

Genetically Modified (GM) Food: A Promethean Gift or a Pandorian Consequence?

Martin Ruffley, Hotel School, Galway Mayo Institute of
Technology, Galway, Ireland.

5/8/2012

There have been few areas in European politics more controversial than Genetically Modified (GM) technology. Throughout the 1990s a wave of protest from politicians, the public and scientists critical of GM propelled the EU to impose a moratorium. To many political scientists this move confirmed that Europe was being increasingly risk averse, sceptical of the way in which science was manipulating nature. Leading Chefs and food writers have also announced their opposition, maintaining that Biotechnology firms have imposed a genetic experiment on the public. GM technology was simply BSE revisited. This paper challenges the idea that GM regulation confirms Europe as risk averse. In contrast to those such as Vogel, this paper argues that such views overemphasise the role of precaution in EU thinking and underestimate the influence of Modern Conservative thinking in defining the role of risk in politics.

Introduction

A lack of scientific consensus offers not an opportunity to invoke precaution but forms the basis from which to resist regulatory intervention. It anticipates not a lowering of the evidentiary bar, but its elevation. Intervention can be justified only once a quantifiable risk assessment has identified an ascertainable risk, not a theoretical uncertainty (Taylor, 2007 p. 6).

Since the 1990s, there has been a great deal of controversy surrounding the introduction of genetically modified (GM) food and crops. Supporters of GM argue that it has been rigorously tested and that it offers significant benefits such as increased yield in developing countries by producing plants that require less insecticide, or plants that grow in extreme drought. It was a view that was endorsed by the British Medical Association (BMA) Report 'Genetically Modified Foods and Health', which stated that there is no robust evidence to prove that GM food are unsafe and that GM food has enormous potential to benefit both the developed and developing world in the long term (BMA, 2004). It is also argued that plant based pharmaceutical crops can be used to grow medical products like blood thinners, clotting agents, anti-arthritic and contraceptive products. Here, no less an authority than the Nuffield Council on Bioethics has argued that: 'there is an ethical obligation to explore these potential benefits, in order to reduce poverty and improve both food security and agriculture in developing countries' (Nuffield Council on Bioethics, 1999).

In such scenarios, genetic modification is often seen as a bountiful utopia, with unprecedented opportunities for supporting mother earth's rapidly growing population. However, critics present it as a precarious nightmare of risk and loss to farmers, consumers and the environment. To opponents of GM, these products pose a threat to ecological biodiversity, impacting detrimentally on birds and insects because they reduce the availability of food for wildlife. More importantly, opponents fear the power of large multi-national companies that present a vision for which there is no proof that the technology is safe (Levidow *et al*, 2005).

It is an argument that has been persuasive to consumers in Europe, which remain opposed to GM food despite the best efforts of the biotechnology industry. As a recent survey showed the majority of Europeans hold a negative view on GM food (Eurobarometer 2010).

There have also been several specific pressure groups, such as the 'Slow Food Movement', that have linked protest to the wider politics of globalisation and modernity. It has also proved a fertile ground for groups such as Greenpeace, Friends of The Earth, the Federation of Green MEPs, and radical national consumer organisations, the organic farmer's organisations and Euro Coop, all of which have attempted to mobilize public opposition to GM. To those such as Beck (1998) and Giddens (1998) these are issues that confirm that we have moved into a new era, a 'risk society' that has replaced an industrial society, where science no longer possesses an overwhelming grip upon the public's imagination (Beck, 1998). This is a society critical of science, worried about its ability to organise, manage and control the escalating risk of modern society. In the view of Beck and Giddens, we have moved from simple modernity to reflexive modernity, where a challenge to scientific elites is endemic. It is not inevitable that serious hazards are more common, but society appears concerned with the future (and also with safety), which generate risk (Giddens, 1998).

Drawing upon Beck's vision of a risk society, David Vogel has suggested that the crises to have gripped Europe in the post-1980s are now more deep-rooted, anchored in a 'public's sense of vulnerability to, and anxiety about, the risk associated with modern technology' (Vogel 2003). In his view, Europeans now live in a *risk averse* society, where the public's perception of regulatory failure' has had a spill-over effect: they make both public opinion more sensitive to the risks associated with new technologies' and create a gap between public expectations and policy effectiveness. Science is no longer a sufficient guide to policy, which has meant that politicians cannot

use 'scientific uncertainty as a justification for avoiding or delaying the imposition of more stringent measures' (Vogel, 2003).

In contrast to Vogel, who argues that European regulation has become increasingly risk averse, this paper argues that he overstates the importance of the precautionary principle, failing to give sufficient weight to the influence of modern conservatism. It also maintains that Vogel downplays the influence of events in the USA and fails to see the impact of reforms at the international level through bodies such as Codex/WTO.

Methodology.

The data has been examined/interpreted from a critical realist position, which acknowledges the value of positivistic methodologies and shares the ontologically foundationist list stance of positivism, but contends that not all phenomena can be observed directly. Rather, it suggests that there are 'deep structural relationships' to political and social events that escape direct observation but, nevertheless, are critical to an explanation of behaviour. As Marsh and Furlong suggest, there may well be significant difference between 'real interests', which reflect material reality, and perceived interests, shaped by powerful forces (Marsh & Furlong 2002, p.20). In the context of this research, importance is attached to the manner in which risk is socially constructed, open to challenge and contestation. Its aim is to show how risk has been reconfigured, (over time) and shaped by the forces of globalisation. Not in the sense that globalisation is simply a force in itself, but rather the manner in which the dominant discursive construction of globalisation has impacted, shaped and constrained the role of risk in politics (see Marsh & Furlong 2002; Hay & Rosamond 2002).

The paper is divided into two sections and investigates the political, economic and ideological backdrop that shaped the emergence of GMOs in the USA and Europe. The first section outlines the regulation of GM in the USA, where GM technology is

seen simply as a variant upon crop breeding. Put simply, the politics of GM regulation in the USA is less about the differences (with conventional food) and more about the similarities. Regulation is not required *if* GM is considered similar to conventional crops/food and therefore can be Generally Regarded as Safe (GRAS). The second section explores regulatory reform in Europe where EU regulation has had to respond to persistent political pressure, emanating from both the USA and the World Trade Organisation (WTO).

The Modern Conservative Onslaught

Inspired by Hayek's view of individual responsibility Conservative Governments have sought to reduce the regulatory burden on industry. In pursuit of this drive to deregulate they have encouraged a more prominent role for risk analysis, separating risk assessment from its management. Science has been elevated so that intervention or risk management is justified on the grounds of 'sound science', or science that can establish a causal relationship. Modern Conservatives argue that risks are a feature of day to day life and that what matters is how, as individuals we make judgements about those risks. Given that a balance has to be struck between competing economic and social objectives (economic growth, employment and technological innovation).

These were ideas that underpinned a chorus of disapproval to the environmental reforms in the USA during the 1970s (and Europe during the 1980s), where regulations had been justified on the grounds of weight of evidence (WOE); scientific arguments that meant *only* that available evidence *indicated* a substance was either harmful or benign. To opponents of both the legislation and WOE this was 'junk science' (science that could not provide certainty with regard to causal explanation) and should not form the basis for acceptable intervention. Given that WOE approaches often rely upon studies that use different methods, moves to use studies on a stand-alone basis tend to

undermine the cumulative nature of evidence. Here, *Daubert v Merrell Dow Pharmaceuticals Inc* (1993) had a significant impact because it separated evidence into individual studies, with a judge as arbitrator of each study's relevance and reliability (Krimsky, 2005). Crucially, it revealed not a lowering of the evidentiary bar, but its elevation, because a lack of scientific consensus offers not an opportunity to invoke precaution, but forms the basis to challenge or resist regulatory intervention. Under a Modern Conservative political agenda, regulation assumes the possibility of risk and contemplates not its complete elimination, but control. And, even when risk is established, it should be subject to considerations of economic feasibility (Taylor, 2004, 2006).

GM Regulation in the USA: Less about Differences, more about Similarities:

In the 1980s, the USA identified biotechnology as a crucial area for economic regeneration, a source of productivity gains in agriculture and an aid toward greater international competitiveness. However, the Federal Government faced two crucial issues. The first issue was whether the government possessed sufficient legal authority to regulate biotechnology. If not, then new rule-making or legislation would be required. The second issue was whether regulation should govern the '*process*' by which GM products were generated, or the '*products*' of this biotechnology.

A working group with personnel drawn from different agencies issued a Coordinated Framework for the Regulation of Biotechnology, which remains the key US government document on biotechnology. This framework established the Biotechnology Science Coordinating Committee, specifying the Environmental Protection Agency (EPA), United States Department of Agriculture (USDA) and the Food and Drug Administration (FDA) as primary agencies for regulating biotechnology. Put simply, the EPA evaluates GM plants for environmental safety, the USDA examines whether the plant is safe to grow and the FDA determines whether the plant is safe to eat (Vogel, 2001).

According to the Coordinated Framework, new legislation was not required for regulating GM products because it was not a break from conventional breeding-techniques. The assumption was that there was nothing unique in using GM seeds to produce plant improvements and that the *product* was essentially *similar* to that grown from conventional seeds. The FDA's stance was that GM foods were '*substantially equivalent*' to unmodified, 'natural' foods and therefore should not be subject to special regulation (Food and Drug Administration, 1992). This was an argument taken by the OECD, which hosted a series of debates on the safety of GM food that culminated in the document: *Safety Evaluation of Foods Derived by Modern Biotechnology* (1993). The OECD argued that GM food did not necessitate a fundamental change in established principles, nor did it require a different standard of safety. The report concluded that if a new food or food component is found to be substantially equivalent to an existing food or food component, no additional safety concerns would be needed.

It was not the '*process*' by which these products were made that was important, but the fact that the product was the same as that delivered by conventional means. In other words, as far as US regulators were concerned, it was not about the differences (with conventional products), but the similarities. This was confirmed in a subsequent report from the National Research Council (NRC), which concluded that 'the product of GM and selection constitutes the primary basis for decisions, and not the process by which the product was obtained (Levidow *et al*, 2005).

In many ways, the different regulatory styles adopted by the USA and Europe reflect the complex political environment in which EU's decision making takes place, where there is a need to secure accord on controversial issues such as food regulation.

This stance, that the product and not the process was the important point at issue, forms the lynchpin to US regulatory policy. It was a position influenced by the view that products emanating from the genetic modification of plants are '*substantially similar*' to non-GM food and, as such, fall under the category of foodstuffs Generally

Regarded as Safe (GRAS). Crucially, this meant that subsequent applications for GM food would not be subject to a comprehensive scientific review, therefore reducing the burden of regulation upon US biotechnology. It also confirmed the general tenor of US government policy, that government must 'avoid excessive restrictions that curtail the benefits of biotechnology to society' (BWG/CoC, 1991).

At the core of the differences between the USA and Europe over GM regulation is whether these plants are different to non-GM plants. The EU argues that genetically engineered plants are not 'natural', while the USA maintains that genetic engineering involves nothing that is fundamentally different from traditional methods of improving characteristics through plant breeding techniques. It is an issue that generates considerable differences among scientists, politicians and the general public.

GM Regulation in Europe: More about Differences, Less about Similarities.

The EU first became interested in the regulation of Biotechnology in the mid-1980s when it established the Biotechnology Regulation Interservice Committee (BRIC), which included representatives from DGs 111, V, X1, and 11 (Levitt, 2003). In drafting a Directive on GMOs, BRIC chose a '*process* rather than a *product* approach' (Vogel, 2001). EU policy-makers took the view that GM products raised sufficient uncertainty to demand new regulation, issuing the Directive 90/220 on the deliberate release of GMOs into the environment, which aimed to prevent 'adverse effects on human health or the environment' and established a legal duty on producers to seek prior approval before release of any GMO in the European Union.

By the mid 1990s, GM crops were proposed for EU-wide commercial approval under Directive 90/220. However, several Member States dissented, demanding a delay to their introduction, so that risk assessments could consider a broader range of effects relevant to crop-protection methods. However, the Commission ignored objections from Denmark, Austria and Sweden and granted approval. As GM crops approached

the commercial stage in the late 1990s, public debate intensified as scientists raised doubts, or presented evidence challenging the safety assumptions of GM crops, prompting a wave of public reaction to the importation of GM maize. Austria banned the import of GM maize, citing the antibiotic resistant marker gene as the main reason and was followed by Luxembourg and Italy. In Sweden, SABA, the largest food chain, removed GM products from their shelves and throughout Europe there was significant pressure on supermarkets to remove GM products (Toke, 2004, p.149).

From the outset, opponents to GM were convinced that the risk assessments presented by industry downplayed uncertainty. Their criticism centred on the fact that the biotechnology companies appeared not to be worried that either GM herbicide-tolerance genes *'could'* spread among weeds or, that GM insecticide could generate resistance among insects. Put simply, even if there were undesirable side effects, US biotech believed these were *acceptable*, provided they caused no greater environmental harm than conventional chemical intensive practices (Levidow, 2001).

The major companies involved in GM technology had anticipated that a range of GM crops and food products would be approved. However, though a small number got through, by the late 1990s the whole process had ground to a halt. The biotechnology industry protested; a significant loss of market share had occurred as a result of a moral panic orchestrated by the media and pressure groups that was not grounded in sound science. The biotechnology industry argued that such a Luddite position would undermine technological innovation in the EU, reducing economic growth and job creation.

In the wake of the OECD's *Safety Evaluation of Foods Derived by Modern Biotechnology* report (1993), the EU revised its legislation, introducing Regulation 258/97 (1997) establishing a legal duty to seek approval before commercialisation of any novel food. In stark contrast to Directive 90/220, this new law introduced a simplified procedure for novel foods: if a GM product is *substantially equivalent* to a conventional

counterpart, then no risk assessment is required (EC, 1997a: 3). It was a procedure designed to harmonise product approval across the Atlantic, as it was consistent with the 1995 New Transatlantic Agenda (NTA), an EU-US inter-governmental initiative aimed at liberalising trade, which had argued that assessments of GM products in both jurisdictions should be introduced simultaneously as a step toward regulatory harmonisation (Levidow *et al*, 2005). However, the term 'substantial equivalence' was not without criticism. To those such as Millstone, it was an example of the undue influence of business on policy, a commercial and political judgement masquerading as if it were scientific (Millstone *et al*, 1999).

By the late 1990s, EU regulation of GMOs was in crisis and conflict within EU regulatory committees simply added more fuel to the fire. Some Member States sought to transform public anxiety into regulatory standards through broader definitions of harm, demanding that scientific uncertainty be extended to risk management. However, not all Member States concurred. In turn, the Commission sought to harmonise regulation through narrow standards, thus facilitating approvals for GM products (Murphy & Levidow 2006). Influenced by public protest against GM technologies, several governments opposed the EU regulatory procedures until legislation on labelling and traceability was in place (an unofficial moratorium) (See Jasanoff, 1990, 2003, 2005). The Italian government suspended the sale of four varieties of GM maize that had already gained EU-wide approval under the simplified procedure, based on a claim of substantial equivalence. The Italian government argued that the products should undergo a full risk assessment (Murphy and Levidow, 2006).

This dispute was settled by the EU Council of Ministers and Parliament in 2003, where the importation and use of GM technology is determined by the EU Directive 2001/18/EC on the deliberate release into the environment of GMOs including commercial cultivation, imports of commodities and research trials. This revised Directive took a broader approach than its predecessor, authorising public access to

information. It also required a broader risk assessment that would be linked with market-stage monitoring to manage any uncertain risks. Directive 2000/18/EC effectively ended the moratorium on marketing GMOs within the EU. Yet, rather than resolve the conflict surrounding GMOs, this legislation has elevated the issue onto another plane, with 'traceability' as the battleground over which GM supporters and opponents are now locked (Jasanoff, 1987).

From the outset GM crops and food have proved especially contentious. Moreover, the political protest sustained throughout the 1990s has meant that initially a moratorium took place and that the Commission's objectives have been 'diluted', confirming at least initially, the importance of precaution, transparency and participation. There can also be little doubt that the role of the precautionary principle has changed over time. Indeed, those such as Oreszczyn have noted that in order to assuage the concerns of USA/WTO the EU emphasised that the precautionary principle could be activated only on *reasonable* grounds, where we could expect 'potentially dangerous effects that jeopardise the chosen level of protection' (Oreszczyn, 2005).

Indeed, Eckley and Selin's work on chemical regulation also confirm the Principle's impact on Community legislation in the 1990s has been 'only marginal, and while it has been included in many of the Commission's texts, it has been 'vague, (Eckley and Selin, 2004). Moreover, the Lisbon Declaration (2000), which lays out the EU's long-term strategy for gaining competitive advantage and technological superiority, makes no reference to the precautionary principle. As a regulatory principle it has also been subject to controversy in trade negotiations where the EU failed to gain its inclusion in the World Trade Organisation (WTO) agreements at either Seattle, 1999 or Doha in 2001. Nor does the principle form an obligation under the Cartagena Protocol on Biosafety. International courts have also been unfavourable, where the WTO Appellate body has been 'diffident' about its normative value. Moreover, the International Alliance of Dietary/Food Supplement Associations

(IADSA) and the U.S. Council for Responsible Nutrition (CRN) both feared the precautionary principle would create unfair trading opportunities.

More recently, Codex has excluded the precautionary principle in its risk analysis standards, marking the end of a long battle between the EU and trade groups (McNally, 2007). In broad areas of public policy these issues have been central: excessive red tape has placed a burden upon industry, undermining competitiveness and inhibiting innovation.

This has ensured that the EU's deliberations on risk are always subject to considerations of economic feasibility. Influenced by modern conservative thinking the EU Better Regulation package has advocated Impact Assessment (IA) as a crucial regulatory principle which is similar to the US Office of management and Budget (OMB) Regulatory Impact Assessment. For those such as Lofstedt, the regulatory pendulum has swung from the precautionary principle to impact assessment (Lofstedt, 2004). Indeed, the EU's stance on GM food/crops has changed considerably with the Commission's endorsement of the amflora potato, created by German chemical company BASF. The Commission has also approved the importation and processing of two GM maize types produced by Monsanto.

Vogel's failure to appreciate this can be attributed largely to his failure to consider both the power of multinational capital and how neoliberal ideas are refracted through influential international bodies such as CODEX and the WTO. These transnational networks are not directly subject to control by national governments and, while their principles are not binding, trade agreements give substantial incentives to conform. They may operate below the level of treaties, but they regulate vast tracts of economic and social life (Kingsbury *et al.* 2005a, p.17; Levidow, Murphy and Carr 2007).

Conclusion.

This paper has argued that the influence of the precautionary principle has diminished, that science has assumed a more prominent role in defining the need and extent of intervention and that reforms in both the USA and Europe have been framed largely by neo liberal ideas that have ensured we examine critically government intervention. Thus, this paper has shown that while the EU's rhetoric toward GM regulation portrays a precautionary position it is clear that under the influence of international bodies such as WTO, Codex and the US FDA the EU has moved progressively toward the American stance. It may well be the case that EU regulation emphasised the differences between GM products and their conventional counterparts, but recent legislation has meant that its view is now more closely aligned with the US: more about similarities than differences between GM and conventional products. Terms such as Substantial Equivalence and important procedural principles such as harmonisation have ensured that the American vision of reduced regulation has impacted upon the EU's position on GM regulation.

In the area of GM technology the biotechnology lobby has argued that precaution has often been used simply as a restraint on free trade, that objections have been based not on sound science but on spurious fears about this new technology. Crucial to its case has been the extended use of precaution in EU decision-making. Here, those such as Vogel often cite the Commission's communication on how the precautionary principle should be interpreted (2000) as evidence that Europe has become risk averse, a situation similar to the 'American scene of the 1970s' where a series of regulatory failures undermined public confidence in how politics and science interact. In his argument the principle of precaution confirms the public's ambivalence toward the role of science in politics and public confidence in the benefits of technological innovation. In contrast this paper has shown that the case of GM shows that the influence of the principle of precaution has been overstated, that science has

assumed an increasingly prominent role in defining both the need and extent of intervention. Indeed, the recent EU decision to accept amflora potato cultivation and the importation of two types of GM maize represents a significant shift from more risk averse policies to those based on sound science.

Bibliography

British Medical Association (2004). Genetically modified foods and health: a second interim statement. www.bma.org.uk/GMFoods.

Beck, U. (1998) Risk Society: Towards a New Modernity. London: Sage.

BWG/CoC. (1991). *Report on national biotechnology policy*, Washington, DC: President's Council on Competitiveness, Biotechnology Working Group, chaired by Vice-President Quayle.

Eckley, N. Selin, H. (2004). All Talk, Little Action: Precaution and European Chemicals regulation. *Journal of European Public Policy*. 11:1

Eurobarometer, Special Eurobarometer 54 food related risks report, Available at <http://www.efsa.eoropa.eu/en/riskcommunication/riskperception.htm>. November 2010. Assessed 06/01.2011

European Commission, (1997a). Regulation 258/97/EC of 27 January 1997 concerning novel food ingredients. *Official Journal of the European Communities*, L43, 14 February: 1-6.

European Commission,(2000). Communication from the Commission on the Precautionary Principle.

European Commission, (2001). 'European Parliament and Council Directive 2001/18/EC of 12 March on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC' *Official Journal L 106*, P.1-38.

European Commission, (2002a). 'Commission decision of 24 July establishing guidance notes supplementing Annex 11 to deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC', *Official Journal*, L200, 30 July, p.22-30.

European Commission, (2003). 'Regulation 1829/2003 of 22 September 2003 on genetically modified food and feed' *Official Journal K268*, 18 October, p.1-23.

Euro Coop (2003). 'Euro Coop calls for True Consumer Choice about GM Food', Brussels: Euro Coop, <http://www.eurocoop.org/publications/en/position/co-existence03>. (accessed 15-7-08).

EU-US Forum. (2000). EU-US Biotechnology Consultative Forum, Final Report, December, <http://europa.eu.int/comm/external-relations/us/biotech.htm>.

Food and Drug Administration (1992). *Statement of Policy: Foods Derived From New Plant Varieties*, 57 FR 22984 (Docket No. 92N-0139), Washington, D.C. Department of Health and Human Sciences.

Giddens, A. (1998). 'Risk Society: The Context of British Politics' in J. Franklin (ed.) *The Politics of Risk Society*. Cambridge: Polity Press. pp 23-34 p.31.

Hayek, F. (1960). *The Constitution of Liberty*. Routledge. London.

Hay, C. & B. Rosamond (2002). 'Globalization, European Integration and the Discursive Construction of Economic Imperatives'. *Journal of European Public Policy*. 9;2.pp. 147-167.

Jasanoff, S. (1990). *The Fifth Branch: science advisors as policymakers*. Harvard University Press. U.S.A.

Jasanoff, S. (1987). *Risk Management and Political Culture*. Russell Sage Foundation. U.S.A.

Jasanoff, S. (2003). 'A living legacy: the precautionary ideal in American law', in Tickner, J. (ed), *Precaution: Environmental Science and Preventive Public Policy*. Island Press.

Jasanoff, S. (2005). *Designs on Nature: Science and Democracy in Europe and the United States*. Princeton University Press.

Kingsbury, B. Krisch, N. & Stewart. R.B. (2005). The Emergence of Global Administrative Law. *Law and Contemporary Problems*, vol 68..

Krimsky, S. (2005). 'The Weight of Evidence in Policy and Law'. *American Journal of Public Health*. 95; supplement 1. pp.129-136.

Krimsky, S. (1991). *Biotechnics and Society: The Rise of Industrial Genetics*. Praeger Publishers.

Levitt, R. (2003). *GM crops and foods. Evidence, policy and practice in the UK: a cases study*. ESRC UK Centre for Evidence Based Policy and Practice: Working Paper 20. Queen Mary University of London.

Levidow, L. (2001). "Precautionary uncertainty: regulating GM crops in Europe". *Social Studies of Science*, 31(6).

Levidow, L. Carr, S. & Wield, D. (2005). European Union Regulation of agri-biotechnology: precautionary links between science, expertise and policy. *Science and Public Policy*. Beech Tree Publishing.

McNally, A. (2007). Precautionary Principle 'left out' by Codex. <http://foodproductdaily.com/news/ng.asp?id> (accessed 29/8/07).

Lofstedt, R.E. (2004). The Swing of the Regulatory Pendulum in Europe: from precautionary Principle to Regulatory Impact Assessment. *The Journal of Risk and Uncertainty*: 28:3; 237-260. Kluwer Academic Publishers.

Marsh, D. & P. Furlong (2002). 'A Skin not a Sweater' Ontology and Epistemology in Political Science' in *Theory and Methods in Political Science* (2nd edition) Stoker, G. & D. Marsh (eds). Palgrave. London.

Marsh, D (2007a). 'Historical Institutionalism and Critical Realism' Mimeo, available from marshdz@bham.ac.uk.

Millstone, E. Brunner, E. and Mayer, S. (1999). Beyond 'substantial equivalence', *Nature* 401(7): 525-26.

Murphy, J. and Levidow, L. (2006). *Governing the transatlantic conflict over agricultural biotechnology: contending coalitions, trade liberalisation and standard setting*. London: Sage.

Nuffield Council on Bioethics (2004). The use of genetically modified crops in developing countries. www.nuffieldbioethic.org

OECD. (1993). *Safety evaluation of foods derived by modern biotechnology: concepts and principles*, Paris: Organisation for Economic Cooperation and Development.

Oreszczyn, S. (2005). 'GM crops in the UK : precaution as process'. *Science and Public Policy*, 32(4), August, pp.317-324.

Taylor, G. (2006). If no Risk is Proven, is there a Risk: Some Reflections on Risk, Science and Environmental Regulation in Ireland after Watson v EPA and Monsanto. *Irish Studies in International Affairs*. 17:99-114.

Taylor, G. (2007). 'If no Risk is Proven: The Reconfiguration of Risk in the British State'. SSRC Working Paper, NU Galway.

Taylor, G (2008). 'Risk, Science and Food: The Politics of Little red sweets'. SSRC working paper, NUI Galway, Galway.

Taylor, G. & Millar, M. (2004). The Politics of Food Regulation and Reform in Ireland. *Public Administration* 82:3:585-603.

Toke, D. (2004). *The Politics of GM Food: A Comparative Study of the UK, USA and EU*. Routledge, Taylor & Francis Group. London and New York.

Vogel, D. (2003). 'The Hare and the Tortoise Revisited: The New Politics of Consumer and Environmental Regulation in Europe'. *British Journal of Political Science*. 33:557-580.

Vogel, D. (2001). *Ships Passing in the Night: GMOs and the Politics of Risk Regulation in Europe and the United States*, paper to Workshop organised by European Institute of Business Administration and Berkeley University of California.