



Public Perception and the Socio-economic Integration of Biotechnology*

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Introduction

There is no doubt that biotechnology will have profound and massive effects worldwide through the major agricultural, food, drink and environmental sectors of industry; these effects are likely to be even greater than those of the pharmaceutical and diagnostic products which are now beginning to come to market. Yet, at the same time, the level of general public understanding of biotechnology is low. Indeed, biotechnology appears to be faced with growing apprehension and antagonism. As the UK Advisory Council on Science and Technology's (ACOST) report (1990) on "Developments in Biotechnology" stated, "Public perception, and governmental response, will be of paramount importance in setting a regulatory framework and determining the rate and

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direction of the diffusion of the technology. The power of public feeling must not be underestimated; consumer resistance and fears for safety and pollution, for example, can seriously encumber commercial prospects."

While opinion surveys show that the general public are largely neutral about biotechnology, active environmental and consumer groups have established themselves to oppose its development and to promote their views through the media to the public at large and to government in the manner of specialised political parties. On the other hand, protagonists for biotechnology, whether scientists or industrialists, have been largely silent up to now, believing it better to maintain a low profile and confident that the solution lies in providing more and better public information and education.

A low profile policy, of course, ignores the fact that unopposed arguments tend to be won by default, whatever their actual merit. Belief in the effectiveness of information and education flies in the face of much long standing socio-psychological research which demonstrates that people generally accept, select or reject information on the basis of pre-existing values, opinions, experience, needs, etc. and of the perceived reliability of the source of information. But the biotechnology industry is peopled by academics-turned-entrepreneurs whose experience is based on the premise that understanding engenders enlightenment and that reason leads to rationality. However, the biotechnology industry is largely peopled by academics turned entrepreneurs whose experience is based on the premise that understanding engenders enlightenment and that reason leads to rationality. Not only is the mere provision of information unlikely to have a big effect in changing general adult public attitudes to biotechnology but scientists and industrialists come fairly low in public opinion surveys on the believed reliability of information sources and only a little higher than those usually rated lowest – journalists and politicians! Although, as will be seen later, television and press journalists (and their editors) act as important sources of information for most people.

Educational measures tend to have to await generation change as the children and students of today become the electorate and consumers of tomorrow. Yet there is good evidence that high-quality information and educational materials can inform and reassure the public and encourage open discussion.

The public acceptance of biotechnology is becoming recognised by policy makers as a key strategic determinant of its development. The European Commission's communication to the Council and to the European Parliament in April 1991 entitled "Promoting the Competitive Environment for the Industrial Activities Based on Biotechnology within the Community", for example, pointed out that "*biotechnology suffers from a bad image amongst policy makers and the general public. Although some of the expressed fears seem exaggerated they are, nonetheless, of great political influence. It is imperative therefore that problems of public acceptability, and ethical questions raised, be recognised and dealt with.*"

It is noteworthy, however, that the USA President's Council on Competitiveness "Report on National Biotechnology Policy" with Vice-President Dan Quayle as its chairman made no reference in February 1991 to the importance of and need for public awareness and understanding of biotechnology in a document which sets out USA policy for the next decade.

It is probably inevitable that biotechnology will develop its potential eventually simply as a consequence of the commercial advantage given to the industries based on it. Where they will be located will depend not only on the scientific and industrial base available in different countries but also on the congeniality, or otherwise, of the local climate to development which, in turn, will depend upon the degree to which its successful socio-economic integration is achieved. The key questions, and those with which this article deals, are "What really is the public attitude to biotechnology?", "How is it influenced?" and "What is being or can be done about it?"

Public opinion

A number of opinion polls on public attitudes to biotechnology have been carried out in the UK, Europe and the USA and all provide an image of the public as having mixed, and even contradictory, feelings about biotechnology coupled with low levels of knowledge.

United Kingdom

In the UK during an early MORI* poll in 1985 of 1,824 people, 52% claimed to know the meaning of genetic engineering, 39% of biochemical engineering, 32% of biotechnology, 32% of immunology, 28% of enzyme technology and 22% of in vitro fertilisation. A national survey of a 2,000 sample was conducted for the Department of Trade and Industry in 1988 and similar percentages of people to those in the MORI survey claimed awareness of biotechnology. The DTI survey (Table I) showed that 55% of social classes** A,B and C1 made the claim but only 26% of social classes C2, D and E. 82% of those with degree-level or above education claimed awareness of biotechnology while 44% with A level or below qualifications and 26% of

* MORI = Marketing Opinion Research International

** **Social classes**

A = Professional and senior managerial

B = Middle managers and service-providing professionals

C1 = All other non-manual workers

C2 = Skilled manual workers

D = Semi-skilled and unskilled manual workers

E = Pensioners, unemployed, etc.

TABLE 1
PROFILE OF AWARENESS OF BIOTECHNOLOGY

| AWARE OF BIOTECHNOLOGY | |
|---|-----|
| (Base: 2000 adults) | |
| SEX | |
| Male | 44% |
| Female | 32% |
| AGE | |
| 16-24 | 36% |
| 25-34 | 43% |
| 35-44 | 46% |
| 45-54 | 44% |
| 55+ | 29% |
| SOCIAL CLASS | |
| ABC1 | 55% |
| C2DE | 26% |
| EDUCATION (GENERAL)* | |
| HND & above | 82% |
| 'A' level & below | 44% |
| No qualification | 26% |
| DAILY PAPER READERSHIP (REGULAR)** | |
| Broadsheet | 65% |
| Serious tabloid | 31% |
| Sun/Star/None | 35% |

Source: Department of Trade and Industry (DTI)

* **Qualifications**

HND & above = Degree or higher diploma
'A' level & below = University entrance level & below
No qualification = General school education

** **Newspapers**

Broadsheet = Quality
Serious tabloid = Serious popular
Sun/Star = Mass circulation popular

those with no qualifications did so. 65% of broadsheet "quality" newspaper readers claimed awareness of biotechnology but only 31-35% of readers of other newspapers. Too much weight should not be put upon such figures for it is probable that an unknown but significant number of people responded according to whether they had heard of the terms, rather than actually understood them, or claimed awareness to avoid embarrassment at appearing ignorant.

United States of America

The most comprehensive public opinion research until recently was that conducted in the USA by the Office of Technology Assessment (OTA) and reported in 1987. Genetic engineering was cited as making life better by 66% of people but 52% still thought it likely that genetically engineered products would represent a serious danger although only 12% could cite a specific potential hazard associated with them. On ethical considerations, 68% believed that creating hybrid plants and animals by genetic engineering was not morally wrong while 42% thought that changing the genetic make-up of human cells was wrong but 80% approved of specific medical treatments arising from genetic engineering. The majority of the population were prepared to accept fairly high risks to the environment for the sake of the potential benefits of genetic engineering but 32% were opposed to field testing of genetically engineered organisms in their own community and 20% would not approve of such testing under any circumstances. Only 42% approved of large scale commercial application of genetically engineered organisms. The OTA report concluded that "A relatively widespread general sense that

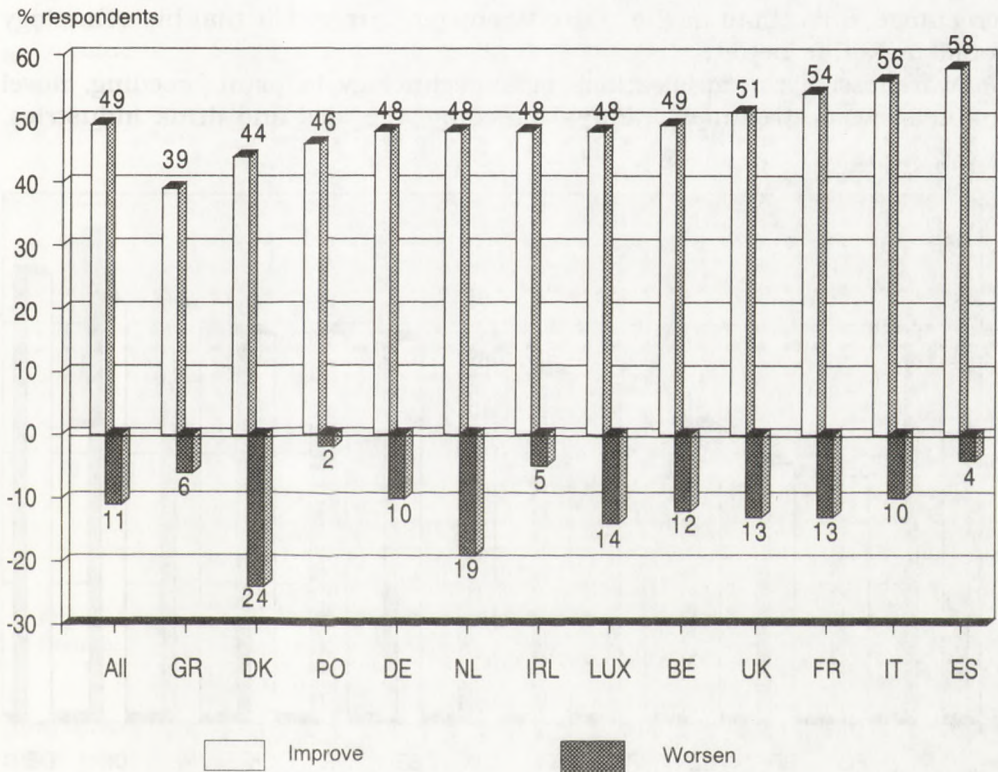


Fig. 1. Effect of biotechnology on "our way of life", by country
Source: Eurobarometer/CUBE, 1991.

a serious danger from genetically engineered products is at least somewhat likely exists in the population, and is independent of education or information about the products."

Europe

The first EC-wide public opinion poll on biotechnology was carried out in March 1991 through the CEC's "Eurobarometer" survey interviewing 12,800 people. Although a large majority thinks new technologies will help to improve their lives, only 49% think biotechnology will do so while 11% think it will "make things worse" (Figure 1). This latter proportion ranges from 2% in Portugal and 4% in Spain to 19% in the Netherlands and 24% in Denmark with the UK intermediate at 13% together with most of the other northern European countries.

Interestingly, precisely the same percentage of respondents, 13%, felt that life would become worse as a consequence of biotechnology in an opinion poll during 1990 which was conducted by Gallup and financed by Eli Lilly in Britain, France, Germany and Italy. However in this survey a higher percentage, 63%, than in the "Eurobarometer" survey felt that biotechnology would make life better.

Awareness of the applications of biotechnology in plant breeding, novel products, waste treatment, animal breeding, the food and drink industries,

Awareness percentage

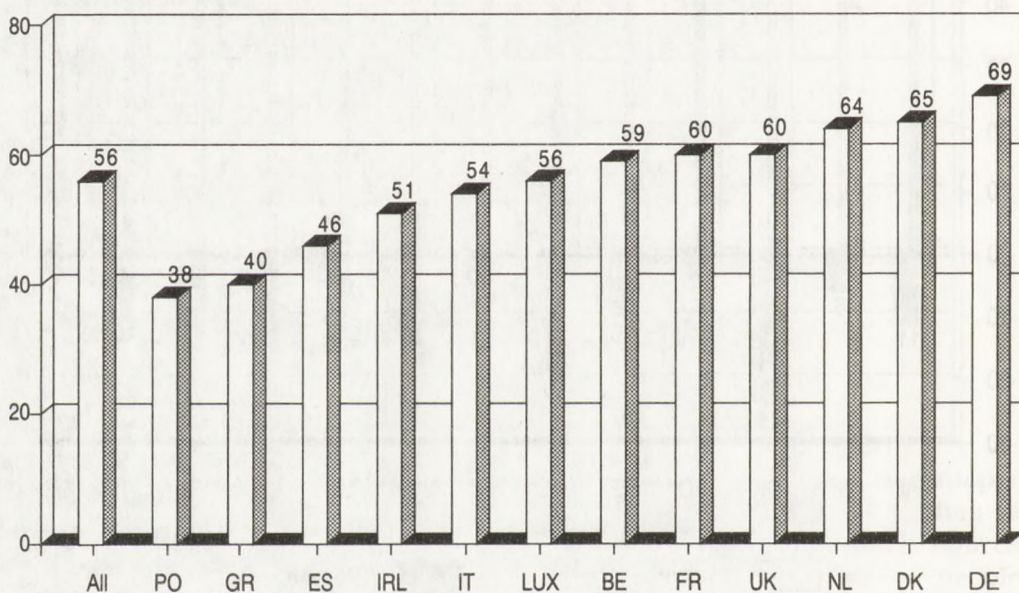


Fig. 2. Awareness of biotechnology applications, by country
Source: Eurobarometer/CUBE, 1991.

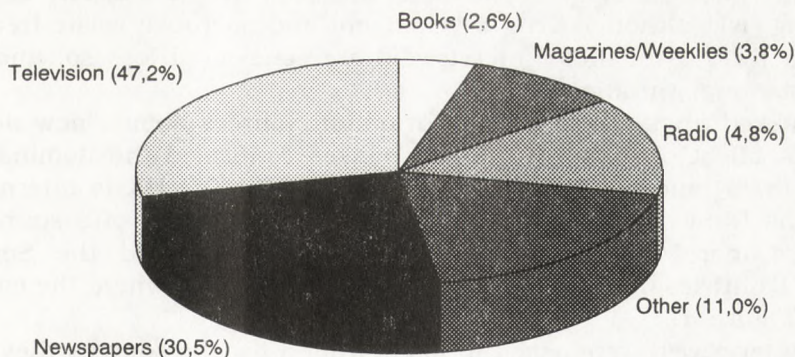


Fig. 3. Main source of information about new developments – Europe
Source: Eurobarometer/CUBE, 1991.

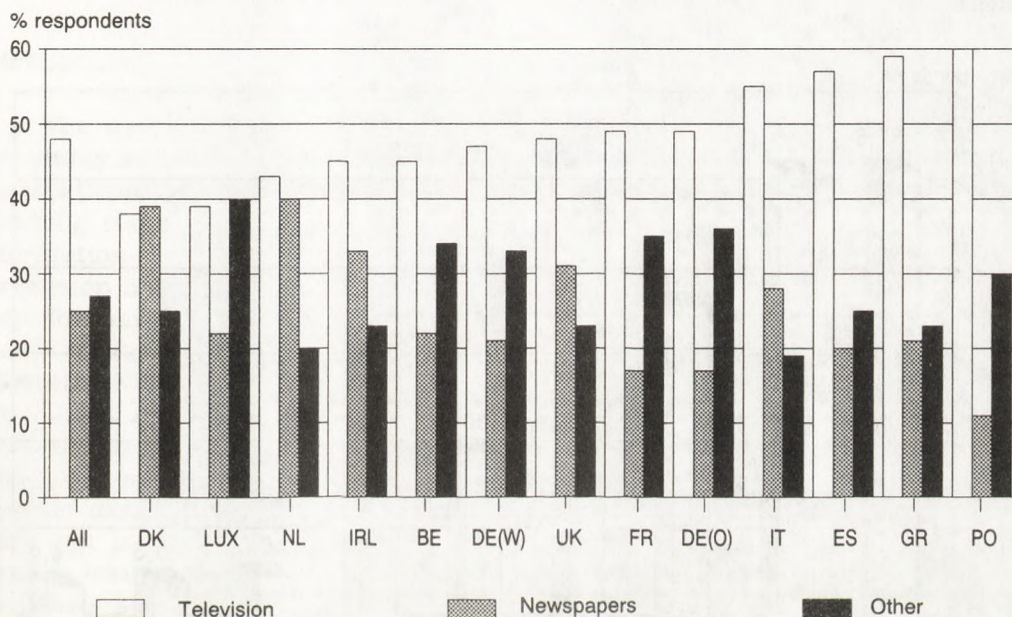


Fig. 4. Main source of information about new developments, by country
Source: Eurobarometer/CUBE, 1991.

pharmaceuticals and gene therapy was measured and the aggregate "awareness percentage" in each of the EC countries is illustrated in Figure 2. These figures summarise sometimes considerable variations between countries with the lowest level of awareness being notably in the applications of biotechnology in food and drink manufacture.

Generally, biotechnology applications are seen by the majority of people as entailing risk, although drug development and microbial waste treatment (both cited by 48% of those interviewed) are considered less so, and there are wide national variations.

When asked about their main information sources about "new developments that affect our way of life", responses confirmed the dominance of television (47%) and newspapers (30%). (Figure 3). The UK is intermediate between the Danes and Dutch for whom television is less of a source and newspapers more than the average across Europe, and the Southern European countries of Italy, Spain, Greece and Portugal, where the converse is found (Figure 4).

Those interviewed were asked to name from a list the sources they would "have confidence in to tell the truth about biotechnology and genetic engineering" (Figure 5). Consumer and environmental organisations together with schools and universities scored the highest in terms of perceived reliability as information sources with industry and political organisations scoring very low.

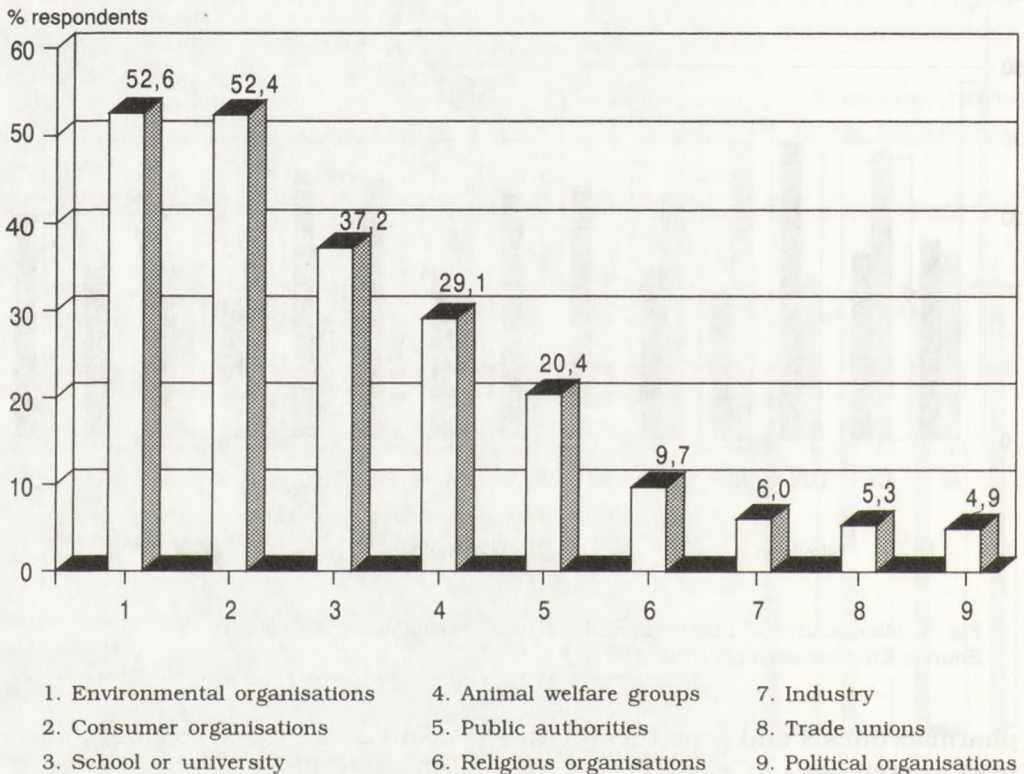


Fig. 5. Perceived reliability of information sources - Europe
Source: Eurobarometer/CUBE, 1991.

Fuller details of the results of the "Eurobarometer" survey are to be published at the end of July 1991 and it is intended to repeat the survey in Spring 1993 to monitor any changes in public attitudes.

The United Kingdom is characterised by having had a much less antagonistic attitude to biotechnology than the USA during the period following the "Berg letter" and moratorium of the early to mid-1970s, and, more recently, than certain European countries such as Germany and Denmark and the European Parliament. (See for example Wolstenholme, 1986). Public understanding and awareness of biotechnology is not high and can be assumed to be overestimated in all of the above surveys. The DTI/MORI 1988 survey demonstrates the high degree to which they correlate with social class, educational level and newspaper readership. By comparison with other European countries, the UK is intermediate on most questions. The national situation in the United Kingdom and six other European countries is summarised with respect to opposition to biotechnology, public relations, legislation and education in Table II.

Influencing public opinion

The use of such terms as "public information" and similar would seem to imply an assumption that there is a direct causal link between information and attitude. This assumption, of course, ignores not only the effect of "noise" during transmission but, much more importantly, that the effect of the information depends both on its content and its selection, interpretation and/or rejection by the recipient. People generally accept, select or reject information on the basis of pre-existing attitudes, beliefs, values, experience, needs, etc and of the believed reliability, or otherwise, of the information source. As Dorothy Nelkin, a leading American science policy analyst, emphasised "*Many scientists still believe that the media are responsible for negative public attitudes towards science, that the tension between science and society reflects the poor public understanding of science, and that an adequately informed public would share the enthusiasm of scientists themselves. Thus, they try through public relations to convince journalists to project a more favourable public image. But this belief over-simplifies the complexities of public attitudes towards science, and underestimates the importance of pre-existing attitudes in shaping readers' interpretation of media images.*"

Nevertheless, sample headlines from recent articles reporting biotechnology breakthroughs show the contrast between the USA and UK, and are very salutary (Table III).

Surveys of the general public's knowledge of science, including biotechnology, characteristically show dismayingly low levels of understanding, at least overall, but deeper investigation presents a slightly differing picture. A UK survey carried out in 1988 (Durant et al) showed, for example, that people were twice as likely to pick the right answer if the question was medical while when faced with a similar metallurgical question were more

TABLE 2
SUMMARY OF NATIONAL SITUATIONS

| | OPPOSITIONS: | PUBLIC RELATIONS: | LEGISLATION: | EDUCATION: |
|------|---|---|---|--|
| BE | One public interest group; no great impact (Vita Vitalis, related to similar Dutch group); farmers' organisation: neutral ("wait and see") | No concerted actions | Re Biosafety recDNA: only for deliberate releases of GMOs? Approval: 11 field tests of transgenic plants; large field trial of rec vaccinia - rabies vaccine | |
| DK | Left political, environmental and consumer organisations; issues: transgenic animals only for improving health, BST rejected | Government (TA, public information), Novo-Nordisk: community information | Gene Law (1986), amended (1989); first transgenic plant trial (1990); work force (trade unions) | Genetic engineering education service for secondary schools (Carlsberg) |
| FR | Not strong; Amis de la Terre ("Green Party") | Programmes: ORGANIBIO, ADEBIO, CHIMIE, ECOLOGIE, French Government (new association - DESCARTES: biotechnology and ethics) | Re Biosafety recDNA: only for R&D; but R&D committees have to be informed | COMETT courses; biotechnology in schools as part of national obligatory curriculum chapters on biotechnology in textbooks on biology |
| D(W) | Green Party fundamentalists, majority of trade unions (except Chemistry Trade Union) | Government, Industry | Gene Law still pending (Summer 1990?); moratorium proposal for deliberate release of GMOs; no licence for rec human insulin factory (HOECHST); first field trial with transgenic plants in 1990 | Biosafety Course System (DECHEMA); programmes, teacher programmes, booklet with transparencies (industry, VCI) |
| NL | Small public interest groups: Young Agrarians, environmentalists, consumers, religious groups; issues: BST, patents on organisms, companies in agro-biotechnology, biotechnology projects in developing countries, deliberate release | Government: NIABA/NBV/Advies Cte Biotech: PR strategy plan 1989; Gist-Brocades; RABO Bank; Biotechnology Forum plan; (NOTA): deliberate release, transgenic animals | recDNA work in General Environmental Safety Law (licences for projects, facilities) | School video course (NIABA/Gist-Brocades/Biology Teachers' Assoc); recDNA GMT video course (also in English) |
| CH | Basler Appell gegen Gentechnologie: biosafety re closed systems and environment | SGCI (standpoints), pharma industry | Re closed/open systems: in preparation | |
| UK | Not strong but increasing: Green Alliance, Patent Concern; issues: biodiversity, bioethics, biotechnology in third world country | Dept Trade & Industry; BioIndustry Association; CIBA Media Resource Service, laymen's publications | Implementation of EC directives on contained use and deliberate of GMOs in Environmental Protection Bill/Act | Biotechnology in schools as a part of national curriculum; National Centre for Biotechnology Education (NCBE); high quality |

TABLE 3
NEWSPAPER AND JOURNAL HEADLINES

Agriculture and Food

The Tomatoes of the Tree
of Knowledge

Economist 14 July 1990

Man-made Yeast Raises
Temperatures

Independent 19 March 1990

Juggling with Nature

Times 29 March 1990

Tomato Castrato

Economist 10 November 1990

Have we the Stomach
for Engineered Food?

New Scientist
3 November 1990

Organic Farm Group
to Rule on Genetics

Daily Telegraph
5 September 1990

Ethics Curbs Threatens
Test Tube Agriculture

Daily Telegraph
29 April 1990

Genetic Engineers Aim
for Apple of their Eye

Independent 16 January 1991

Genetic Cheese

Daily Telegraph
16 January 1991

Gene Transplants

Gene replacement Research
May Lead to New Treatments

Wall Street Journal
22 April 1991

Gene Transplant Therapy
in Girl 'Achieving Success'

Independent
20 February 1991

Committee to Investigate
Ethics of Gene Transplants

Daily Telegraph
20 February

Ethics Chasing Science

Independent 10 May 1991

Life Patents Plan Cast
Scientists in 'Role of God'

Sunday Observer 5 May 1991

Whose Genes Are They,
Anyway?

Independent 6 May 1991

Gene Research Makes Man
out of Mouse

Daily Telegraph 9 May 1991

The Frankenstein Factor

Weekend Guardian
16 March 1991

General

Move to Allay Concern over
Genetic Engineering

Daily Telegraph
3 January 1991

Bioremediation in for the Kill

Financial Times
12 December 1991

Ferment in the Laboratories

Japanese Industry Supplement to
Financial Times
3 December 1991

Safety Fears Could Hit
Biotechnology

Daily Telegraph
27 November 1990

Genetic Control

Daily Telegraph
26 March 1990

Scientists 'May Face Jail
if they Break Genetic
Guidelines'

Independent 24 April 1991

Britain Opts for Secrecy
on Genetic Engineering

New Scientist 17 March 1990

likely to pick the "wrong" answer. When people were asked to rank different scientific disciplines as more or less rigorously scientific, medicine was given a higher "scientific" rating even than physics. Those who did better on their factual knowledge of science were more likely to discriminate between the disciplines of science and the high rating for medicine came predominantly from those whose "understanding" scores were low.

Recent research into public perception of science shows that people are often rather better at assimilating information, or making sense of contradictory information, than surveys suggest but do so when they need information and relate it to their own experience. People may resist scientific explanations

if it is not clear how they can help them or meet their needs or, even more so, if they are ambiguous or contradict personal experience.

Researchers in the public perception of science would agree that attempts to improve access to scientific information are, in principle, highly desirable. The problem lies not with the attempt to "popularise" science, but the way in which it too frequently tends to be done. People do not want to be told a collection of abstract facts by experts. Rather, different sections of the public may want different kinds of information, or information made available in different ways, to make their own use, or interpretation, of it. Pressure groups and self-help groups already often do this quite effectively.

The challenge for scientists wishing to explain their science to the general public is to learn to understand the public or, rather, the many publics. The key is convincing people in their own language that they want to know: capitalists are influenced by capital gain, politicians by political gain and individuals by individual gain. Improving the general level of understanding of biotechnology, and hence its socio-economic integration, can only be achieved by providing what people want to know and in the context in which they want to know it.

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Sources of further information

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