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**Public Understanding of Science –  
Perceptions of and Attitudes towards  
Biotechnology in Denmark**



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# **Public Understanding of Science - Perceptions of and Attitudes towards Biotechnology in Denmark<sup>1</sup>**

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# 1 Introduction

This paper presents the results from a large-scale survey, conducted at the end of 2000, on perceptions of and attitudes towards biotechnology within the Danish population. It examines the Danes' over-all interest in science and research; their interest in and perceptions of biotechnology; and their attitudes towards this particular area of research. The paper examines the impact of social determinants on perceptions and attitudes regarding biotechnology and discusses the methodological problems connected to measuring perceptions of biotechnology.

In order to contextualize the results of the survey, it is relevant to start off with a brief description of the public policies concerning biotechnology in Denmark and the different formalized levels of public involvement in the debate concerning biotechnology. Previous Danish research on public understanding of biotechnology is also presented.

## 1.1 Public policies concerning biotechnology

Up until the 1980s, there was little political awareness of and relatively few policies concerning biotechnology. In 1976 the Registration Committee concerning Genetic Engineering (RUGE) was founded, aiming at assessing international development and the need for domestic regulation in this policy area, but in general political interest and initiatives were limited.

In 1986 the Gene Technology Act was adopted by the Danish parliament as a consequence of developments in the industrial sector, where two medical companies had announced their plans for using GMOs in the production of insulin and human growth hormone. Denmark became the first country to adopt a specific act to regulate biotech R&D. The act placed a ban on deliberate release, with the modification that the ban under extraordinary circumstances could be bypassed by the Minister of the Environment. In 1991 two EEC directives on contained use and deliberate release were implemented in Danish legislation, which led to a new act and an annulment of the ban<sup>2</sup>.

Alongside the policies regulating the application of biotechnology, initiatives were taken to stimulate further research on the issue. The first government biotech R&D programme (BIOTEK) was initiated in 1987, with a total frame of 475 million DKR (64 million EUR). The programme aimed at stimulating basic research as well as applied research. The end of 1980s was marked by an explicit concern to assess the potentials of biotechnology in relation to industrial utilization and societal benefits, and it was a period of new companies entering the scene of industrial application of biotechnology.

Biotechnology has remained a high priority area in Danish research policy since the middle of the 1980s. The BIOTEK programme was followed by BIOTEK II with a total frame of 456 million DKR (61 million EUR) for the period between 1991 and 1995. In the second half of the 1990s, biotech R&D has figured among the yearly government research priorities (forskningspakker), in 1998 with particular focus on potential progress

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<sup>2</sup> Jelsøe, E. et al. 1998. Denmark. in J. Durant et al. *Biotechnology in the public sphere - A European sourcebook*. Science Museum.

in health care on the basis of biotech R&D<sup>3</sup>. A budget of 470 million DKR (63 million EUR) has been provided for the period between 2000 and 2005 in order to establish an innovation centre in biotechnology. The biotech centre project builds on close cooperation between existing research units at different institutions and integrates relevant societal institutions and companies in coordination and research activities.

The Government formulated in 1998 a detail-strategy on biotech R&D. The strategy accentuates the need to inform the public about advances in research in and application of biotechnology, since the consequences of R&D developments in biotech are far-reaching and concern the entire population. The national strategy suggests that research in both ethics and environmental and health risks should be stimulated in this respect. Regarding the subject of this paper, it is relevant to mention that the below definition of biotechnology employed by the Danish Government is referred to as in accordance with the definition suggested by The European Federation of Biotechnology.

**Biotechnology is the integration of natural sciences and engineering sciences in order to develop and produce organisms, cells, and molecular analogues for the combating of disease, environmental improvement, food production, energy production, and industrial production.**

## 1.2 Biotechnology and the public

In Denmark, several important actors play a role in involving the public in questions concerning the biotechnology sphere in terms of supplying information and creating opportunities for public assessment of developments in biotech R&D.

The Danish Board of Technology - that replaced The Technology Board (1985-1995) - is an independently organized government-initiated institution with the purpose to stimulate public debate about new technologies and advise Parliament on public assessment of different technologies.

The Danish Board of Technology arranges so-called 'consensus conferences' that engage citizens directly in the assessment of different technologies, including modern biotechnology. A group of 12-15 citizens are chosen to examine a specific controversial technological issue that has broader societal consequences. The citizen panel points out important perspectives to discuss, they cross-examine relevant experts in the field, and they then arrive at a consensus position. The outcome of the process is presented to policymakers and the public.

The citizen-based consensus conference is a Danish invention, and it has been adopted by a number of countries as an efficient model of direct public participation in questions concerning the consequences of new technologies in society. Several consensus conferences have been held in Denmark on issues relating to biotechnology. The Danish

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<sup>3</sup> Aagaard, K.. 2000. *Dansk forskningspolitik - Organisation, virkemidler og indsatsområder*. Analyseinstitut for Forskning.

Board of Technology also engages in other activities aimed at informing and involving citizens on technology issues, ranging from perspective workshops and role plays to hearings in parliament and the publication of reports and books on issues of interest to the general public.

Another important institution is The Danish Council of Ethics, created by statute in 1988, with the assignment of advising and informing Parliament and citizens about ethical problems raised by developments within the national health service and the field of biomedicine. The council has published a series of books on ethical dimensions in relation to biotechnology and financially supports public meetings and seminars on ethical aspects of biotechnology.

From the middle of the 1980s the NGO NOAH actively has raised questions concerning the utilisation of GMOs in the production of insulin and human growth hormone. NOAH was the first NGO opposing modern biotechnology, and also important as a source of information on the subject, supplying the public with knowledge about genetic engineering. In a series of publications Noah has described and discussed research in biotechnology and the prospects and applications of industrial products involving GMOs. Other NGOs such as 'Active Consumers' (Danmarks Aktive Forbrugere) and Greenpeace have also since been involved in raising a critical voice on behalf of the general public, not least regarding the perceived health-risks of GM food, and the question of whether or not to label genetically manipulated food products.

The NGOs have contributed to stimulating public debate, as have the media. Examining the intensity and character of media coverage of biotechnology, Jelsøe et al. (1998) conclude that there has been a continuing educational aspect of media coverage through the last decades, even though the proportion of informative articles has declined over the years. Through the 1990s fewer articles dealt with a general questioning of gene technology. Instead, especially at the end of the 1990s, the media engaged in critically discussing specific techniques and achievements that were now reality rather than hypothetical, such as the cloning of Dolly and Monsanto's Roundup-Ready soya.

The over-all impression is that there are relatively good conditions for public involvement in the debate concerning biotechnology in Denmark. There are several institutionalised channels of information from the biotechnology sphere and also a number of channels of influence from citizens towards biotechnology. It must be added that some degree of non-formalized engagement in the debate about biotechnology also appears in Denmark, such as the sudden protest gatherings in connection to the first arrivals of GM foods in Denmark.

The Eurobarometer analysis of European citizens' perceptions of biotechnology indicates that public debate and information flow regarding biotechnology are fairly inclusive in Denmark. The average general knowledge of biotechnology is high in Denmark in comparison with other European countries. In 1996 the average score on the biotech knowledge index of Danish respondents was only surpassed by the Netherlands<sup>4</sup>.

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<sup>4</sup> European Commission. 1997. *The Europeans and modern biotechnology - EB 46.1*. Brussels.

### 1.3 Research projects on public perceptions of biotechnology

Few quantitative studies have been conducted on attitudes towards biotechnology in Denmark. At the end of the 1980s Borre carried out a survey on behalf of The Technology Board in order to assess public attitudes and perceptions on the issue. Borre constructed an additive index building on four questions to measure the degree of support for biotechnology within different segments of the population. Borre concludes that there are significant differences within the Danish population; according to the study men, well-educated, and young people were the most supportive in their attitudes towards modern biotechnology<sup>5</sup>.

Using the exact same questions, the same index of support has been constructed, based on data from the 2000 survey, in order to do time-series analyses on attitudes towards biotechnology. This paper will comment on the development between 1989 and 2000.

At the end of the 1990s a number of surveys was conducted by private research institutes on behalf of either newspapers or labour market organizations. In addition to these quantitative studies a series of qualitative interview-based studies have been performed by publicly financed research centres. Amongst these are the MAPP centre at the Aarhus School of Business that pays particular attention to consumer attitudes towards GM food and the Centre for Bioethics and Risk Assessment in Copenhagen<sup>6</sup>.

From a European perspective, the most interesting prior research results in relation to this paper are those of the Eurobarometer surveys. Four surveys were conducted during the 1990s on the public understanding of biotechnology. In the 2000 survey, a number of questions that appear in the Eurobarometers were included in order to examine developments in public perceptions of biotechnology. In some cases we have chosen to moderately rephrase the questions, and the results are decisively different from the Eurobarometer results. In the following we will substantiate the importance of the questionnaire design in relation to creating valid measurement of public perceptions of biotechnology.

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<sup>5</sup> Borre, O. 1989. *Befolkningens holdning til genteknologi - Diffusion eller mobilisering?*. TeknologiNævnet.

<sup>6</sup> Further information about the MAPP- and BioEthics analyses can be found at <http://www.mapp.hha.dk/> and <http://www.bioethics.kvl.dk/index.htm>.

## 2 Public perceptions of and attitudes towards biotechnology in Denmark

In the following, main results from the 2000 survey on the public understanding of biotechnology in Denmark are presented. The survey population is representative of the Danish population in terms of age, gender, school education, and geographic locality, and encompasses a total of 1398 respondents.

The venture point is a description of the over-all level of interest in research amongst Danish citizens, with special attention to the development in interest over the last decade. Subsequently results are presented with regard to the Danes' perceptions of science and research in general, in order to estimate the relative importance of biotechnology compared to other areas of research.

The main focus is on perceptions of biotechnology in particular. Respondents' perceptions of biotechnology are categorized and the distribution on five main categories is described. We discuss the methodological difficulties implied by measuring perceptions and depict differences between different categories of citizens regarding perceptions of modern biotechnology.

Finally we offer a brief description of expectations and attitudes towards biotechnology amongst Danish citizens.

### 2.1 Interest in research

The interest in research in general has continuously increased over the last decade amongst the Danes. Table 1 shows the distribution of self-reported interest on four categories ranging from 'not at all interested' to 'very interested'. The percentage of respondents declaring themselves 'very' or 'somewhat' interested in research has increased from 51 in 1989 to 75 in 2000.

**Table 1: Self-reported interest in research; per cent**

	1989	1997	2000
Very interested	16	19	24
Somewhat interested	35	38	51
Slightly interested	35	32	21
Not at all interested	13	10	4
Don't know	1	1	0
Total	100	100	100
N	1512	1397	1397

Men and well-educated tend to be more interested in research than other categories of citizens, but analyses of the survey results from 1997 and 2000 reveal a levelling of interest in research between different groups within the population. In 2000 the average

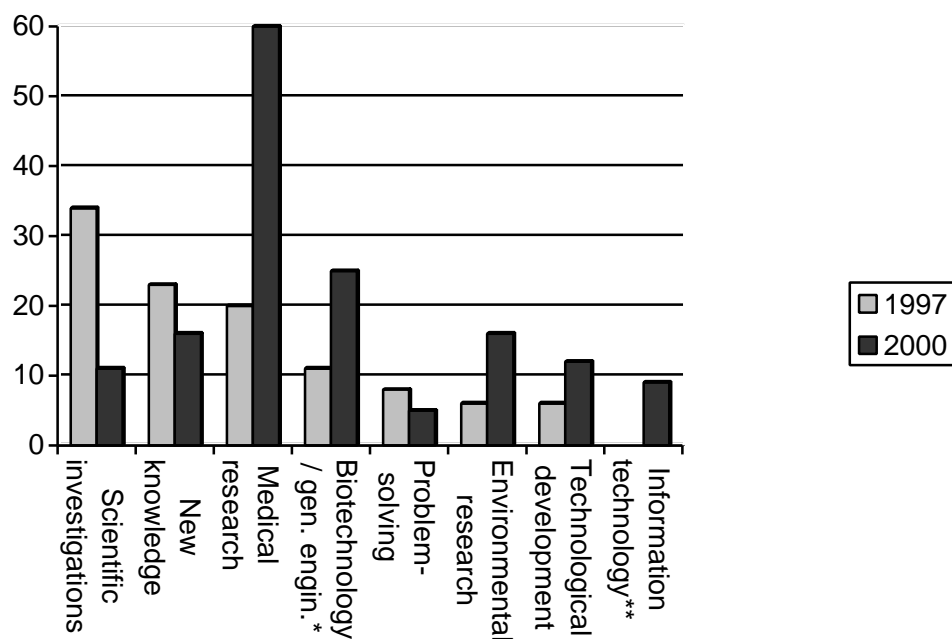
interest in research is relatively high and homogeneous among both women and men, well-educated and less educated, and different age-cohorts<sup>7</sup>.

We consider this relatively high general interest in research to be an important precondition for public involvement in debating research policies and the development of new technologies. As will be illustrated later, the level of interest is significant in explaining both the range of perceptions and the attitudes in relation to research in general and biotechnology in particular. The level of interest in research is traditionally emphasized in quantitative approaches to the Public Understanding of Science.

## 2.2 Perceptions of science and research

When confronted with words such as 'science' and 'research' a range of specific research fields and broader terms come to the mind of Danish citizens. In 1997 there was a tendency to express perceptions in broad terms such as 'scientific investigations' or 'new knowledge', whereas in 2000 a significant share of respondents chooses to express perceptions in connection to research in terms of specific research fields such as 'medical research', 'biotechnology', or 'environmental research'.

**Figure 1: Perceptions of science and research; per cent**



\* In the 2000-survey the categories 'Genetic engineering' and 'Biotechnology' are separate.

\*\* The category 'Information technology' was not included in the 1997-survey.

<sup>7</sup> Siune, K. and N. Mejlgaard. 2001. *Folk og Forskning - opfattelser og holdninger, 1997 - 2000*. Analyseinstitut for Forskning.



Figure 1 shows the distribution of perceptions on a number of categories for 1997 and 2000. It is noticeable that perceptions regarding 'biotechnology' or 'genetic engineering' have increased from 11 to 25 pct. over the three-year period. Unprovoked, 1 out of 4 respondents mentions biotechnology - or a related term - when asked what comes to mind when thinking about science and research in 2000. This is a rather high proportion of respondents, and it brings biotechnology into the second highest position regarding the distribution of perceptions of science and technology. Biotechnology is only outranked by 'medical research' that has a unique position in the minds of the Danish citizens. Medical research is also the research area that the Danes are most interested in and the area that the majority is in favour of prioritising in terms of increasing the public financing of research.

There is a statistically significant correlation between gender, age, and educational background on the one hand and perceptions of science and research within the area of biotechnology on the other. In 2000, women are more likely to think of biotechnology, when asked about perceptions of science and research, than are men. Young people are more likely to mention biotechnology than the elder, and the well-educated mention biotechnology more often than the less educated.

### **2.3 Perceptions of modern biotechnology**

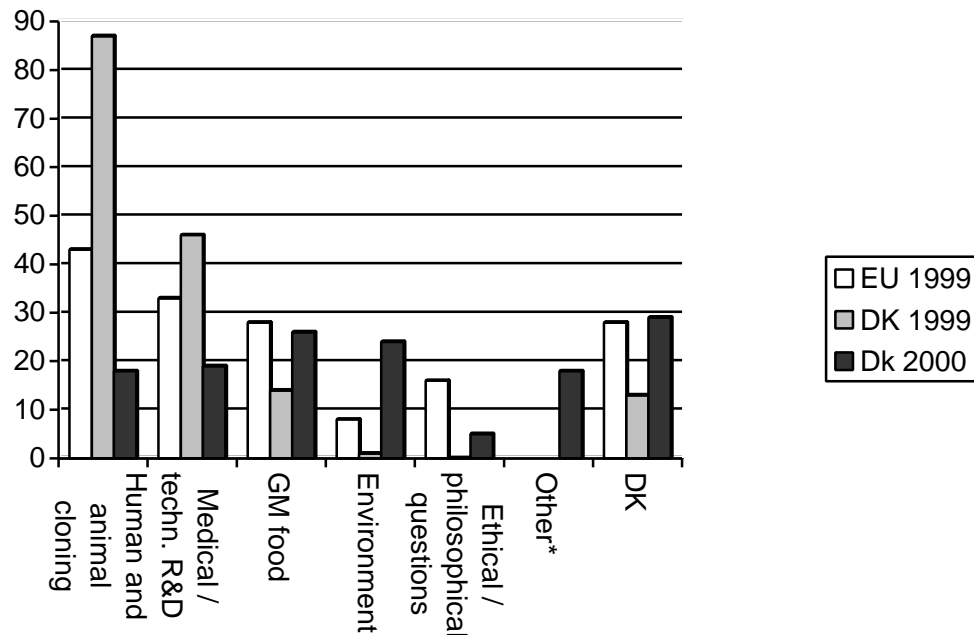
Taking the analyses one step further, we now examine the Danes' perceptions not of science and research in general, but of modern biotechnology in particular<sup>8</sup>. In the 2000 survey we asked respondents to express their immediate thoughts when thinking about modern biotechnology. The answers were distributed according to a preclassification of five categories, originating from the Eurobarometer surveys on biotechnology, and to the extent that answers could not reasonably be fitted into the categories, they were categorized as 'other'. The categories have been applied rather narrowly to respondent answers, resulting in a relatively large proportion of 'other'-answers.

As a general methodological remark, it is surprising that respondent answers have fitted so neatly into five categories in the Eurobarometer surveys. In the 2000 survey even a very inclusive application of the categories would have left a number of answers that in no way fitted into the preclassification. The distribution of answers is shown in figure 2, where the black bars represent the results from the 2000 survey.

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<sup>8</sup> The term 'perceptions' could be used in a broad sense to cover the entire spectre of public interest in, understanding of, thoughts about, and attitudes towards the research area. In this paper the term is used narrowly to describe the immediate thoughts and associations that spring to mind, when a person is confronted with the word 'biotechnology'.

**Figure 2: Perceptions of modern biotechnology; per cent**



\* The category 'other' is not included in the EB-survey.

### Measuring perceptions

In figure 2 the white and grey bars represent results from the Eurobarometer survey 52.1, conducted ultimo 1999 in 15 states. The white bars illustrate the distribution of perceptions in the entire survey population, and the grey bars represent the Danish fragment of the survey population.

Comparing the Danish figures in 1999 and 2000 respectively illuminates remarkable differences. In 1999, 87 pct. of the Danish citizens thought of 'human and animal cloning' when asked about immediate perceptions of biotechnology, whereas the corresponding figure in 2000 is only 18 pct. People who think of 'medical research or scientific progress' are also strongly over represented in 1999 in comparison with 2000, whereas the share of respondent answers in the remaining three categories are higher in 2000 than in 1999. It is equally remarkable that only 13 pct. of respondents have no perceptions of biotechnology in 1999, whereas 29 pct. fit into this category in 2000.

In order to understand this apparently substantial development in perceptions of biotechnology in Denmark, a media surveillance has been performed for both survey periods, covering the time spectre from one month prior to the starting date for data collection up until the end of the survey period. For the Eurobarometer survey in 1999 this period is from October 1 to December 15, and for the 2000 survey the period is between September 9 and December 3. Three newspapers have been selected as indicative of the general topics on the public agenda, and the quantity and the contents

of articles concerning biotechnology have been examined<sup>9</sup>. The amount of articles containing the words 'biotechnology', 'genetic engineering', 'cloning', or a combination of the three words are noted in table 2. Not all of the articles have modern biotechnology as their main subject, but in all articles words relating to biotechnology are used.

**Table 2: Number of articles on biotechnology**

	01.10.99 - 15.12.99	09.09.00 - 03.12.00
Biotechnology	21	39
Genetic engineering	73	30
Cloning	27	19
All words included	108	78

As shown, the total amount of articles with reference to the subject was large in 1999, and this result contributes to understanding the relatively higher proportion of respondents in 1999 having specific perceptions of biotechnology. The fact that only 13 pct. of the respondents have no perception of biotechnology could be explained by the relatively higher density of media coverage in the period prior to and during the data collection. Biotechnology had a relatively higher position on the media's agenda in 1999.

What remains to be examined is the difference in the distribution of perceptions on the five categories between the 1999 survey and the 2000 survey. Concentrating on the category 'human and animal cloning', a closer look on the articles containing the word 'cloning' reveals that respectively 11 articles in 1999 and 10 in 2000 within the period prior to and during the interviewing actually deal with human and animal cloning as the major issue.

There are no severe differences in the contents of the articles that could lead to the conclusion that 'cloning' had a more prominent position on the public agenda in 1999 than in 2000. In both survey-periods a number of articles concerns general ethical questions related to human and animal cloning. In 1999 these articles were inspired by a conference arranged by the Danish Council of Ethics and the University of Copenhagen. In 2000 the articles on general ethical questions emanated from a hearing arranged by the Danish Board of Technology on therapeutic cloning.

In the 'news' category the 1999-articles describe the potential cloning of a mammoth grounded in the discovery - and transporting - of a 23.000 years old well-preserved mammoth in Siberia and the successful cloning of a calf in Texas. In 2000 the articles in the news category describe the proclamation of an American cult that preparations are being made to do reproductive cloning of a human being and an approval by the EGE to do research in stem cells.

Even though the contents of the articles are obviously not the same in the two survey-periods, the content analysis finds no substantial evidence suggesting that cloning as a subject of public concern is of more importance in 1999 than in 2000. In order to explain

<sup>9</sup> The newspapers are Politiken, Information, and JyllandsPosten. The two first mentioned have in earlier studies been chosen as indicative of public debate in relation to political and economic decision-making (Jelsøe et al. 1998).

the fundamental difference between the 1999 survey and the 2000 survey in perceptions tending towards cloning, the focus will thus be shifted towards the exact phrasing of the question posed to respondents in 1999 and 2000 respectively.

In the 2000 survey respondents were asked to answer the following question: *'Please tell me what comes to your mind, when you think of modern biotechnology in a broad sense?'*. In 1999 the exact same words had been used, but subsequently the sentence *'that is including genetic engineering'* had been added. In the Danish edition of the 1999 Eurobarometer-questionnaire used for the Danish segment of respondents, the words 'genetic engineering' were translated into 'gensplejsning' (gene splicing) which is a rather slim expression compared to 'genteknologi' (gene technology), which would have been an alternative Danish translation of 'genetic engineering'.

Taking into account that there was no particular focus on cloning in the media at the time of the 1999 survey, the massive intensity of associations regarding human and animal cloning amongst the Danish segment of respondents suggests that the phrase 'gensplejsning' sets in motion a line of associations in the direction of 'cloning'. In 2000, where respondents were asked of their thoughts regarding biotechnology in general, and the subsequent sentence *'that is including genetic engineering'* was excluded, there was a levelling between the categories of perceptions.

This comparison between the distribution of perceptions in 1999 and 2000 indicates that the way in which perceptions are operationalized is decisive for the result of the inquiry. It is unlikely that 87 pct. of the Danish population - everyone but three persons when excluding the respondents with no perceptions - should conceive of biotechnology in terms of cloning, unless they were exposed to a specific stimulus. It is somewhat more likely that 87 pct. of respondents think of cloning when guided by the word 'gensplejsning', and it must be emphasised that the 1999 survey in fact was measuring perceptions of genetic engineering rather than biotechnology.

Split ballot questions on expectations to biotechnology / genetic engineering respectively in the Eurobarometers through the 1990's are indeed suggestive of the importance of distinguishing between the words 'biotechnology' and 'genetic engineering' and the results presented here underscore the need of linguistic clarification in measuring perceptions.

### **Differences of perceptions within the Danish population**

A number of variables are of relevance in relation to explaining the range and character of perceptions of biotechnology. This section describes the relationship between gender, age, educational background, and general interest in research on the one hand and perceptions of biotechnology on the other hand.

The general interest in research has significant impact on the range of perceptions of biotechnology. Table 3 shows the relationship between the range of perceptions, operationalized as the amount of categories mentioned, and the self-reported interest in research.

**Table 3: Interest in research and range of perceptions of modern biotechnology; per cent**

	Very interested	Somewhat interested	Slightly interested	Not at all interested	Total
0 categories	19	24	45	67	29
1 category	41	43	43	30	42
2 categories or more	40	33	12	3	29
Total	100	100	100	100	100
N	328	706	296	61	1391

It is clearly indicated that the range of perceptions regarding biotechnology increases proportionately with the general interest in research. Amongst the Danes, who consider themselves 'very interested' in research, 40 pct. have perceptions of biotechnology relating to at least two of the six categories, including 'other'. Only three pct. of those 'not at all interested' in research have an equivalent range of perceptions. Oppositely as many as 67 pct. of the Danes, who consider themselves 'not at all interested' in research, have no perceptions of biotechnology, in comparison with only 19 pct. of those, who are 'very interested' in research.

The difference between male and female respondents is marginal. There is a minor tendency towards a stronger emphasis on 'human and animal cloning' amongst women, but the general impression is that there is a relatively homogenous distribution of men and women on the six categories of perceptions. Table 4 shows the relationship between gender and perceptions of biotechnology.

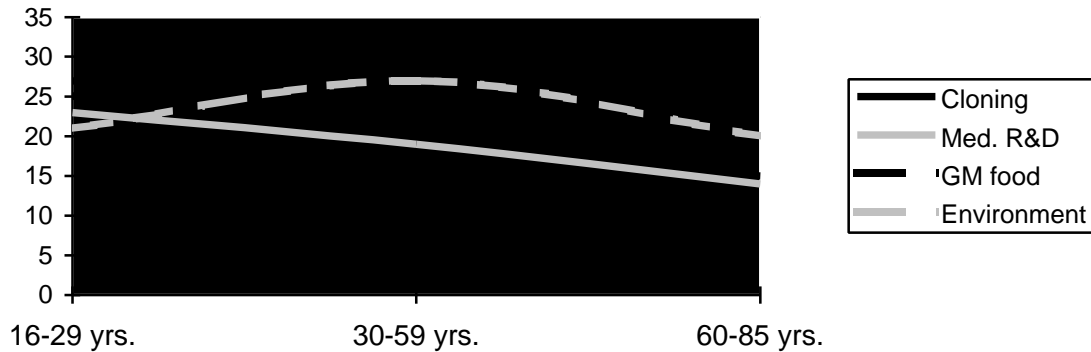
**Table 4: Gender and perceptions of modern biotechnology; per cent**

	Men	Women	Total
Cloning	17	20	18
Medical research	19	18	19
(Gen.) modified food	27	26	26
Environment	25	24	24
Ethical questions	4	6	5
Other	21	15	18

More men than women give answers to the open question concerning associations to biotechnology that are incompatible with the five categories from the Eurobarometer surveys. There is no systematic tendency in these answers that explains this difference.

Age has a larger impact on perceptions of biotechnology than gender. Figure 3 shows the distribution of perceptions amongst the young, the middle-aged, and the elder. The categories 'other' and 'ethical/philosophical questions' are excluded.

**Figure 3: Age and perceptions of modern biotechnology; per cent**



The young have relatively homogeneously distributed perceptions of biotechnology. Each of the four categories is mentioned by 21 to 27 pct. of the young respondents. Amongst the elder the span is the same, but generally perceptions are fewer, with the categories being mentioned by 14 to 20 pct of this age group.

Amongst the middle-aged perceptions are less homogeneously distributed. Special awareness is given to 'Genetically modified food' and 'the environment', whereas 'cloning' and 'medical research - technological development' rank somewhat lower in the minds of this age-group.

In table 5 the range of perceptions is depicted in combination with level of school education. There is a very clear connection between the level of school education and the number of categories mentioned, where the well-educated have a significantly higher range of perceptions regarding biotechnology.

**Table 5: School education and range of perceptions of modern biotechnology; per cent**

	7. grade	8.-10. grade	High school	Total
0 categories	41	33	16	29
1 category	39	43	41	42
2 categories or more	20	24	43	29
Total	100	100	100	100
N	259	728	401	1388

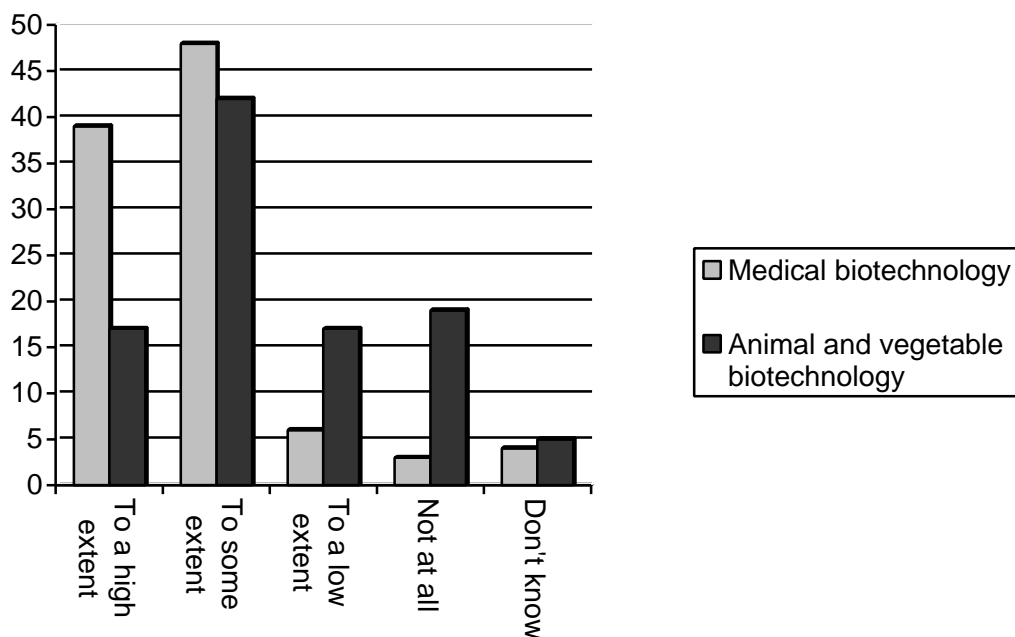
It is a regular pattern for each of the categories of perceptions that a higher percentage of the well-educated mention the category than the less educated. Especially concerning GM food the awareness is much higher amongst the well-educated, whereas there is only a marginal difference regarding perceptions of biotechnology in terms of considerations about 'the environment'.

## 2.4 Expectations towards research in biotechnology

A number of recent studies suggests that public assessment of biotechnology R&D varies according to the application of the specific research area - within the biotechnology field - in question<sup>10</sup>. There is generally a sceptical attitude towards biotechnology in food production, whereas the level of support for the application of biotechnology in areas of genetic testing and the production of new medicines and vaccines is relatively high.

The results of the 2000 survey are in accordance with these earlier findings. Respondents were asked, to which extent they expect modern biotechnology to help create a better life, distinguishing between medical biotechnology aiming at developing new medicine and treatment on the one hand, and animal and vegetable biotechnology aiming at creating new and better food on the other.

**Figure 4: Expectations. Does modern biotechnology help create a better life?; per cent**



<sup>10</sup> See Durant, J. et al. 1998. *Biotechnology in the public sphere - A European sourcebook*. Science Museum; Thulstrup, J. 2000. *Danskernes syn på bioteknologi - En analyse af det holdningsmæssige landskab over for bioteknologi*. Institut for Konjunktur-Analyse.

Figure 4 shows the expectations of the Danish population regarding biotechnology in the sphere of medicine- and food production respectively. The general level of expectations is decisively in favour of medical biotechnology. 87 pct. of the respondents expect of medical biotechnology that it will 'to a high extent' or 'to some extent' help create a better life, whereas expectations towards biotechnology in food production is lower.

Men hold higher expectations towards biotechnology in both fields than women. As mentioned earlier, women generally think of biotechnology somewhat more than men when confronted with words such as science and research, but at the same time their expectations are more sceptical.

The somewhat paradoxical relationship between a relatively high level of awareness and a relatively low level of expectations is also characteristic of the expectations of the respective categories of educational background towards biotechnology. The well-educated, who have a higher level of awareness of biotechnology, have more sceptical expectations than the less educated regarding the potential benefits of biotechnology.

In general the social background variables gender, school education, and age have a limited predictive capacity in relation to expectations towards biotechnology. The causal relations are statistically significant, but the differences between men and women, different age groups, and different levels of school education are still limited.

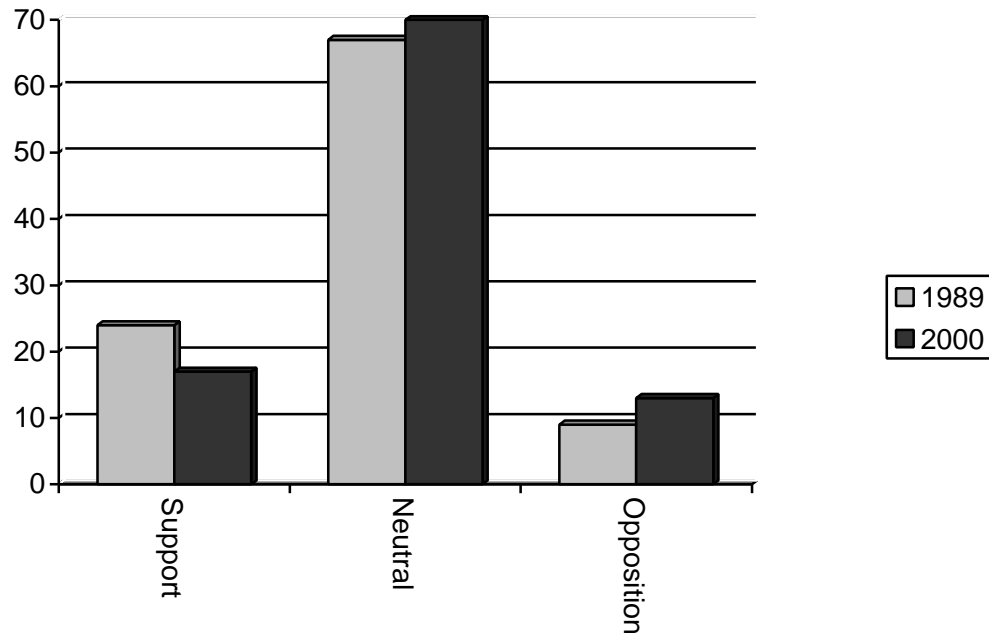
Conversely, the variable 'self-reported interest in research' proves rather interesting in relation to expectations towards biotechnology. A high level of general interest in research correlates with a high level of expectations towards biotechnology, with reference to both food production and medical research.

## **2.5 Attitudes towards biotechnology**

Reconstructing an additive index of support for biotechnology from the 1989 survey gives an indication of the development of attitudes towards biotechnology within the Danish population. Over the last decade there has been a moderate decline in support for biotechnology in Denmark, as illustrated in figure 5.



**Figure 5: Attitudes towards biotechnology; per cent**



Within the theoretical framework of what could be termed 'a model of mobilization', it could be hypothesized that over time attitudes towards a new technology such as modern biotechnology would tend to divide into both stronger support and stronger opposition rather than converge into consensual positions. The Eurobarometer results support the thesis that a higher level of knowledge of biotechnology tends to drag attitudes towards the extremes of either a high level of support or a high level of opposition.

Comparing the Danish 1989 and 2000 distribution of attitudes towards biotechnology this is not the case. The share of respondents within the 'neutral' and 'opposition' categories has moderately increased, while support has decreased. The general tendency of change in attitudes is thus in disfavour of biotechnology.

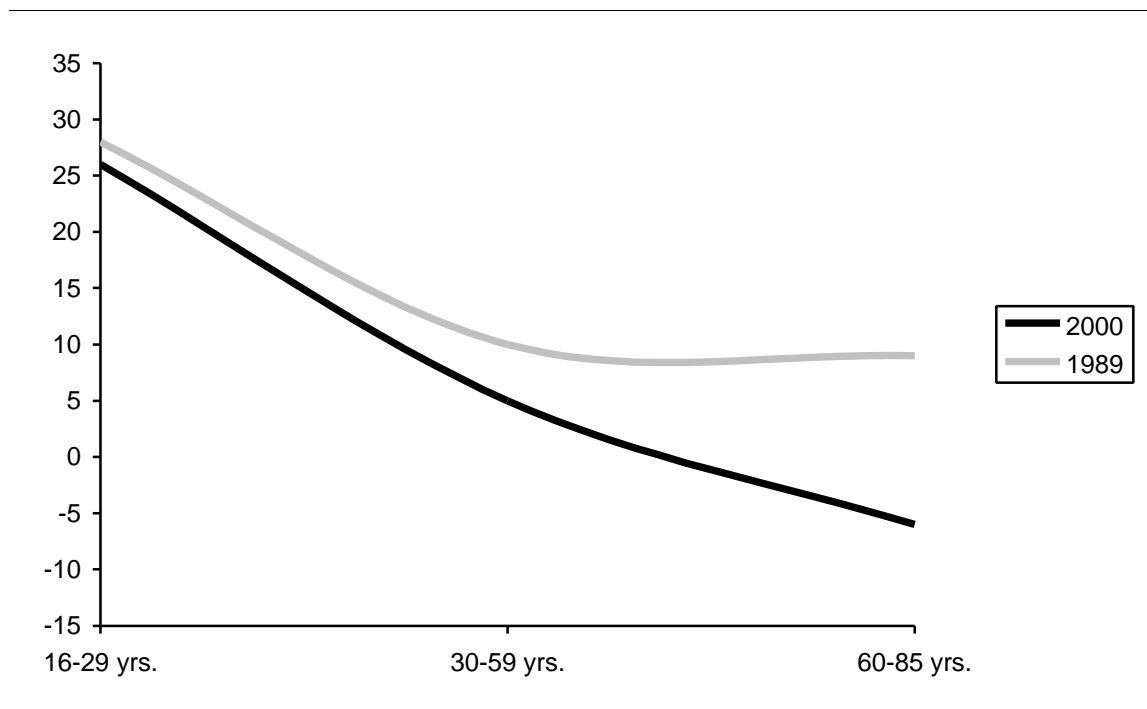
Men are generally more supportive of biotechnology than women. Table 6 shows that the support for biotechnology has declined amongst both men and women over the last decade, but the tendency is predominant amongst women, thereby reinforcing the difference between men and women.

**Table 6: Gender and attitudes towards biotechnology; per cent**

	Men		Women		Total	
	1989	2000	1989	2000	1989	2000
Opposition	8	10	11	16	9	13
Neutral	62	66	72	73	67	70
Support	30	24	17	11	24	17
Total	100	100	100	100	100	100
N	726	686	783	705	1509	1391

Regarding the attitudes towards biotechnology within different age groups, figure 6 shows that young people are more supportive than elder. Figure 6 also reveals that support for biotechnology has declined the most amongst the elder between 1989 and 2000. This development intensifies the difference in attitudes between the young and the elder, just as the difference between men and women is accentuated.

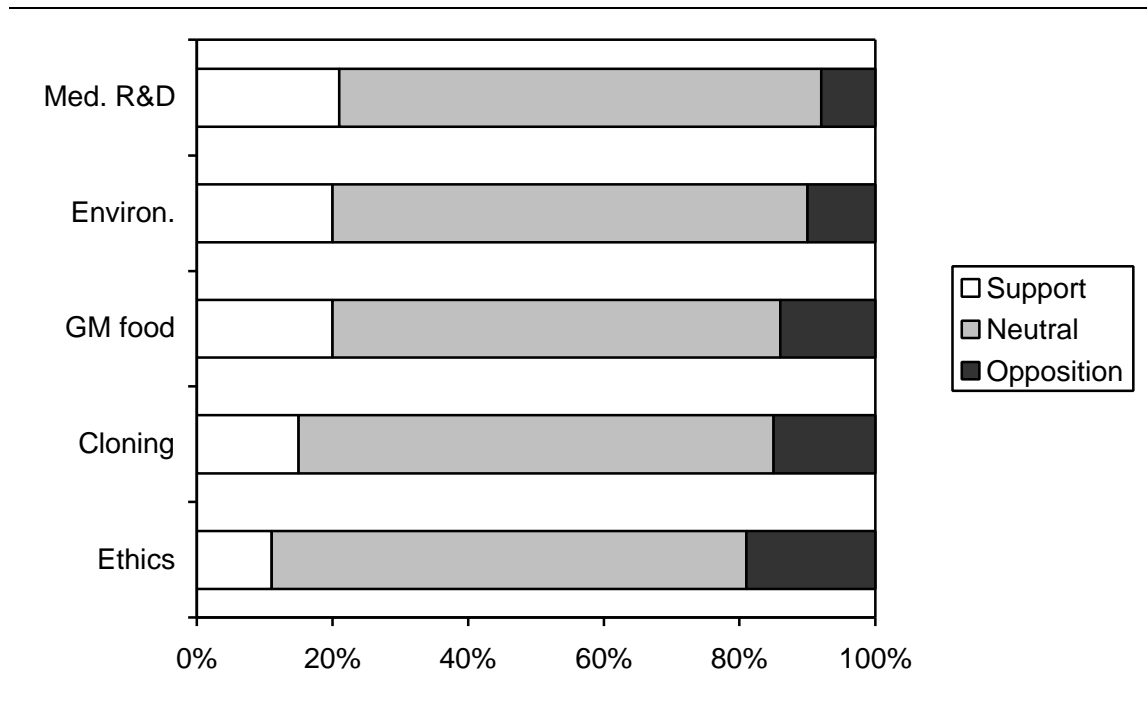
**Figure 6: Age and attitudes towards biotechnology; Support - opposition (difference in per cent point)**



Finally, it is relevant to examine the relationship between perceptions of modern biotechnology and attitudes towards biotechnology. It has already been shown that expectations towards biotechnology depend on the specific research area in question, with expectations being higher regarding the benefits of medical research than of food production. Figure 7 shows that, on average, people who perceive of biotechnology in

terms of medical research are more supportive than respondents who associate biotechnology with GM food.

**Figure 7: Perceptions and attitudes towards biotechnology; per cent**



GM food is the area within the field of biotechnology that Danish citizens in 2000 most frequently mention when asked about perceptions of modern biotechnology. GM food is a subject of concern and interest in Denmark, which is also reflected in a relatively high level of both media coverage and research effort. It is interesting that among the respondents who perceive of biotechnology in terms of GM food there is the lowest share of 'neutral' attitudes towards biotechnology. Respondent answers indicate that an awareness about GM food provoke strong opinions regarding biotechnology in general.

Respondents who perceive of modern biotechnology in terms of 'human and animal cloning' or 'ethical / philosophical questions' are the least supportive of biotechnology in general, whereas perceptions of biotechnology in terms of 'medical research - technological development' or 'the environment' lead to the highest level of support for biotechnology in general.

### **3 Conclusions**

The configuration of actors on the biotechnology scene in Denmark creates good conditions for public involvement in debating aspects of biotechnology. These actors include government institutions, the media, and NGO's, and the relatively well-functioning channels of information and influence are reflected in a high level of knowledge of biotechnology in the Danish public, as well as a high level of awareness of biotechnology in comparison with other areas of research.

Perceptions of biotechnology are quite homogeneously distributed on the categories 'cloning', 'medical research - technological development', 'GM food', 'the environment', and 'ethical / philosophical questions'. Perceptions of biotechnology are influenced by social determinants such as gender, age, and school education, regarding both the range and direction of perceptions.

In measuring public perceptions of biotechnology in surveys, it is of great importance that the operationalization is done carefully, with attention to the contingency of respondent answers upon the exact phrasing of the questions posed. Comparing the 2000 survey with results from the 1999 Eurobarometer survey suggests that using the words 'genetic engineering' when measuring perceptions of modern biotechnology sets in motion a specific line of associations in the direction of 'human and animal cloning', thereby creating an invalid measurement of perceptions of modern biotechnology as a broader area. Excluding the words 'genetic engineering' from the question results in a significantly different distribution of perceptions, which indicates that methodological considerations are of critical importance in designing questionnaires.

The Danish population has generally higher expectations to biotech R&D within the area of medical research than in the area of food production. This result is in accordance with previous results on a European level. The 2000 survey also indicates that perceptions of biotechnology influence the general attitudes towards this area of research. Respondents who perceive of biotechnology in terms of 'medical research' or 'the environment' are generally more supportive towards biotechnology in general than respondents who associate modern biotechnology to 'ethical / philosophical questions' or 'human and animal cloning'.

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