

Paul Mobbs,
Mobbs Environmental Investigations,
3 Grosvenor Road, Banbury, Oxon. OX16 8HN.
Phone/fax 01295 261864.
Email: mobbsey@gn.apc.org
URL <http://www.gn.apc.org/pmhp/meir.htm>

**Mobbs'
Environmental
Investigations**

* Environmental consultancy
* Research
* Campaigns coordination

**Response to the
Nuffield Council on Bioethics
consultation paper -
*'Genetically Modified Crops:
The Social and Ethical Issues'***

July, 1998

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1. Introduction

The report

This report has been produced on behalf of the '*Free Range Environmental Activism Network*'. Members of the network have commissioned a response to the paper issues by the Nuffield Council on Bioethics¹. This report concentrates on the issues surrounding *sustainable development* and the *precautionary principle*, and not solely the technical issues which others may wish to comment upon. More information on the Free Range Network is available via their website².

I have prepared this report along with the Network's co-ordinator on biotechnology issues, Phil Pinder. I am an independent 'environmental investigator' based in Banbury, Oxfordshire. I have been an active environmentalists for many years. I trained in the engineering industry before setting up my current business in early 1992. Since then I have been working across the UK as a consultant to community groups and small businesses in the fields of planning, waste management, sustainable development, pollution and risk assessment. Phil Pinder runs his own consultancy business, with a specialism in biotechnology issues, in Cardiff.

Details of the commission

It is anticipated that the Council's consultation exercise will illicit many responses on the technical uncertainty that biotechnology and genetically modified (GM) crops pose. In anticipation of this the Free Range Network wish to consider the wider social and ethical implications of GM crops, and not solely the technical problems. In terms of the content of this report the focus is on the current main theme of both national and international development agendas - *sustainable development*.

Irrespective of the detailed issues, the aim of achieving sustainable development carries with it a whole range of social and ethical considerations with regard to how we as a society manage resources in order to meet human needs. Biotechnology and the development of GM crops must therefore be seen as part of the greater framework of sustainable development.

The report begins by considering the origins and the meaning of sustainable development. In relation to risk and the development of GM crops. It then considers the precautionary principle. Finally, in relation to the eight points set by the Nuffield Council, the wider technical, social and ethical issues relating to the development of GM crops are discussed.

For your assistance, a copy of this report has been provided on floppy disk as a DOS Text and an Adobe Acrobat 2.1 file.

If you wish to invite myself and members of the Network to meet and discuss the issues raised in the report as part of your investigations of this issue, we would be more than happy to assist you.

¹ '*Genetically Modified Crops: the social and ethical issues*', Nuffield Council on Bioethics, April 1998.

² <http://www.gn.apc.org/pmhp/rangers/>

2. The wider framework - Sustainable Development

This section considers the national and international development of the principles of 'sustainable development', and how this should be considered in decision making on biotechnology policy. It then goes on to examine one of the core principles of sustainable development - the precautionary principle. Finally, the issue of public/stakeholder participation in the GM crops issue is examined, and as part of this there is a discussion on the divide that exists between traditional science and environmental philosophy.

2.1. What is 'Sustainable Development'

The origins of sustainable development

Defining sustainable development is very difficult. There are many different definitions that, while taking common terminology from the general debate on sustainable development, depend largely for their meaning on the vested interests of the originator. This problem was highlighted very well by the Town and Country Planning Association in relation to the different interpretations that are used in the field of planning:

"...it is a vague concept that, at once, offers a comprehensive, consensual and conservative approach able to weld together quite disparate and conflicting interests in environment and development. But, because it is vague and its implications poorly understood, in practice it offers few clear solutions. Anyone can sign up for sustainable development so long as it requires no specific commitment to do anything that will threaten their material interests."

Sustainable development has not, in our view, ever really occupied an important place in the debate on biotechnology, even though it was one of the programme areas considered at the Rio Summit. Essentially the debate has been between those who wish to promote biotechnology as a way of solving environmental and agricultural problems, and those who believe that the risk of such technologies outweigh the potential benefits. In terms of sustainable development there is also a balancing of issues which must take place in order that the use of biotechnology can be carried out in a manner which enhances the capacity for human society to improve its lifestyle without endangering the environmental, social and economic systems which underpin its existence. ***But when we talk about sustainability it is not just a matter of evaluating risks - we must also evaluate the purpose of the technology, its moral and ethical implications, and the alternative options that exists for achieving similar ends.***

The origins of sustainable development are numerous. One can see the basic philosophy in 17th Century English radicalism, or the philosophy of the Great Plains Indians of the USA. In many ways sustainable development is a common-sense led set of principles that lie within many human philosophies - irrespective of race or religion there are a whole range of principles which humans share. But the origin of the 'modern' concept of sustainable development was the perceived 'environmental crisis' of the 1960s/1970s. The need to manage human society in the interests of the environment were first coherently expressed at the First United Nations (UN) conference of Environment and Development at Stockholm in 1972. For the first time nations came together to consider the importance of environmental systems, and not just the economic ones. The issues raised at the Stockholm Conference and the move towards considering the environment as an essential factor in development

were discussed in a book which became one of the important texts of the early environment movement, '*Only One Earth*'³.

At the United Nations Conference on Environment and Development in Rio de Janeiro (the '*Earth Summit*') in June 1992, 20 years after the Stockholm Conference, a new convention on the need to integrate the environment into social and economic decision making was produced. The convention on sustainable development, entitled 'Agenda 21'⁴ (the Agenda for the 21st Century), set out for the first time detailed definitions of what sustainable development was, and set objectives and targets for achieving it. The conference also set out 27 principles in the '*Rio Declaration*' which practically defined the meaning of sustainable development in a series of simple statements [see Appendix 5.1]. These principles provide a simple way of assessing 'sustainability', and help define the relevant matters before proceeding to a detailed analysis.

The one problem with sustainable development has been translating the overarching international principles in Agenda 21 into national codes or action plans which the public, business and government agencies can implement. The Governments' white paper on the environment, '*This Common Inheritance*'⁵ did give some guidance on general principles of environmental protection, and it also advanced the use of the precautionary principle well before it was defined in Agenda 21. In relation to biotechnology there is guidance in Chapter 16 of Agenda 21; in the UK there is guidance in Chapter 21 of '*Sustainable Development - The UK Strategy*'⁶; at the European Union level, sustainable development and biotechnology are discussed in Chapter 5 of the EC's response to Agenda 21⁷.

Defining Sustainable Development

As well as the sources noted above, one of the important sources of terminology was the report of the World Commission on Environment and Development. This Commission, also called the 'Brundtland Commission', set issues for debate which would be investigated in detail at the 'Earth Summit'. The '*Brundtland definition*' of sustainable development is the most quoted and universally accepted. However, the Brundtland Report⁸ definition is nearly always truncated (the two qualifying clauses are omitted) failing to give the full paragraph in its original context...

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains two key concepts:

- *the concept of needs, in particular the essential needs of the world's poor, to which over-riding priority should be given;*
- *the idea of **limitations** imposed by the state of technology and social organisations on the environment's ability to meet present and future needs."*

³ '*Only One Earth: The care and maintenance of a small planet*', Barbara Ward and René Dubos. André Deutsch Ltd. ISBN 0 233 96308 1. First published 1972.

⁴ '*Agenda 21*', United Nations Conference on Environment and Development Final Document, UNCED 1992.

⁵ '*This Common Inheritance: Britain's Environmental Strategy*', Cm1200, HMSO 1990

⁶ '*Sustainable Development: The UK Strategy*', Cm 2426, HMSO 1994

⁷ '*Report of the Commission of the European Communities to the United Nations Conference on Environment and Development*', European Commission 1992

⁸ '*Our Common Future*', the report of the World Commission on Environment and Development (the 'Brundtland Commission'), Oxford University Press 1987

The Brundtland quote is a '*concept*' - and like any concept it must be interpreted to be relevant to the area in which it is used. In interpreting the 'concept' of sustainable development, we have highlighted the idea of '*limitations*' because this is very relevant to biotechnology. The Brundtland Report makes it clear that, although technology is able to perform many tasks, not all of the tasks, and their results, are desirable when considering the well-being of this and future generations. ***In any consideration of the sustainability of any particular GM crop the first consideration must be whether it has value given the other non-GM options - the fact that an end is achievable by a certain technological process is not justification for allowing it.***

However, sustainability is much more than the definition given in the Brundtland Report. The full statement from the Brundtland Report, given above, phrases 'sustainable development' in a wider social, political and economic arena. Other publications extend the basic definition to other areas of human development. But even within Brundtland's definition there are three concepts which require precise definition:

- **The first is development** - *which is not the same as growth*, although the two are often used synonymously. The two are often confused. Growth involves the physical expansion of a system. Sustainable growth is ultimately contradictory since there are physical limits imposed by the Earth and its natural resources and ecosystems. Development, by contrast, implies improvement and progress, and can include social and cultural as well as material dimensions. Sustainable development therefore emphasises prudent management and the recognition that natural resources are not simply free goods to be pillaged and pilfered at will.
- **The second concept is need** - defined in the Brundtland Report as '*meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life*'. The environment simply cannot cope with meeting the material standards enjoyed by the rich while, at the same time, supplying basic necessities to the burgeoning populations of the developing world.
- **Thirdly, there is the concept of future generations.** This involves the notion of stewardship. We have a moral duty to look after our planet and to hand it on in good order to future generations; this means improving already degraded areas and avoiding irreversible damage (such as the destruction of species) or imposing risks on the future (from toxic or radioactive wastes, for example). Stewardship has been the core of UK environmental policy for many years, but sustainable development still presents new challenges because of the need to consider social, ethical and economic systems, not only environmental ones.

Looked at in this way the criteria for sustainable development are very tough indeed.

- First, it will require a review of political, ethical and social systems - not just economic ones.
- Second, it implies a wholesale shift from exploitation to conservation through the accurate costing of resources which are currently considered free (the air, for example, used and polluted by power stations), or subtracting value for the degradation of environmental and social systems, and then '*internalising*' those costs into current assessment systems.
- Third, there has to be a withdrawal now from those activities whose effects transcend generations, and which rob or endanger future generations.

The 'issues' outlined for consideration in the consultation paper appreciably fail to explain the

issues in this context.

Finally, we have to consider how we adapt this all-embracing view of sustainability into one which is applicable and relevant to local and everyday issues. In our view there are five primary goals which need to be implemented in order to achieve true sustainability:

- **Conservation:** Sustainable development means the efficient use of non-renewable energy and mineral resources through higher productivity, recycling, development of alternative technology and substitution wherever these are possible and not environmentally harmful. It also means maintenance of biological diversity. It will also require the economic valuation of natural capital assets regarded as free, as well as valuing the degradation of natural systems (including human communities). The conservation goal can be said to be to ensure the environmentally efficient use of human and natural resources.
- **Balanced development:** This goal is concerned with the use of physical resources and their impact on the environment. Resource conservation requires patterns of development that minimise consumption, promote the re-use of materials and prevent the waste of valuable natural resources. The goal here is to achieve an appropriate balance between the 'developed' and the natural environment.
- **Environmental quality:** At the very least environmental quality means that processes must be avoided which degrade or pollute the environment. But it must also be an aim to improve and enhance environmental quality in those areas already degraded or grossly polluted. This goal is therefore to prevent or reduce the use of processes that are harmful to the environment and human health.
- **Social equality:** A pattern of inequality has developed that intensifies the pressure on the environment from the high per capita demands of the rich and the struggle for survival of the poor. The conflicts that arise are a major obstacle to co-operation. Greater equity will not in itself achieve sustainability since under present economic systems both wealth and poverty degrade the environment. But greater equity will remove the sources of conflict and is a precondition for political co-operation and commitment. The scale of inequity was first assessed in the Brundtland Report, and was further considered at UNCED through the proposals drawn up in Agenda 21.
- **Participation in decision making:** Commitment will only be achieved through participation. This goal is to change values and attitudes by encouraging the increase of participation in decision-making at all levels. Change cannot simply be ordained from above - it must also be stimulated from below. Within democratic systems of government non-governmental organisations (NGO's) are able to promote ideas and mobilise support for them. Dispersal of power from the central state to the local level will encourage innovation, responsibility and support for locally-relevant policies on sustainable development.

The above goals must be acknowledged within any strategy which aims to institute sustainable development policies - purely economics or development led goals will not achieve a sustainable system - it just makes the existing economic system '*environmentally friendlier*'.

2.2. Agenda 21, Sustainable Development and Biotechnology

So how do we extend the philosophy of sustainable development to encompass biotechnology, and in particular the development of GM crops? To a large extent we can already look to the 'official' interpretation of sustainability issues that originates from the Rio Summit:

- Chapter 16 of Agenda 21 - the main objectives of this have been summarised in appendix 5.2;
- Chapter 21 of the UK Sustainable Development Strategy⁹;
- Chapter 5 of the EC's response to the Rio Earth summit.

It is important to note that the 'Rio+5' (or CSD+5 - CSD means 'the UN Commission on Sustainable Development') conference in New York in June 1997 did not specifically revisit the principle of the ethics, use and safety of biotechnology. Therefore the sources outlined above are our main criteria to evaluate the 'sustainability' of biotechnology/GM crops. In considering these three sources we have to ask the following questions:

1. Is the interpretation of these documents still valid given the change in understanding about biotechnology and its effects?
2. To what extent has public opinion changed? (given that public participation must be part of the sustainability criteria)
3. Has the understanding of what constitutes sustainability moved on in such a way that the original assumptions are now invalid?

The scope of the research that must be undertaken to produce a definitive assessment of the sustainability of GM crops is, because of the time and expense, outside the scope of the commissioners' this report. However it is possible to draw the following conclusions from the general content of the three sources noted above:

1. Balancing risks and benefits:

All the three sources stress the balance which must be made between the perceived benefits of biotechnology, and the potential short-term and long-term risks that may result. But in assessing this balance the weight must be given to the need to ensure that environmental protection is given the greatest priority. Agenda 21 sets this out as a series of clear '*management activities*'...

"16.32. Governments at the appropriate level, with the support of relevant international and regional organisations, the private sector, non-governmental organisations and academic and scientific institutions, should:

- (a) Make the existing safety procedures widely available by collecting the existing information and adapting it to the specific needs of different countries and regions;*
- (b) Further develop, as necessary, the existing safety procedures to promote scientific development and categorisation in the areas of risk assessment and risk management (information requirements; databases; procedures for assessing risks and conditions of release; establishment of safety conditions; monitoring and inspections, taking account of ongoing national, regional and international initiatives*

⁹ Note that the current document, referenced above, is under review by the Department of the Environment, Transport and the Regions. There are no specific proposals yet relating to biotechnology.

- and avoiding duplication wherever possible);*
- (c) *Compile, update and develop compatible safety procedures into a framework of internationally agreed principles as a basis for guidelines to be applied on safety in biotechnology, including consideration of the need for and feasibility of an international agreement, and promote information exchange as a basis for further development, drawing on the work already undertaken by international or other expert bodies;*
 - (d) *Undertake training programmes at the national and regional levels on the application of the proposed technical guidelines;*
 - (e) *Assist in exchanging information about the procedures required for safe handling and risk management and about the conditions of release of the products of biotechnology, and co-operate in providing immediate assistance in cases of emergencies that may arise in conjunction with the use of biotechnology products."*

It is arguable whether this has been achieved in the UK since in practical terms the clause, "*with the support of relevant international and regional organisations, the private sector, non-governmental organisations and academic and scientific institutions,*" is not satisfied. We do not believe that such open cooperation currently exists within the UK. This is for a number of reasons ranging from the use of '*commercial confidentiality*' clauses to restrict access to information, or to the organisational obfuscation which prevents NGOs and the public from gaining access to the relevant information.

It is clear from my own research into the use of GM products under both the '*contained use*'¹⁰ and '*deliberate release*'¹¹ systems that it has never been intended for the general public through NGOs to take part in the debate. For example, in a recent telephone conversation with the Health and Safety Executive (HSE) I discovered that the register of establishments carrying out work under the '*contained use*' regulations has no index - hence it is very difficult for the public to use the register without going to London and trawling through every file.

There is also the issue of how the balancing of competing issues is assessed by the regulatory bodies. It is clear to us that many members of the general public who take an interest in the development of GM crops consider that environmental protection is not valued as highly as the development of new products when the five main bodies involved in making decisions on application [*the Department of the Environment, Transport and the Regions (DETR), the Health and Safety Executive (HSE), the Advisory Committee on Genetic Modification (ACGM), the Advisory Committee on Releases to the Environment (ACRE) and the Advisory Committee on Novel Foods and Processes (ACNFP)*] evaluate the development proposals. This is an obvious deviation from the principles outlined in Agenda 21 and other documents which stress the balancing of risks, but with the absolute guarantee of the precautionary principle where the effects are not readily determinable.

The situation regarding public confidence in the objectivity of the regulators is made worse when we such conflicting signals coming from government and regulators. For example, Government bodies such as English Nature asking for a moratorium¹² on the release of GM crops to the environment, whilst at the same time the heads of government regulators such

¹⁰ Regarding the information provisions of The Genetically Modified Organism (Contained Use) Regulations 1992 (SI. 1992/321 as amended by SI. 1993/15).

¹¹ Regarding to the information provisions of The Genetically Modified Organism (Deliberate Release) Regulations 1992 (SI. 1992/3280 as amended by SIs 1993/15 and 1995/304).

¹² '*UK advisors call for modified crop moratorium*', ENDS Daily, 8/7/98 - see Appendix 5.3

as the Environment Agency¹³ are allowing GM crops to be tested on their land.

With regard to the first of the three questioned posed at the beginning of this section, it is clear that the level of understanding about biotechnology has increased amongst the public - even if part of this increase may be the result of what scientists in the biotechnology field consider to be unjustified risks. With regard to the second of the questions, it is clear that there is public dissatisfaction with the current '*balancing*' of risks. The recent Parliamentary Office of Science and Technology (POST) report on GM foods¹⁴ clearly shows [section 5.3] the variety of views held by members of the public in different counties. Other opinion polls¹⁵ demonstrate a clear majority of the public are against GM crops. ***We must therefore address the transparency of the decision making processes on the risks different GM crops pose, and ensure that the relevant data is in the public domain.***

2. The importance of regulatory systems

Both the UK Sustainable Development Strategy and the European Commission document stress the importance of legislation as a means to control the '*unwelcome*' aspects of biotechnology. From the point of sustainable development we do not consider this approach to be sufficient. The balancing of risks and benefits requires that there be systems to prevent the damage or potential damage of the environment from genetic manipulation, but there must also be the absolute backup of the precautionary principle where regulation is difficult or where the risks are uncertain. Legislation on its own does not achieve this - there needs to be a '*belt and braces*' approach which ensures that lapses in control never occur because of the potential damage which could result. Or, where such in-depth control cannot be demonstrated to be effective, the development should not be permitted.

Evidence suggests that the current legislative system does not work in a manner sufficient to guarantee the control of GM crops. The recent POST notes [Table 4.1] the breaches of authorisations granted for GM crop releases. But if this data were not unsettling enough, the result of a recent judicial review¹⁶ of the implementation of the GMO regulations led to a decision by the Court that the government regulators were themselves illegally operating the regulatory system. At the same time the biotechnology industry is arguing that the current regulatory system is unnecessarily restrictive and should be simplified¹⁷. This divergence of views from those within the system does not encourage confidence in the control systems.

In response to the Rio Summit the European commission document states¹⁸...

"Although there is no fully-fledged methodology for accurately predicting either the exact type or magnitude of risk potentially associated with the introduction of any GMO, such assessments can be made. The flexible, case-by-case system envisaged by the Community will not only allow work to continue but will also help

¹³ 'Environment Guardian to Test Genetic Crops on His Land', The Observer, 19/7/98 - see Appendix 5.3

¹⁴ 'Genetically Modified Foods: Benefits and Risks, Regulation and Public Acceptance', Parliamentary Office of Science and Technology, May 1998.

¹⁵ MORI poll for GeneWatch, June 1998. See Appendix 5.4

¹⁶ 'Court of appeal rules that government acted illegally over genetic maize trial crop - but refuses to order its destruction', Friends of the Earth Press Release, 21st July, 1998 - see Appendix 5.3

¹⁷ 'Biotech firms demand GMO law revision rethink', ENDS Daily - 24/07/98. See Appendix 5.3

¹⁸ Conclusion of section 2, chapter 5.

in the development of assessment models. What is more, it should also help build public confidence and acceptance of the technology and its products."

This summation of the purpose of the legislative process is self-contradictory, and can be shown to be operated in such a manner in the UK (not least because of the outcome of the recent judicial review). If no assessment of risk is possible, how can we reliably operate a risk assessment as part of the process? Also, if the legislative approach is there to build confidence in the process, why is public confidence waning?

The sustainable regulation of GM crop releases should not only operate at the level of legislation. There must be protection in depth. That means that the system should not only provide legislative guidelines, but policing by the industry itself, and adequate information provision on authorised activities so that the public can also monitor the situation. The current system fails to do this.

3. The 'value' of new GM products

Returning to the Brundtland definition, the notion that there is a 'limitation' on what development should take place does not, in our view, currently form part of the assessment procedure in Europe. The assessment procedure considers the 'risk' the product/crop presents if released. However there is no assessment procedure to compare the desirability to produce a GM crop against the options for other plant development techniques, or even other agricultural or management processes which would achieve the same ends. There is also the issue of product patenting, and the potential effects of this on the security of agricultural systems and the food supply.

Perhaps the great debate that will arise out of the GM crops issue will not be directly the issue of genetic modification itself, but rather how the development of GM crops fits within the wider scene of the intensive agriculture industry. Modern agriculture is heavily reliant/dominated by a few large corporations who not only supply the seed, but also the agrochemicals that are needed to grow them. These corporations are also the main backers of GM crop development.

There are important social and ethical implications of giving such power over basic human necessities such as food production which must be openly discussed. This is particularly important in the context of the Developing World where recent global treaties such as the Global Agreement on Tariffs and Trade (GATT), and proposed new agreements such as the Multilateral Agreement on Investment (MAI), would also give these large corporations the power to enforce their will where national governments tried to prevent them extending their influence over agriculture. We have already seen the effects of this in relation to GM crops because of the attempts by some European countries to block the imports of GM crops from the USA.

This change in the debate has already begun in the United States where the US Food and Drug Administration has been at the centre of a furore regarding the application by some GM crop companies to class their products as 'organic' because they can be grown without pesticides and fertilisers. The proposal led to a large backlash from US consumers who did not believe that GM crops could be properly called organic since their production was not due to natural processes. On a broad-brush evaluation the benefits of some GM crops are apparent, but recent scientific studies have cast doubt on the great claims of the

biotechnology companies; not only have GM crops been shown to damage beneficial insects¹⁹, but there is a potential problem with the 'pollution' from the pollen of GM crops²⁰ affecting non-GM crops, and potentially jumping the species barrier with closely related weeds. If, for example, pesticide resistance were transferred to weed populations it would result in potentially more damaging pesticides having to be used with the obvious disbenefits for the environment.

The '*nightmare scenario*' that many people see is that the natural processes of nature would, once a nominally 'safe' GM crop had been let loose from the controlled conditions of the laboratory, cause genetic modifications to be passed to other plants. This has serious implications in practice, particularly in relation to plants which are closely related to agricultural weeds²¹. We would recommend, as an illustration of a '*worst case scenario*', the Nuffield Council read the book '*The Death of Grass*'²². This describes the spread of a virus which affects all grass species - which includes the world's main foodstuffs such as rice and wheat - and the effects this has on civilisation. Genetic modification does not only have the potential to confer genetic resistance to disease, it can also confer susceptibility. If we did ever reach the situation portrayed by the biotechnology industry where in 20 years time all the major food crops of the world were genetically modified we would risk a very similar fate to that outlined John Christopher's book.

What we have to balance in the evaluation of the 'sustainability' of biotechnology and GM crops is therefore not just the limited effects of GM crops on certain valued or important plant or animal species. It is also the potential for the disruption of agriculture, and the possible effects on human systems that might have.

On this theme, the new 'threat' that some see on the horizon is the 'terminator' gene²³. The purpose of the terminator gene is to prevent a plant producing viable seed. This means that the farmer must continually purchase seed from the company who produce it, and will be unable to save seed from year to year. This has obvious impacts not only from the point of view of the potential risks from the gene jumping to other plants in the same or different species, but also from the point of view of sustainable farming. If farmers, particularly in the developing world, were unable to save seed, that could lead to the commercial exploitation of food production on a scale not so far seen in industrialised agriculture. ***The terminator gene is a prime example of where the comparative sustainability assessment should take place, not just to consider the relative risks of different crops, but also to consider the desirability of the whole purpose of the GM crop and the potential effect on social and economic systems. Without such systems what confidence can the public have that the wider implications of certain genetic modifications have been considered when licensing development?***

A definition of 'sustainable biotechnology'

The issue of the value and purpose is alluded to in paragraph 21.7 of the UK Sustainable Development Strategy...

¹⁹ The Times, October 22 1997. See Appendix 5.3

²⁰ '*Herbicide-resistant rape spreads its manipulation*', DIE TAGESZEITUNG Nr. 5401, 6 December 1997. See Appendix 5.3

²¹ There is a good discussion of this issue in section 4.2.3 and 5.5 of the POST report.

²² '*The Death of Grass*', by John Christopher. First published 1956.

²³ The Guardian (society pages), Wednesday April 15, 1998. See Appendix 5.3

"To achieve sustainability, it is important both to strive for appropriate application of biotechnology, and to minimise the risks of damage to the environment."

However, despite discussing risks to the environment, at no point does the UK Sustainable Development Strategy enlarge on the issue of the 'appropriate application of biotechnology'.

We believe that since the agreement of chapter 16 of Agenda 21, and the UK and European texts that were written in response to it, there has been a change not only in the knowledge base about GM crop development, but also the public's perception of it. Also, the purpose of genetic modification has progressed from minor changes which affect the quality of the crop, to major modifications to the gene-line which could have much wider implications on agriculture and the environment should defects manifest themselves. Although the Rio+5 Conference in New York did revisit the issue of biotechnology²⁴, it only considered issues relating to the implementation of the original text of Agenda 21 and did not attempt to revise the principles on which the development of biotechnology should be based. There is therefore a need to update existing guidance on 'sustainable biotechnology'.

As noted above, there is a need to find a system to evaluate the wider effects of GM crop developments which does not solely consider direct environmental harm. We have to consider the social and economics effects in order to decide whether a chosen crop development is not only environmentally safe, but it is morally, ethically, socially and economically safe too. Although this is not directly stated at the present it is alluded to in passing in the Rio+5 report on biotechnology²⁵...

"Developing countries should set up mechanisms to facilitate the evaluation of research and development activities in biotechnologies and the commercialisation of those technologies, as well as to assess their ecological, health and socio-economic and ethical implications in specific contexts."

If the advice from the New York conference is valid for Developing Countries, I do not see why there should be an argument for not adopting similar procedures in the Developed Countries too.

In order to evaluate the social, economic, moral and ethical issues it is essential there is wider public involvement and consultation on these issues. This is acknowledged in the Rio+5 report²⁶...

"Important for the sustainable use of biotechnologies is the establishment of an effective and transparent national decision-making structure to deal with the legal and policy issues related to the safe and sound management of biotechnologies."

Following on from this, concern was also noted about certain areas of development in biotechnology, particularly in relation to food²⁷...

"The need for further efforts leading to international agreement on principles to be applied in risk assessment and the management of all aspects of biotechnology is

²⁴ 'Environmentally sound management of biotechnology: Overall progress achieved since the United Nations Conference on Environment and Development', UN Commission on sustainable Development, 21 January, 1997. E/CN.17/1997/2/Add.15

²⁵ Paragraph 29, 'Environmentally sound management of biotechnology', UNCSD E/CN.17/1997/2/Add.15

²⁶ Paragraph 6, *ibid.*

²⁷ Paragraph 14, *ibid.*

widely recognised... A considerable number of non-governmental organisations, women groups and indigenous people in both developed and developing countries have expressed concern that the promotion of biotechnology is quite undesirable without some international mechanism in place to protect people from possible adverse effects resulting from genetically altered foods and animals, as well as from disadvantages that a biotechnology-driven market might bring to small farmers in developing countries."

What we see in the development of understanding and policy in sustainable biotechnology from the Rio Conference to the New York Conference is a positive shift away from purely the management of the hazards of biotechnology to a position where the wider non-environmental hazards are becoming more relevant. Particularly in relation to GM crops it is not enough to consider just the environmental effects - the effects on the social and economic aspects of agriculture and on society/consumers in general is equally important.

It would be possible to do a exhaustive analysis and compatibility matrices of all the points in the referenced sources on sustainable development and biotechnology, with the inaccuracies corrected in the light of new information. But even a basic analysis of current trends in development against the Rio Principles demonstrates that there are contradictions.

The issues which must be resolved are:

- To what extent the wider effects of GM crop development, particularly the social and economic effects, are considered within the current control systems. It is clear from our own experience in researching these issues and other published material that there are problems in the assessment of potential effects, and what weight is given to these effects. Principle 4 may be satisfied by the current system, but it can be clearly demonstrated that current trends are in conflict with Principles 8, 15 and 16.
- There is no clear place for the precautionary principle under the current procedures (more on this in the next section).
- There is a clear problem regarding public involvement in the licensing/authorising procedures for '*deliberate release*' of GM crops, and especially the '*contained use*'. This is clearly contrary to Principle 10.
- In terms of the Brundtland definition itself, there is currently no system to assess the new/proposed GM crops against the three key parameters of that definition - need, limitations and future generations. This lack of 'vision' for how GM crop developments might conceivably fit in with the move to more sustainable systems of resource use and human development is one of the great flaws in the entire system. Without -
 - any objective assessment as to whether a certain development is desirable given the '*need*' of humanity;
 - any comparison as to whether the potential uncertainties about its development, given the different development options available, would lead us to '*limit*' part or all of the proposed development; and
 - an assessment of the benefits or disbenefits to '*future generations*', given the potential environmental, social and economic effects;
 it is not possible to demonstrate that the current development of GM crops is assisting or detracting from the attainment of sustainable development.

2.3. The Role of the 'Precautionary Principle'

The role of the '*precautionary principle*' is central to the application of sustainable development when we are considering the risks of particular actions based upon scientific principles. Given the ready application of the principle to areas such as biotechnology it is curious that the use of the precautionary principle is very rarely discussed, particularly in relation to regulatory systems.

The UK Sustainable Development Strategy notes the following with regard to the precautionary principle, reiterating the guidance from the white paper on the environment...

"3.12 Primarily, the Government remains committed to basing action on fact, not fantasy, using the best scientific information available; precipitate action on the basis of inadequate is the wrong response. However, when potential damage to the environment is both uncertain and significant, it is necessary to act on the basis of the precautionary principle. This was described in the 1990 White Paper in the following terms:

"Where there are significant risks of damage to the environment, the Government will be prepared to take precautionary action to limit the use of potentially dangerous materials or the spread of potentially dangerous pollutants, even where scientific knowledge is not conclusive, if the balance of likely costs and benefits justified it"

In relation to Principle 15 of the Rio Declaration²⁸ it goes on to state...

"This wording is a useful reminder that the principle can be applicable to all forms of environmental damage that might arise; nor should it apply only to the actions of government."

These are very strong words for government in relation to 'unknown' risks. However European law through the Treaty of Rome (as amended by the Maastricht Treaty) goes further by defining the precautionary principle in law²⁹...

"Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. It shall be based on the precautionary principle and on the principles that preventative action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay. Environmental protection requirements must be integrated into the definition and implementation of other Community policies."

Given the position in the Treaty of Rome it is curious that in its response to Agenda 21 the European Commission stated, as noted earlier, that *"Although there is no fully-fledged methodology for accurately predicting either the exact type or magnitude of risk potentially associated with the introduction of any GMO, such assessments can be made."* This is not only contradictory, but it is in clear conflict with Article 130R of the Treaty of Rome.

In 1995 the Department of the Environment published its own guidelines³⁰ on risk

²⁸ See Appendix 5.1.

²⁹ Paragraph 2, Article 130R, The Treaty of Rome (as amended by the Maastricht Treaty)

³⁰ Chapter 5, 'A Guide to Risk Assessment and Risk Management for Environmental Protection', DoE 1995.

assessment, which included an explanation of the precautionary principle and its application. However the content of these guidelines is clearly in conflict with not only the UK Sustainable Development Strategy, but also the Treaty of Rome and Principle 15 of the Rio Declaration. In particular, the limitations quoted on the application of the precautionary principle are clearly more limited than those envisaged at the European and international level.

Annex 2 of the guidelines gives an example of the type of risk assessment that can be carried out for GM crops. In many ways it is similar to the risk assessments that are submitted as part of the approval for the 'deliberate release' of GM crops. But the guidelines fail the test of the formally stated precautionary principle, particularly in relation to GM crops, because:

- The assessment of risk for most GM crops is not an exercise in quantifying the effects of uncertainty. In actuality risk assessments focus entirely on the known and quantifiable risks and do not consider the effects of uncertainty or confidence in data and assumptions. The lack of empirical research to prove some of the assumptions made in risk assessments is one of the main problems in validating risk assessments.
- The likely costs of a mistake in the evaluation of the risk are rarely, if ever, assessed. In the absence of such an analysis it is not possible to operate the precautionary principle in terms of the balancing of economic and environmental costs.
- There is an important issue relating to the disparity in risk perception between the regulators and originators of risk assessments, and the general public. Given the emphasis given in Agenda 21 to public participation in decision making it is essential that the evaluation of risk be based on a realistic assessment of society's view of the perceived risk, and not the experts view (see following section).

Chapter 4 of the POST report on GM crops provides a good analysis of the issues involved in risk analysis and risk perception. But most importantly the information and references in the chapter demonstrate the variability in the evidence that make risk assessment difficult. For example, the debate over pollination distances is crucially important when considering the potential spread of genetic modifications to similar crops or weeds near to the test sites.

It is clear that current risk assessment procedures fail in the adoption of the precautionary principle for the reasons outlined in the EC's response to Agenda 21 - "*there is no fully-fledged methodology for accurately predicting either the exact type or magnitude of risk potentially associated with the introduction of any GMO*". It is not likely that the biotechnology industry would be willing to undertake the studies necessary to objectively establish realistic assessment procedures which can incorporate the precautionary principle because it is not in their interest to do so. If it is not possible to assess the uncertainties rather than the certainties in the development of GM crops, and the likely economic and environmental implications of the failure of the GM crop, it is not possible to properly apply the principle.

There must be some sort of investigation of how to acquire the information needed to assess the effects and uncertainties on the development of GM crops. If the biotechnology industry and regulators continue to only consider the known effects rather than producing evidence to identify the areas of risk, and the likely consequences of failure, it will not be possible to implement the precautionary principle in a meaningful and verifiable way. An important aspect of this process must be producing assessment criteria which are relevant to the general public's perception of the risks and consequences rather than the views of the industry or regulators.

2.4. Sustainability and Public Participation in the GM Debate

As noted in the previous section, sustainability demands that the public are involved in decision making processes. Involvement is not merely a matter of responding to newspaper advertisements which give notice of GM crop trials. It is also essential that in making an assessment of the effects of GM crops that the system of checks, validation procedures and risk 'values' clearly concurs with views of the general public.

Annex 5 of the DoE's guidelines on risk assessment give an appraisal of the factors affecting risk perception. This highlights the difference in perception that might exist between people working in the biotechnology industry, regulators (who, for the most part, are ex-industry employees), and the general public. It sums up this disparity very well in the statement³¹ ...

"Risk policy should reflect the best objective analysis but in the short term, may have to modify the conclusions drawn from that analysis to take account of the perceptions of those who will be affected by the decision."

This clearly in transferring the emphasis on the assessment of risk from the position of the profession to the position of the general public.

Principle 10 of the Rio Declaration³² clearly puts the views of the general public at the centre of decision making. This is reiterated in Agenda 21

"8.3. The overall objective is to improve or restructure the decision-making process so that consideration of socio-economic and environmental issues is fully integrated and a broader range of public participation assured. Recognising that countries will develop their own priorities in accordance with their prevailing conditions, needs, national plans, policies and programmes, the following objectives are proposed:

- (a) To conduct a national review of economic, sectoral and environmental policies, strategies and plans to ensure the progressive integration of environmental and developmental issues;*
- (b) To strengthen institutional structures to allow the full integration of environmental and developmental issues, at all levels of decision-making;*
- (c) To develop or improve mechanisms to facilitate the involvement of concerned individuals, groups and organisations in decision-making at all levels;*
- (d) To establish domestically determined procedures to integrate environment and development issues in decision-making."*

...and was further reinforced at the Rio+5 conference³³ ...

"64. The principle of public participation is at the heart of implementation of sustainable development at the national level. The effectiveness of participation rights critically depends, first, on appropriate access to relevant information, which is often permitted through a right to request relevant data, primarily where environmental matters are concerned. Secondly, it depends on access to judicial remedies and means of redress, mostly as public interest litigation, either in the form of class actions or by standing rights or rights of intervention."

³¹ Paragraph 3, Annex 5, 'A Guide to Risk Assessment and Risk Management for Environmental Protection', DoE 1995.

³² See Appendix 5.1

³³ 'Rio Declaration on Environment and Development: application and implementation', UN Commission on Sustainable Development, 10 February 1997. E/CN.17/1997/8

It is questionable to what extent the spirit of Agenda 21 is implemented in practice in the UK. As with many public registers, data on GM crops is not easy to come by. But more importantly, the conferring of a legal right to see information does not mean that in practice that right can be easily exercised by the average person. From our own experience of many public registers, not only those relating to GMOs, the information available to the public varies in form, quality and availability. This is especially so for GMOs since it is such a sensitive issue. Also the 'fast tracking' of GM crop applications by DETR has effectively prevented participation in the decision making process and access to information about it.

Some of the regulatory bodies have considered these issues in a small way, but their approach has been very cautious and for that reason the results to date have been minimal. The ACGM's report, '*Risk Communication and Public Perception*'³⁴, to take an example, posed the question of how the ACGM should relate to the general public in order to gauge opinions relevant to their task. But in general, there does seem to be a reluctance on the part of bodies like the ACGM to engage in dialogue with interested members of the public - the main reason apparently being a fear of hostility or a negative response to 'complex' issues such as biotechnology.

Public bodies must hold the trust of the public in order to have legitimacy. Trust is not something that is readily given, but is something that is the result of proven goodwill and dialogue over a period of time. If the ACGM and other biotechnology regulators cannot undertake free and open dialogue with the general public then they should not expect the public's trust. And with the issue of genetic modification, where study after study demonstrates a strong opposition to such technologies amongst the general public, the regulators cannot readily expect public support for their work.

Some years ago the Health and Safety Executive compiled a document entitled, '*The Tolerability of Risk from Nuclear Power*'. In many ways that document sought to address the same paradox to which the ACGM was addressing itself - how to seek public acceptance and reassurance for a technology that the general public have a fundamental mistrust of. But unfortunately the HSE's work on the '*tolerability of risk*' found little support with the public because the results of the document were counter intuitive to the public's understanding of the issues. Instead of actually addressing the issue of public concern in the regulation and oversight of nuclear plants it sought to belittle the public's concern by introducing the concept of '*relative risks*' - likening one type of activity to the other. This is of course something which the public do not do in the manner of a risk appraisal, and consequently the HSE's deductions found little support. This issue is actually highlighted in the DoE's risk assessment guidelines³⁵.

Finally, to quote a recent study on the public acceptance of biotechnology³⁶...

"The findings of this study highlight, inter alia... [the public's] sense of 'inevitability' and fatalism, reflecting perceptions of the possible future pervasiveness of GMOs in foods... People's mixed feelings about the integrity and adequacy of present patterns of government regulation, and in particular about official 'scientific'

³⁴ '*Risk Communication and Public Perception*', Health And Safety Commission - Advisory Committee On Genetic Modification, 2 October 1997. Ref. ACGM/971P19 - see Appendix 5.5.

³⁵ Paragraphs 4/5, Annex 5, '*A Guide to Risk Assessment and Risk Management for Environmental Protection*', DoE 1995.

³⁶ '*Uncertain World - Genetically Modified Organisms, Food and Public Attitudes in Britain*', Grove-White et. al., Lancaster University 1997

assurances of safety... The role of the BSE crisis in compounding latent public unease about limits of 'expert' knowledge, both generally and in relation to GMO possibilities specifically... The serious limitations in practice of the established GMO political and regulatory framework, for reflecting the true character of public concerns... The disturbing relationship between present latent anxieties in this field, and wider issues of trust in the UK's political institutions highlighted by recent opinion surveys".

The current method of public consultation for GM crop development does not allow free expression of the public's views. Furthermore, the debate on risk is usually aimed at nullifying the public's concerns rather than addressing them. We must seek to initiate a more detailed debate which looks at not just risk management, but the ethical basis for allowing the development of this technology, the need for an ethical approach to risk appraisal, and specific guidelines for consideration of the precautionary principle in risk appraisal. This is what concerned members of the public want - but they also consider such a dialogue is unlikely to take place because it would require a reassessment of the position of the biotechnology industry itself.

2.5. Science and Environmental Philosophy

It is not possible to conclude this discussion of biotechnology, sustainable development and public participation and perception without considering the public understanding of science. ***Much of the formal effort by academics and government in relation to the 'public understanding of science' usually involves trying to educate people that some risks - for example nuclear power, or genetic engineering - are worthwhile and beneficial to society and therefore should be tolerated. In fact for many 'sceptical' members of the public this is not the issue - instead they wish to be listened to in order that their views can be heard and acted upon - fundamentally it becomes a matter of personal freedom to choose.***

This issue is especially relevant in relation to biotechnology because of the disparity between the 'world views' of the biotechnology industry and that of the environment movement. Unless we seek to address this difference in views we will never be able to resolve the issues the Nuffield Council has outlined in its consultation paper.

An Environmentalist's Perspective

Classical theology gives man 'dominion' over the globe. Once the 'Earth' was discovered, it was mapped; once mapped divided up between owners; once owned the natural resources exploited. So much of human discovery has been implicitly linked with 'ownership' and 'exploitation'. Even today scientific research has that same theme of 'economic imperialism' running through it.

Western society was dominated by theological law until the Renaissance. The new knowledge that emerged at that time challenged the conventions of theology and led to the sidelining of 'spiritual' restrictions on living to more 'temporal' ones. The Bible ceased to be the main book of law, and instead society made laws based on the need to regulate human activities - in particular commerce and the ownership of property (for example, in the UK

much of our law stems from property-ownership, be it planning law, environmental law, or even criminal law). The advances in science and knowledge were at the forefront of this. New understandings of scientific principles led to new technological applications of that knowledge. New technology led to greater and more 'efficient' exploitation of natural resources.

The '*Age of Reason*' begins with Descartes. He originated the idea of '*reductionism*' - the concept that any system can be broken down into its constituent parts and studied in order to understand how the system as a whole can be understood. He also outlined one of the essential core values of science - that any scientific truth must be independently reproducible and verifiable. It is the 'reductionist' view of science which today forms the core of our society. At school, as we progress towards taking exams, we are asked to specialise in certain technical areas. In government and local authorities technical 'experts' are now a central part of the justification of policy.

Fundamentally the basis of the scientific society is the assumption that science can model any process in nature, and therefore develop or adapt technologies to deal with any unforeseen problems. This fundamental assumption held that it is possible to produce simple mathematical or computer models of the ways systems work. Then, by providing sufficient quantities of data to run the models, you could understand the effects of any development or course of action that is proposed. If the model was ever in error, all that meant was that you had to devise a more sophisticated model, or find better or more detailed data.

This Cartesian 'reductionist' view of science began to falter in the 1970s as it was clear that there were some things which could not be modelled. Modelling essentially involved finding patterns in a random jumble of events. But in life there are some sequences of events which are just too complex to find any pattern in. Meteorology is a good example of an area of science which is still subject to extreme doubt about its results - and which fail in a very public way when the models break down. But even in other fields such as medicine, or the safety of highly dangerous industrial plants, there is the same uncertainty. This then has been the important lesson which decision makers in all areas of society have had to learn during the 1970s and 1980s - that science does not give absolute answers; every scientific answer must be qualified in terms of probability, and this certainty or level of probability is related to the quality or certainty of the scientific models involved. The BSE crisis is a good example of a situation which arose essentially as a result of the Government continually advertising scientific research as '*fact*' when it was actually only '*reasoned deduction*'. As events progressed and more research was carried out it became clear that these initial deductions were grossly incorrect.

In many ways we now have a backlash against the 'culture of science'. This is partly due to the fact that the public, once enamoured of all things scientific, have now become very sceptical about the role science plays in their lives. But within science itself there has been a growth in the number of individuals who regularly challenge or berate traditional scientific practices. Some have even speculated that traditional science has now reached its limits³⁷, and we must seek to develop a new understanding of what science is, and who it serves.

It is also important, from the view of the environmentalist, to contrast the issue of science with technology. The peak of the technological revolution must be viewed as the 1950s and

³⁷ 'The End of Science: facing the limits of knowledge in the twilight of the scientific age', John Horgan, Abacus Books. ISBN 0 349 10926 5. [First published 1996]

1960s. During this period science became its own theology. People had faith that science could solve any problem, meet any need, and ultimately it would be science that would give man the power to be the transcendent all-knowing being that classical religion portrayed as 'perfection'. That bright white future was tarnished with the first realisation at the end of the 1960s that science was not in control. Far from it - science and technology gave man more power than the natural systems of the Earth were able to cope with.

Rachel Carson's book, '*Silent Spring*'³⁸, is one of the best starting points to begin looking at how the confidence in science and technology became tarnished and then doubted by the public. In '*Silent Spring*' the whole issues of human development and the environment is laid bare. The short-sightedness of our own development is contrasted to the long-term nature of global ecosystems. It also highlights that small, even insignificant levels of mans pollution can cause tremendous effects of humans and wildlife. '*Silent Spring*' was one of the first books to tackle the effects of pesticides - particularly DDT - in the environment and in the food chain. In a similar fashion the argument has now moved on to 'endocrine disrupters'³⁹ - minute traces of chemicals in the environment which mimic the body's own hormones and disrupt development.

Human technology has not necessarily led to a better standard of living. For some people, in some countries, life is certainly less troublesome it was fifty years ago. But what the technological society has brought about is essentially a '*culture of consumption*'. We consume more to feel better. We '*conspicuously consume*' to obtain notoriety or status. If the economy of a country is in trouble then the obvious way to solve the problem is to get people to consume more.

But despite all these advances, there is still poverty, disease and inequality. It is debatable whether science is therefore a force which improves our lives or merely provides more difficulties; whether it frees us or, through technology, enslaves us. The response of the environment movement has therefore been to 'selectively' adopt 'appropriate technology' where these technologies can be shown to be beneficial and environmentally benign. Biotechnology, of course, is one of the areas where the environmental movement do not believe that the potential benefits of the developments that are offered outweigh the perceived harm.

The public vs. biotechnology

The debate about biotechnology has to be set against this background. The public's response to biotechnology and GM crops is typified by the feeling many people have that their views and wishes mean nothing in the face the biotechnology industry - which in turn is given huge support by the agrochemical companies, who also fund political parties and many government institutions. In many ways it is a conspiracy theory - but it is the best of all conspiracy theories in that people's experiences through the media and through the activities of the industry are fed and amplified to believe it.

The concepts of 'reductionism' and 'reproducibility' - and hence the certainty of '*scientific*'

³⁸ '*Silent Spring*', Rachel Carson, Penguin Books. First published 1962.

³⁹ The 'endocrine' system is the body's control mechanism - chemical in the blood stream and the nervous system carry messages around the body to initiate or stop development processes. Disrupting these systems causes problems as diverse as birth defects and cancer to sterility and premature puberty.

proof - hold very little value. Faced with overwhelming global concepts such as climate change or ozone depletion, traditional science has come to represent a problem not a solution. For many people the scientific 'expert' has been totally discredited by issues such as BSE and nuclear power.

It is against this background that people are being asked to accept GM crops; and for this reason it is not surprising that the public have little confidence in the 'experts' representing the industry or the regulators. The views of the public are also deeply affected by the views expressed by the consumers organisations, and even Prince Charles⁴⁰, who have spoken out against the development of GM crops. The image the public have of those involved in biosciences is also influenced by their view of the subject. To many the phrase '*Frankenstein Food*' is a illustration of the process that is undertaken in producing new products, not just the GM crop itself. Also, in terms of other branches of science, the cloaking of biotechnology in secrecy and 'commercial confidentiality' does not inspire trust. If we make a comparison with the medical profession, the oath of "*I will prescribe regimen for the good of my patients according to my ability and my judgement and never do harm to anyone*" gives doctors benefits in the public perception that geneticists just don't have.

For the average person the very practices proposed by biotechnology are in conflict with what many perceive as common sense. Transferring plant characteristics between the same or similar species is one thing, but transferring genetic information from completely separate species, or even a different phylum, offends common sense. Other developments in biotechnology such as cloning or xenotransplantation are also morally and ethically repugnant to many. It is this level of outrage, and also this level of despair about the attention which is being given to the public's offence to these developments, that has led to the recent wave of attacks against trial sites for GM crops. One could liken it in many ways to the long standing campaign against vivisection.

It is not a satisfactory situation for 'science' - and biotechnology is for many people one of the unacceptable faces of 'science' - to continue work to its own agenda with no regard for public opinion. It is also not satisfactory for the biotechnology industry, in response to public opposition, to fund PR campaigns which seek to belittle the public's concerns with simplified slogans on the safety and benefits of biotechnology. The wider issue, which biotechnology has been swept up in, is that the public no longer believe that 'science' is there to serve society. Instead the public see the use of science and 'experts' as a tool to justify developments and schemes which they consider to have no relevance or benefit to their lives - be that nuclear power, waste incineration, or long-life tomatoes. We must address the issue of who controls science, and who it serves - this is especially true in relation to biotechnology where the public view it as an extension of the agrochemical industry's corporate philosophy for market domination.

⁴⁰ 'Praise For Genetic Food Warning By Prince', The Scotsman, June 9, 1998. See Appendix 5.3.

3. Issues in the Consultation Paper

This section considers the specific point raised by the Council. Many of the point made below reference issues raised in the discussions in the previous section.

3.1. What are the principles by which we should control the development and application of GM crops? Do present regulatory systems reflect these principles?

It is arguable what principles actually govern the development and application of GM crops.

The main driving force is obviously industry's desire to develop and market crops which can be sold as a contractual 'package' with specific chemical fertilisers and pesticides. As yet we do not believe that anyone has examined the sustainability of this objective despite there being some evidence that the long term effects of such systems are damaging to agricultural systems and the environment. There are issues not only about the risks that GM crops present to the environment, but also the potential effects that changes in farming practices will have on rural communities, particularly in the Developing World.

In terms of Government's approach, in our view it is divisively split. On one hand there is the Department of Trade and Industry which is promoting biotechnology as a means of increasing the UK's technical base. On the other there are DETR and MAFF who both act as promoters and regulators. As the recent judicial review of the regulation of GM crops trials has shown the regulators themselves are not operating the trials lawfully.

As noted in the previous section, while there is much talk about the benefits and risks, there is very little discussion about the '*sustainability*' of GM crop development. Irrespective of the potential benefits or threats to the environment, if there are other effects caused by the agrochemical industry's promotion and marketing of GM crops which would damage rural communities that in itself is an important material consideration in allowing/disallowing their development. Such an assessment has not yet been carried out in relation to the specific crops currently under development.

As noted in the previous section, we must evolve a more meaningful definition of 'sustainable development' as it relates to biotechnology. This should not only consider the direct environmental effects, applying the precautionary principle where necessary, but it should also consider the indirect effects on social and economic systems.

3.2. Is there an ethical obligation to ensure that non-GM foods continue to be available and distinguishable from GM foods?

The fundamental freedom that has been promoted in the Western World since the Second World War is 'choice'. However the rise of more and increasingly powerful corporations which control large sections of the market, be it Microsoft in the field of computers or Monsanto/Novartis/Zeneca in the field of GM crops, must be considered detrimental to freedom of choice. Globalisation stands to be the issue of 'freedom' in the 21st Century that the conflict between communism and Capitalism was in the 20th.

But the issue of 'choice' cannot be considered solely from the position of the demand and supply based market. Since the Second World War the development of global trade, and in particular the development of GATT and its enforcement through the World Trade Organisation (WTO) has led to a loss of national sovereignty. It is curious that the Conservative government between 1979 and 1997, while outwardly maintaining a strong line on sovereignty in relation to Europe, was at the heart of global lobbying for the setting up of the WTO in 1994, and the development of Multilateral Agreement on Investment (MAI).

Even if the UK wanted to it could not block the import of mixed GM/non-GM foodstuffs because of the international undertakings we have made to the WTO. Other countries in Europe who are trying to prevent the import of GM crops are already experiencing pressure from the US Government and agrochemical companies represented by the WTO. It is not merely an issue of market choice - it is the issue that an industrial sector is able to use the global trade system to force countries to accept their product or face trade sanctions. This situation will worsen should the MAI be agreed in its current form because it will give corporations the power to sue governments for damages should their business be 'damaged' by state actions - a definition of which could include the tightening of legislative regimes.

We agree that it is important to retain choice in the market, but we do not see how that is possible given the determination of the companies marketing these products to enforce their will using current trade agreements. It may well be that the ethics of such agreements must be considered as part of the 'choice' argument if the corporations continue to use their powers to override the wishes of sovereign states. Fundamentally, the enforcement of corporate will using international trade agreements is unsustainable because it overrides public opinion and can act against the agreed decisions of a state to develop towards sustainability in a way which suit their own circumstances.

3.3. How can consumer choice be adequately safeguarded?

Under the current system we do not believe that choice can be safeguarded. There is the issue of international trade noted above. But it is also clear that in matters such as GM crops the government itself - via the specialist sections of the departments involved in the development and regulation of GM crops - has committed itself to assisting the development of products irrespective of public concerns. To our knowledge there has never been a structured '*sustainability appraisal*'⁴¹ of this policy, or of the effects, benefits or disbenefits for the UK.

The main issue in terms of choice is labelling, and the enforceable segregation of GM and non-GM foodstuffs:

- Labelling is a sensitive issue in itself. For those who fundamentally oppose GM crops labelling is not acceptable because it would still permit the development and marketing of products. There is also the issue regarding the certainty over which labels can be set given that some recent tests in Switzerland shown that GM free crops from the USA had been contaminated with GM crops, including GM crop varieties which had not yet received clearance in Europe⁴².

⁴¹ In terms of the Government's own guidelines in '*Policy Appraisal and the Environment*', Department of the Environment 1991.

⁴² '*Swiss find banned gene-change corn*', Reuters News, 04:03 PM ET 03/06/98

- Regarding segregation, it is a deliberate practice in the USA to process GM and non-GM crops together in order to ensure that a differential market does not develop. Unless the USA, which is one of the world largest producers of 'ubiquitous' foodstuffs such as soya and maize, introduces legislation to prevent this it will be difficult to prevent this happening.

There is, in our opinion, no mechanism in the UK or any proposals for such a mechanism that can give adequate safeguards to consumer choice. We would recommend to the Council that they give serious consideration to recommending the new Food Standards Agency, which is currently being set up to take over food safety functions from MAFF and the Department of Health (in the wake of the BSE/E.coli Crises), be charged with the responsibility for ensuring consumer standards and choice in the area of GM/non-GM products. We do not believe that the matter can be safely left to DETR or MAFF. We need a body who can represent the consumer interest without conflict with the promotion of biotechnology. There is a general review of consumer choice and safety issues in Appendix 5.6.

3.4. How should we handle the uncertainty that exists in making predictions about the long-term environmental impact of crops?

As noted in the previous section, the first point in any decision should be a '*sustainability appraisal*'. As part of this there should be an assessment of the risks and benefits to determine whether there is a need to block the development under the precautionary principle. If that hurdle is passed then there should be a wider ranging assessment of the sustainability of the proposal given the potential effects not only on the environment, but on social and economic systems, and rural/agricultural communities in the Developed and the Developing World.

As noted earlier there is a problem with the current risk assessment of GM crops in that only the certain effects are considered. There needs to be a much greater effort to explore the uncertainty in development proposals, using the whole range of knowledge that is available. The assessment procedures must also be open to the public, with minimal restriction on access for reasons of commercial confidentiality.

Also, in order to allay public concerns about the safety on GM crops, there must be an adequately funded and independent research body of some kind which is able to evaluate new evidence, from inside and outside the biotechnology industry, and give its advice to regulators and government. We consider that the current system of '*advisory committees*' (ACRE, ACNFP, etc) who rely heavily on the biotechnology industry and associated bodies for their membership does not provide the guarantees of independence which the public can have confidence in.

3.5. Do people wish to be more involved in decision-making about the application of the technology? If so, how can this be achieved?

The first stage must be to make the current public registers of information more available. For example, DETR used to make information on 'deliberate release' applications available on the internet through Sheffield University. I was recently informed that DETR were

considering withdrawing this service - no reason was given, although the recent attacks on GM crop test site is obviously leading some in the industry to restrict information on the location of sites.

There must be better access to information. The current system, which involves people travelling many miles to London or the regional headquarters of the Environment Agency is not satisfactory. There are also major problems with the access to material on the 'contained use' of GMOs.

Next, the various advisory committees must have some form of contact with interested members of the public. Carrying out surveys or consultation exercises is not enough - there should be some form of public participation in the operation of these advisory committees so that issues can be raised and investigated. Some committees, such as ACRE, already have limited access to meetings and agenda papers. However these committees still widely use the label of 'commercial confidentiality' to restrict access to certain documents. It is my experience, not only in terms of biotechnology but also pollution control and local authorities that the parts of the meeting that are held out of the public area are those which consider the very issues which the public want information about - safety, compliance with authorisations and unforeseen events/accidents.

Finally, there must be a review of current legislation to give the public a more timely and meaningful input into the authorisation processes for the release and contained use of GMOs. An important part of this must be the provision of information on new application or variations to existing authorisations in accessible locations - such as central libraries. The patenting of particular GM crops should be sufficient protection against the theft of intellectual property, so there is no reason why such all-embracing protection should be given to documents under the guise of '*commercial confidentiality*'. Finally, as part of the licensing and enforcement of conditions, there should be a requirement for each test site to have some form of public liaison committee in order that the public can interact with their local development facilities. Such bodies are already a part of the licensing of nuclear facilities, large quarries and chemical installations (albeit with varying degrees of success). This should operate for both the release and contained use of GMOs.

The success of any consultation procedure is of course the feeling on the part of the public that their comments have been listened too and considered. We therefore consider that the licensing authorities should produce consultation reports, in a similar way to those which are currently produced by the Environment Agency or Local Planning Authorities and the Planning Inspectorate, so that people can not only see that their comments were logged, but they can also get some form of explanation as to whether their comments were considered relevant or not. In situations where there is public concern regarding particular GMO developments or a particular test site there should be a procedure for some form of public local inquiry to be convened to hear evidence and objections. Such procedures exist under planning and environmental pollution/waste licensing systems. We see no reason why such procedures could not be applied to the contained use and deliberate release of GMOs.

3.6. What benefits do you think that this technology might have for developing countries? Under what conditions could these benefits be realised?

From a limited appraisal - none. The main reason for this is that if the '*technology transfer*' called for under Agenda 21 were free and open there would be no problem. But it is obvious that the development of GM crops is specifically related to the control and maintenance of markets as part of intensive agriculture systems. Long experience in the Developing World, particularly in relation to the agricultural developments established as part of the World Banks' 'Structural Adjustment Programmes', have failed to deliver any benefits to the majority of people in developing countries.

The development of the 'terminator gene' is the obvious example of the direction companies are going with regard to exerting control over markets. In the USA there has already been protracted litigation between Monsanto and some farmers because of 'contractual infringements' relating to the growing of 'Roundup Ready' soya and cotton.

3.7. What are the responsibilities of companies with regard to the development and commercialisation of GM crops?

Until we have some sort of strict liability for any damage caused by GM crops we do not believe that current regulatory systems bind any company to the safe and responsible development of GMOs. As has been seen with incidents in other industries, such as the Bhopal disaster or the operation of oil companies in Nigeria, unless we can have some form of minimum liability standards enforced globally companies will always be able to walk away from the problem, paying only minimal damages.

In terms of company attitudes to the development of GM crops, they currently have an imperative to succeed in the development of products come what may. The biotechnology industry is capital intensive. Companies such as Monsanto and British Biotech have committed large quantities of capital to the development of these products to the point where failure could risk the future of the company. For these reasons we cannot expect these companies to be generous and co-operative in the development of better regulatory systems and systems for public participation.

Fundamentally, the confidence in the operation of companies developing GM crops will rest on the effectiveness of the regulators, and their will to back up their decisions with legal action where necessary.

3.8. What is the ethical acceptability of patents associated with novel GM crops?

If the seed market were operated openly there would be no problem. The issue is that the companies who are developing GM crops are also the major seed producers. If they decide that only GM crops will be sold from year X, there is very little that could be done about it. The acceptability of patenting GM crops is therefore dependent of the maintenance of a market for non-GM crop seed.

The issue of crop seed is also a matter of biodiversity. If we do not maintain a sufficient diversity of foodstuffs, for example through seed banks operated by horticultural institutes (e.g., the Henry Doubleday Association has an extensive seedbank which are 'loaned' to small gardeners/allotment holders) then we risk diminishing the biodiversity of our food

sources to the point where new diseases or pests would make them unviable.

4. Conclusions

Sustainable development has not, in our view, ever really occupied an important place in the debate on biotechnology. Essentially the debate has been between those who wish to promote biotechnology as a way of solving environmental and agricultural problems, and those who believe that the risk of such technologies outweigh the potential benefits. But when we talk about sustainability it is not just a matter of evaluating risks - we must also evaluate the purpose of the technology, its moral and ethical implications, and the alternative options that exists for achieving similar ends.

What we see in the development of understanding and policy in sustainable biotechnology from the Rio Conference to the New York Conference is a positive shift away from purely the management of the hazards of biotechnology to a position where the wider non-environmental hazards are becoming more relevant. Particularly in relation to GM crops it is not enough to consider just the environmental effects - the effects on the social and economic aspects of agriculture and on society/consumers in general is equally important.

The sustainable regulation of GM crop releases should not only operate at the level of legislation. There must be protection in depth. That means that the system should not only provide legislative guidelines, but policing by the industry itself, and adequate information provision on authorised activities so that the public can also monitor the situation. The current system fails to do this.

The role of the 'precautionary principle' is central to the application of sustainable development when we are considering the risks of particular actions based upon scientific principles. Given the ready application of the principle to areas such as biotechnology it is curious that the use of the precautionary principle is very rarely discussed, particularly in relation to regulatory systems. The assessment of risk for most GM crops is not an exercise in quantifying the effects of uncertainty. In actuality risk assessments focus entirely on the known and quantifiable risks and do not consider the effects of uncertainty or confidence in data and assumptions. The likely costs of a mistake in the evaluation of the risk are rarely, if ever, assessed. In the absence of such an analysis it is not possible to operate the precautionary principle in terms of the balancing of economic and environmental costs. There is an important issue relating to the disparity in risk perception between the regulators and originators of risk assessments, and the general public.

It is clear that the level of understanding about biotechnology has increased amongst the public - even if part of this increase may be the result of what scientists in the biotechnology field consider to be unjustified risks. Opinion polls demonstrate a clear majority of the public are against GM crops. We must therefore address the transparency of the decision making processes on the risks different GM crops pose, and ensure that the relevant data is in the public domain.

The current method of public consultation for GM crop development does not allow free expression of the public's views. We must seek to initiate a more detailed debate which looks at not just risk management, but the ethical basis for allowing the development of this technology, the need for an ethical approach to risk appraisal, and specific guidelines for consideration of the precautionary principle in risk appraisal.

It is not possible to conclude this discussion of biotechnology, sustainable development and public participation and perception without considering the public understanding of science.

Much of the formal effort by academics and government in relation to the 'public understanding of science' usually involves trying to educate people that some risks. In fact for many 'sceptical' members of the public this is not the issue - instead they wish to be listened to in order that their views can be heard and acted upon - fundamentally it becomes a matter of personal freedom to choose.

The wider issue, which biotechnology has been swept up in, is that the public no longer believe that 'science' is there to serve society. Instead the public see the use of science and 'experts' as a tool to justify developments and schemes which they consider to have no relevance or benefit to their lives. We must address the issue of who controls science, and who it serves - this is especially true in relation to biotechnology where the public view it as an extension of the agrochemical industry's corporate philosophy for market domination.

In terms of the specific questions posed by the Council:

- *What are the principles by which we should control the development and application of GM crops? Do present regulatory systems reflect these principles?*

The main driving force is obviously industry's desire to develop and market crops which can be sold as a contractual 'package' with specific chemical fertilisers and pesticides. As yet we do not believe that anyone has examined the sustainability of this objective despite there being some evidence that the long term effects of such systems are damaging to agricultural systems and the environment. If there are indirect effects caused by the agrochemical industry's promotion and marketing of GM crops which would damage rural communities that in itself is an important material consideration in allowing/disallowing their development.

- *Is there an ethical obligation to ensure that non-GM foods continue to be available and distinguishable from GM foods?*

The rise of more and increasingly powerful corporations which control large sections of the market must be considered detrimental to freedom of choice. But the issue of 'choice' cannot be considered solely from the position of the demand and supply based market. Even if the UK wanted to it could not block the import of mixed GM/non-GM foodstuffs because of the international undertakings we have made to the WTO. We agree that it is important to retain choice in the market, but we do not see how that is possible given the determination of the companies marketing these products to enforce their will using current trade agreements.

- *How can consumer choice be adequately safeguarded?*

Under the current system we do not believe that choice can be safeguarded. The main issue in terms of choice is labelling, and the enforceable segregation of GM and non-GM foodstuffs. Labelling is a sensitive issue in itself because those who fundamentally oppose GM crops because it would still permit the development and marketing of products. Regarding segregation, unless the USA introduces legislation to prevent this it will be difficult to the mixing of GM and non-GM crops. We would recommend to the Council that they give serious consideration to recommending the new Food Standards Agency be charged with the responsibility for ensuring consumer standards and choice in the area of GM/non-GM products.

- *How should we handle the uncertainty that exists in making predictions about the long-term environmental impact of crops?*

The first point in any decision should be a 'sustainability appraisal'. As part of this there should be an assessment of the risks and benefits to determine whether there is a need to block the development under the precautionary principle. If that hurdle is passed then there should be a wider ranging assessment of the sustainability of the proposal given the potential effects not only on the environment, but on social and economic systems, and rural/agricultural communities in the Developed and the Developing World.

- *Do people wish to be more involved in decision-making about the application of the technology? If so, how can this be achieved?*

The first stage must be to make the current public registers of information more available. Next, the various advisory committees must have some form of contact with interested members of the public. Finally, there must be a review of current legislation to give the public a more timely and meaningful input into the authorisation processes for the release and contained use of GMOs. Additionally, as part of the licensing and enforcement of conditions, there should be a requirement for each test site to have some form of public liaison committee. Finally, the success of any consultation procedure is of course the feeling on the part of the public that their comments have been listened too and considered. We therefore consider that the licensing authorities should produce consultation reports so that people can not only see that their comments were logged, but they can also get some form of explanation as to whether their comments were considered relevant or not. In certain situations there should be a procedure for some form of public local inquiry to be convened to hear evidence and objections.

- *What benefits do you think that this technology might have for developing countries? Under what conditions could these benefits be realised?*

From a limited appraisal - none. The main reason for this is that if the 'technology transfer' called for under Agenda 21 were free and open there would be no problem. But it is obvious that the development of GM crops is specifically related to the control and maintenance of markets as part of intensive agriculture systems.

- *What are the responsibilities of companies with regard to the development and commercialisation of GM crops?*

Until we have some sort of strict liability for any damage caused by GM crops we do not believe that current regulatory systems bind any company to the safe and responsible development of GMOs. Fundamentally, the confidence in the operation of companies developing GM crops will rest on the effectiveness of the regulators, and their will to back up their decisions with legal action where necessary.

- *What is the ethical acceptability of patents associated with novel GM crops?*

If the seed market were operated openly there would be no problem. The issue is that the companies who are developing GM crops are also the major seed producers. The acceptability of patenting GM crops is therefore the dependent of the maintenance of a market for non-GM crop seed. The issue of crop seed is also a matter of biodiversity. If we do not maintain a sufficient diversity of seed we risk diminishing the biodiversity of our food sources to the point where new diseases or pests would make them unviable.

5. Appendices

5.1. The Rio Declaration

REPORT OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT*

(Rio de Janeiro, 3-14 June 1992)

Annex I

RIO DECLARATION ON ENVIRONMENT AND DEVELOPMENT

The United Nations Conference on Environment and Development,

Having met at Rio de Janeiro from 3 to 14 June 1992,

Reaffirming the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972, a/ and seeking to build upon it,

With the goal of establishing a new and equitable global partnership through the creation of new levels of co-operation among States, key sectors of societies and people,

Working towards international agreements which respect the interests of all and protect the integrity of the global environmental and developmental system,

Recognising the integral and interdependent nature of the Earth, our home,

Proclaims that:

Principle 1:

Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 2:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Principle 3:

The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

Principle 4:

In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 5:

All States and all people shall co-operate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.

Principle 6:

The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the field of environment and development should also address the interests and needs of all countries.

Principle 7:

States shall co-operate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.

Principle 8:

To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.

Principle 9:

States should co-operate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies.

Principle 10:

Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle 11:

States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.

Principle 12:

States should co-operate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. Unilateral actions to deal with environmental challenges outside the jurisdiction of the importing country should be avoided. Environmental measures addressing transboundary or global environmental problems should, as far as possible, be based on an international consensus.

Principle 13:

States shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage. States shall also co-operate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.

Principle 14:

States should effectively co-operate to discourage or prevent the relocation and transfer to other States of any activities and substances that cause severe environmental degradation or are found to be harmful to human health.

Principle 15:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Principle 16:

National authorities should endeavour to promote the internalisation of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Principle 17:

Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Principle 18:

States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted.

Principle 19:

States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith.

Principle 20:

Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development.

Principle 21:

The creativity, ideals and courage of the youth of the world should be mobilised to forge a global partnership in order to achieve sustainable development and ensure a better future for all.

Principle 22:

Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognise and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.

Principle 23:

The environment and natural resources of people under oppression, domination and occupation shall be protected.

Principle 24:

Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and co-operate in its further development, as necessary.

Principle 25:

Peace, development and environmental protection are interdependent and indivisible.

Principle 26:

States shall resolve all their environmental disputes peacefully and by appropriate means in accordance with the Charter of the United Nations.

Principle 27:

States and people shall co-operate in good faith and in a spirit of partnership in the fulfilment of the principles embodied in this Declaration and in the further development of international law in the field of sustainable development.

* * * * *

a/ Report of the United Nations Conference on the Human Environment, Stockholm, 5-16 June 1972 (United Nations publication, Sales No. E.73.II.A.14 and corrigendum), chap. I.

5.2. Summary of Chapter 16, 'Agenda 21' - The Environmentally Sound Management of Biotechnology

REPORT OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT

(Rio de Janeiro, 3-14 June 1992)

Chapter 16

ENVIRONMENTALLY SOUND MANAGEMENT OF BIOTECHNOLOGY

INTRODUCTION

Biotechnology is the integration of the new techniques emerging from modern biotechnology with the well-established approaches of traditional biotechnology. Biotechnology, an emerging knowledge-intensive field, is a set of enabling techniques for bringing about specific man-made changes in deoxyribonucleic acid (DNA), or genetic material, in plants, animals and microbial systems, leading to useful products and technologies. By itself, biotechnology cannot resolve all the fundamental problems of environment and development, so expectations need to be tempered by realism. Nevertheless, it promises to make a significant contribution in enabling the development of, for example, better health care, enhanced food security through sustainable agricultural practices, improved supplies of potable water, more efficient industrial development processes for transforming raw materials, support for sustainable methods of afforestation and reforestation, and detoxification of hazardous wastes. Biotechnology also offers new opportunities for global partnerships, especially between the countries rich in biological resources (which include genetic resources) but lacking the expertise and investments needed to apply such resources through biotechnology and the countries that have developed the technological expertise to transform biological resources so that they serve the needs of sustainable development. Biotechnology can assist in the conservation of those resources through, for example, ex situ techniques. The programme areas set out below seek to foster internationally agreed principles to be applied to ensure the environmentally sound management of biotechnology, to engender public trust and confidence, to promote the development of sustainable applications of biotechnology and to establish appropriate enabling mechanisms, especially within developing countries, through the following activities:

- (a) Increasing the availability of food, feed and renewable raw materials;
- (b) Improving human health;
- (c) Enhancing protection of the environment;
- (d) Enhancing safety and developing international mechanisms for cooperation;
- (e) Establishing enabling mechanisms for the development and the environmentally sound application of biotechnology.

PROGRAMME AREAS

A. Increasing the availability of food, feed and renewable raw materials

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To meet the growing consumption needs of the global population, the challenge is not only to increase food supply, but also to improve food distribution significantly while simultaneously developing more sustainable agricultural systems. Much of this increased productivity will need to take place in developing countries. It will require the successful and environmentally safe application of biotechnology in agriculture, in the environment and in human health care. Most of the investment in modern biotechnology has been in the industrialised world. Significant new investments and human resource development will be required in biotechnology, especially in the developing world.

The following objectives are proposed, keeping in mind the need to promote the use of appropriate safety measures based on programme area D:

- (a) To increase to the optimum possible extent the yield of major crops, livestock, and aquaculture species, by using the combined resources of modern biotechnology and conventional plant/animal/micro-organism improvement, including the more diverse use of genetic material resources, both hybrid and original. Forest product yields should similarly be increased, to ensure the sustainable use of forests;
- (b) To reduce the need for volume increases of food, feed and raw materials by improving the nutritional value (composition) of the source crops, animals and micro-organisms, and to reduce post-harvest losses of plant and animal products;
- (c) To increase the use of integrated pest, disease and crop management techniques to eliminate overdependence on agrochemicals, thereby encouraging environmentally sustainable agricultural practices;
- (d) To evaluate the agricultural potential of marginal lands in comparison with other potential uses and to develop, where appropriate, systems allowing for sustainable productivity increases;
- (e) To expand the applications of biotechnology in forestry, both for increasing yields and more efficient utilisation of forest products and for improving afforestation and reforestation techniques. Efforts should be concentrated on species and products that are grown in and are of value particularly for developing countries;
- (f) To increase the efficiency of nitrogen fixation and mineral absorption by the symbiosis of higher plants with micro-organisms;
- (g) To improve capabilities in basic and applied sciences and in the management of complex interdisciplinary research projects.

B. Improving human health

The improvement of human health is one of the most important objectives of development. The deterioration of environmental quality, notably air, water and soil pollution owing to toxic chemicals, hazardous wastes, radiation and other sources, is a matter of growing concern. This degradation of the environment resulting from inadequate or inappropriate development has a direct negative effect on human health. Malnutrition, poverty, poor human settlements, lack of good-quality potable water and inadequate sanitation facilities add to the problems of communicable and non-communicable diseases. As a consequence, the health and well-being of people are exposed to increasing pressures.

The main objective of this programme area is to contribute, through the environmentally sound application of biotechnology to an overall health programme, to:

- (a) Reinforce or inaugurate (as a matter of urgency) programmes to help combat major communicable diseases;
- (b) Promote good general health among people of all ages;

- (c) Develop and improve programmes to assist in specific treatment of and protection from major non-communicable diseases;
- (d) Develop and strengthen appropriate safety procedures based on programme area D, taking account of ethical considerations;
- (e) Create enhanced capabilities for carrying out basic and applied research and for managing interdisciplinary research.

C. Enhancing protection of the environment

—

Environmental protection is an integral component of sustainable development. The environment is threatened in all its biotic and abiotic components: animals, plants, microbes and ecosystems comprising biological diversity; water, soil and air, which form the physical components of habitats and ecosystems; and all the interactions between the components of biodiversity and their sustaining habitats and ecosystems. With the continued increase in the use of chemicals, energy and non-renewable resources by an expanding global population, associated environmental problems will also increase. Despite increasing efforts to prevent waste accumulation and to promote recycling, the amount of environmental damage caused by overconsumption, the quantities of waste generated and the degree of unsustainable land use appear likely to continue growing.

The need for a diverse genetic pool of plant, animal and microbial germ plasm for sustainable development is well established. Biotechnology is one of many tools that can play an important role in supporting the rehabilitation of degraded ecosystems and landscapes. This may be done through the development of new techniques for reforestation and afforestation, germ plasm conservation, and cultivation of new plant varieties. Biotechnology can also contribute to the study of the effects exerted on the remaining organisms and on other organisms by organisms introduced into ecosystems.

The aim of this programme is to prevent, halt and reverse environmental degradation through the appropriate use of biotechnology in conjunction with other technologies, while supporting safety procedures as an integral component of the programme. Specific objectives include the inauguration as soon as possible of specific programmes with specific targets:

- (a) To adopt production processes making optimal use of natural resources, by recycling biomass, recovering energy and minimising waste generation; 6/
- (b) To promote the use of biotechnologies, with emphasis on bio-remediation of land and water, waste treatment, soil conservation, reforestation, afforestation and land rehabilitation; 7/ 8/
- (c) To apply biotechnologies and their products to protect environmental integrity with a view to long-term ecological security.

D. Enhancing safety and developing international mechanisms for cooperation

—

There is a need for further development of internationally agreed principles on risk assessment and management of all aspects of biotechnology, which should build upon those developed at the national level. Only when adequate and transparent safety and border-control procedures are in place will the community at large be able to derive maximum benefit from, and be in a much better position to accept the potential benefits and risks of, biotechnology. Several fundamental principles could underlie many of these safety procedures, including primary consideration of the organism, building on the principle of familiarity, applied in a flexible framework, taking into account national requirements and recognising that the logical progression is to start with a step-by-step and case-by-

case approach, but also recognising that experience has shown that in many instances a more comprehensive approach should be used, based on the experiences of the first period, leading, inter alia, to streamlining and categorising; complementary consideration of risk assessment and risk management; and classification into contained use or release to the environment.

The aim of this programme area is to ensure safety in biotechnology development, application, exchange and transfer through international agreement on principles to be applied on risk assessment and management, with particular reference to health and environmental considerations, including the widest possible public participation and taking account of ethical considerations.

E. Establishing enabling mechanisms for the development and the environmentally sound application of biotechnology

The accelerated development and application of biotechnologies, particularly in developing countries, will require a major effort to build up institutional capacities at the national and regional levels. In developing countries, enabling factors such as training capacity, know-how, research and development facilities and funds, industrial building capacity, capital (including venture capital) protection of intellectual property rights, and expertise in areas including marketing research, technology assessment, socio-economic assessment and safety assessment are frequently inadequate. Efforts will therefore need to be made to build up capacities in these and other areas and to match such efforts with appropriate levels of financial support. There is therefore a need to strengthen the endogenous capacities of developing countries by means of new international initiatives to support research in order to speed up the development and application of both new and conventional biotechnologies to serve the needs of sustainable development at the local, national and regional levels. National mechanisms to allow for informed comment by the public with regard to biotechnology research and application should be part of the process.

Some activities at the national, regional and global levels already address the issues outlined in programme areas A, B, C and D, as well as the provision of advice to individual countries on the development of national guidelines and systems for the implementation of those guidelines. These activities are generally uncoordinated, however, involving many different organisations, priorities, constituencies, time-scales, funding sources and resource constraints. There is a need for a much more cohesive and co-ordinated approach to harness available resources in the most effective manner. As with most new technologies, research in biotechnology and the application of its findings could have significant positive and negative socio-economic as well as cultural impacts. These impacts should be carefully identified in the earliest phases of the development of biotechnology in order to enable appropriate management of the consequences of transferring biotechnology.

The objectives are as follows:

- (a) To promote the development and application of biotechnologies, with special emphasis on developing countries, by:
 - (i) Enhancing existing efforts at the national, regional and global levels;
 - (ii) Providing the necessary support for biotechnology, particularly research and product development, at the national, regional and international levels;
 - (iii) Raising public awareness regarding the relative beneficial aspects of and risks related to biotechnology, to contribute to sustainable development;
 - (iv) Helping to create a favourable climate for investments, industrial capacity-building and distribution/marketing;
 - (v) Encouraging the exchange of scientists among all countries and discouraging the "brain drain";
 - (vi) Recognising and fostering the traditional methods and knowledge of indigenous peoples and their communities and ensuring the opportunity for their participation in the economic

and commercial benefits arising from developments in biotechnology;

- (b) To identify ways and means of enhancing current efforts, building wherever possible on existing enabling mechanisms, particularly regional, to determine the precise nature of the needs for additional initiatives, particularly in respect of developing countries, and to develop appropriate response strategies, including proposals for any new international mechanisms;
- (c) To establish or adapt appropriate mechanisms for safety appraisal and risk assessment at the local, regional and international levels, as appropriate.

5.3. News Articles

UK advisors call for modified crop moratorium

—
ENDS Daily - 08/07/98

A bubbling UK debate on genetically modified plants became more intense today, as England's official nature conservation advisory body called for a four-year moratorium on commercialisation of some types of modified crops.

Confirming a position it first took earlier this year along with similar organisations representing Scotland, Wales and Northern Ireland, English Nature said that crops modified to resist herbicides or insects should not be planted commercially until more is known about implications for agricultural practices.

The organisation fears that widespread commercial growing of such crops will worsen a trend towards more intensive farming that has already harmed many types of farmland wildlife, including birds such as the skylark and song thrush. "We know that crop management systems with herbicide resistant crops will eliminate all weeds," Brian Johnson of English Nature told ENDS Daily. "We [also] know that any further reduction in weeds will have profound effects."

A moratorium is necessary, Dr Johnson continued, because several modified crops are moving towards

commercialisation and could very quickly be planted over large areas of farmland. English Nature wants the moratorium to last until 2002, when it says that a "raft" of government-commissioned research into the broader implications of growing modified crops will have been published.

British environmental groups and the opposition Liberal Democrat party have leapt to support a moratorium, calling for it to cover all modified crops. But the government dismissed a moratorium as legally impossible. A moratorium affecting crops that had received marketing approval under the EU's 1990 "deliberate release" directive would clearly be anti-competitive, a spokesperson for the environment ministry told ENDS Daily.

Only if new evidence on individual varieties was presented suggesting risks could the government act, the spokesperson said. "If English Nature has got new evidence on specific crops that could be a danger to the environment then let them show it to us," he went on.

According to English Nature and environmental groups such as the Royal Society for

the Protection of Birds (RSPB) and Friends of the Earth, this focus on individual crop safety is at the root of the problem. "We need a moratorium to take stock because none of the regulatory processes is looking at wider agricultural and environmental implications," said Jonathan Curtoys of the RSPB.

But the government insists that it is not ignoring wider implications. In June, environment minister Michael Meacher met with English Nature, the RSPB and other conservation bodies to discuss the issue. An initial position statement on general implications of genetically modified crops for the environment and for agriculture will be released later this month, according to the environment ministry.

Contacts:

- English Nature (<http://www.english-nature.org.uk>), tel: +44 1733 455000;
- Friends of the Earth England, Wales and Northern Ireland (<http://www.foe.co.uk>), tel: +44 171 1555;
- UK environment ministry (<http://www.detr.gov.uk>), tel: +44 890 3000.

Environment guardian to test genetic crops on his land

The Observer, Sunday 19th July 98

by Johnathan Calvert and Lucy Johnson.

The Chairman of the government body charged with protecting the environment is growing genetically modified crops on his land.

Last month the Observer revealed that Lord de Ramsey, head of the Environment Agency could make more than £1 million by selling greenfield land from his huge Cambridgeshire estate.

He is one of a number of landowners being paid by the US multinational company Monsanto to have such crops tested on their land.

The crops have been attacked by the Prince of Wales, green campaigners and the Royal Society for the Protection of Birds, who fear that they may have a catastrophic effect on wildlife and the food chain.

Last week English Nature called for a three year moratorium on the crops until research into the effects on wildlife has been completed.

De Ramsy will not discuss why he has allowed Monsanto to test on his land. A conservative and friend of John Major, he is paid more than £50,000 a year for his two and a half day post at the Environment Agency.

The quango was set up two years ago to make 'a better environment for present and future generations'. One of it's

aims is to 'encourage the conservation of natural resources, animals and plants'.

Liberal Democrat MP Norman Baker said de Ramsey's relationship with Monsanto was 'incompatible' with his role at the Agency. 'This is a scandal,' he said. 'He's there to protect the Environment and he's potentially helping to destroy it. How can he reconcile his duty with the fact that he is carrying out possibly dangerous experiments?'

The family of John Fellowes, fourth Baron de Ramsey, farms 6,500 acres from it's base at Abbots Ripton, near Huntingdon. The farm manager has allowed Monsanto to use a small area to test a sugar beet genetically engineered to tolerate Roundup, a powerful herbicide.

The farm will be paid for the loss of crops on the land.

"Roundup is a Monsanto product that is extremely toxic to plants,' said Sue Mayer, director of GeneWatch. 'It use will mean the destruction of all plants, which will have a knock on effect on wildlife.

'This flies in the face of the government's proclaimed policy to reduce herbicide use. It confirms our fears that inside the government and it's agencies there is a pro genetic

engineering mood that is at odds with public feeling.'

Friends of the Earth spokesman Adrian Bebb said 'if he [de Ramsey] is growing genetically modified crops on his land there's an obvious and worrying conflict of interest. His agency should be taking a strong stand against this'.

Monsanto a St Louis based company is worth more than £20 billion and is one of the of the largest agricultural biotechnology companies. It's recent merger with the Pharmaceutical giant American Home Products makes it the sixth biggest corporation in the US.

In the last three months it has spent more than £1 million on an advertising campaign to persuade the British public that genetically modified crops are both safe and desirable.

A spokeswoman for the Environment Agency said it gave 'qualified support' for the trials on de Ramsey's land and recognised the 'potential benefits'.

'We share English Natures concerns about the escape of genetically modified material into the wild and it's impact on the Environment. But the whole point in carrying out the trials is to assess the risk and the benefits'.

Friends of the Earth Press Release, 21st July, 1998

COURT OF APPEAL RULES THAT GOVERNMENT ACTED ILLEGALLY OVER GENETIC MAIZE TRIAL CROP - BUT REFUSES TO ORDER ITS DESTRUCTION

The Court of Appeal has today ruled that the Government acted unlawfully in allowing a genetic maize trial in Devon to go ahead. The ruling will have important ramifications for all national seed list trials in the UK. However, the judges have refused the plea by organic farmer, Guy Watson, to have the trial crop of genetically altered maize in a field adjacent to his farm removed. Guy Watson, FOE and the Soil Association - the organisations backing the court challenge - are now calling on the Government's contractors NIAB to take immediate action and remove the genetic crops next to Mr Watson's farm.

During the court hearing the Government admitted that it had acted unlawfully in dispensing with statutory legal requirements of the national seed list trials which state that two replicated trials must be conducted before national seed trials can proceed. The judges commented on this admission as "on its face a most remarkable and, indeed, regrettable statement". The Government will now have to reassess the whole seed list process, affecting up to 163 genetically-engineered seed trials around the UK. This is a potentially serious setback to the biotech industry, delaying the introduction of commercially grown genetically-engineered crops in the UK by up to two years. The Government has indicated that it is considering controversial retrospective legislation - a move which will be opposed by Friends of the Earth and the Soil Association. Both organisations call on the Government to use this period to carry out root and branch reform of the legislation and regulations supposedly governing genetically engineered crops, and the potentially catastrophic effects on organic and non-GMO crops.

The parties bringing the court challenge are dismayed that the Court of Appeal did not uphold arguments that the consent to plant the genetically-engineered crops was incorrectly granted to Sharpes Seeds not the National Institute of Agricultural Botany (NIAB), and that the risks of cross pollination between the genetically engineered maize and the organic sweetcorn were not properly assessed. The

judges accepted that there was a genuine concern but felt that the chances of cross-pollination was no more than minimal given that the crops had now been planted over 2 km away. This does not however answer Guy Watson's concerns as he must now bear the consequences if cross-pollination does indeed occur.

Pete Riley, Food Campaigner at Friends of the Earth, said: "This historic ruling by the Court of Appeal demonstrates that rather than being tightly regulated, the rush to develop these Frankenstein foods has led to an astonishing Government disregard towards even the most basic laws.

Government now has to decide whether it is going to further demonstrate its support for the biotech industry by introducing retrospective legislation, or use this historic opportunity to delay the commercial introduction of these Frankenstein foods until a proper debate can take place that deals with the numerous concerns about this dangerous new technology.

However, despite this ruling, the organic farmer, Guy Watson, still has the threat of genetic pollution hanging over his head. Both the Government and the legal system have failed to protect farmers from cross pollination whilst industrial farming steams ahead. No farmer will be able to guarantee their crops are free of genetic pollution unless the Government gets a grip on the release of genetic crops."

Richard Young, Policy and Campaigns co-ordinator of the Soil Association said: "This judgement makes it crystal clear that there is currently no protection for farmers who want to grow GMO-free crops, or consumers who want to eat them. The judges acknowledged that the Soil Association will not accept any genetic contamination in organic food. We urge ministers to ensure that the future of organic farming is not threatened by the uncontrolled planting of genetically-engineered crops."

Luke Anderson, co-ordinator of the local campaign, and on behalf of Guy Watson, said: "We are bitterly disappointed that the Government is unwilling to offer any protection

to our organic farm. Even according to the Government's own figures there is likely to be some degree of cross-pollination. Any contamination of our sweetcorn will lead to the loss of its organic status and consumer confidence. Due to the widespread introduction of GMOs into the food chain many people rely

on the fact that our organic food is guaranteed free from genetic contamination.

However we have achieved a significant victory. It is disgraceful that it has taken an expensive legal challenge and the Court of Appeal for the Government to finally admit that they have acted unlawfully."

Friends of the Earth
26-28 Underwood Street
Tel: 0171 490 1555 N1 7JQ

E-mail: info-request@foe.co.uk
URL: <http://www.foe.co.uk/> London
Fax: 0171 490 0881

Biotech firms demand GMO law revision rethink

ENDS Daily - 24/07/98

European biotechnology companies are calling on the European Parliament and Council of Ministers to throw out a planned revision of the 1990 EU law on marketing of genetically modified organisms (GMOs), known as the "deliberate release" directive.

Tim Stocker, chairman of an industry task force studying the proposed EU law revision, said the law needed a radical overhaul, not the modest alterations currently on the table.

Speaking on Wednesday at a hearing held by the European Parliament, Mr Stocker said the approval process for GMOs should be wrested from member states and handed to a central EU organisation. Such a body should be staffed by scientific experts from member states, who would take scientific, not political, decisions on whether a GMO is safe, he said.

"We know from experience that the [current system] is a lottery. The new proposal does not get over the problem that the decision depends on political caprice," he told ENDS Daily following the hearing. Mr Stocker said the EU industry association, EuropaBio, would be lobbying MEPs and governments to scrap the proposal when they examine it this autumn. "We should...go back to the drawing board," he said.

Environmental groups have resisted the idea of scrapping the proposal, pointing out that it would take years to draw up a new one. Speaking at the hearing, a Greenpeace spokesperson called on EU legislators to strengthen the 1990 directive by introducing a system of civil liability combined with mandatory insurance for biotechnology companies to cover damage caused by GMOs. The group also wants tight labelling rules for modified foods and the removal of "fast track" regulatory procedures for some GMOs.

The European Commission proposed a revision the deliberate release directive last year (ENDS Daily 26 November 1997). EU environment ministers held a first "orientation debate" on the proposal in June, raising questions about how far it should go on issues such as product labelling, risk assessment and monitoring of modified crops (ENDS Daily 18 June). Last month, MEPs called for the introduction of liability provisions under a parallel EU law on the use of GMOs in laboratories and industrial processes (ENDS Daily 22 June). A parliamentary source said then that a similar demand under the deliberate release law was likely to be made.

Contacts: EuropaBio, tel: +32 2 735 0313.

The Times, October 22 1997

By Nigel Hawkes

SCIENTISTS in Scotland have urged caution in the introduction of genetically modified crops after discovering that they could harm lady ladybirds. Nick Birch and a team from the Scottish Crop Research Institute in Dundee found that female ladybugs that ate aphids that had fed on genetically modified potatoes laid fewer eggs and lived only half as long as the average. The team tested a potato plant that had been modified to produce a natural insecticide that discouraged aphids from feeding

on them.

The team found that the modified potatoes did indeed suffer reduced attack but the cut, of 50 per cent, was insufficient on its own, so it was important that ladybugs also did their work.

The team says in the institute's annual report that the ladybirds continued to eat the aphids but the effects suggested that such crops could have unexpected consequences.

DIE TAGESZEITUNG Nr. 5401, 6 December 1997 (Germany - TRANSLATION)

Herbicide-resistant rape spreads its manipulation

by Jurgen Voges

Genetically engineered rape plants on a test field in Gehrden near Hanover have passed on their herbicide-resistance gene to ordinary rape growing in the area. The Niedersachsen Ministry for Ecology (NLV) has been able to show that normal rape situated at a distance of 200 metres from the test field of the Hoechst/Schering subsidiary AgroEvo has been transformed into transgenic, herbicide-resistant rape.

The Niedersachsen Minister of the Environment, Monika Griefahn, said that the NLV research in Gehrden confirmed her worst fears. "Once the manipulated genes are released into the surroundings, there is no way to contain them," said Griefahn yesterday in Hanover. Bees and wind spread the pollen of genetically engineered plants just as they do with other plants, and in this case they also spread the artificial genes.

The open-air field trial to grow the genetically modified rape, which is resistant to the herbicide Basta [glufosinate ammonium], was authorised in 1995 by the Robert Koch Institute in Berlin, in the face of opposition from Griefahn. AgroEvo merely had to provide an eight-metre safety border around the test field.

Niedersachsen financed its own research programme, parallel to the open-air field trial, at a cost of DM450,000. Within a radius of 1,000 metres around the test field, the NLV indexed plants and collected hundreds of thousands of

seeds from wild plants and normal rape growing in the area.

The NLV has so far tested only the rape seed it has collected, for the Basta resistant gene. The seeds were fed a solution containing the Basta herbicide. Seeds that grew into plants in spite of the Basta were then tested for the herbicide-resistant gene. Environment Minister Griefahn is concerned that further tests will show that the resistance gene has been carried over into wild plants as well. Most likely this would occur with plants that are related to rape, such as mustard or wild radish. A transfer of resistant genes to these type of plants would cast doubt on the whole concept of Total Herbicide, by which the seed of the genetically modified plant is sold together with the corresponding herbicide. Wild plants that had absorbed the resistance gene from the genetic rape would then thrive magnificently as weeds and increase, in spite of the use of Basta.

Following the first NLV findings, it is clear for Monika Griefahn "that in the neighbourhood of transgenic fields cultivated plants can also become transgenic". This would harm also those farmers who declined to use genetically modified crops. They would no longer be able to guarantee to the consumers that their products are not genetically modified.

Translator's note: Niedersachsen (Lower Saxony) is one of the largest states in Germany. The research study was initiated and funded by the state government of Niedersachsen. The Robert Koch Institute is responsible for authorising test licences.

The Guardian (society pages), Wednesday April 15, 1998

A potential end to an age-old farming practice may be in sight with a hi-tech development from the US government that can genetically switch off plants' ability to reproduce. US patent 5,723,765, awarded jointly last month to the world's largest cotton-seed company and the US Department of Agriculture will allow companies to stop farmers collecting seeds to plant again in following years.

What is being dubbed the 'Terminator Gene' by the genetic engineering industry would, when licensed to seed and chemical companies, pass more control of global crops to US companies and force farmers to buy new seeds each year.

While this is not such a great problem in developed countries where few farmers collect seed, it could have far-reaching economic and cultural effects in poor countries where the technology is aimed, say critics of the technology.

"The goal is to increase the value of proprietary seed owned by US seed companies and to open new markets in second and third world countries," said US dept of Agriculture (USDA) spokesman Willard Phelps.

"Our mission is to protect American technology and to make us competitive in the face of foreign competition," said USDA molecular biologist and primary inventor of the technology Melvin J Oliver.

"We expect the new technology to have global implications," said Murray Robinson, president of Delta and Pine Land, the company that developed the technology with the US government and dominates global sales of cotton seeds.

"It has the prospect of opening significant world-wide seed markets to the sale of transgenic technology for crops in which seed is currently saved and used in subsequent plantings." While proponents of terminator technology, which is being tested first on cotton and tobacco, claim that small farmers will be unaffected, concerned agronomists say the reality is different.

"It's terribly dangerous," said Hope Shand, research director of the Canadian RAFI group. "Half the world's farmers are poor. They provide food for more than 1 billion people but they can't afford to buy seeds every growing season. Seed

collection is vital for them." News of the technology has created a furore in developing countries. "The better off farmers will be forced to pay, but their poor neighbours will no longer be able to exchange breeding material with them. No one will breed for their needs. It could force millions of small farmers out of plant breeding altogether," said Neth Dano of the Filipino group SEARICE which works with small farmers.

There are further fears that pollen from the crops carrying the Terminator gene will blow into and 'infect' the fields of farmers who either reject or cannot afford the technology, says Chilean agronomist Camila Montecinos of the Centre for Education and Training.

"Farmers could find that their seeds are infertile when it is too late. It could lead to a decline in food security for the poorest communities. This may be the neutron bomb of agriculture," she said.

The Terminator gene would be immediately attractive for agro-chemical companies now developing genetically engineered seeds. Because these seeds are patented, and licensed to farmers for one growing season only, the companies are having to employ private security guards to ensure that farmers do not reuse their seeds.

Philip Angell, US director of corporate communications of agro-chemical corporation Monsanto told the Guardian last week: "This technology might prove attractive." He added that it was "not very different from 'hybrid' crops", which do not reproduce.

Monsanto is spearheading the global genetically-modified food revolution with technology being used on 50 million acres of crops this year and it has a minor shareholding in Delta and Pine Land. The two companies have a joint cotton-seed venture in China. The \$10-billion-a-year giant has spent more than \$2 billion in the past two years buying up seed companies and developing genetically-modified crops.

"This is outrageous," says Shand. "The technology was developed with taxpayers' money. It is designed to give the multinational seed industry the capacity to control the world's food supply and weaken the role of public breeders."

The Scotsman, June 9, 1998,

Praise For Genetic Food Warning By Prince

Christopher Cairns, Environment Correspondent

CONSUMER campaigners last night welcomed the intervention by the Prince of Wales in the debate on genetically modified foods.

The prince urged geneticists to stop "playing God" with nature, and said that consumers should have a choice between organic and genetically modified (GM) foods.

His call for better safeguards coincided with the launch of a publicity drive by the world's largest agrochemical company, Monsanto, which is lobbying for permission to begin growing GM crops in Britain.

Writing in the Daily Telegraph, Prince Charles, who farms organically on his own agricultural properties, rejected any comparison between new genetic techniques and traditional crop and animal husbandry.

We were now, he said, using genes directly to mix animals, bacteria and plants with species with which they would not naturally be able to cross breed. "I happen to believe that this kind of genetic modification takes mankind into the realms that belong to God, and to God alone," he said. "a do we have the right to experiment with, and commercialise, the building blocks of life? "We live in an age of rights - it seems to me that it is time our Creator had some rights too." He went on to express concerns over herbicide-resistant crops encouraging more chemical use and resulting in "sterile fields" with no wild plant or insect life.

He warned: "We simply do not know the long-term consequences for human health and the wider environment of releasing plants bred in this way." Although only a handful of GM foods have been approved for use and sale in the United Kingdom, almost all processed foods now on sale contain soya, most of which comes from the United States, which does not segregate GM and natural crops.

Prince Charles called for more consumer choice. "I personally have no wish to eat anything produced by genetic modification, nor do I knowingly offer this sort of produce to my family or guests," he said.

The prince's comments were welcomed by the Church of Scotland. Dr Donald Bruce, the director of the Church's society, religion and

technology project, said that they did not believe genetics per se was necessarily playing God, but there had to be a line drawn somewhere. "It is ethical, for example, to ask who are the winners and losers are likely to be before charging ahead with this new science," he said.

"The winners, are going to be big multinational companies who will improve their profits.

The most obvious immediate loser is someone who does not want to eat GM foods but cannot avoid doing so."

Last night, Monsanto said it welcomed the prince's intervention and said it was generating exactly the kind of informed debate it wants in the country. "We are perfectly happy with his contribution. We knew he was going to do this and we decided to press ahead with our launch anyway," said Ann Foster, a Monsanto company spokeswoman.

"On the ethical questions he raises, there has been cross-breeding going on for some time, we are not doing anything new, we have simply learned how to do it better than before.

We welcome moves to improve labelling and offer consumers more choice." Campaigners said the prince's call for urgent action to ensure people could tell whether they were eating the new foods reflected the concerns of millions of people worried about the implications of eating GM ingredients.

The National Consumer Council (NCC) said the prince was more in tune with consumer concerns than European Union policy makers, who had failed to insist GM foods and normal crops are kept separate and clearly labelled. The NCC's director, Ruth Evans, said: "Consumers want to know how their food has been produced because, for a variety of reasons, many do not wish to eat foods from GM sources."

In ruling last month, the EU stated that all foods sold in the community in which GM material can be detected should be clearly labelled as such. Environmentalists, however, argue that because the new rule does not cover ingredients which themselves have been derived from GM plants - such as soya and certain oils which have DNA and proteins processed out of them - consumers have been betrayed.

In an ICM poll published last week, 85 per cent of respondents said they wanted GM foods to be separated from normal crops at source. The poll

also found that 95 per cent wanted foods derived from GM crops to be labelled.

04:03 PM ET 03/06/98

Swiss find banned gene-change corn

ZURICH (Reuters) - Swiss government scientists have backed up environmental campaigners who complained that shippers were importing genetically altered American maize barred from Europe.

Two Rhine barges loaded with maize were impounded in the Swiss city of Basle during the past week after complaints from Greenpeace and two local Swiss environmental groups.

Prosecutors sent samples to government labs and reported on Friday that ``both laboratories have stated independently of each other that there is evidence the two shipments contained genetically altered maize strains that are not approved."

They said they were investigating possible criminal charges against the shippers.

Greenpeace said the maize, a mixture of traditional and gene-change strains, came from a large U.S. shipment unloaded in the Dutch port of Rotterdam.

Swiss authorities have so far only approved only one type of gene-change maize, created by Swiss pharmaceutical company Novartis AG. About 10 other types are grown in the United States, Greenpeace says.

^REUTERS@

5.4. GeneWatch/MORI Poll

press release

Sunday 14 June 1998 - For immediate release

77% of the public believe there should be a ban on growing genetically engineered crops and food in Britain

The conclusive results of a new MORI poll (1) indicate that the vast majority of the British public are currently opposed to the growing of genetically engineered crops in this country – the questions, results and poll techniques are attached.

Commissioned by GeneWatch, the independent organisation which monitors developments in genetic engineering, the MORI poll shows that 77% want a ban on the growing of such crops until their impacts have been more fully assessed. A similar number (73%) are concerned that genetically engineered crops could interbreed with natural, wild plants and cause genetic pollution.

The MORI poll also reveals that 61% of the public do not want to eat genetically modified foods (an 8% increase since a similar MORI poll was conducted in December 1996) and 58% of the public oppose the use of genetic engineering in the development of food (a 7% increase on 1996) (2).

"How much more evidence does the Government need that the public do not want genetically engineered foods and that this opposition is increasing?" said GeneWatch Director, Dr Sue Mayer. "Until now, the Government has taken little account of public opinion and has been complacent about the risks of introducing genetically engineered crops."

From next year, herbicide resistant oilseed rape could be the first genetically engineered crop to be grown commercially in Britain. A GeneWatch report, "Genetically Engineered Oilseed Rape: Agricultural Saviour or New Form of Pollution?", to be published tomorrow, concludes that new research casts doubts on previous safety assessments and that serious damage could be done to the environment and farming.

Public rejection of genetically engineered foods could have serious consequences for food producers and retailers, who would be forced into an increasingly difficult search for products which could be guaranteed to be non genetically engineered. Farmers could be faced with major problems from genetic pollution and uncontrollable herbicide resistant weeds. "In fact, the only people who are likely to benefit are the huge multinational companies which are developing the crops," says Dr Mayer. "The Government should not be rushed into introducing this new technology but should listen to its electorate and declare an immediate halt to the commercial exploitation of genetically engineered crops until the whole issue has been properly evaluated."

For further information, contact Sue Mayer on 01298 871558 (phone & fax)
GeneWatch, 5 Post Office Row, Litton, Buxton, Derbyshire, SK17 8QS
Or Kay Wright/Michele Corrado at MORI on 0171 928 5955

Notes to editors

1. Interviews conducted with 950 adults aged 15+. Interviewed face-to-face, in-home, using CAPI (computer assisted personal interviewing) technology between 6-8 June 1998 in 84 sampling points throughout Great Britain. Data have been weighted to reflect the national profile

2. Trend information has been included from a MORI/Greenpeace poll: 1,003 interviews among adults aged 15+ were conducted by telephone between 13-15 December 1996. Data have been weighted to reflect the national profile

About GeneWatch

GeneWatch is an independent organisation concerned with the ethics and risks of genetic engineering. It questions how, why and whether the use of genetic technologies should proceed and believes that the debate over genetic engineering is long overdue.

GeneWatch's Director, Dr Sue Mayer, has been involved in monitoring developments in genetic engineering for eight years and was Director of Science at Greenpeace UK from 1990 to 1995. She is a co-author of 'Uncertain World. Genetically modified organisms, food and public attitudes in Britain' published in 1997.

MORI Poll For GeneWatch, June 1998

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Interviews conducted with 950 adults aged 15+. Interviewed face-to-face, in-home, using CAPI (computer assisted personal interviewing) technology between 6-8 June 1998 in 84 sampling points throughout Great Britain. Data have been weighted to reflect the national profile

Where appropriate, trend information has been included from a MORI/Greenpeace poll: 1,003 interviews among adults aged 15+ were conducted by telephone between 13-15 December 1996. Data have been weighted to reflect the national profile

Q1. The following questions are about genetic engineering and genetically-modified food.

Genetic engineering makes it possible to artificially change the genetic make-up of, for example, plants, animals and micro-organisms (bacteria etc). The changes made to these are maintained in future generations of the same plants, animals and micro-organisms.

In the food industry, this technique has already begun to be used. There are, for example, already genetically-engineered soya beans and maize. Modifying the genetic make-up through genetic engineering causes, for example, beer to ferment faster, cheese to mature quicker, pigs to grow larger, makes grain immune to pests and tomatoes age more slowly.

Supporters of genetic engineering in the food sector are expecting benefits such as more exact breeding techniques, better products and more efficient production methods.

Critics are afraid of immeasurable health and ecological risks, like the creation of organisms resistant to disease.

The EU is discussing the labelling of food that is produced using genetic engineering.

Thinking of genetically modified food or food derived from genetic engineering, what is your opinion towards the development and introduction of such food. Would you say you....?

	% 1996	% 1998	% CHANGE 96-98
A - Support it to a great extent	6	6	0
B - Support it slightly	25	16	-9
C - Neither support nor oppose it	16	15	-1
D - Oppose it slightly	24	21	-3
E - Oppose it to a great extent	26	37	+11
Don't know	2	5	+3
SUPPORT	31	22	-9
OPPOSE	51	58	+7

Q2. To what extent do you agree nor disagree with this statement: "I personally would be happy to eat genetically modified food"? Just read out the answer that best applies.

	% 1996	% 1998	% CHANGE 96-98
A - Strongly agree	5	5	0
B - Tend to agree	22	21	-1
C - Neither agree nor disagree	17	10	-7
D - Tend to disagree	23	24	+1
E - Strongly disagree	30	37	+7
Don't know	2	3	+1
AGREE	28	26	-2
DISAGREE	53	61	+8

Q3. Last November, the French Government announced a ban on the growing of genetically-engineered crops in France until there has been public debate on whether they are safe and whether there is public support for genetically-engineered foods. At present, there is no such ban on the growing of genetically-engineered foods in this country. To what extent do you agree or disagree that the British Government should announce a similar ban on the growing of genetically-engineered foods in Britain until their impact has been more fully assessed? Just read out the letter that best applies.

	%
A - Strongly agree	51
B - Tend to agree	26
C - Neither agree nor disagree	9
D - Tend to disagree	9
E - Strongly disagree	2
Don't know/can't say	3
AGREE	77
DISAGREE	11

Q4. If genetically-modified plants (such as oilseed rape and sugar beet) come into contact with natural, but related plants in the wild, it is possible for them to breed, transferring the genetically-modified material into the wild. How concerned are you, if at all, that genetically-modified plants may come to breed with wild, natural plants in this way? Just read out the letter that best applies.

	%
A - Very concerned	38
B - Fairly concerned	35
C - Not very concerned	14
D - Not at all concerned	6
Don't know/can't say	7
CONCERNED	73
NOT CONCERNED	20

5.5. ACGM Report, 'Risk Communication and Public Perception'

ACGM/971P19

HEALTH AND SAFETY COMMISSION - ADVISORY COMMITTEE ON GENETIC MODIFICATION

2 October 1997

Risk Communication and Public Perception

Introduction

1. The aim of this paper is to suggest how ACGM's work on risk communication and public perception might be advanced on the basis of the conclusions reached at its last meeting.

2. Paper ACGM/97/P6 was designed primarily to stimulate thought about the fundamental issue of how risk is perceived by the public and how regulatory bodies should communicate information about risk. Some recent thinking on these issues, both in relation to risk generally and in relation to biotechnology specifically, was reviewed.

3. Attention was drawn to the views of Prof. Peter Sandman, in particular his identification of the public response to risk as something determined by objective information about the nature of the hazard and the likelihood of its realisation which is then amplified (or even diminished) by one or more 'outrage' factors, e.g. whether exposure to the hazard is involuntary, the familiarity of the hazard, whether the hazard is acutely catastrophic or chronic, scientific uncertainty. According to Sandman's model, the basis of risk communication should be an analysis of the 'outrage' factors, so that communication the actual sources of concern about a risk are addressed.

4. ACGM broadly agreed with this analysis, but recognised the acute difficulties in applying it to public concerns about biotechnology. A fundamental problem is the non-homogeneity of the public. Different groups of people, even different individuals, may be motivated by quite different combinations of outrage factors in relation to a specific hazard. When risk is being communicated in person to a small audience with whom there is dialogue and interaction, it may be possible to tailor messages to different individuals or groups; for wider, less personal communication, however, risk communicators have to make informed assumptions about the range of outrage factors which must be

addressed.

5. Assumptions may be better informed if risk communicators understand more about the mechanics of risk perception. ACOM recognised the continuing value of research in this area but felt that it lacked the expertise to initiate and supervise such research itself. This was an area, however, in which the Interdepartmental Liaison Group on Risk Assessment (ILGRA) was already active; AEA Technology had been commissioned in February to explore a wide range of risk communication scenarios with a view to developing a set of principles for government departments to use in improving their risk communication. ILGRA appeared the appropriate forum for pursuing the fundamental questions about public perception and risk communication. ACGM, however, and the other advisory committees concerned with biotechnology, had an interest in feeding into ILGRA their particular experience of risk communication.

6. Among the 'outrage' factors identified by Sandman and others are openness and responsiveness: regulatory bodies and industry may be viewed with suspicion because their decision-making is seen as secretive or otherwise inaccessible, and they appear unwilling to engage in public debate and to take seriously the views of the public. This seems particularly relevant to biotechnology; the National Biotechnology Conference in March identified public demand for, inter alia, transparency and openness in the regulatory system, and opportunities for the public to participate in decision-making. There was also scepticism about the independence of advisory committees; this was connected with negative perceptions about meetings held in private, the confidentiality of papers and records of meetings, and absence of 'public' representatives on committees. Since ACGM's last meeting, a report by the Conference rapporteur, Prof. Richard Macrory of Imperial College, London, has been issued. This is

attached at Annex I for members' information; members are also invited to comment on the key issues and recommendations, particularly those under the headings of 'National regulatory committees' and 'Wider issues of principle'.

[Annex I is withheld under Exemption 10 of the Code of Practice on Access to Government Information]

Disclosure of ACGM agendas and papers

7. In response to some of the concerns expressed at the National Biotechnology Conference, ACGM agreed that, subject to the HSC's consent, its agendas should be put on the Internet and that papers should be made available to members of the public on request. The HSC has now decided that all advisory committees - and the HSC itself - should adopt this approach. ACGM's 40th meeting is the first at which the new arrangements are being applied.

8. Agendas will be placed on the Internet at about the same time as they are sent to members and will remain there for three months, or until the next meeting's agenda is available. The website will be headed by a brief description of ACGM's (and the sub-committee's) function and the contact address of the Secretariat from whom papers may be requested. It is intended that all agenda items should appear on the Internet, but there is provision for items to be removed where the agenda item itself contains information protected by section 28 of the Health and Safety at Work etc. Act 1974, exceptions in the Environmental Information Regulations 1992, or exemptions in the Code of Practice on Access to Government Information.

9. Papers are subject to disclosure under the Code, and the HSC will consider in the autumn a common policy for disclosure. In the meantime, the Secretariat will apply its own disclosure markings to papers. These are explained fully at Annex II. The intention is to ensure that as much information as possible may be disclosed; hence the marking, 'MAY BE DISCLOSED IN PART', to avoid whole papers being withheld on account of certain sections being confidential. The guidance at Annex II also draws the important distinction between fully open disclosure and the limited,

discretionary disclosure permitted to members for purposes of consultation. Members are invited to comment on the markings.

10. Minutes of meetings will be among the papers which may be requested. The disclosure markings for papers discussed at meetings will obviously have implications for disclosure of sections of the minutes.

'Public interest' representation on ACGM

11. The issue of 'public interest' representatives on advisory committees is one which the HSC considered when it was reviewing the role and structure of advisory committees last year (see ACGM 971 P7). Although no rigid requirement was introduced, the general feeling of the HSC was that advisory committees should consider whether and how the public interest should be represented when reviewing membership. It was recognised that there are formidable difficulties in identifying people who are truly representative and who are willing and able to serve on committees. Since 1987, Mr Colin Franks has sat on ACGM as a representative of local authorities' interests and as an informed non-expert. In fact, as local authorities have no direct remit in GM matters, they may be seen as representative of wider public interest.

A Way Forward

12. It is clear that the fundamental questions of how risk is perceived and how understanding of such perception should inform communication are not ones to which ACGM is qualified to find answers. As suggested at the last meeting, ILGRA is the obvious government forum within which they should be pursued. ACGM, however, should continue to develop its awareness of these questions and of the continuing efforts to tackle them. As well as keeping members abreast of ILGRA's work in this area, the Secretariat can draw members attention to any other papers or events of particular interest.

13. ACGM has a role in bringing its members' own experience of risk communication to the attention of ILGRA. There may also be value in sharing experience with other biotechnology advisory committees, e.g. ACRE, ACNFP and GTAC, so that common factors can be identified. It is suggested that IGGMOT may be

able to facilitate this as it already comprises representatives of the Secretariats to most relevant committees. Members are also invited to consider the merits of bringing together members of the various committees to discuss common factors. In this connection, it should be noted that the Green Alliance is organising a seminar on 10 November to discuss the transparency and openness of the biotechnology advisory committees.

14. ACGM needs to consider what further action it could take to address the specific issue of its own transparency and openness. It must be emphasised, however, that ACGM cannot take any decisions unilaterally; any initiatives would have to be approved by the HSC which will judge them partly in terms of their implications for other advisory committees. Final decisions would also be subject to careful consideration of resource implications. All these considerations must be set on the context of the Government's commitment to greater openness and public access to information; a White Paper on future Freedom of Information legislation is expected in December.

15. Members are also invited to consider whether more should be done to improve the transparency and accessibility of the decision-making processes central to the regulation of contained use of GMOs. This is discussed further in paragraphs 30 to 35.

16. In summary, therefore, it is proposed that ACGM concentrate on those issues more immediately within its scope, viz exploring the transparency of its own procedures and of the regulatory system on which it advises. In so doing, it will be addressing one significant 'outrage' factor in public perception on which there appears to be substantial consensus between academic risk communication experts. At the same time as pursuing this more focused agenda, it should continue to keep in view the broader questions and contribute, as necessary, to the deliberations of ILGRA.

Openness/Transparency

17. Members are invited to consider whether there are further ways in which (subject to the HSC's agreement) ACGM could be made more open to the public. As generally felt at the last meeting, ACGM is probably less subject to

public interest than some other advisory committees. That, however, could change. Issues such as waste from contained use facilities and the containment of viruses may well arouse public concern and closer scrutiny of the regulatory and advisory framework; the Secretariat has already noticed a significant increase in the volume of Parliamentary questions and Ministerial correspondence over the last few months. There is also the question of whether spontaneous efforts to be more accessible have a positive impact on public trust and confidence which is quite independent of active interest in exploiting that accessibility. Is there a rationality in people strongly favouring a more open committee without themselves having any wish to attend its meetings or read its papers?

18. The actions already being undertaken, i.e. placing agendas on the Internet and making papers available, are a significant development. The Secretariat will monitor the numbers accessing the relevant website and consequent requests for papers or other information. Is it possible, however, that the Internet itself may be perceived as a barrier by some interested sections of the public? Should more thought be given to the need for 'low-tech' dissemination of information? It may be that there is a correlation between antipathy (or lack of access to) information technology and a tendency to distrust biotechnology and other 'new' technologies.

19. As well as monitoring the extent of interest in ACGM's business, it would also be instructive to gauge whether those requesting papers - or simply referring to agendas - find them comprehensible and reassuring. This raises some awkward questions - and perhaps points up a distinction between openness and transparency. On the one hand, the essential purpose of papers is to inform and elicit advice from members of the Committee who are necessarily people with an atypical degree of background knowledge and technical expertise. That essential purpose may not be easily reconciled with an objective of making papers easier for lay readers to understand. On the other hand, is the comprehensibility of papers a serious issue? A proportion of those taking advantage of the new accessibility arrangements may well be scientists or others from public interest groups with enough technical literacy to understand papers as

written for ACGM members. Also, how dependent is reassurance upon comprehension? Rational judgements that ACGM is equipped to consider the issues within its remit may be based upon the style and degree of detail in papers rather than on understanding of their content. Perhaps attempts to simplify the presentation of such issues for the benefit of an uninformed public would be self-defeating and compromise ACGM's credibility. The public may well accept that experts in a specialised field, when speaking to one another, will use data - and a whole technical vocabulary - incomprehensible to the uninitiated. Reassurance may lie simply in observing a rigorously challenging application of expert knowledge to complex questions.

20. On the same basis, if meetings were to be made accessible to the public, this could have a symbolic value unrelated to the actual level of interest in attending meetings. There was some discussion of this at ACGM's last meeting, but members are invited to explore further the advantages and disadvantages. Again, it must be emphasised that ACGM may not take any decisions in this area independently of HSC and its other advisory committees. The following paragraphs offered some initial ideas to promote discussion.

21. Clearly, ACGM could not be charged with secrecy and inaccessibility if its meetings were open to the public. Open meetings may dispel impressions that the Committee is an uncritical advocate of GM and draw attention to the balance of different views assured by the tripartite structure. Equally, the unsensational nature of much of ACGM's discussion might be reassuring to a public which feels threatened by the pace of change in this area; it could be seen that the Committee is considering safety as opposed to endorsing scientific advances. The presence of an audience might also act as a stimulus to members, helping to maintain a high level of discussion.

22. An audience might equally act as an inhibiting factor, discouraging frank discussion. Members are invited to explore just why this should be. Can a distinction be drawn between the issue of confidentiality for commercial or other reasons and mere reticence born of unfamiliarity with open meetings? Is the latter a barrier which can - and should - be overcome? In the case of the former, the public should not

be permitted to attend the discussion of agenda items directly concerning confidential matters; the Secretariat will already have allocated an appropriate disclosure marking to the papers on question. If members anticipate that they will want to raise confidential material during discussion of 'open' items, they could be given the opportunity of contacting the Secretariat in advance. Members are invited to consider how likely or necessary this would be.

23. The preceding two paragraphs are based on an assumption that the public might be present as a passive audience. Consideration should also be given to the advantages and disadvantages of interaction between the Committee and the public at meetings. Again the advantages seem obvious; ACGM could be presented as not only open but also responsive to the public; it would answer calls for clarification and even address concerns raised by the public rather than conducting its deliberations solely on its own and the Secretariat's terms.

24. Viewed from another perspective, however, these very advantages could be drawbacks. If meetings were dominated by interaction with a public audience, ACGM's essential function could soon be subverted. HSC committees, with their tripartite structure, are designed to be representative of certain interests and to provide a source of independent specialist advice - which is not the same as public opinion. There is also the fundamental difficulty of identifying truly representative public opinion; the individuals attending and participating in more open ACGM meetings may actually represent little more than their own interests.

25. Consideration should, however, be given to the value of inviting to meetings those who contact HSE or Ministers with particular concerns, especially where they indicate some knowledge of ACGM and interest in its judgements. Such people may be few in numbers but well connected with public interest groups and in a position to generate positive or negative messages about ACGM. Allowing them the opportunity to listen to - and participate in - discussion of their concerns could effectively address those concerns, especially when they are focused on the way in which decisions are taken (or advice formulated) rather than the content of specific decisions or advice. It may also serve simply to clarify concerns and dispel

misunderstandings.

26. There may also be merit in considering special 'open' meetings of ACGM whose function would be to give the public an opportunity to draw their concerns to the Committee's attention. ACGM would be there to assimilate and comment on those concerns, rather than to fulfil its usual role of advising HSC/E. Agendas could be tailored to a public audience - and even be compiled on the basis of suggestions tabled in advance by those interested in attending. It would be important to make the status of such meetings absolutely clear, so that they are not perceived as attempts to patronise - or even hoodwink - the public.

27. In this connection, the point made about papers in paragraph 13 may be relevant to public attendance at regular meetings. Would people want to be reassured that they were observing real' meetings whose content they may not fully understand? Would they be suspicious of a meeting in which discussion was simplified for the sake of accessibility to lay observers, and dismiss it as a public relations gimmick?

28. The distinction between openness in terms simply of allowing the public to observe meetings, and public participation in meetings is crucial. In pursuing its work on openness and transparency, ACGM should not be challenging its own constitution and purpose as representative of certain defined interests and source of independent specialist advice. Even if active participation of the public were permitted, ACGM would have to separate public views and opinions from its own advice. Such views and opinions may be taken onto account by the Committee as it develops that advice, but ACGM should not be an neutral channel of public opinion. Again, the issue of representative public opinion has to be emphasised. Taking forward the issue raised in paragraph 9 above, members may wish to consider whether there ought to be an increase in 'public' representation on ACGM.

29. Members are invited to consider the questions raised in paragraphs 17 to 28 and to offer views on:

whether the Internet is sufficiently accessible to all who may have interests/concerns about ACGM's activities;
the extent to which reassurance may be based

on openness as distinct from transparency, i.e. seeing what is happening rather than fully understanding all of it;
whether there should be an expansion in 'public' representation on ACGM;
the pros and cons of admitting members of the public to meetings, including:
inviting individuals who have raised particular concerns; passive attendance vs. active participation;
special 'open' meetings.

Transparency of the decision-making process for approval of GM activities

30. Public concern may sometimes focus on particular activities and on the robustness of the critical process leading to decisions on approval. There is some evidence that the public, including those with a high degree of technical understanding, are often uncomfortable with the concept of case-by-case expert judgement which underpins so much of that process. This can be seen as a worrying lack of transparency; what is wanted is an unlocking of the 'black boxes' in which much of the decision-making seems to take place. Can we show just what 'expert judgement' means? What are the criteria that inform that judgement?

31. It may be argued that expert judgement is concerned largely with the handling of uncertainty which cannot be accommodated in a neatly schematised decision process. The public's counter-argument may be that experts should be able to demonstrate how the limits of uncertainty are defined from case to case; otherwise, what assurances does the public have that decisions are not based on caprice - or hidden considerations of ethics or costs and benefits?

32. For risk assessment of contained use activities, it should be fairly easy to present the hazard identification stage (in relation to human health) as a logical, even mechanical, process. Even here, however, judgements have to be made of likelihood, e.g. of persistence or survival when determining access factors, or of biological activity when determining damage factors. This element of uncertainty, to be resolved by the application of expert judgement, increases at the other stages of the risk assessment and for environmental hazard identification.

33. The proposed challenge, therefore, is to develop a guide, possibly in the form of a decision tree, which could be used to demonstrate to a concerned - or merely curious - audience how notifications under the Contained Use Regulations are scrutinised. Undoubtedly, this would be an extremely demanding task, especially if the proposed guide were to be cast in a form comprehensible to those with no technical background. HSE would also need to be confident that the substantial investment of resources required was justified. Members are asked to consider especially the extent of the demand for the proposed guide, and how it might be gauged.

34. Such work would fall primarily to HSE, but the assistance of ACGM and the Technical Sub-Committee would be extremely valuable. A necessary condition of the proposed guide would be a rigorous analysis of current decision-making procedures, particularly to isolate the content of expert judgement and to test its defensibility; the Sub-Committee may be able to assist in this. ACGM itself may be able to advise on more presentational issues, helping to identify the style and content appropriate to expected audiences. Indeed an crucial part of the exercise would be identifying the sorts of audience whose concerns would be addressed by the proposed guide.

35. Consideration should also be given to the current arrangements for making information on notifications available to the public. Would perceptions of openness - and confidence in the regulatory system - be enhanced if the public register held information on notified activities (rather than the minority of activities for which consents are granted) and details of HSE's judgements (and, if applicable, the advice of ACGM's Technical Sub-committee)? It may be instructive to consider experience under the Deliberate Release Regulations; complete applications together with ACRE's advice are included on a public register.

36. Members are invited to consider the ideas in paragraphs 30 to 35 and to offer views on:
 whether a fully transparent guide to the decision-making process for approval of contained use activities would be effective in addressing public concerns;
 whether it would be possible to 'open up' the element of expert judgement;

the sorts of audience for which such a guide should be designed;
 what should be included on the public register of notifications.

Non-safety considerations in decision-making

37. At the National Biotechnology Conference, there were recommendations that the remit of advisory committees be widened so that they might consider the justification for proposals brought before them. This reflected other indications that some sections of the public explicitly wish ethical implications, costs and benefits to be considered when regulatory decisions are being made. Indeed, if we return to the analysis of risk perception in terms of outrage factors, we are reminded of the extent to which judgements of risk may be bound up with non-safety considerations.

38. A distinction must be drawn between purely ethical concerns ('GM is immoral because it's about playing God with nature') and the cloaking of safety concerns in language expressive of fundamental ethical concern ('GM is unnatural and wrong because the consequences for the environment of tampering with genetic material are unknown'). In the latter case, efforts to improve openness and transparency may help to demonstrate how a concern expressed in terms of ethics is, at root, a safety concern which can be addressed in terms of safety. Where, however, concerns ~ based on questions of fundamental ethics, to argue in terms of safety is to miss the point.

39. The Contained Use Regulations do not provide for non-safety considerations to be taken into account when evaluating notifications. It would also appear that the introduction of such a dimension into decision-making - if it were a realistic possibility - would have to apply across the regulatory framework for GM. ACGM is, however, invited to consider what such considerations might be - or how to set about determining them - and how they might be included in the decision-making process; this consideration should be based on the hypothesis that existing regulatory constraints do not apply. What ~ the ethical considerations, distinct from those which can be analysed in safety terms, on which there is broad public consensus? If cost(benefit considerations were

to be taken into account, how might benefits be characterised? Would public concerns be addressed by consideration of the economic benefits attached to GM activities in terms of wealth or jobs created? Or would only 'pure' benefits count, e.g. increase in scientific knowledge, medical advances, developments targeted at increasing crop yield and preventing famine in the Third World?

Broader issues of public perception and risk communication

40. As explained in paragraph 12, the Secretariat will continue to draw to members' attention papers relevant to the broader issues underlying ACGM's activities in this area.

41. Attached at Annex III is a paper by Dr Peter Bennett of the Department of Health (DH). This draws on the Department's experience of risk communication and on various published material, including some which was the basis of ACGM/97/P6. Its aim is to help identify issues likely to raise communication challenges whilst providing general guidance about risk communication strategies. It also suggests sources of further assistance and analysis.

[Annex III is withheld under Exemption 2 of the Code of Practice on Access to Government Information.]

42. The paper is commended to members as an accessible review of current thinking which serves as a useful reminder that successful communication is an interactive process, and that there is a fine balance to be struck in avoiding unwarranted attempts to impose a view while still doing justice to available scientific evidence. Although the paper attempts to

schematise the risk communication process (see section 4), it still recognises that the social response to an incident is an unpredictable variable. In other words, no matter how well something is technically communicated, there is still ample room for a different interpretation from that which was intended.

43. As mentioned in paragraph 5, HSE, on behalf of ILGRA, has commissioned research by AEA Technology with a view to developing principles for effective risk communication, and to advise on how best practice could be developed and implemented across Government.

44. Phase One of the study was to gather information on risk perception and communication from a variety of sources, in order to prepare a draft set of principles for good risk communication. Phase Two will involve case studies to test and develop generic principles and specific guidance and to find ways of disseminating best practice. Although Phase One has been completed, no report can be released until Phase Two has also been completed. In the meantime, the author, Tony Taig, is willing to give a presentation on risk communication to ACGM. Members may wish to consider whether this would be of interest at ACGM's next meeting.

ACTION

45. Members are invited to consider this paper, including the attached annexes, and to offer views on the questions raised in paragraphs 6, 29,36,39 and 44.

END

5.6. Genetic Engineering And Food Crops

Overview

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"Genetically modified food is highly controversial, as has been shown by recent examples of genetically modified soya beans and maize. Supporters see it as a way of using scientific advances to develop new foods that could be cheaper than existing ones, while offering the possibility of reduced pesticide use. Opponents see genetically modified food as potentially harmful. If it is not banned, they would at least like it labelled so that consumers can avoid it if they choose"⁴³

This unusually clear statement sums up the present situation with regard to the application of genetic biotechnology to food production. Without entering the ethical arguments about altering nature and playing god, it is clear that the relatively new and powerful science of genetic engineering has raised issues about acceptable boundaries and potential outcomes of its application.

The medical use of genetic engineering to produce therapeutic agents and to augment non-germline DNA (non-inheritable genes), under contained conditions has the potential to ease the suffering of many people and potentially to cure many life threatening conditions. However the use of genetic engineering to create modified organisms that are intended for release into the general environment is quite different. In the case of genetically modified foodstuffs, the justification has more to do with increased profits than the aim of increased yield and altruistically feeding the third world.

The Science

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Genetic engineering is a developing part of the field of biotechnology. Biotechnology can be defined as the manipulation of biological materials to produce a defined end product. A good example of biotechnology is the brewing

process. The natural metabolic processes of yeast are harnessed under controlled conditions to provide the end product, ethanol. Brewers have been developing more efficient yeasts over thousands of years by simply selecting and "breeding" the strains that provide the best yield. The essential and critical difference between this 'classical' type of biotechnology and genetic engineering is that genetic engineering is a process whereby the genetic code of the chosen organism is directly modified.

All living things have a genetic code. This code carries the required information for the structure and function of the organism. The code is held in the form of nucleic acid. In most life forms the nucleic acid is DNA (Deoxy-ribo-nucleic acid). This DNA exists in the form of a double stranded helix, the two strands being joined via bonds between complementary nucleotide bases. It is the particular sequence of these bases that holds the genetic code. A gene can be basically described as a sequence of bases that control the formation of a single functional protein. Thus a gene has a defined functional action within the cell. Examples being; structural genes, regulator genes and even temporal genes.

Genetic engineering, in simple terms, is the process whereby the ability to splice sections of DNA from different sources in vitro (outside the organism / in glass) and insert the recombined DNA into a recipient is exploited. Thus a novel single, or set, of genes can be created to produce new synthetic abilities in the recipient cell / organism.

Initially this technology was used to enable the production of single functional proteins (including therapeutic products) in easy to harvest forms. A good example of this is the hepatitis B vaccine produced in yeast. Now it is possible to put the genes for some entire biosynthetic pathways into one sequence of DNA thus multiple step synthesis of complex products can be undertaken in the recipient host.

The Perceived Gains

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The perceived gains arising from the application

⁴³ Genetically Modified Food, Research Paper 97/8, House of Commons Library, 20th Jan 1997.

of genetic engineering to food crop production include increased yields, less pesticide use, novel products with longer shelf lives, 'value added status' etc. There have also been claims that genetic engineering can solve third world food shortage and food quality problems simply by beefing up the protein content and disease resistance of the staple food crop of any specific area.

The wondrous fact is that the potential of genetic engineering technology is almost unlimited. Think of a product and the chances are that either now, or very soon, it could be created for you. If we take the view that "All is for the best in this best of all possible worlds". That the biotechnology companies, regulatory bodies, and governments allow only tested and safe technology to be used for the purely altruistic gain of humanity, then why should we make such a fuss?

The Potential Problems

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The entire argument against the non-contained use of genetic engineering technology is based on three major points all of which can overlap to form a cohesive whole. Firstly, there is the moral and ethical question concerning the very action of altering the nature of living things and from a religious perspective 'playing god'. It is best to consider morals and ethics to be a personal matter for the conscience of the individual. This, however, does not negate the very real importance of such considerations in deciding on your standpoint. To put it in very basic terms, just because we can do something, it doesn't mean that we should.

Secondly, there are lessons to be learned from history when considering the application of new technologies. Radiation science and technology was going to be the great panacea for all the problems of humankind. This of course led to claims of electricity too cheap to meter, the application of the technology to create nuclear weapons and the continuing problems caused by Chernobyl. It must be added that benefits were also created in terms of medical diagnostics and treatment for previously lethal cancers. This, admittedly simplified, history demonstrates that great care must be taken in how we decide to apply the technologies arising from scientific study.

The third issue is in many ways the most important, the need for complete risk analysis before the release of genetically modified organisms (GMOs) into the general biosphere. In some ways it is sadly too late as GMOs have already been released in both research sites and on a commercial basis. In the UK we still have a chance to assess the potential problems before commercial exploitation of plant GMO technology.

The foreseen problems of GMO plant release in the general environment include Health risks from direct exposure to transgenic factors, final products and pesticide residues. Genetic pollution of similar crops, weeds and wild relatives. Herbicide resistance, impact on biodiversity and water pollution⁴⁴. There are of course the unforeseen problems which are impossible to quantify. The following case studies provide examples of unforeseen problems.

Case Studies

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Case Study One: Eosinophilia-Myalgia Syndrome [EMS] and Tryptophan.

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An epidemic of a new disease occurred in 1989. The disease was characterised by raised levels of a white blood cell sub-type (Eosinophilia) and severe muscle pain (Myalgia). Over 1500 people were affected by this disease, with some estimates stating 10 000 cases in the USA⁴⁵. At least 37 deaths have been associated with EMS. Currently many patients are still suffering with chronic manifestations of the disease⁴⁶.

EMS was linked directly to the consumption of dietary supplements of tryptophan. Tryptophan is an essential amino acid (amino acids are sub-units of proteins, essential means one of those eight amino acids that cannot be created by the body). There are few claims that it is important as

⁴⁴ Weed Control on the Farm: Management of GM Herbicide Resistant Crops, Friends of the Earth, 1997.

⁴⁵ Ahmad S.R. Clauw D., 1991, Lancet vol 338, 1512.

⁴⁶ Mayeno A.N. Gleich G.J., 1994, TIBTECH vol 12, 346-352.

a therapeutic agent and it is doubtful that any supplement is needed given the protein rich western diet. It has been suggested that large quantities of tryptophan in any form can be dangerous⁴⁷.

Tryptophan has however been taken to improve depression, PMT and insomnia⁴⁸. Investigation of EMS showed that it was linked to supplements made by one particular company and further, that cases could be linked to the use of one specific strain of GMO bacteria used to produce the Tryptophan⁴⁹. It seems that the disease was due to an, as yet, uncharacterised compound that was not filtered out of the fermentation broth produced by the altered *Bacillus amyloliquefaciens* strain V. It is not yet possible to conclude that the disease causing factor was produced as a by-product of the genetic changes in strain V alone, as changes in the post fermentation processing of the tryptophan were also made during the period in which the contaminated batches were created. However, the fact that the problems were specific to tryptophan produced by only one company (Showa Denko K.K.) would suggest that both the genetic modification and the changes in the post production filtration protocol were causative factors in producing the contaminant.

This case raises two important points. Not only does it highlight that small changes in normal genetic function, in a well understood biosynthetic pathway, can cause a simple product to have unforeseen life threatening properties, but also that, poor manufacturing practice and a need to cut corners to increase profits will increase the dangers associated with the use of modified organisms.

Case Study 2: Brazil Nut Genes In Soya Beans

Attempts to increase the quality of protein in soya beans by genetic engineering led to problems of allergic reactions in people who are sensitive to the added proteins. Soya beans are deficient in the essential amino acid methionine. With the aim of adding value to soya beans an attempt was made by the company Pioneer Hi-Bred to

transfer the Brazil nut genes for the methionine rich protein 2S albumin, in theory (as usual) everything would be fine. Luckily, as it is known that Brazil nuts cause allergic reactions in sensitive people, the resulting transgenic soya beans were tested and found to contain the same allergens as Brazil nuts. Given that such nut allergies can range in severity from mild itching to sudden death, a very important fact was proved:

An allergen from a food known to be allergenic can be transferred in to another food by genetic engineering⁵⁰.

In this case the soya beans were withdrawn. Given the great potential for novel proteins expressed in transgenic foods to be allergenic, we are faced with a terrifying situation of Russian roulette. This is a situation to which the regulatory bodies seem slow to respond. We have every reason to distrust such products, our lives may depend on it. If for no other reason, clear labelling of all products which may contain GM constituents is vital.

The Situation Now

The current situation in the UK and in Europe is one of change. In the UK we are faced with the possibility of the first GM crop being accepted for sale to farmers. The industry hoped that GM oilseed rape would gain seed listing status by the spring of 1998, but planting has been effectively stalled by the Department of the Environment, Transport and Regions (DETR) declaring a long consultation period⁵¹. Seed listing is required for all varieties that are sold as viable seed. The seeds (National lists of varieties) regulations ensure that all seeds of the same variety are sold under the same name, have been correctly tested and are distinct from other varieties. If this herbicide resistant Oilseed rape gains its seed listing it will become the first GM plant crop to be grown commercially in the UK.

The main product of oilseed rape is food grade oil. Oilseed rape is the fourth most common crop grown in the UK. Despite the potential for large

⁴⁷ Ahmad S.R. Clauw D.,1991, Lancet vol 338, 1512.

⁴⁸ Mayeno A.N. Gleich G.J.,1994, TIBTECH vol 12, 346-352.

⁴⁹ Belongia E.A. Hedberg C.W. et al, 1990, N Engl J Med Vol 323, 357-65.

⁵⁰ Nordlee J.A et al, 1996, N Engl J Med Vol 334, 688-92.
Nestle M., 1996, N Engl J Med Vol 334, 726-727.

⁵¹ Guardian, 10 Feb 1998.

scale planting of GM oilseed rape and the common usage of its oil by the food industry, oil produced from GM oilseed rape would not require labelling under current legislation (currently only novel proteins not equivalent to those from normal are required to be labelled)⁵². Apart from being the first potential GM crop for the UK, the proposal of the modified oilseed rape raises many questions about safety and trade problems⁵³. Many of these problems are common to all modified crops, but as the oilseed rape will form a test case for UK acceptance, they are particularly relevant. The proposed oilseed rape variety contains a transgenic gene from a soil bacteria that conveys resistance to the herbicide glufosinate ammonium. This herbicide is non-selective in its action, it is commonly used to clear all vegetation from areas and prior to harvest to remove foliage for easier harvest of crops like potatoes. Glufosinate has toxic effects on humans and animals mainly affecting the nervous system, in addition it is toxic at low concentrations to many aquatic invertebrates.

Currently Glufosinate is not used widely on oilseed rape, however, the ability to remove all weeds from the GM crop without damaging it must lead to its greater use. This increased use is of course the main reason for creating the crop in the first place, with the company producing the herbicide (Hoechst Schering AgroEvo) owning 75% of the shares in the company (Plant Genetic Systems NV) marketing the modified oilseed rape⁵⁴. In addition to increased use of toxic herbicide directly, the possibility of modified oilseed rape spreading into adjacent fields of other crops, means that other herbicides will be required to remove it as a weed.

Cross-breeding of modified oilseed rape with adjoining or even remote wild type (normal) varieties and closely related weed species can lead to possible rapid spread of resistance genes in oilseed rape species and weeds with the resulting potential for the creation of 'superweeds'⁵⁵.

Such superweeds would of course require yet

⁵² ENDS Report, Jan 97, No 264, 42.

⁵³ Diamand E., Nov 97, Friends of the Earth Briefing Sheet.

⁵⁴ Ibid.

⁵⁵ Mikkelsen T.R. et al, 1996, Nature Vol 380, 31. Timmons A.M. et al, 1996, Nature Vol 380, 487. Kling J., 1996, Science Vol 274 (11 Oct), 180-181.

more herbicides to enable their control. If we predict that in the future similar crops resistant to other types of herbicides are produced by various companies, we have the very real potential for the creation of multiple resistant crops and weeds, the logical upshot of this would be plant strains with the potential to out compete many normal plants in both agricultural and natural habitats.

Oilseed rape is generally insect pollinated so there is a risk of genetic contamination of honey and the unknown effects of transgenic DNA reaching the human food chain. Increased use of herbicides on resistant crop filled fields may also adversely effect already threatened field ecosystems leading to the potential demise of the little remaining field biodiversity left by modern farming practices⁵⁶.

It would seem that, yet again, the profits of large multinational companies will come before the needs of society and long-term research into the effects of the general release of GMOs. A typical example of the lobbying going on by companies and nation states is the stance being taken by the USA. High level US officials, including the President and the Secretary of State, have been raising issues of fundamental damage to agricultural trade relations with the EU at recent summit meetings. There were even veiled threats of a trade war, with the US Trade office possibly seeing the slow uptake of products by the EU and its reluctance to take firm decisions on GM products as restraint of trade. The major concern of the US currently is in regard to GM Maize, with US exports of corn and associated products being worth \$1 billion per annum⁵⁷, it is not surprising that a bit of US trade bullying is expected⁵⁸.

The Need For Clear Legislation

The central theme of GE when applied to food products is one of profit for the companies who often produce the very herbicides to which these modified crops are resistant. There is a very real danger that if these crops are farmed

⁵⁶ Diamand E., Nov 97, Friends of the Earth Briefing Sheet.

⁵⁷ Fox J.L., 1998, Nature Biotechnology Vol 16 (Jan), 11.

⁵⁸ ENDS Report, June 1997, No 269, 29.

commercially and their products are not clearly labelled, or worse, mixed with normal products that we will all be part of a vast free experiment on their long term effects. For this reason it is vital that a strong framework of legislative control is created with full regard for the safety of the biosphere and human health.

Various European countries have placed bans on GMO imports or have declared specific control measures on selected products and processes. An interesting example is Austria where politicians are struggling to respond to a massive public vote against genetic engineering last year. The Austrian government published its proposals for solving this problem in December, with the aim of improving public participation in decision making. It also published a new draft law on liability for GMO releases, which would make companies legally responsible for any adverse consequences⁵⁹. Austria has recently received support from Sweden, Denmark, Ireland and France for their ban on the import of GM maize (also banned by Luxembourg). If these countries support Austria or abstain in a vote the EU will not be able to overturn the ban and will be forced to consider the issue⁶⁰.

A survey of 16 000 people across the EC found that 74% believed that modified food should be labelled. That of the organisations they trusted to tell them the truth about GMOs the most popular were environmental bodies, with 26% support, the industry getting only 2% support⁶¹. This survey alone demonstrates the urgent need for real public information and participation in decisions relating to this technology and in consumer choice.

At present no labelling framework exists. The European union is fractured on this issue with a series of semi-definitive labelling ideas being pushed around, any forthright labelling suggestions being watered down to appease the international trade interests⁶². Ireland has recently decided to introduce a voluntary labelling system for GMOs. There are concerns that it may be misleading as no testing of products is foreseen. This could mean that foods which may have GMO products will be labelled as definitely containing these products.

⁵⁹ ENDS Daily, 5 Jan 1998.

⁶⁰ ENDS Daily, 22 Jan 1998.

⁶¹ ENDS Report, June 1997, No 269, 29.

⁶² ENDS Report July 1997, No 270, 43.

Environmental groups call for segregation of GMO and non-GMO crops at source to avoid this problem⁶³.

The British Government has responded to the growing fears of consumers by developing a new consultation initiative to seek people's views on the issues surrounding biological research. This was announced in late November 1997 by John Battle, the Minister for Science, Energy and Industry. The Minister was quoted - "Biotechnology - genetic research - is an area which has potential for substantial growth over the next few years. It has already made a big contribution to healthcare, from antibiotics and vaccines to human insulin and cholesterol test kits. By the year 2000, it is claimed all new pharmaceutical products launched will include some input from biotechnology. As a result, the biotechnology industry is likely to become a major source of new jobs in the next century. "These developments offer hope. But they also raise difficult ethical questions and there is a real fear that technological advances are outstripping our capacity to handle them....I am determined to address those concerns and ensure the people's voice will be heard. "I want to see much more open discussion about these important questions. As a contribution to this, I am today announcing a decision to hold a public consultation exercise on the issues arising from developments in genetic and biological science. I want that consultation to include as broad a range of views as possible. The first stage is to talk to people with experience of holding public consultation exercises of this nature. This process will lead to public events in the summer of 1998. Mr. Battle continued: "At the end of the twentieth century, the pace of change is ever increasing. I want people to be confident in a future that will be different and better. Biotechnology will play an important part in the way we shape the future. I believe that it can offer unparalleled opportunities for improvements in the quality of our lives on this planet. But at the same time, we must protect human rights to ensure that scientific developments prove to be not dehumanising, but life-enhancing⁶⁴.

It is clear from this statement that genetic engineering has the support of the Government. It seems that the true views of the public will be subverted by the government to support a nice

⁶³ ENDS Daily, 15 Jan 1998.

⁶⁴ DTI Press Release P/97/762, 24 November 1997.

thriving industry. We have seen the promise of new technologies turn into Chernobyl and BSE. Do we really want and need a technology that has the potential to change the very fabric of life on earth. If this technology is allowed to be applied to food production we will become the lab rats in a corporate experiment of global proportions. Given the potential for genetic change of the human genome, these companies will literally have sold humanity for the sake of ever greater profits.