthusiastically described by some of its proponents at conferences (i.e. as 'engineering life') one is struck by the thought that this is what many of the NGOs thought they were objecting to when they campaigned vigorously against biotechnology in the late 90s. It certainly has the potential for great controversy.

Although possibly out of the remit of the Council, the most sensitive of emerging nanotechnology applications with the public currently would appear to be nanotechnology applied to food – since it raises many of the generic 'risk perception' issues that made GM food so controversial. Invisible risks to person body and family, benefits which may not accrue to the risk bearer, distrust of the involvement of large corporations etc. The recent House of Lords inquiry into this topic is a good source for this discussion[6].

Again possibly out of the immediate remit of the Council, a very significant emerging technology application is climate geoengineering (large scale-manipulation of the carbon cycle or of incoming solar radiation – see Royal Society 2009)[7]. Insofar as the earth's climate is a product of a coupled physical-technological-biological-human system there may well be issues that would ultimately fall within the Council's remit (bioengineered crops which reflect sunlight, ocean fertilization, bio-sequestration of greenhouse gasses etc.). Geoengineering raises a number of profound ethical and governance issues[8].

Question 5 – Social, Cultural and Geographical Factors in Attitudes towards Emerging Technologies

We know from longstanding research on attitudes to new technologies that a range of factors can make an issue appear less acceptable to people (identifiable victims, invisible hazards, a technology not fully understood by scientists, a 'dread' outcome such as cancer, and distrust in authorities or promoters). Equally, visible benefits can serve to attenuate people's concerns, as when a procedure which promises relief from a fatal illness will be accepted despite significant uncertainties.

However, controversy rarely arises as a result of any of these factors alone. Rather social and cultural factors inevitably play a role – in the case of the GM controversy in Europe the issue became associated with US-Europe trade disputes, the action of impersonal large companies (Monsanto), the activities of the NGO organisations to destroy crop trials, and in the UK the 'Frankenfoods' campaign by one of the UK's newspapers the Daily Mail. All of these factors combined in what is called 'social amplification of risk'[9] – a dynamic social and cultural process – to heighten concerns.

Much of this is out of the control of the promoters or regulators of a technology, although a clear conclusion from research is that greater openness about risks and uncertainties by both governments and industry, as well as ongoing dialogue with stakeholders and the affected public(s) can help considerably[10]. What is less helpful is simply to reiterate the known facts about the science – in the mistaken views that this will automatically bring public views in line with scientists' expectation (the so-called deficit model of science communication).

Question 7 Political Traditions

It is clear that fundamental values also have a bearing on the ways technologies are viewed – witness the different stances on stem cell research taken in the USA and Europe currently. In this respect it is also not true to say that Europe is always 'precautionary' and the USA always 'liberal' in approaching new technologies – as was sometimes claimed when the agricultural GM controversy was at its height. Local context and vales, issue emergence, and the dynamic amplification factors noted above are all important for understanding reactions at any point in time. Equally, there is no single public opinion on such issues, just different publics with different values and positions.

Interestingly, in our nanotechnology deliberation study noted above, we found very few US-UK differences on attitudes towards the two applications (nano-energy and nano-enhancement respectively) that we studied, despite predicting them[3].

Question 8 Common Policy Issues

While application matters one can identify generic categories of ethical and governance issues, which are often raised by members of the public when they deliberate about new (and in particular bio-) technologies[11]. Generally people show enthusiasm for many new technologies and the possibilities that scientific developments will bring. However, they also raise questions, including:

<u>Need</u> Who will benefit and will benefits and risks be equitably shared?

<u>Choice</u> Will people be given the information to make informed choices about any risks?

<u>Regulation</u> Who will set the regulatory framework and how will compliance be policed?

Risk and Scientific 'Ignorance' – How will risk be assessed and what are the potential consequences of any long-term unknowns or gaps in current knowedge?

Responsibility Who will be held responsible if something does go wrong, for both remediation and redress to victims?

Trust Underlying all of the above will be questions about the trustworthiness of both science and risk governance?

13 & 14 Risk, Precaution and Governance Frameworks
This issue could occupy several theses – but in a word both risk assessment and precaution have been deployed with different emerging issues. Indeed regulatory frameworks insist that 'safety' be established for new products as they come to the market. The problem is that with many emerging technologies there may currently be gaps in knowledge that make quantitative risk assessment less than useful. Such situations are sometimes described as decision making under ignorance[12] and call for different modes of evidence gathering and appraisal (scenarios and horizon scanning, decisions which can be easily reversed, research to gather evidence, a precautionary approach etc.). But there is no 'one cap fits all' here – assessment and regulatory tools must be tailored to the specifics of any emerging issues.

15 The Role for Public Opinion
The arguments for incorporating public perspectives in upstream technology assessment was discussed at some length in Ch7 of the Royal Society's nanotechnologies report[5] as well as the influential work by Demos[4] and others[10]. I do personally believe that there is a clear role for such opinion. Generic objectives of 'upstream' dialogue and public participation mechanisms have been proposed in the Royal Society report as follows:

1 Incorporating Public Values in Decisions

2 Improving Decision Quality

3 Resolving Conflict between Parties

4 Improving Trust in Institutions

5 Informing or Educating People

One might also add to this list – although it is implicit - as a way of framing the regulatory and risk assessment challenge, as well as the reflexive function of transforming the ways the scientists and engineers involved in deliberative processes view their work.

Any engagement exercise should be designed, and evaluated, with its objective(s) clearly in mind.

16 &17 Public Engagement and Methods
Generic methodologies for public engagement are also discussed in Ch 7 of the Royal Society report – which can range from full-scale multi-stage deliberative

exercises or citizen juries through to more informal focus groups or opinion polling. Again methods should be selected to fit purpose.

However, upstream issues do present particular difficulties of process design. In particular the likelihood of very low prior knowledge of the technology on the part of participants means that one often cannot – unlike with many other issues – convene a focus group with the simple instruction 'and what do you think about X' assuming that common group dynamics will take over. Sufficient information has to be provided, possibly with competing expert input, and often involving extended debate and reflection. For our US-UK nanotechnology deliberations we devised a 4.5 hour protocol with initial presentations on the technologies, further discussion of written materials, small 'World Café' type debates, and final deliberation sessions[3]. The NanoJuryUK in 2005 also used an extended format (over several weeks) including presentations by experts although even here participants struggled with the material[13].

All of this suggests more 'in depth' approaches may be more appropriate to the upstream case. However, in so doing a dilemma is that the organisers might then 'over-frame' the issues, getting back only what they put in as prompts or perspectives. Genuine public deliberation should allow participants to raise issues and concerns that they themselves have generated.

Equally, with emerging issues there may be very different views being presented by promoters and critics of a technology, with very little concrete evidence available that might allow people to choose between the two – hence even a citizen jury format might result in inconclusive outcomes.

Regarding evaluation it should always be budgeted from the start (allow perhaps 10-20% of total dialogue costs). There are two main elements when evaluating exercises in deliberative democracy. First how well did the process match up to set criteria and objectives, and second whether identifiable and desired outcomes were achieved[14]. The latter is clearly far more difficult to demonstrate as it involves engagement with scientists and policy over time[15].

If you require further information about this note do to hesitate to contact me.

Prof Nick Pidgeon
Understanding Risk Research Group
School of Psychology
70 Park Place
Cardiff University
CF10 3AT
PidgeonN@cardiff.ac.uk 14 June 2011

TECHNICAL NOTES

[1] Details of the *Understanding Risk* research programme may be found at www.understanding-risk.org

[2] Details of the Centre for Nanotechnology in Society at UC Santa Barbara can be found at www.cns.ucsb.edu

[3] Pidgeon, N.F., Herr Harthorn, B., Bryant, K. and Rogers-Hayden, T. "Deliberating the Risks of Nanotechnologies for Energy and Health Applications in the United States and United Kingdom," *Nature Nanotechnology* 4, no. 2 (2009): 95–98.

4 Wilsdon, J. and Willis, R. *See-Through Science: Why Public Engagement Needs to Move Upstream* (Demos: London, 2004)

5 Royal Society and The Royal Academy of Engineering (2004) *Nanoscience and Nanotechnologies: Opportunities and Uncertainties*, RS Policy Document 19/04, (London: Royal Society); see also Rogers-Hayden, T. and Pidgeon, N. (2007) "Moving Engagement 'upstream'? Nanotechnologies and the Royal Society and Royal Academy of Engineering's Inquiry," *Public Understanding of Science* 16, 346-364.

6 House of Lords Science and Technology Committee (2010) *Nanotechnologies and Food*. HL Paper 22-I. London.

7 The Royal Society (2009) *Geoengineering the Climate: Science, Governance and Uncertainty* (Science Policy Centre Report 10/09.

8 Corner, A. and Pidgeon. N.F. (2010) Geoengineering the climate – the social and ethical implications, *Environment: Science and Policy for Sustainable Development,* 52(1), 24-37.

9 N. Pidgeon, R. E. Kasperson, and P. Slovic, *The Social Amplification of Risk* (Cambridge, UK: Cambridge University Press, 2003).

10 See House of Lords Science and Technology Committee (2000) Report on *Science in Society*; also T. Dietz and P. C. Stern, Eds., *Public Participation in Environmental Assessment and Decision Making* (National Research Council, National Academies Press: Washington, DC, 2008)

11 See for e.g.: Grove-White, R., Macnaghten, P., Mayer, S. and Wynne, B. (1997) *Uncertain World: Genetically Modified Organisms, Food and Public Attitudes in Britain,* Centre for the Study of Environmental Change, Lancaster; Bickerstaff, K., Simmons, P. and Pidgeon, N. (2008) Constructing responsibility for risk(s): negotiating citizen-state relationships. *Environment and Planning A,* 40, 1312-1330; Davies, S., Macnaghten, P. and Kearnes, M. (2009) *Reconfiguring Responsibility: Lessons for Public Policy,* Part I of the report on Deepening Debate on Nanotechnology (Durham: Durham University).

12 Stirling, A. (2008) Science, precaution and the politics of technological risk. *Ann. N.Y. Acad. Sci.*, 1128, 95-110.

13 Pidgeon, N.F. and Rogers-Hayden, T. (2007)"Opening Up Nanotechnology Dialogue with the Publics: Risk Communication or 'upstream engagement'? *Health, Risk & Society* 9, no. 2, 191–210

14 See Rowe, G. and Frewer, L. (2000) 'Public participation methods: a framework for evaluation' *Science, Technology & Human Values*, 25(1), 3-29.

15 Bickerstaff, K., Lorenzoni, I., Jones, M. and Pidgeon, N. (2010) Locating scientific citizenship: the institutional contexts and cultures of public engagement. *Science Technology and Human Values*, 35(4), 474-500.