

**The Landscape of Mass Mediated  
Articulations of Biotechnology**

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# **The Landscape of Mass Mediated Articulations of Biotechnology**

The objective of this paper is to explore the associations made in mass mediated articulations of biotechnology. It serves as the basis for further analyses of mass mediated controversies and the purpose is to establish a map of the landscape of mass mediated articulation of biotechnology. Which kinds of genetic research and technology are articulated in what way? What can be associated to what in the mass mediation and when is it portrayed as controversial? In short this is a study of associations in the news production that serves as a way of establishing an empirical archive for further work. It is based on a relational ontology inspired by French philosopher Bruno Latour, supplemented with the method of content analysis developed within sociology of mass media. The aim is to study the production of networks of articulation in mass media by looking at the outcome (the articles), which they produce.

A comprehensive description of mass media analysis inspired by Latour (1999a; 1999b; 1996; 1987; 1986) is presented in Horst (2003). Here it suffices to say that any mass mediated article about biotechnology is the productive result of efforts to associate certain occurrences with other occurrences and phenomena in a certain way including reference to certain sources with the aim of creating a newsworthy story. Each article can therefore be seen as a set of associations and the object of this study is to describe these associations. I have found that the method of content analysis within media sociology provided a useful starting point for such an analysis (Gunter 2000; Pedersen et al. 2000; Lund 1997; McQuail 1994). The objective of content analysis is to study the content of an amount of mass mediated articles, in order to search for patterns according to some sort of coding scheme. I have, however, had to shape this methodology in particular ways so that it could function within the overall methodological framework of the relational ontology.

A relational ontology implies that the phenomena associated in networks do not have any independently determined identity, but rather that they are the result of the particular construction of associations in particular way. In this context it

means that the content analysis has to be designed as an inductive analysis – exploring networks of articulation by inductively exploring what kinds of categories can be used to characterise content. Thus, the coding scheme and the construction of the different variables and categories are as much the outcome of the analysis as the quantitative figures describing their frequency. The interpretative work put into the construction of reliable variables and definitions of categories are equally important for the description of the topology of the articulation of genetics as the quantitative measure of frequencies.

## **Constructing the archive**

The indeterminacy of phenomena does not just pertain to categories of content, but also to the overall object of study. How is it possible to identify a particular set of mass mediated article that can function as a credible and valid archive for the exploration of associations? In short this is a question of how to define the archive, and this poses rather many challenges in this connections. As a starting point I have chosen to follow the distinction between ‘red’ and ‘green’ biotechnology (Bauer 2002) and limit the object of study to ‘red’ biotechnology, that is, human genetics primarily applied within the health care services, but also forensic applications fall under this category. Agricultural (‘green’) biotechnology is left out because it is possible to detect a rather clear distinction between the two different applications and focusing on one of them makes it simpler to construct reliable categories for the coding scheme.

But this still leaves the problem of unity or at least relations in a sample of articles. Is it possible to identify a related sample of articles, which allows the analyst to treat the stories as a coherent set of data. Articulation of health care related biotechnology occurs in a lot of different types of articles. As news from scientific frontiers or political debates on regulations, as human interest stories about patients with great hopes and fears, as contributions to ongoing controversies on how to employ the new technologies and so forth. They also come in different genres from news reports to interviews, editorials and letters to the editor. Sometimes the articulation of biotechnology is the main focus of an article and sometimes it is a frame of reference or a side story. This touches upon a second problem, that of delimiting the object of study. What are *not* articulations of biotechnology? When is the reference to biotechnology so peripheral, that it makes more sense to leave an article out of the archive?

These difficulties in defining the object have been essential in the way I have designed the data collection. Instead of narrowing the object of study down to a central definition I have expanded the term biotechnology by creating a long list of keywords. In this way, the term ‘red’ biotechnology has come to signify a diverse and dispersed object of discourse artificially constructed on the basis of a list of approximately 30 keywords. The list was created by pilot studies, where I collected some 250 articles<sup>1</sup> and then kept adding new keywords until I was sure to include all of these 250 articles. After this initial construction, the list functioned as a search mechanism, whereby I could search the media for articles that included one or more of these keywords.

A preliminary archive could then be established as the total of mass mediated articles, which included these keywords<sup>2</sup>. In this way the definition of ‘articulation of biotechnology’ has been very inclusive, although this archive was later reduced to include only articles where biotechnology were given a substantial role in the article. *Substantial* was in this context defined as more than a single sentence, rather it had to be topic of articulation in a full paragraph or so. The problem of delimitation of the archive has therefore been dealt with as an integrated part of the analysis, not as a problem to be managed before the ‘real’ analysis. It should be noted that establishing the archive is of course contingent in that it could have been done in other ways. But it is not arbitrary – and the reason for describing the delimiting actions in detail is exactly to make this point clear.

It should also be noted that the data unit in this archive is the article, which is not necessarily the same as the unit of *story*. For this study of associations it was found to be acceptable. First of all because it most often makes sense to say that an article covers one story, simply by being *one* article, although the same story in other relations can be seen to be composed of many stories. Secondly, it is the most valid way of counting frequencies in a content analysis. And thirdly, subsequent analyses will employ other ways of analysing stories (Horst 2003). In the following I will use the terms ‘stories’ and ‘articulations’ interchangeably

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<sup>1</sup> This sample was created by reading two daily newspapers in a period of 1½ years between 1997-1999 and collecting all the articles, which were articulating health care related genetic knowledge and technology or knowledge production concerning human genetics.

<sup>2</sup> Technical difficulties unfortunately has made it impossible to count the number of articles in this preliminary archive, but a guess is that it included almost twice as many articles as finally selected, that is, 2500-3000.

and the term ‘article’ about the analytical unit of the study. It is also important to stress that both news (journalistically written articles) and views (opinion pieces, including both letters to the editor, longer analyses and editorials) have been included in the analysis. Although it is interesting to notice if there are any differences in the two types of articles they are basically both part of the mass mediated coverage of biotechnology. It should be clear that the objective of this analysis is not as much to analyse journalistic practices as to observe the outcome in the form of a mass mediated landscape of ‘red’ biotechnology.

For practical reasons I have had to limit the number of media included in the search process, but it was important that the chosen media represent a fairly broad spectrum in order to give the analysis a reasonable amount of generality. Unfortunately, I had to leave electronic media out, since the search process within these media would have been too extensive. This is the case for TV and radio, where it is very time consuming to search systematically for coverage of particular issues in Denmark. A slightly different argument pertains to the Internet, where it is relatively easy to search, but where it is extremely difficult to know what archive one is actually searching in. On this background I have chosen to study the written media, and specifically national newspapers.<sup>3</sup> Focusing on newspapers furthermore has another advantage, since in a Danish context it is the type of media, which most clearly has a distinct editorial style. This means that it is possible to make some informed choices on which media to choose, since I also had to limit the number of written media.

The choice fell on four (initially five) national newspapers of different character. These are the two large broadsheets, the social-liberal *Politiken* and the conservative-liberal *Jyllandsposten*. The third large broadsheet in Denmark *Berlingske Tidende* has been left out because the editorial style of *Berlingske Tidende*, with regard to new technology, was thought to be relatively close to that of *Jyllandsposten*. In order to broaden the analysis two other newspapers have been included: The tabloid *Ekstra Bladet*, and the intellectual niche newspaper *Information*. *Ekstra Bladet* has a general reputation of being populist as well as the most radical tabloid in Denmark. On the contrary *Information* has a reputation of being elitist, left wing oriented and focused on environmental

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<sup>3</sup> A study of the food chains in the Danish media supports this method, since it was shown, that electronic media to a very large degree replicate news stories from the printed media (Lund 2000).

issues. A fifth newspaper, *Aktuelt* was included at the beginning, but it went in during the period under analysis (spring 2001) and has therefore been excluded from the set of data.<sup>4</sup> Two other smaller national newspapers could have been included, but has been left out. This is the business paper *Børsen* and the Christian democratic paper *Kristeligt Dagblad*. With regard to the business angle it should be noted, that *Jyllandsposten* has quite an extensive business coverage and I will argue, that this make up for the exclusion of *Børsen*. It is perhaps more problematic that *Kristeligt Dagblad* is left out, because it does intend to have a distinct editorial style. On the other hand criticism of biotechnology inspired by Christian views also do appear in the other newspapers and is therefore not excluded from the analysis.

The four newspapers were searched electronically for a period of 4½ years (august 1997 to December 2001), and all articles, which contained at least one of the keywords in the list, were collected. Since a lot of these articles only made very sporadic references to ‘red’ biotechnology they were subsequently screened according to the above-mentioned criteria, where genetic knowledge or technology should be health care related and also the focus of at least a separate paragraph. As mentioned previously, articulation of biotechnology did not have to be the main story, but it should be the object of more than one sentence for the article to be included in the data set. Articles, which were primarily concerned with ‘green’ biotechnology, were also screened out. The result was a set of 1575 articles, which function as the central set of data in the following analysis.

Table 1 describes the contributions to this archive with respect to each newspaper. It appears that *Politiken* is the newspaper, which has articulated the subject of biotechnology in most articles. *Jyllandsposten* is quite similar to *Politiken* apart from the fact that the issue is covered less often and rarely in editorials. *Information* articulates the issue quite extensively, considering that this newspaper has fewer daily pages. Here the issue is often articulated in editorials and long news articles, and it also seems that *Information* has a higher amount of views compared to news than the other papers. It should be noted that

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<sup>4</sup> A preliminary analysis of the first three years of coverage, however, indicated that the coverage in *Aktuelt* were very close to the average of all papers in most variables observed. I have taken this to indicate that no particular editorial style is disregarded with the exclusion of *Aktuelt*.

a large proportion of the articulation of biotechnology in *Information* is health care related and also that the coverage seems to be much more sceptical than the coverage in the other papers. In contrast *Ekstra Bladet* has the almost opposite profile. It is more rarely articulated in general, and especially health care related biotechnology is not offered very much attention compared to other areas of application (primarily forensic uses). Generally it is seldom covered in the front page, in editorials and also comparatively more seldom in views.

Table 1	<i>Politiken</i>	<i>Jyllandspost</i> <i>n</i>	<i>Information</i>	<i>Ekstra Bladet</i>
N	629	446	317	183
Front page articles	6%	5%	7%	1%
News	74%	79%	68%	71%
Large news articles*	29%	32%	43%	37%
Views**	19%	18%	24%	12%
Editorials	4%	1%	5%	2%
Not health care related***	23%	24%	15%	57%
Negative towards biotechnology	24%	16%	37%	16%

\*Articles, which in computer print were longer than one A4 page

\*\*The reason news and views do not sum up to 100% is because there was a third category of reviews and announcements

\*\*\* Articles, where human genetics were not linked to health care, but rather to forensic or other issues.

## Coding of content

The objective is to identify patterns in the associations created in articles concerning biotechnology, and furthermore to see, which of these stories are described as controversial. This includes two analytical operations. First the construction of a general map of the associations created in the mediated articulation. In this connection the following research questions have been seen as relevant:

- What type of biotechnology is discussed?
- What stages in techno-scientific development is in focus?
- What are the problems, which biotechnology is articulated as relieving?
- What is the geographic origin of the occurrence(s) articulated as news?
- Which human actors are presented in the article?



The second step is to explore the question of controversy. It is obvious that controversy is a highly fluctuating concept. How should controversy be evaluated? According to media sociology, it can be argued that controversy in itself is an important feature in the articulation of occurrences as newsworthy stories. Therefore a high amount of mass mediated attention towards certain issues is a mark of controversy. Controversy, however, is probably not the only reason for mass mediated articulation of ‘red’ biotechnology, and I have therefore chosen to define controversy more explicitly as disagreement between definitions of problems and solutions. When an issue is controversial there is no unanimous articulation of definitions of problems and solutions.

By exploring how biotechnology is presented in terms of problems and solutions it is therefore possible to establish a kind of measurement for controversy. Since the default interpretation of a technology is most commonly to articulate it as a solution, the analysis of controversy can focus on how much a technology is described as a problem: The more a particular application of genetic knowledge or technology is problematised and articulated as a problem in itself, the higher the amount of controversy. The operational definition of this measure has been to ask:

- Is the main articulation of biotechnology in each article positive or negative?

From these research questions I constructed a code scheme with 6 variables. In order to improve reliability I have constructed each question with a fixed set of answer categories as shown in the code scheme in appendix A. The variables and answer categories were selected on the basis of a number of pilot studies on small sections on the material. Following the inductive ambition presented in the beginning, the code scheme is therefore not a generic analytical tool constructed without connection to the actual data material. On the contrary the construction of the scheme has been an integrated part of the analytical work. The questions it poses to the individual article should be seen as a generalisation of comparisons between the articles. This relational construction of the code scheme also means that the categories I have chosen for the different variables do not imply to be universal or completely congruent to a knowledge base (e.g. medical science) outside the material. When I classify problems to be solved by biotechnology in different groups of diseases it is on a basis of what makes sense when looking at the articles – not what is correct when looking at the

medical classification of disease. Thus, I have a category called ‘Traditionally known inheritable diseases’, which is not a proper medical classification, just as it cannot be unequivocally distinguished from other groups for instance the one called Obesity and metabolic disorders. These categories have grown out of an observation in the pilot study, that the articles themselves make these distinctions. Sometimes they articulate inheritable diseases as a particular group of diseases and sometimes they speak of metabolic disorders. It might to a certain extent be the same diseases they refer to, but this is not always the case.

Here we touch upon a fundamental characteristic of the following investigation. The object of study is the mass mediated articulations in their positivity. This means that I do not see these articulations as representations that can be compared to other - more true or real – representations in other social domains. All the categories represented in the code scheme reflect real constructions in the media – but the categories do not necessarily imply any intrinsic quality of realness outside the mediated realms. On this basis the analysis is committed to validity claims of internal consistency, coherence and intersubjectivity, but not of measurement in relation to any ‘objective’ knowledge base. As far as the code scheme goes this means that the arguments for constructing the code scheme in the particular way should be transparent and convincing. It also means that given the particular construction of the code scheme any observer would classify articles in the same categories. I have chosen to deal with all these questions of validity in a process of constant communicative validation (Kvale 1994:239). Two students have helped me code the articles and we have had a constant dialogue on interpretations, kept a log on decisions and so on. The main reason for choosing this method of validation is precisely the fundamental assumption that the scheme itself is as much an outcome of the analysis as the figures of frequency.

### **Introduction to analysis**

The analysis covers a total of 1575 articles. As it appears from table 1 not all of these articulated health care related biotechnology. Altogether 405 articles are primarily occupied with other uses of biotechnology, primarily genetic testing in the judicial system. I have chosen as a general rule to disregard these articles. Although they articulate the same types of technology – primarily the genetic test – it proved to be difficult to use the same variables as with the health care related stories. Where nothing else is mentioned the following analysis is based

on the 1170 articles that are concerned with health care related problems and solutions.

It should be mentioned that the following is a description of the kind of associations that are most frequent in terms of number of articles. The relevance of this measure can be discussed since the articles can vary according to their length and editorial placement. On this background I have included some editorial categories in order to elaborate on the very one-dimensional measurement of number of articles. When it is considered a contribution, I therefore include two other variables. First of all, I have looked at the placement in the paper. Placing a news story on the front page indicates top-priority, whereas placement in later sections indicates lower priority or communication to special segments. Secondly, I have sometimes distinguished between journalistic articles and opinion pieces. Most important, however, is it to be constantly aware that the analysis measures associations in articles, but this does not reveal anything about causal explanations. From this analysis it is only possible to observe associations in the form of co-variance, not in the form of dependent and independent variables. Therefore, the tables and figures of frequency in the following have been designed to be easy to read, not to document causal explanations.

The analysis is structured in three parts. The first is a general description of associations between phenomena in the articles: which kinds of technological applications, health problems and techno-scientific stages are presented in the articles? The second part deals with the association of sources to the other phenomena, and tries to answer whether there are distinct patterns in the way different actors are associated as sources to different phenomena. The third part of the analysis is concerned with the question of controversy and investigates whether particular problems, techno-scientific applications, techno-scientific stages and actors are particularly articulated as controversial.

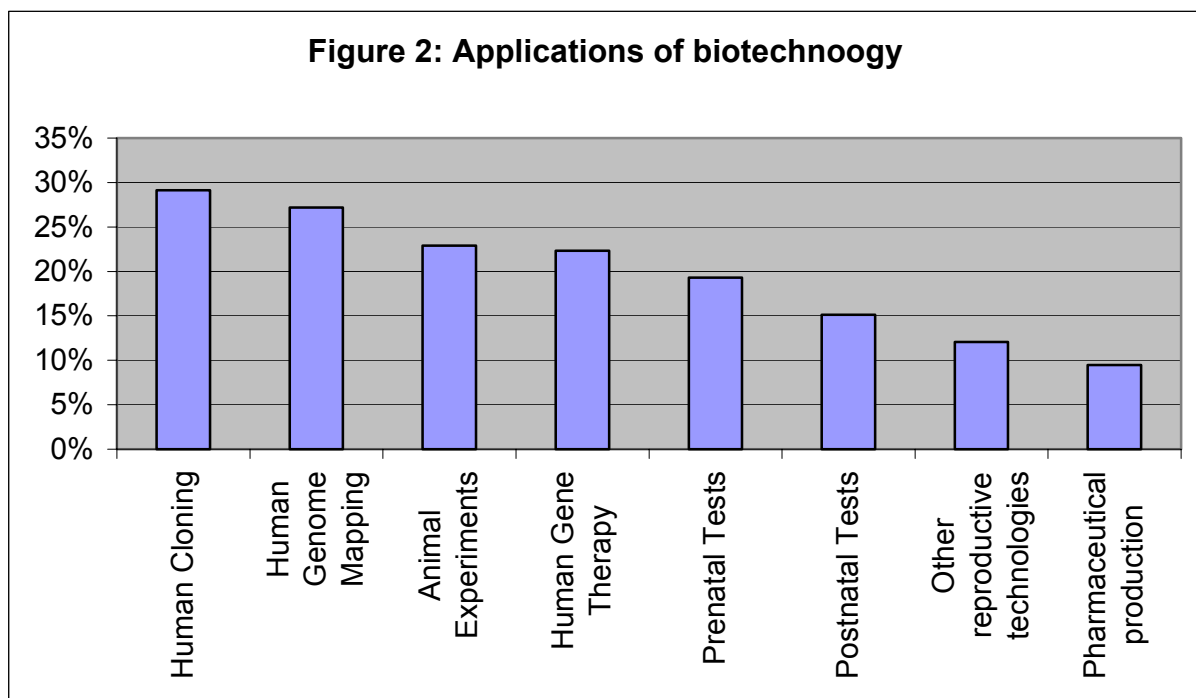
## What are the newsworthy issues

This section is an effort to characterise the newsworthy issues in the articulation of biotechnology. During the pilot studies, four variables were constructed that could provide an overview of this:

- Applications of biotechnology
- Stages in the techno-scientific development of a technology
- Articulation of problems to be solved by biotechnology
- Geographic origin of occurrence to be treated as news

### Applications of biotechnology

Biotechnology can be seen as a broad field of practices covering many distinct technologies, techniques or fields of applications. Rather than trying to define these different technologies according to some technical criteria, I have let the way the articulations construct distinct fields of application be the main categories. Thus I have identified 8 different applications that seemed to be articulated as distinct from each other in the articles.



It should be noticed in figure 2 that the fields of application are not mutually exclusive since an article can easily cover more than one of these fields. As the figure shows, the eight applications are articulated with different frequencies.

This is not remarkable in itself since the eight categories do not imply any kind of even distribution. It is, however, obvious that those fields of application, which generally can be said to be at a more preliminary research stadium (such as gene therapy and human cloning), are covered relatively more often than applications which are further developed in terms of concrete use (such as reproductive technologies, genetic tests and genetics in pharmaceutical research and production). Revolutionary or far-reaching uses of biotechnology thus receive most attention. The articulation of the eight types of application also differs in other aspects and I have tried to summarise the main findings in table 3.

Table 3: Characteristics of coverage of different fields of application

	Average monthly Coverage	Standard Deviation/month	Frontpage rate	Single-issue rate
Humane Cloning	6,4	9,5	3%	47%
Humane Genome Mapping	6	3,8	4%	39%
Animal Experiments	5,1	4,4	3%	19%
Humane Gene Therapy	4,9	7	7%	54%
Prenatal Tests	4,3	3,3	8%	46%
Postnatal Tests	3,3	2,2	5%	21%
Other reproductive technologies	2,7	2	3%	27%
Pharmaceutical production	2,1	2	3%	11%

The first column in table 3 is an indication of the number of articles covering the particular application each month. The second column is an expression of the intensity in articulation over time. A large standard deviation indicates big differences in attention between different months and thus it serves as an indication that the application in question has been articulated in concrete case stories receiving much attention at some points in time. This is the case with cloning and gene therapy. On the other hand a small deviation indicates, that the articulation is much more stable. The next column is an indication of perceived importance, as putting an article on the front-page signals high priority. It appears that genetic tests (especially prenatal) and human gene therapy are fields of application, which most often has been presented as important in this way, but the differences are relatively small.

Finally the last column is a result of the fact that articles often articulate more than one of the fields of application, and it has been a methodological choice to reflect this inclusion in the coding practice. On this background the last column indicates how often any field of application is articulated as the single issue in an article. This measure indicates whether a field of application seems to be a newsworthy article in itself or whether it is most often combined with other fields of application. In this connection it is noticeable that all applications routinely are presented together with each other. Gene therapy is the application, which most often stands alone, but still it is associated to other fields of application in nearly half the articles. In the following paragraphs I will present the main characteristics of the articulation of the different fields of application. In addition to table 3, these descriptions also draw upon Figures A1-A8 (Monthly frequency of each application) and table B (Frequency in combinations between fields of application), see appendix B. Furthermore I have observed the headlines of the concrete articles in each group.

*Human cloning* is the most intensely articulated application, although it is not often on the high priority front pages. As mentioned the differences in time are big and concentrated around three periods. I have elsewhere provided a detailed account of the articulation of cloning. Generally it should be noticed that although it is relatively high on the agenda, it is seldom front-page news. Furthermore it appears from table B that when cloning is associated with other fields of application it is most often animal experiments. This is primarily because Dolly the sheep plays an important role in the discussions of human cloning.

*Genome mapping* is used about articles, which specifically articulate the human genome project, but also other articles, which present new discoveries of genes or mutations. This field of application receives a lot of attention that is quite evenly distributed. The table also reveals that genome mapping is relatively often covered as the single issue. From table B in appendix B it appears that when it is associated with other fields of application these are most often postnatal testing and pharmaceutical use, but the patterns of association with other applications are inclusive so that most combinations occur. Altogether this suggests that genome mapping is articulated in a continuous stream in the mass media. It never receives extremely high amounts of attention but the issue of genome mapping is articulated in many different contexts.

The total number of articles about genome mapping is 318, of which three out of five articulate it as the single field of application. Many of the stories concentrate on general issues concerning the project of genome mapping, but the sample also include articles that present new knowledge about particular genes and diseases or human characteristics: “Gene for speech problems found”, “Happiness is genetically determined”, “Gene for dyslexia found” “A gene for baldness”, “Gene can cause asthma”, “Gene regulates the good cholesterol”.<sup>5</sup> These presentations could be taken to indicate a kind of genetic determinism<sup>6</sup>, but it must be considered that headlines can have a sharper edge than the rest of the article and furthermore other headlines seem to point in the reverse direction: “Man is more than genes”, “Two descriptions are better than one”, “The ambiguity of genes”, “Do alcoholic genes exist”[!] and “Tracking the gene for Gucci-boots”.<sup>7</sup> Besides these kinds of articles that primarily deal with genetic knowledge as a code, which holds some kind of information about the phenotype of humans, there are also articles that seem to be more concerned with the status of genetic knowledge as an economic resource that should not be taken undue advantage of: “Genetic register sold abroad”, “Fear of monopoly on genes”, “Gene trade raises concern” and “Easy game for bio-pirates of the rich world”.<sup>8</sup> Also questions concerning new legislation on patents on biotechnological innovations fall in this category of genetic knowledge as a resource that should be treated properly.

The category *animal experiments* is used about articles, where animal experiments are articulated as relevant for the purpose of learning about the human genome and health care related genetics. It does not include animal experiments presented as having only agricultural purposes. The articulation of this field of application is very similar to that of cloning. As mentioned above

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<sup>5</sup> *Politiken* 23 February 1998, *Politiken* 10 June 1998, *Politiken* 13 September 1999, *Ekstra Bladet* 6 July 2001, *Jyllandsposten* 26 June 1998 and *Jyllandsposten* 16 August 1999 respectively.

<sup>6</sup> The amount of genetic determinism in newspaper coverage has been object of several studies (Condit 1999; Nelkin & Lindee 1995). Conclusions of these studies are contradictory and seem to indicate that the findings depend on the analytical perspective.

<sup>7</sup> *Politiken* 19 February 1998, *Politiken* 27 June 1999, *Politiken* 15 January 2000, *Jyllandsposten* 19 October 1998 and *Information* 28 February 1998 respectively

<sup>8</sup> *Politiken* 26 July 1998, *Politiken* 26 July 1998, *Jyllandsposten* 29 January 1999 and *Information* 12 January 1998 respectively.

this is not strange since they are very often articulated in the same articles (45% of the articles on animal experiments also treat human cloning, table B). Furthermore, although the distribution of articles about animal experiments is more equal between months than that of cloning, it still follows more or less the same pattern (high attention in the same months – figure A1 and A3 in appendix B). Compared to human cloning, however, animal experiments are not very often the single issue in an article. On this background it seems that animal experiments in this selection of articles is not articulated as a newsworthy issue in itself, but it is quite often articulated as a part of stories about human cloning. When the issue of animal experiments *is* articulated on its own, it seems that research on a wide range of animals can provide useful knowledge: “Worm explains sexual needs”, “About primeval genes in green flies”, “Gene made mice faithful”, “Mammoth cloning”, “Calves cloned from breast milk” and “Mapping pigs genome”<sup>9</sup>. As it appears from these quotes, it seems that animal cloning and identification of genes is articulated as the two major areas where research on animals can benefit research in health care related biotechnology.

The high amount of articles about *gene therapy* is connected to one particular case in Århus beginning in July 1999. This case evolved around a research project on gene therapy against liver cancer and it is analysed in depth elsewhere (Horst 2003). Here it should be noted, however, that more than a third of the articles about gene therapy concentrate on this case. This is probably the reason for the relatively high amount of front-page stories and the high amount of articles articulating only gene therapy (highest single-issue rate). On the other hand, when gene therapy is associated to other fields of application, it seems that gene therapy can be combined with all the other types of application, as none stand out as particularly common (table B in appendix B). Had it not been for this particular case, the articulation of gene therapy might have resembled that of pharmaceutical production, which I will shortly return to as a field of application, which occasionally is articulated as a single issue in specific stories, but elsewhere is articulated as a part of the general development within biotechnology.

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<sup>9</sup> *Politiken* 27 September 1999, *Information* 22 December 1997, *Politiken*, 23 August 1999, *Ekstra Bladet* 24 January 1999, *Jyllandsposten* 27 April 1999 and *Politiken* 29 June 2000 respectively.



Taken together prenatal and postnatal *genetic tests* are the most commonly articulated field of application (31%). I have chosen to separate the two kinds of tests, since they seem to generate different kinds of articulations. As a starting point it is only every fifth of the articles, which covers both kinds of tests. Furthermore, they are presented differently, as I will try to show in the following.

Of all the fields of application *prenatal tests* are the most likely to appear on the front page. At the same time articles about prenatal tests are relatively evenly distributed and they are also relatively often the single issue in an article. On this background it seems that although there are no spectacular case stories about prenatal tests it is a type of application, which create stories in its own right. This is interesting because prenatal tests have been a standard service in the Danish health care sector for more than 20 years. This observation therefore means, that familiarity with a technology does not necessarily mean decreasing mass mediated articulation.

A quick look at the headlines from articles about prenatal tests, show that stories focus on both the concrete service and the more abstract societal consequences of this practise. Some articles focus on technical aspects of the service: “Blood test can reveal risk of handicap”, “Scanning: Differences in service to pregnant women” and “Foetus counselling should be improved”<sup>10</sup>. Other focus on future possibilities: “Choose yourself: Boy or a girl” and “Free trade in foetus control”<sup>11</sup>. There are however, also a large group which discuss the basic logic behind prenatal tests: “No to a selective society”, “On the road to eugenics”, “Should I have been an abortion” and “Help to children with Down’s syndrome instead of testing pregnant women”<sup>12</sup>. If we combine the impression from these headlines with the observation from table B that prenatal tests most often is associated with other reproductive technologies a pattern emerges. It seems, that prenatal tests is often discussed as an application that allows for selecting (or designing) babies. Similarly it appears to be closely connected to the issue of abortion, whereas treatment or preventive measures are not so often thematised.

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<sup>10</sup> *Jyllandsposten* 13 February 1998, *Politiken* 17 April 2001 and *Information* 26 August 1998.

<sup>11</sup> *Jyllandsposten* 6 July 2001 and *Information* 28 March 1998.

<sup>12</sup> *Jyllandsposten* 14 July 2001, *Information* 22 August 1997, *Ekstra Bladet* 13 May 2001 and *Politiken* 20 August 1999.

*Postnatal tests* on the other hand, seems to be represented very differently. They are rarely articulated as the only issue in an article, and most common is that it is associated with genome mapping (42%, table B). Articles about this issue are evenly distributed with no spectacular cases, but contrary to representations of prenatal tests, the focus in these stories seem to be on future possibilities of testing humans for diagnostic, preventive or even therapeutic reasons. Some of the stories focus on single genes or disorders like “Cancer risk can be revealed by spit test”, “Can I see your crime genes” and “Bad hearing is seen in blood”<sup>13</sup>. Other articles focus on genetic knowledge about an individual in general: “DNA chips depict your constitution”, “The crystal ball of the future”, “Get your own personal DNA profile” and “Know yourself – know your genes”<sup>14</sup>. As also discussed in connection to the stories about human genome mapping the most striking feature is the essentialism ascribed to genes. It seems that in the genes, we can find determinate answers about the future, so the tests is presented as the crucial point of no return. Get the test and your destiny will be disclosed.

Many of these representations also seem to imply that this new knowledge can be troublesome: “Gene test and future anxiety”, “Straining knowledge about genes” and “Genome: Oracle or Nemesis”<sup>15</sup> and some go so far as to issue warnings against tests: “The ethical council warns against mail order tests” and “Warning against cancer gene test”<sup>16</sup> Contrary to the case of prenatal tests, however, these warnings seem to be related to the individual herself. It is the troubling situation of knowing about ones own future that is at stake here, not so much the consequences for society in general. If compared to prenatal tests it seems that postnatal tests are primarily presented as newsworthy because of their prospects as an application designed for individual consumption. Warnings are primarily issued as consumer guidance, where warnings against prenatal tests more often take the shape of general resistance (against eugenics and abortion).

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<sup>13</sup> *Politiken* 20 March 2000, *Information* 5 March 2001 and *Politiken* 8 March 1999.

<sup>14</sup> *Politiken* 4 November 1999, *Information* 21 December 1998, *Jyllandsposten* 8 May 2000 and *Jyllandsposten* 11 April 2000.

<sup>15</sup> *Politiken* 31 March 2001, *Jyllandsposten* 29 September 2000 and *Information* 19 March 2001.

<sup>16</sup> *Politiken* 27 July 1998 and *Jyllandsposten* 3 March 2001.

It seems relevant in this connection to make some brief comparisons with the large amount of newspaper articles that does not treat human genetics in connection to health care related issues. This is relevant, because the large majority of these articles focus on the forensic use of genetic tests.<sup>17</sup> Especially two issues have been treated as controversial: widening the access to DNA-testing of fatherhood and the construction of a national register of DNA profiles from criminal suspects. It is interesting that these forensic uses apparently give rise to issues of a more general and collective nature, than health care related genetic tests that primarily focus on issues concerning individual consumer problems. In contrast, proponents of the forensic use of genetic tests stress the benefits for society as such, but also the opponents often refer to general social developments: “Grotesque snooping” “Give us back a state of justice” and “Lawyer calls DNA test pure Gestapo”<sup>18</sup>. In short these differences between the articulation of different uses of genetic tests seem to indicate that prenatal tests are primarily controversial because of their linkage to eugenics and selection, postnatal tests in the health care system are primarily covered as a technology for individual consumption and postnatal tests outside the health care system are primarily controversial with regards to the protection of privacy in a constitutional state.

The category of *Other reproductive technologies* refers to the fact that human cloning and prenatal tests are treated as two special cases. Articles, which fall in this category, therefore mention other applications of biotechnology in connection with fertility and pregnancy: IVF, micro-insemination, sperm donation, and pre-implantation diagnostics. In this category I have also included general descriptions of designing or engineering babies. It is possible, that this status as a residual category has consequences for the outcome. In any case it is not very distinct compared to the other fields of application with regard to any of the quantitative measures. It is relatively seldom articulated as single issue. Not surprisingly it often appears in association with prenatal tests and human cloning, but also gene therapy is often mentioned together with reproductive technologies. Some of these articles focus on new possibilities in fertility treatment, but looking at the headlines, it seems that the idea of artificially

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<sup>17</sup> When human genetics is discussed without reference to health care problems it is almost exclusively in connection to forensic uses of genetic tests.

<sup>18</sup> *Jyllandsposten* 28 January 2000, *Ekstra Bladet* 3 November 1999 and *Information* 9 June 1998.

creating babies generally is a hot issue: “Designer babies: genes for sale”, “The man made man” and “Short-cut [genvej, MH] to the perfect human being.”<sup>19</sup> It is interesting, that there also seems to be a certain freak appeal in the articulations: “Baby with three parents”, “Experiment with babies”, “Parents demand super seed” and “Eggs can be fertilized without sperm”<sup>20</sup> Thus it seems like the articulation of reproductive technologies primarily are preoccupied with the possibility of designing babies, but these creations are presented with a mixture of fascination and horror.

Finally the term *pharmaceutical uses* of biotechnology designates both the production and the utilization of pharmaceuticals. As figure 2 indicates this is not a very prominent field of application in the mediated articulations. It rarely figures on the front page and the coverage does not seem to be dominated by any particular case stories, as it is evenly distributed between months. Only every tenth article covering pharmaceutical uses is it the single issue, and this implies that it does not have a high news value in itself. In stead it is often associated with either animal experiments or genome mapping. Business angles are relatively frequent in the articulation of this technology, and the framing seems to be rather positive within the time-span of the present analysis: “Fusion generates money for research”, “Biochip can become gold” and “Gene breakthrough turn technology shares to gold.”<sup>21</sup>

Summarising it seems that revolutionary or far-reaching uses of biotechnology receive most attention, but familiarity with a field of application does not necessarily lead to decreasing interest. Some of the applications, like cloning and gene therapy, are articulated in spectacular case stories, leading to a very uneven distribution of the attention between months. The articulation of these two types of application is analysed in Horst (2003). In contrast, other types of application, such as genome mapping and genetic tests, seem to receive attention on a much more stable basis. For instance, genome mapping is articulated in a continuous stream in the mass media. It never receives extremely high amounts of attention but the issue is articulated in many different contexts and in

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<sup>19</sup> *Politiken* 5 December 1999, *Information* 26 November 1999 and *Jyllandsposten* 27 September 1998.

<sup>20</sup> *Politiken* 2 August 2001, *Information* 9 April 1999, *Jyllandsposten* 9 April 2001 and *Politiken* 12 July 2001.

<sup>21</sup> *Jyllandsposten* 1 February 2000, *Jyllandsposten* 13 November 2001 and *Jyllandsposten* 28 June 2000.

association to most of the other fields of application. Also genetic tests are frequently articulated, and it appeared sensible to distinguish between the articulation of prenatal, postnatal and forensic tests. Whereas prenatal tests were primarily articulated as controversial because of their linkage to eugenics and selection, forensic tests were controversial with regards to the protection of privacy in a constitutional state. In contrast to this, postnatal tests were primarily articulated as a technology for individual consumption.

### **Stages in the techno-scientific development of a technology**

The term technoscience has been adopted to avoid an a priori distinction between technology and science. Nevertheless, it is possible to question whether the media articulate stages in research and development of technology and whether there are differences between these articulations. On the basis of the pilot studies it seemed relevant to operate with a threefold division between basic research, applied research, and routine use.<sup>22</sup> On top of this, two other categories were needed as one kind of articles dealt explicitly with regulatory aspects and another group articulated general background information often incorporating all of the above-mentioned stages.

It should again be noticed, that the categories in no way claim to be a description of research and technology as it takes place in laboratories and research institutions, where the distinction between for instance basic and applied research can be quite difficult to uphold. In the context of media analysis, however, it turned out to be a reasonable way of categorising the mediated articulations. The categories have been described so that *basic research* is used about presentations of new knowledge and discoveries within biotechnology, which is not directly linked to the solution of a concrete problem. Altogether 25 % of the articles have this primary focus. Of these two thirds focus on specific new discoveries of genes, mutations or technologies, whereas the last third are general descriptions of advances in basic genetic research. *Applied research* on the other hand is used about the articulation of biotechnology, which explicitly is addressed to solving a concrete problem, e.g. new therapy, diagnostic tool, or new reproductive technology. Approximately 23 % of all articles present this type of applied research.

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<sup>22</sup> The coding was designed, however, to make it possible to distinguish between 2 kinds of reporting basic research. The first is the articulation of new discoveries of genes or techniques, and the second is articulation of basic genetic research in general.

Whereas the stories of basic and applied research all have some sort of *novel* knowledge, technology or technological use as its core focus, another 27% primarily articulate *routine* use of biotechnology. An example could be an article about the fact that the use of amniocentesis is declining, accompanied by discussions of possible reasons behind this decline. Furthermore, 20% of the total sum of articles focuses on issues of *public regulation*, and this is both in connection to discussions about the use of specific technologies – gene therapy, foetal diagnostics – but also in relation to regulation of specific forms of praxis in the research community – research on embryos, patenting genes and so on. Finally the focus in the remaining 5 % has been termed *background*, as these articles can be seen as general updates on the techno-scientific development. From this, it is obvious that seen as a whole, all four of these distinct techno-scientific ‘stages’ receive attention.

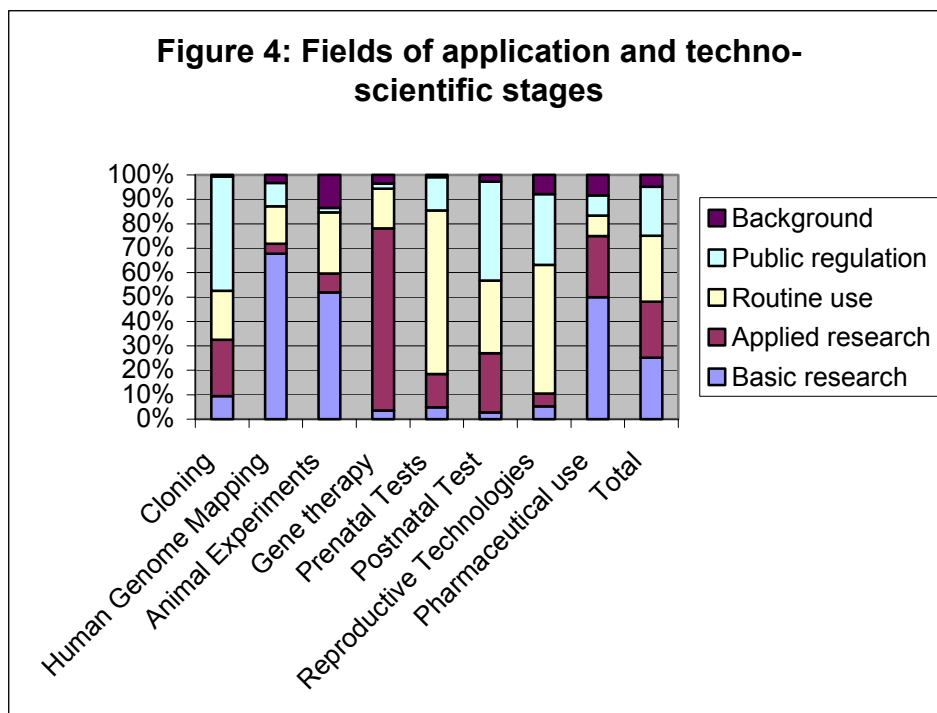


Figure 4. Techno-scientific focus of articles which only cover one field of application, N=668. It should be noted, that the lowest N is found in Pharmaceutical use (n = 12) and Postnatal test (n=37)

When we look at the fields of application separately, however, large differences become obvious. In figure 4, I have excluded all articles, which cover more than one technology so as to present the differences between the coverage of the individual technologies more clearly.

From figure 4 it appears that applications like Human genome mapping, Animal experiments, Gene therapy and Pharmaceutical use are very often associated to a prime focus on research aspects. Of these, gene therapy is primarily articulated as an object of applied research, e.g. as research conducted with a specific aim of treating a particular problem. The other three are most often articulated as objects of basic research. Thus judging from the mediated coverage it would seem, that gene therapy is further advanced in the direction of concrete applications, than for instance pharmaceutical uses. Furthermore figure 4 reveals that genetic tests (both prenatal and postnatal) and reproductive technologies are rarely articulated with the primary focus on research. Instead they are more often associated to routine use and/or public regulation. Finally the issue of cloning stands out as the field of application most often covered with the prime focus on public regulation.

It might be viewed as strange that a prime focus on routine use is also found in some articles concerned with human cloning and gene therapy, although these technologies are not yet implemented in any routine use. This can be explained by the fact that newspaper articles (especially more polemical viewpoints) sometimes use the rhetorical technique of describing the anticipated development, as was it already real. Sometimes it is obvious from the way the argument is put, that it is a future vision, but at other times it is quite hard to decide on the basis of the newspaper article, whether human gene therapy for instance is presently a working therapy. Following the general analytical strategy of mapping the mass mediated stories as they present themselves, human cloning has been coded as routine use if it is presented like this – no matter that no laboratory has yet officially presented it as such.

### **Newsworthy problems**

Health care related biotechnology is primarily described as solutions to health care related problems such as different kinds of diseases as shown in figure 5. Again it should be noticed that although they bear some resemblance to official categories of diseases, the taxonomy does not claim to be correct, as a medical classification. The category of *traditionally known inheritable diseases* covers the long list of different kinds of diseases which have been known to be inheritable or congenital and therefore traditionally an object of medical

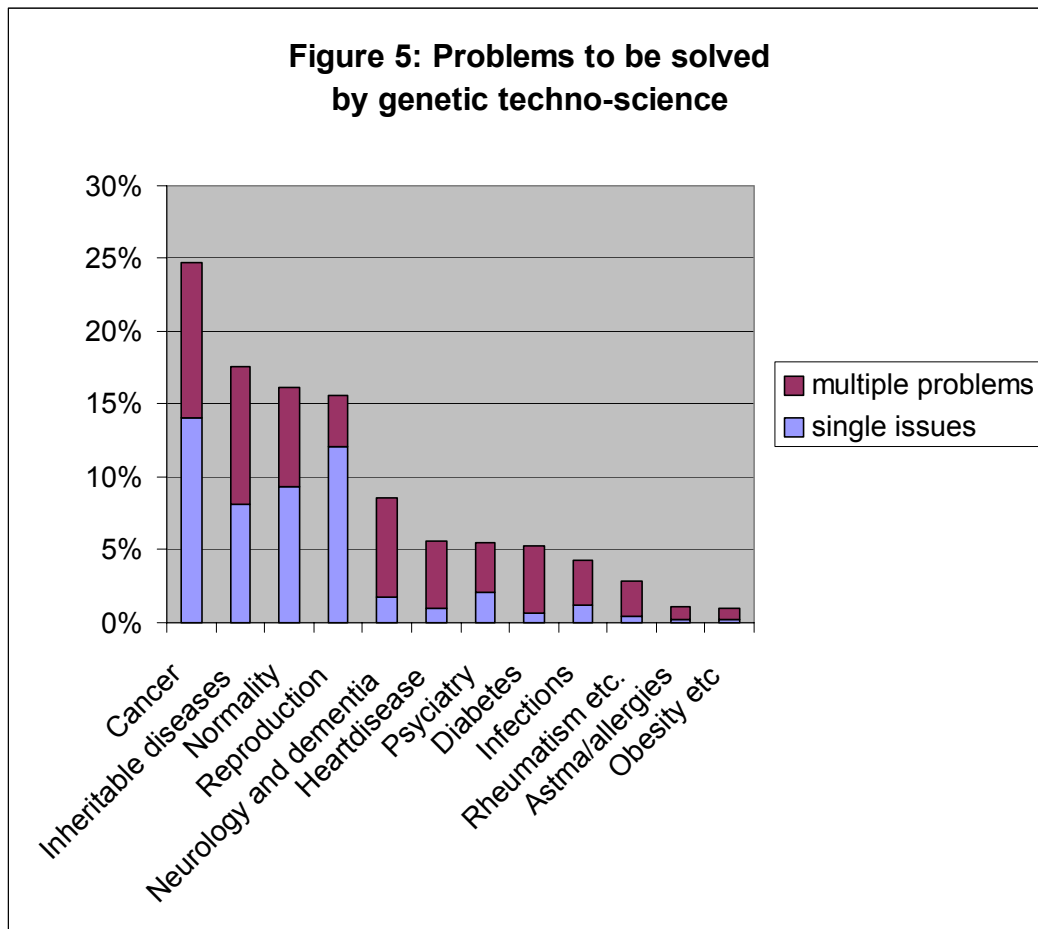
genetics.<sup>23</sup> Furthermore the groups of diseases have been supplemented with the category of normality as it turned out, that many of the articles are concerned with genetic dispositions for intelligence, hair colour, weight, psychological characteristics and so forth.

As figure 5 shows, Inheritable diseases is still widely articulated as a problem to be solved by biotechnology, but almost as much attention is devoted to issues of normality and reproduction. Whether the amount of interest devoted to issues concerning normality is high or low (around 16%) depends on the perspective, but it is fair to say that issues of normality are receiving more attention than most of the disease groups. On the other hand, taken as a whole the problems articulated to be solved by biotechnology is primarily diseases of various kinds as altogether 67% of the total number of articles associate to at least one of these disease groups.

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<sup>23</sup> As example chromosome deviations like Down's syndrome, monogenetic dominant diseases like Huntingdon's Chorea, monogenetic recessive diseases like cystic fibrosis, as well as deformities typically discovered by ultrasound scanning of foetuses. Practically the category has been defined by a list constructed on the basis of a medical compendium.





Cancer seems to be the dominating problem, as every fourth of the articles is associated to cancer. The spectacular case about gene therapy to liver cancer patients has some part in this high figure, but it must still be considered as remarkable. Especially when compared to the other major disease groups like heart diseases, diabetes, rheumatism, and allergies it is obvious that cancer has a special status. Considering these other groups of diseases, it is interesting that neurology and dementia receives relatively much attention – and it can be added that in particular this attention is given to Alzheimer’s disease. On the other hand Astma/allergies as well as Obesity are not problems that seem to take up much mediated space in connection to biotechnology.

It can be observed that all the disease groups, which are not articulated very often, are also seldom the single issue in an article. It seems that none of these disease groups are able to generate newsworthy stories in themselves, but as a general field of problems to be solved by biotechnology they do receive

attention. Cancer on the other hand, is apparently a story in it self, as more than half of the stories on cancer only focus on this problem.

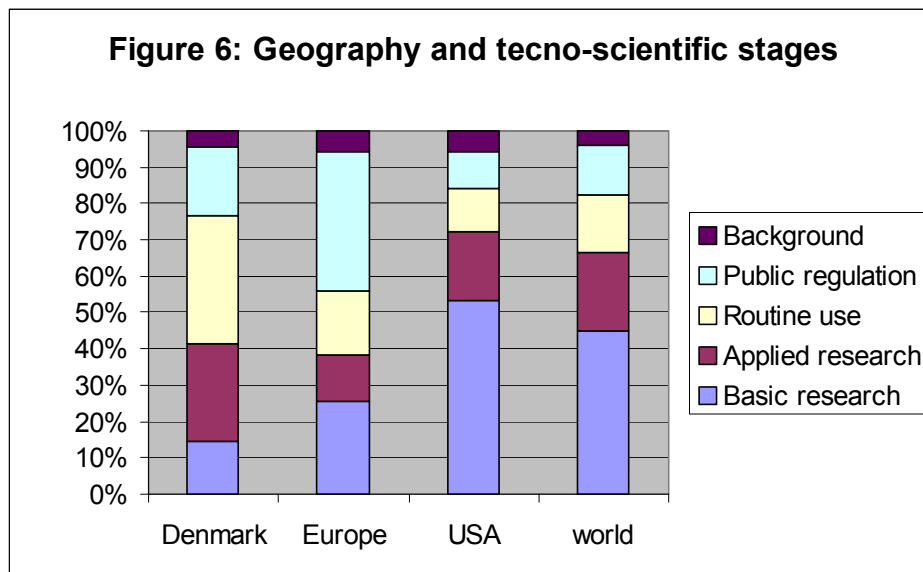
Seen in relation to specific fields of applications, some interesting patterns can be observed in table C (appendix B), as some fields of application is primarily associated to particular disease groups. For instance Traditionally known inheritable diseases are often linked to prenatal tests (57% of articles covering inheritable diseases), whereas cancer is linked to gene therapy (52%). From mass mediated coverage then, it seems that whereas the perceived chance of fighting cancer should be found in gene therapy (as in the case from Århus), inheritable diseases should instead be fought by prenatal testing. Reproduction is primarily connected to human cloning (61%) which is perhaps not strange since cloning can be seen as reproduction. But also neurological diseases are primarily linked to cloning (55%) and this is probably due to the increasing interest in therapeutic cloning, which is often linked to a cure of Alzheimer. Finally issues of normality (51%) as well as psychiatry (77%) are linked to genome mapping. A strong interpretation of these figures could be, that in these areas solutions are not presented as developed equally far as with the other groups, since genome mapping is primarily concentrated on finding genes for particular traits and diseases.

Summarising the mediated articulation of problems, cancer is a dominating theme, and associated to a cure by gene therapy. Inheritable diseases are also still a major issue and should be avoided by prenatal testing. Human cloning, on the other hand, is associated to reproductive problems and neurological diseases, both of which are also of relative importance. The other groups of diseases are rarely articulated as single issues and there is not a single field of application that seems to be the answer to the problems they pose. Psychiatry, though, is special, since it seems that there are no solutions to psychiatric problems although we might discover the genetic causes. Finally, issues of normality do get relatively much attention and is primarily portrayed as a question of identifying single genes connected to particular traits and characteristics.

### **Geographical origin of stories**

As biotechnological research and applications have global implications, mass mediated news on these topics possibly originate all over the world. The pilot study, however, demonstrated that it would make sense to divide the world in

four parts: Denmark, Europe, USA and the rest of the world.<sup>24</sup> The most noticeable thing is that almost all news articles focus on occurrences in the ‘western world’. From figure D (Appendix B) it appears that almost two thirds of the articles cover stories that originate in Denmark (60%), whereas the rest is divided between USA (19%) and Europe (16%) and only 4% from the rest of the world.



From figure 6 it is evident that stories from Denmark is relatively less concerned with basic research as with applied research and routine use of technologies. This tendency can be further clarified in table E (appendix B), where it emerges that the Danish stories particularly deal with gene therapy and the routine uses of genetic tests and reproductive technologies. Furthermore it appears from table F that Danish stories are particularly concerned with Inheritable diseases and Cancer, whereas most of the other disease groups receive relatively low attention.

Stories from Europe primarily deal with aspects of public regulation, and from table E it appears that this is especially in connection with human cloning. This is interesting since the time period covered do not include spring 1997, where the cloning of Dolly in Scotland was published. Furthermore, animal experiments and the general mapping of the human genome are relatively

<sup>24</sup> It is the geographical origin of the occurrence that is coded. A story about new research in USA is coded as USA even though it might contain reactions from Danish researchers. Another article that deals solely with Danish reactions is coded as Denmark.

common issues in stories from Europe. On the other hand applied research as well as routine use do not receive very much attention. Likewise it appears from table F that European stories relatively rarely present specific health problems to be solved by biotechnology as more than one third do not cover specified diseases or problems to be solved.

The stories from USA on the other hand do not deal with regulation. In stead they focus primarily on basic research, and from table E it appears that the mapping of the human genome is in focus in more than one third of these articles. Compared with the Danish and European stories, it can be observed from table F that the American stories deal with a lot of different health problems, which biotechnology is intended to relieve, for instance cancer, heart diseases, diabetes and neurological diseases. The American stories however have one thing in common with European stories and that is a comparatively high amount of stories that cover biotechnology in relation to normality. This is one of the more controversial uses of biotechnology within the health care sector and so the mass mediated articulation leaves the impression, that the most far reaching consequences of biotechnology is coming from outside Denmark.

Finally, stories from outside Europe and USA only make up 4 per cent of the total coverage. These stories cover different aspects of biotechnology, although there is comparatively more focus on research than on routine uses and public regulation. From table E and F it appears that there is a remarkably large amount of the stories that focus on reproductive problems and fields of applications related to reproduction (Cloning, reproductive technologies and animal experiments). This implies that reproduction seems to be the major problem for biotechnology to solve in the rest of the world.

All together these differences can be interpreted to imply a mass mediated picture in which new breakthroughs with extensive consequences primarily comes from abroad. Whereas American stories primarily articulate new discoveries with far-reaching consequences and possibilities of curing heart-diseases, cancer, diabetes, neurological diseases and so on, European stories are much more concerned with issues for regulation, particularly in connection to human cloning. In contrast, the domestic research front is portrayed as primarily occupied with concrete uses of knowledge and technology in diagnose and therapy. With the exception of gene therapy as a cure for cancer, Danish news is not so concentrated on revolutionary research, but focus considerably more on

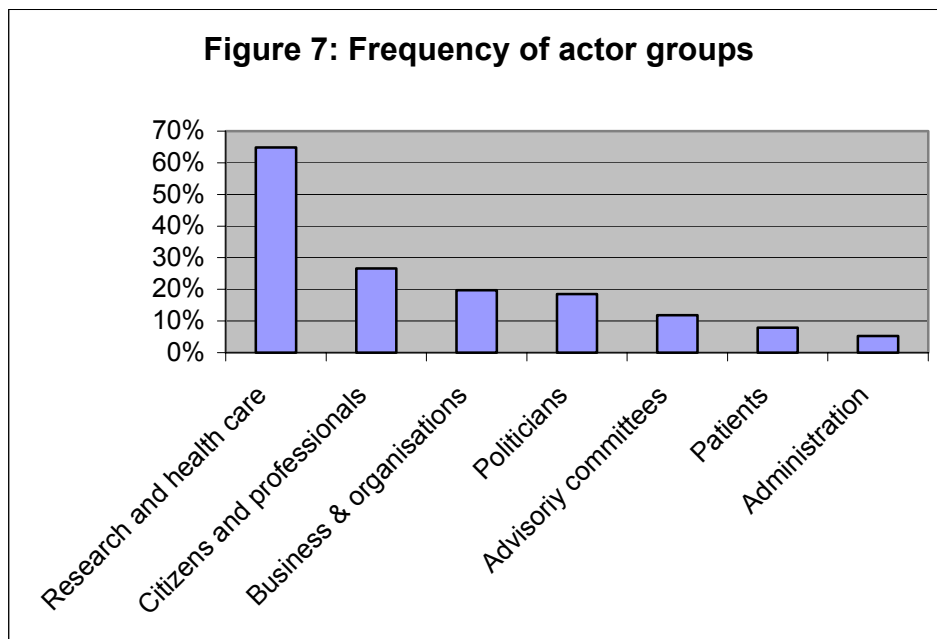
the concrete and practical implications of genetic tests and reproductive technologies in the daily life of ordinary people.

## **The articulation of human actors**

This part investigates what kind of human actors that appears in the stories about biotechnology. The basic assumption is that actors are articulated in different roles by being inscribed in the network of articulation. It is the productive work of the mediating practice to articulate the actors in these roles, for instance as genetic researcher or politician. A human actor is articulated as an actor in so far as he is presented in a particular role as performing actor. This should not be taken to imply that there is no connection to actual living persons by the same names as the actors articulated in the article. Rather it is used to emphasise that they are shaped, created or negotiated by journalistic work. It is the practice of exploring the network of articulation that lead to the articulation of actors in certain ways.

In this context, it should also be emphasised that it is the mediated articulation of an actor that is the object of the analysis. A member of the Ethical Council is only counted as such, if he is explicitly presented this way in the article. Just like researchers are actors, which is presented as researchers in the concrete article. I am not trying to measure how often the ethical council or its members get through with a message in the media. Rather I am counting how often the mediated stories include an actor presented as member of the ethical council. The objective of the analysis is to describe the way the mediated stories articulate biotechnology, not to study how the mediated articulation fits with an outside reality.

Furthermore, observing the mediated articles it is not possible to determine what kind of relation the journalist has had to the human person articulated in a role as actor. For instance whether the journalist has used the person as direct source to the story or whether the relation is more indirect. The analysis is therefore not designed to make distinctions between, for instance, sources and other kinds of actors in the articles. Rather, the articles are taken at face value and all the actors presented are included no matter whether they are cited directly, indirectly or in other ways recognised as actors.



Again the pilot study was used to design a list of categories of actors that seemed appropriate for the analysis of associations. Altogether 20 different actor-categories were found and they have been clustered in 7 different groups. Acknowledging that most articles present more than one actor, the analysis has been designed so as to make it possible to code each article for more than one actor category. The categories have furthermore been supplemented with a count of the number of actors in each article.

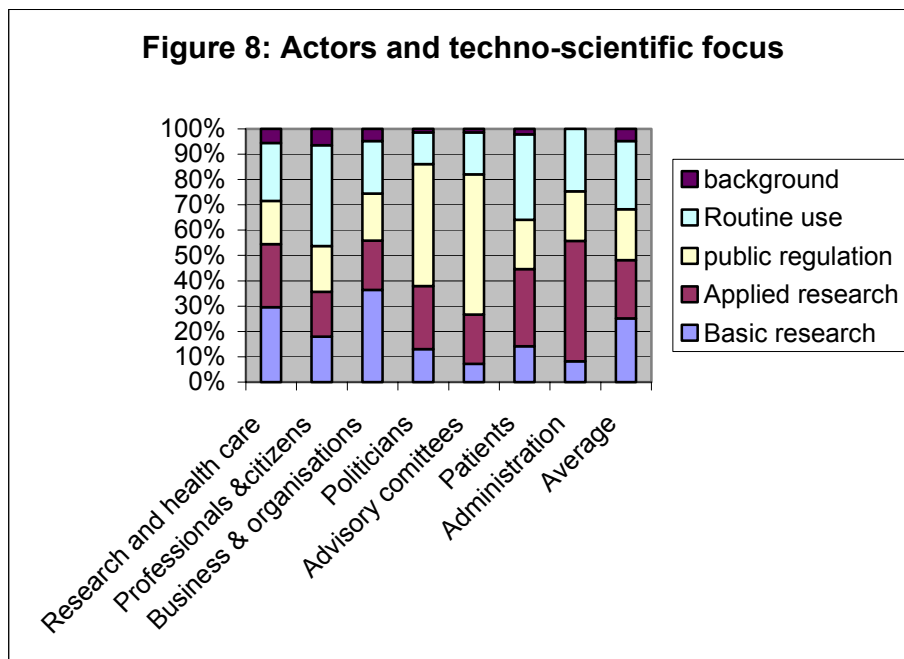
From figure 7 it appears that by far the most common group of actors are researchers and health care professionals, as two thirds of the articles include this group. Further details are available from table G in appendix B, where it is shown that this group is primarily medical researchers and other scientists. Danish and international medical and natural scientists each appear in approximately one third of the total sum of articles, whereas Danish social scientists appear in 8% of the articles. The last group, however, very often appear as authors of opinion pieces (Every third article is a opinion piece). Finally health care professionals (nurses, midwives and so forth) appear in 6% of the articles. On this background it must be concluded that stories about biotechnology very often associate to medical and scientific expertise.<sup>25</sup>

<sup>25</sup> In this connection it can also be mentioned that scientific journals are cited in 11% of the articles (of these are 1% Danish), hereby also stressing a rather widespread use of scientific sources.

In order to expand the analysis of each group of actors I have inquired into what kind of techno-scientific stages as well as fields of technological applications they are associated to in the articles. From figure 8 it can be seen, that researchers and health care professionals appear a little bit more often in articles focusing on basic research, but the distribution is very close to the average. From table H in appendix B it can similarly be observed that researchers and health care professionals are articulated in association to all the fields of application, but relatively rarely in stories about reproductive applications, such as cloning, prenatal tests and other reproductive technologies.

The second group of actors is made up of individual persons such as citizens (13%), professionals outside the health care sector (10%) and celebrities (6%), and this group is articulated in little more than a fourth of the articles. It should be noted that more than half of the appearance of ordinary citizens has the form of opinion pieces, whereas the other two types mostly appear in news (table G). In contrast to the group of researchers it appears from table H that citizens and professionals are most often associated to technological applications relevant for human reproduction such as cloning, reproductive technologies and prenatal tests. Similarly it can be observed from figure 6 that they are often associated to routine use of technologies and less often to either basic or applied research. Altogether, citizens and professionals are therefore comparatively most often articulated in connection to routine use of reproductive applications.

The third group of actors consists of business and organised interests, which altogether appear in every fifth of the articles. International firms are most common, since they are articulated in 12% of the articles, whereas Danish firms only appear in 6% of the articles. Organised interests, such as unions and industry organisations appear in 5% of the articles. None of these subgroups are very often authors of opinion pieces, but are primarily articulated in journalistically written news articles. From table H it can be observed that this group of actors primarily are associated to pharmaceutical use of biotechnology and from figure 8 it appears that business and organisations relatively more often is associated with basic research than other groups.



Politicians are articulated in almost every fifth article. It appears that Danish MP's (8%) are articulated more often than cabinet members (5%) and they are also more frequently authors of opinion pieces. The most frequent political actors, however, are international politicians (9%). From figure 8 it emerges that public regulation is by far the most common techno-scientific stage for politicians to be associated to, and furthermore it can be seen from table H that of all the different fields of application, politicians are most frequently associated to cloning.

The fifth group is the advisory committees. In Denmark there are three types of permanent boards producing advice and other input to the policy process. Of these the Council of Ethics and members of this council is by far the most frequently articulated actors (9%). The Board of Technology is primarily a body for organising participatory processes and other dialogues over science and technology – this is probably one reason why this body is only very rarely articulated as actors (1%). Finally the system of Research Ethics Committees works as authorising bodies in connection to ethical aspects of medical research on humans. These committees are cited in 2% of the articles. It can be observed that while members of the Council of Ethics relatively often authors opinion pieces; the members of the Research Ethical Committees have only done this on one single occasion. From figure 8 it appears that just like politicians, these advisory bodies primarily appear in articles focusing on regulatory aspects and



primarily in connection to reproductive technologies, but also cloning and prenatal tests are fields of applications that committees appears in connection to.

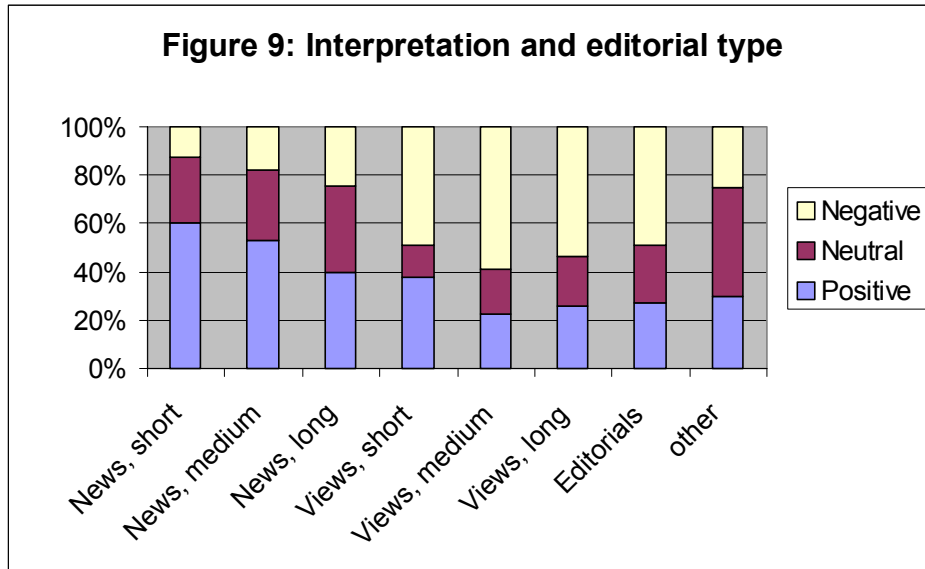
Patients or their relatives are articulated in altogether 8% of the articles. It is most frequently the patient organisations, which are articulated as actors (5%), but also individual patients (3%) and their relatives (2%) appear every now and then. From table G it appears that relatives are frequently articulated as authors of opinion pieces, whereas actual patients and the patient organisations mostly appear in news articles written by journalists. From figure 8 it can be seen that this group is primarily articulated in connection to routine use of technologies and also in relation to applied science. Concerning different fields of application it can be seen from table H that patients and relatives most often appear in connection to prenatal tests and gene therapy.

Finally, the group of administrators are articulated in 5% of the articles and this is almost completely in journalistically written news. Apparently administrators do not write opinion pieces as administrators, but they do appear every now and then in news articles. They are to a large degree associated to applied research, whereas they are not associated to basic research. Furthermore it can be seen from table H that they primarily appear in relation to the applications of gene therapy and genetic tests (both prenatal and postnatal).

## **Controversial issues**

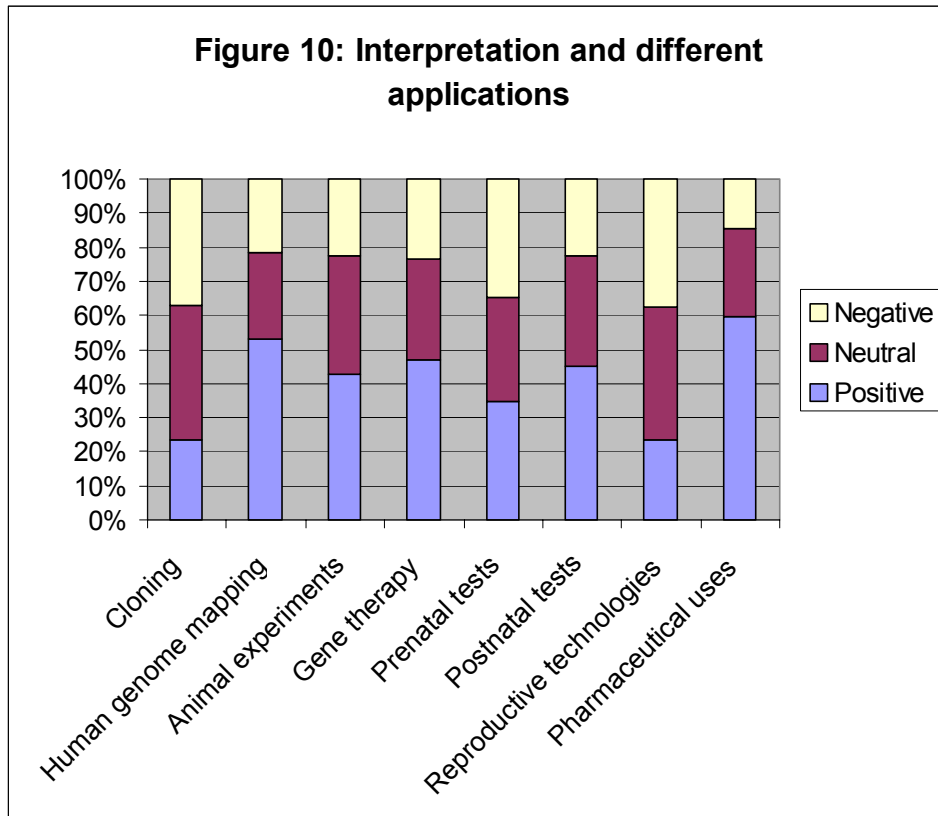
In the present analysis, controversy has been interpreted as a question of whether biotechnology is presented as a problem or a solution. The more biotechnology is presented as both a problem and a solution, the higher the amount of controversy. As a practical definition of this I have designed a category measuring whether the article interprets the biotechnological application in question in a positive, negative or neutral way. The overall picture reveals that 43% of the articles must be said to be positive, that is, presenting biotechnology as a solution to problems, 27 % are negative, that is, presenting biotechnology as posing more problems than solutions and finally 30% must be said to be neutral. It should be observed that in the following figures the category of neutral includes all the articles that did not have a clear positive or negative interpretation. Therefore it is not necessarily a measure of less

controversy, but can be taken to imply either that the article is neutral or diffuse, or that several interpretations are presented in the same article.



Since controversy, as mentioned, could be regarded as a news value in itself I will start by examining a few editorial variables in terms of their presentation of biotechnology. Figure 9 shows that news is more positive towards biotechnology than views (opinion pieces and editorials). This is not very strange as it is probably one of the strong criteria for writing and publishing an opinion piece that something is being problematised. But it should be noticed that more than half of the opinion pieces are explicitly interpreting biotechnology as a problem rather than as a solution. It can also be noticed from figure 9 that longer news articles are less positive than shorter. Furthermore, it appears from figure K in appendix B that front page news are more positive than articles placed elsewhere in papers, although the difference is not huge. To expand on this, it appears from figure L that the more fields of applications an article associate, the less positive it is and the more neutral (and possibly also diffuse) it becomes. A strong interpretation of this is that complexity increases controversy.

Figure 10 demonstrates the association between interpretation of biotechnology and the different fields of applications mentioned in the article. Since many articles cover more than one field of application, I have supplemented figure 10 with figure M in appendix B, which only includes articles that covers only one field of application.

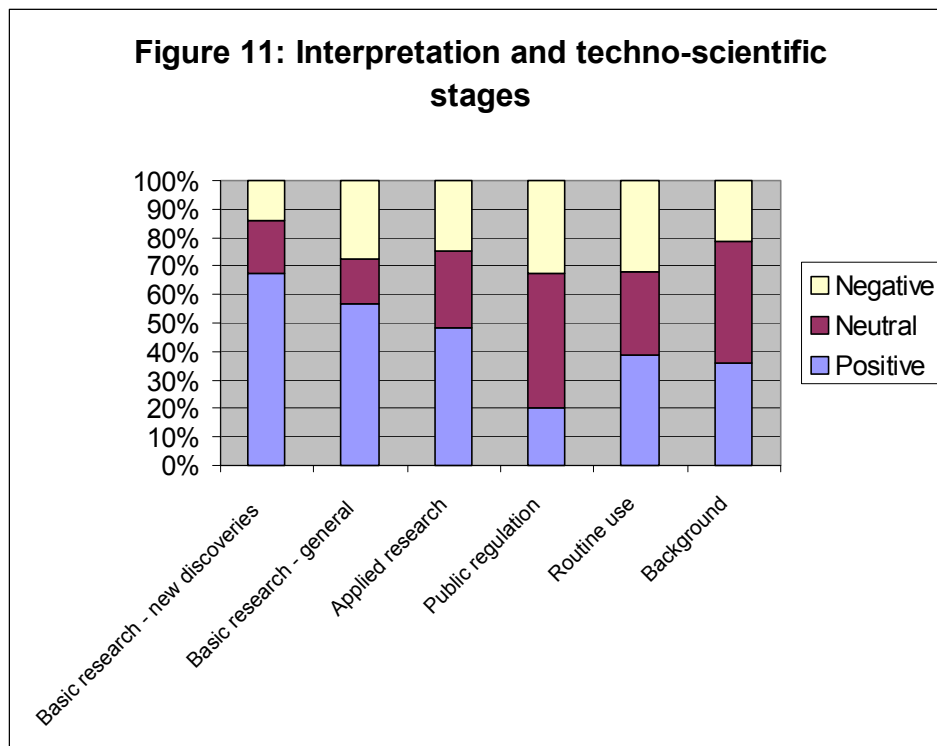


The most noticeable observation from figure 10 and figure N is that all fields of application can be interpreted as posing problems instead of solutions, and therefore we must conclude that all fields of application is to a certain extent presented as controversial. It also appears that applications associated with human reproduction, such as Cloning, Reproductive technologies and Prenatal tests are interpreted most negatively. Similarly it can be seen from figure N in appendix B that these three fields of application are the ones that are discussed rather more frequently in opinion pieces than in news articles. On this background it is probably fair to say, that when biotechnology is discussed as a means to control or change human reproduction it is most controversial.

Furthermore it appears from figure M that when articulated as a single issue, the application of postnatal tests is also viewed relatively more negative than when covered in connection to other technologies (as in figure 10). This is probably because it is often associated together with human genome mapping where the interpretation of biotechnology is relatively more positive. Exactly the opposite is true of gene therapy and animal experiments, which seems to be interpreted more positively when they are the only issues in an article than when they are

associated to other issues. In the case of animal experiments this is probably due to the fact that this field of application is very often articulated together with cloning where the interpretation is much more negative.

Pharmaceutical uses can be seen to be the field of application, which is most often interpreted in a positive fashion as a solution to problems. This is even more evident from figure M (but it should be taken into account that in figure M the total number of articles that articulate pharmaceutical use as single issue is rather low, n=12). And finally, the articulation of human genome mapping can also be seen to be a bit more positive than the average, with no difference whether it is covered as single issue or as one among several fields of application.



The understanding of controversial issues is further expanded by figure 11, which displays how biotechnology is interpreted either positively or negatively when the focus is on different techno-scientific stages. The category of basic research has been divided in two because it appeared that articles presenting particular new discoveries are rather more positive than articles presenting basic research in general. And whereas applied science is less often articulated positively, the articulation could also be seen to be more ambiguous (higher

frequency of neutral) than in the case of basic research, where articles less often present biotechnology ambiguously.

It also appears from figure 11 that it is when biotechnology is associated to issues of public regulation that it is interpreted as most problematic. This is not strange, since the category itself implies that regulation might be necessary. More interesting is, however, that routine use is interpreted more negatively than all the different stages of research. From this it can be concluded that biotechnology does not become less controversial when it becomes an established practice. Rather than breeding less controversy, it seems that familiarity and routine use makes biotechnology more contested. In this connection it should be observed from figure O in appendix B that it is also relatively more frequent for views to focus on routine use and public regulation than the other technoscientific stages.

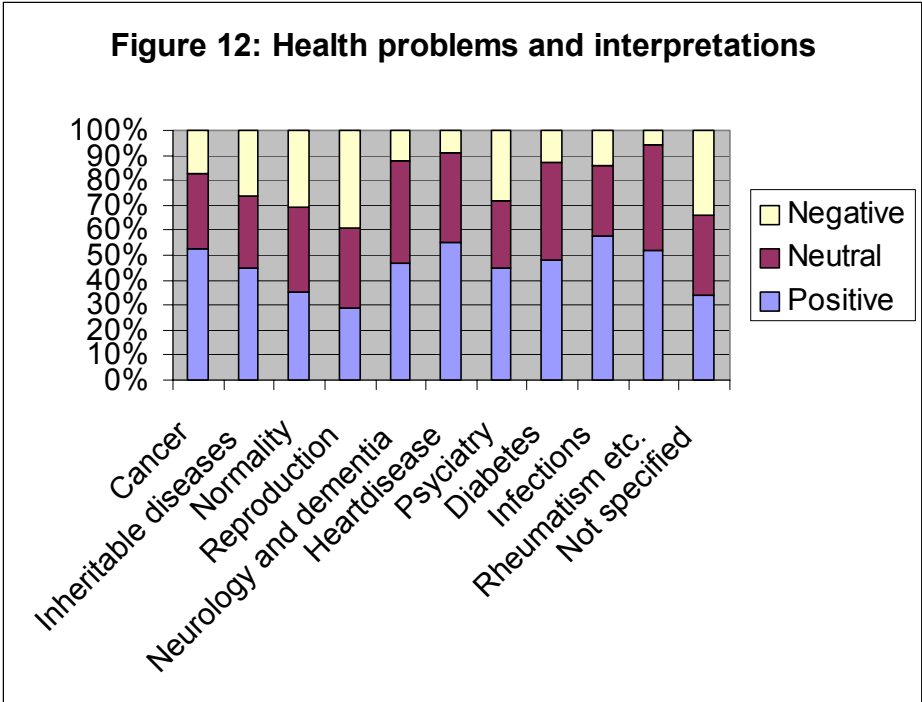


Figure 12 shows that all identified health problems can be associated to negative interpretations of biotechnology, although it is not very common with Neurological diseases, Heart diseases, Diabetes, Infections and rheumatism. Cancer is close to average, but Psychiatric diseases seems to pose a particular case, where biotechnology is considered more problematic than with the other groups of diseases. Traditionally known inheritable diseases are also articulated in association to rather more negative interpretations, but changes to normality

as well as solutions to reproductive problems are the most controversial issues. In the case of reproductive problems the number of negative articles outweigh the number of positive. Furthermore it should also be noticed that articles, where no diseases are specified, also appears to interpret biotechnology rather negatively. It is therefore evident that articulating a somatic health problem is far more often associated to positive articulation than no specification of problems or association to normality or reproductive problems.

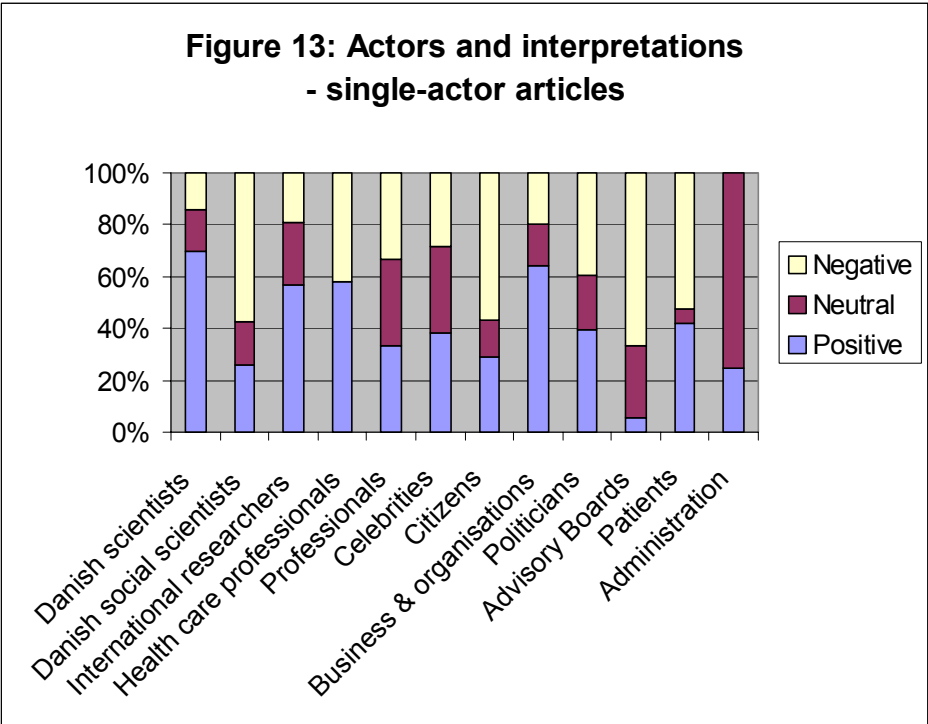


Figure 13 reveals the associations between different actor groups and the interpretation of biotechnology. This association is not straight forward, as most articles presents several actors and one of them can therefore easily be presenting divergent interpretations than the rest. I have therefore chosen only to include articles articulating a single actor in figure 13. As it can be observed from figure Q, however, single-actor articles are more polarised and less often neutral in interpretation. Thus, the selection of single-actor articles displays a more polarised picture than the whole collection of articles. In appendix B, therefore, I have included table P, where it is possible to view the interpretative frequencies for all articles. Especially with regard to the three groups of Politicians, Advisory boards and Patients & relatives, figure 13 differs rather much from table P. When these three groups are associated with other actors they are much more frequently articulated in articles where the overall

interpretation is neutral or diffuse. When they are single actors in an article, however, the interpretations put forward are much more polarised.

Furthermore, it should be observed in figure 13 that the two largest groups of actors (Researchers & health care professionals and Professionals & Citizens) have been split into the original categories. This division is due to the fact that there were rather large internal differences between the categories in these groups and furthermore these two groups were large enough to be split.

From figure 13 it appears that members of advisory boards (primarily the Council of Ethics) appears to be the most critical. Also Danish social scientist, Citizens and Patients are primarily appearing in articles that interpret biotechnology rather negatively. Politicians and Professionals seem to be equally divided between generally positive and negative accounts. For both actor groups it appears from table P that when they appear in multi-actor articles, these are more often neutral or diffuse. Celebrities and health care professionals appear in articles that are slightly more often positive than negative. But most positive is the articles where Danish medical and natural scientists, international scientists and business & organisations appear.

An overall comparison between figure 13 and table P gives the impression that most actors are articulated in articles that present both positive and negative interpretations of biotechnology, although some actors are primarily associated to positive interpretations (scientists and business) and other to negative interpretations (Advisory Boards, Danish social scientists, citizens and patients).

## Conclusion

Biotechnology has been covered as an issue of controversy throughout the period between August 1997 and January 2002. From the present analysis it is evident that all the different applications of biotechnology identified in this chapter can be articulated as controversial, although it is more frequent with some of them. Two thirds of the articles articulate a concrete problem to be solved by biotechnology. In this context it is far more frequent that somatic health problems are associated to a positive interpretation of biotechnology, than changes in normality and reproductive problems. Also articles mentioning no specific problems appear to be more critical. On a general level, natural and medical scientists are by far the most frequently articulated kind of actors in the articles. Together with business and organisations they tend to be articulated in articles with an overall positive interpretation of biotechnology, whereas advisory boards, social scientists, citizens and patients tend to be associated to negative interpretations.

Revolutionary or far-reaching uses of biotechnology receive most attention and human cloning is the field of application, which has been articulated in most articles throughout the period. Together with the applications of prenatal tests and other reproductive technologies it forms an area of biotechnology which is often articulated with a focus on routine use of these technologies at the same time as it is interpreted as highly controversial. Actors associated to this articulation are often Advisory boards, Politicians and Professionals and citizens. In comparison it is relatively rarely researchers and health care professionals.

Similar to cloning, the articulation of gene therapy is concentrated in spectacular case stories that receive a large amount of articulation in few months. In contrast to cloning, this application is articulated rather positively and even more so, when it is the single issue in an article than when it is associated to other applications. Finally, it is very often associated to cancer. Gene therapy can therefore be seen as a prime example on a field of application associated to applied medical science, with the aim of creating solutions to problems of serious disease.

In contrast to cloning and gene therapy, other types of application, such as genome mapping and genetic tests, seem to receive attention on a much more



stable basis. For instance, genome mapping is articulated in a continuous stream in the mass media. It never receives extremely high amounts of attention but the issue is articulated in many different contexts and in association to most of the other fields of application. Also genetic tests are frequently articulated, and it appeared sensible to distinguish between the articulation of prenatal, postnatal and forensic tests. Whereas prenatal tests were primarily articulated as controversial because of their linkage to eugenics and selection, forensic tests were controversial with regards to the protection of privacy in a constitutional state. In contrast to this, postnatal tests were primarily articulated as a technology for individual consumption. Altogether it seems that the mapping and exploration of the human genome as well as the application of this knowledge in post-natal genetic tests and gene therapy is not as controversial as the use of biotechnology in matters of reproduction.

# Appendix A: Code scheme

## A. Løbenr.

### A1. Rubrik

## B. Dato:

## U. Tid: måned/år

## C. Medie:

1. Politiken
2. Ekstra Bladet
3. Aktuelt
4. Jyllandsposten
5. Information

## D. Placering:

1. Forsiden
2. Første sektion
3. Andre sektioner

## E. Genre:

1. Redak. art. kort
2. Redak. art. mellem
3. Redak. art. lang
4. Debat kort
5. Debat mellem
6. Debat lang
7. Leder
8. Anmeldelser
9. Andet

## F. Geografi:

1. Danmark
2. Europa
3. USA
4. Resten af verden

## G. Gen-teknologisk område (ikke udeluk)

1. Dyreforsøg og dyrs genom
2. Identifikation af hum. gener og mutationer
3. Medicinfremstilling eller –anvendelse
4. Genetiske test på humane fostre og æg
5. Genetiske tests på fødte mennesker
6. Genetisk screening
7. Andre reproduktions-teknologier
8. Human kloning
9. Human genterapi (og gensplejsning)
10. Andet

## H. Sygdomme (Ikke udeluk)

1. Traditionelt kendte medfødte sygdomme
2. Kræft
3. Hjerte/kar
4. Sukkersyge
5. Astma/Allergier
6. Gigt/bevægeapparat
7. Fedme/stofskiftesygd.
8. Demens/neurologiske
9. Psykiatri
10. Infektionssygdomme
11. Reproduktion

12. Normalegenskaber

13. Andre sygdomme

14. Ikke specificeret

15. Ikke syg/sund.relat

## I. Fokus

1. Grundforskning
2. Anvendt forskning
3. Off. regulering
4. Rutinemæs. anv.
5. Baggrund

## I2: hvis grundforskning

1. Ny opdagelse af gener/mutation/tekn
2. Kortlægning og patentering af gener

## K. Hovedindtryk:

1. Positiv
2. Negativ
3. Neutral/diffus

## L. Antal aktører:

1. En
2. To
3. Tre
4. Fire
5. Fem
6. Seks
7. Seks+
8. Ingen

## N. Aktør-roller

1. Genetiske forskere og. selskaber/foren.
2. Andre læger og medicinske selskaber
3. Andre naturvid. forskere
4. Hum/Sam forskere
5. Udenlandske forskere
6. Sundhedsprof.
7. Det Ethiske Råd
8. Teknologirådet
9. Videnskabetiske komiteer
10. Sundhedsminister og –ministerium
- 10a. Forskningsminister mv.
11. Sundhedsstyrelsen
12. Andre embedsmænd
13. Regeringsmedlemmer
14. Folketingets sundhedsudvalg
- 14a. Folketingets forskningsudvalg
15. Øvr. danske politikere
16. EU-aktører
17. Udland. politikere
18. Sygdoms- og patientforeninger
19. Patienter
20. Pårørende

21. Arbejdsmarkedsorg.
22. Virksomheder (DK)
23. Virksomheder (udl.)
24. Andre organisationer
25. Professionelle (ikke sundheds.)
26. Kendte og kulturpers.
27. Konkrete borgere
28. Statistiske befolk-ningsundersøgelser
29. Sundhedsvid.fagblade og -tidsskrifter
30. Udl. videnskabelige. tidsskrifter
31. Andre medier
32. Andre roller
33. Ingen roller

## **Appendix B: Tables and figures**

Figures A1-A8: graph with monthly coverage of each technology

Table B: Associations of fields of application

Table C: Associations of fields of application and problems

Figure D: Geographic origin of stories

Table E: Geographic origin and applications

Table F: Geographic origin and problems

Table G: Actors and journalistic genre

Table H: Actors and different fields of application

Figure K: Interpretation in different sections of paper

Figure L: Interpretation and number of applications in each article

Figure M: Interpretation in single-application articles

Figure N: Applications in news and views

Figure O: Techno-scientific stages in news and views

Table P: Interpretations and actors

Figure Q: Interpretation and number of actors

Figure R: Interpretation and geographic origin

Figure A1: Cloning

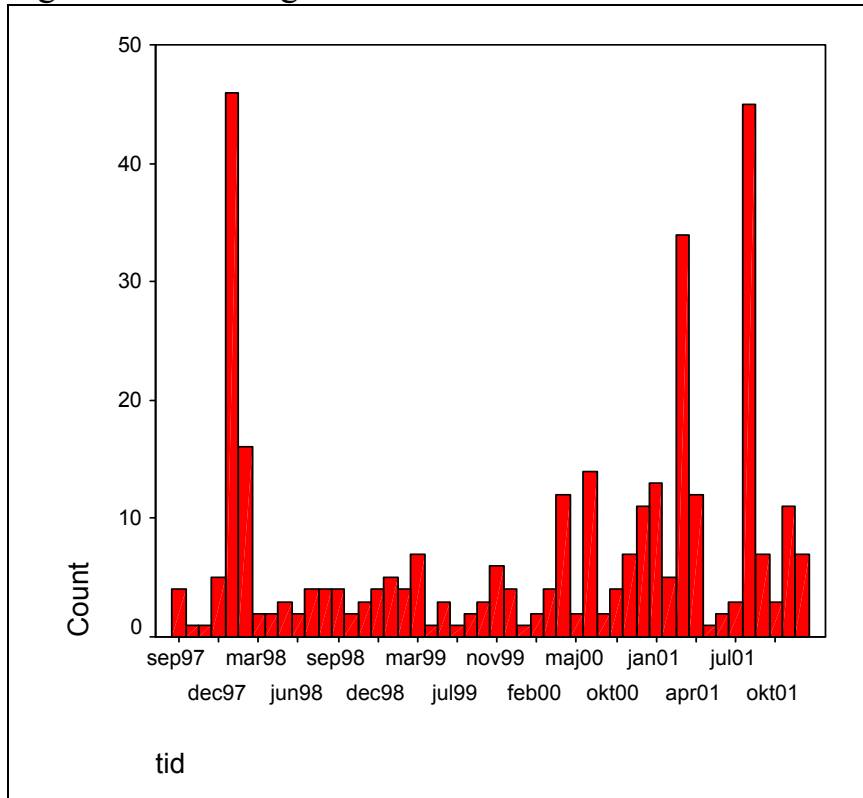


Figure A2: Human genome mapping

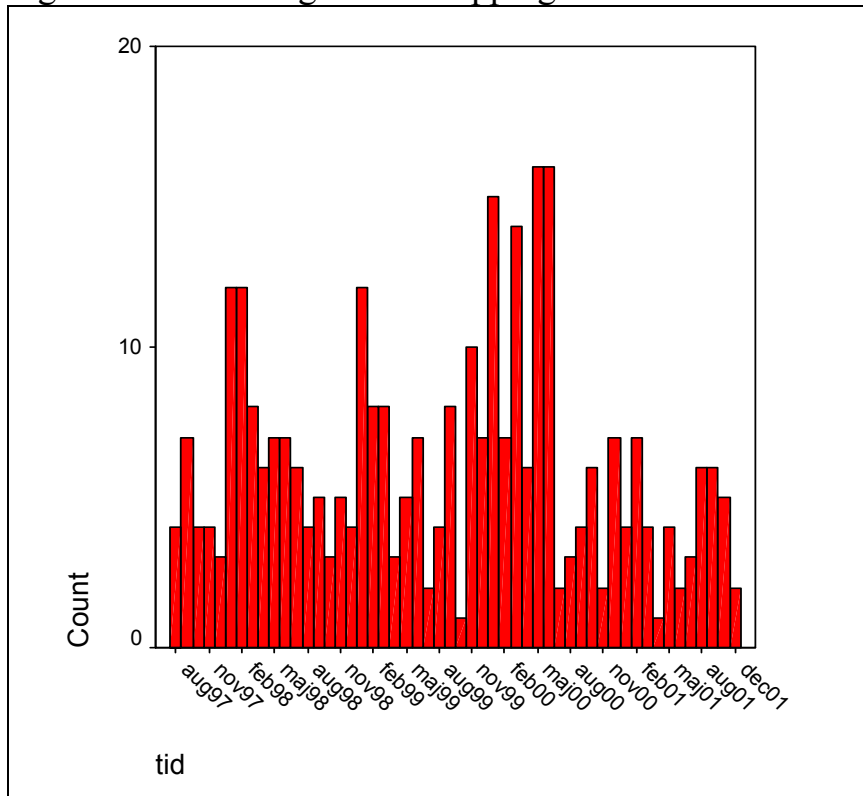


Figure A3: Animal experiments

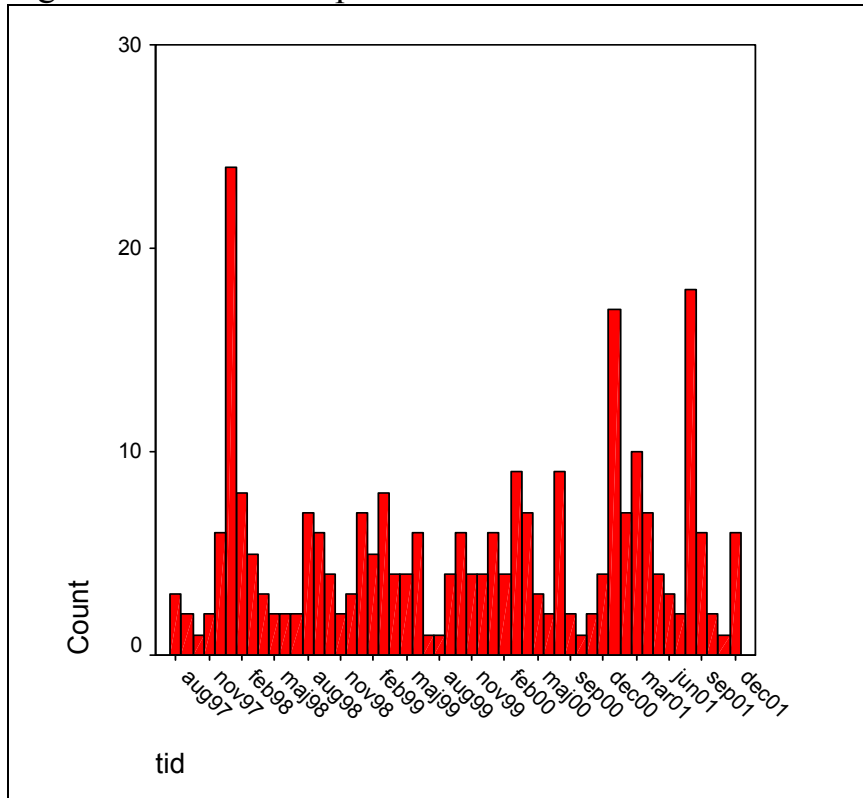


Figure A4: Human gene therapy

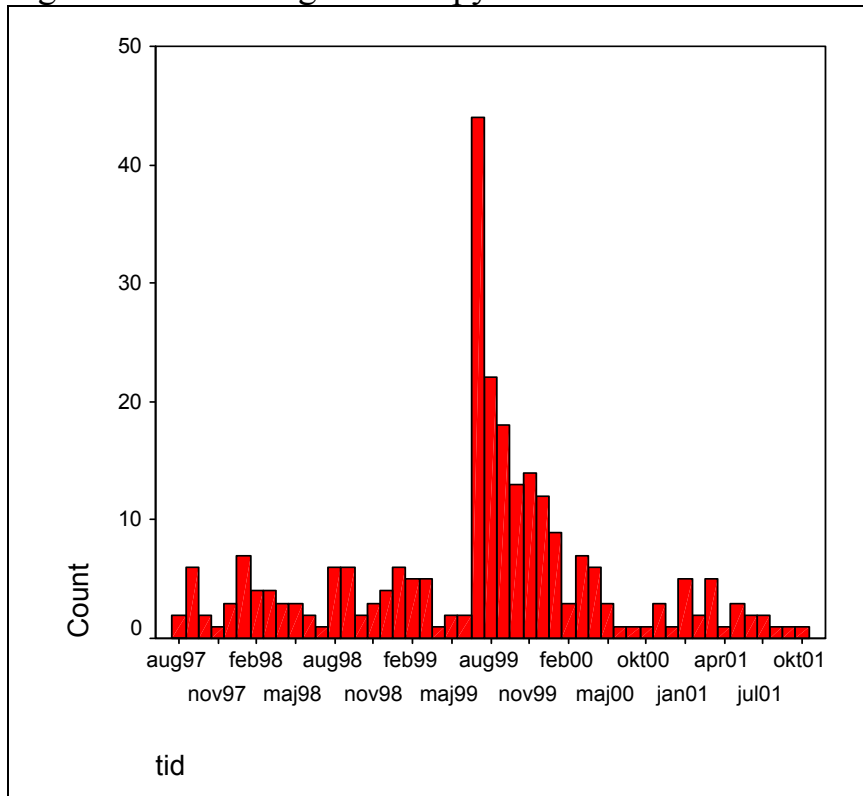


Figure A5: Prenatal tests

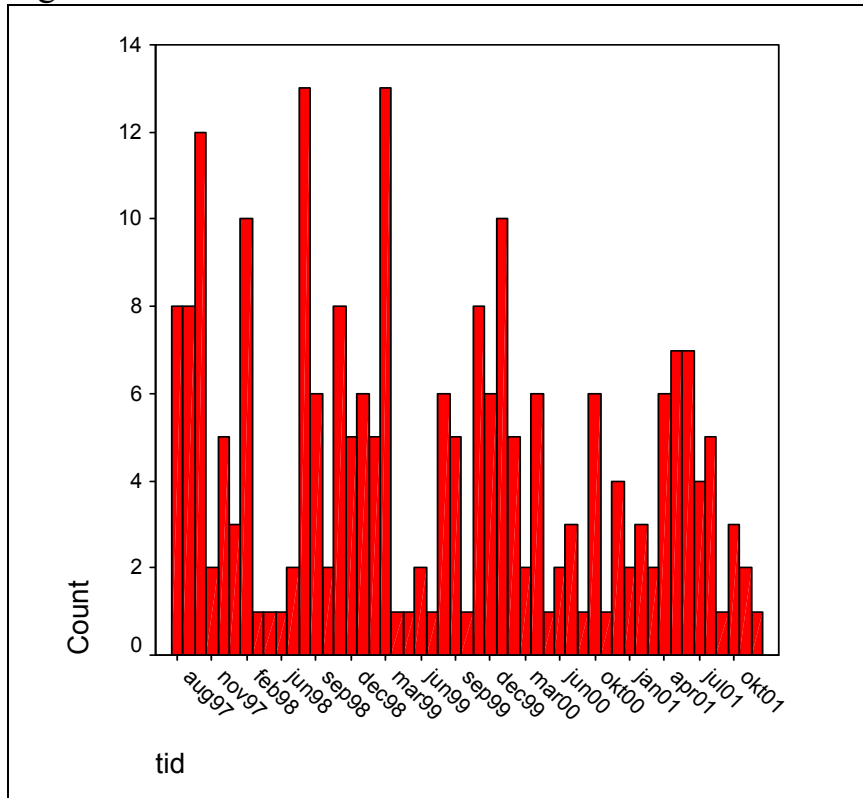


Figure A6: Postnatal tests

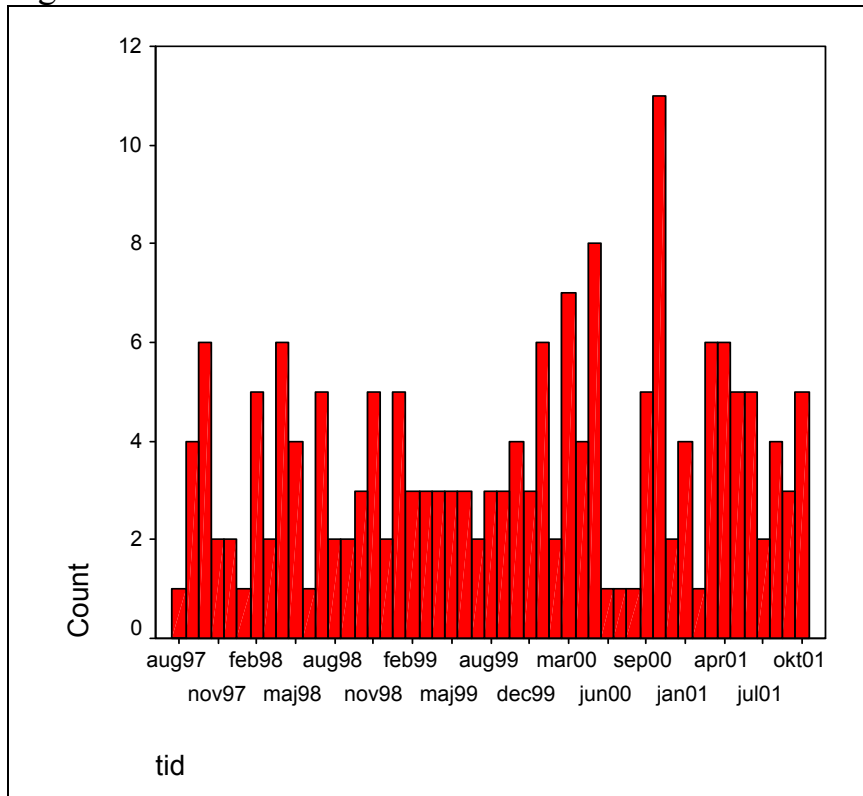


Figure A7: Other reproductive technologies

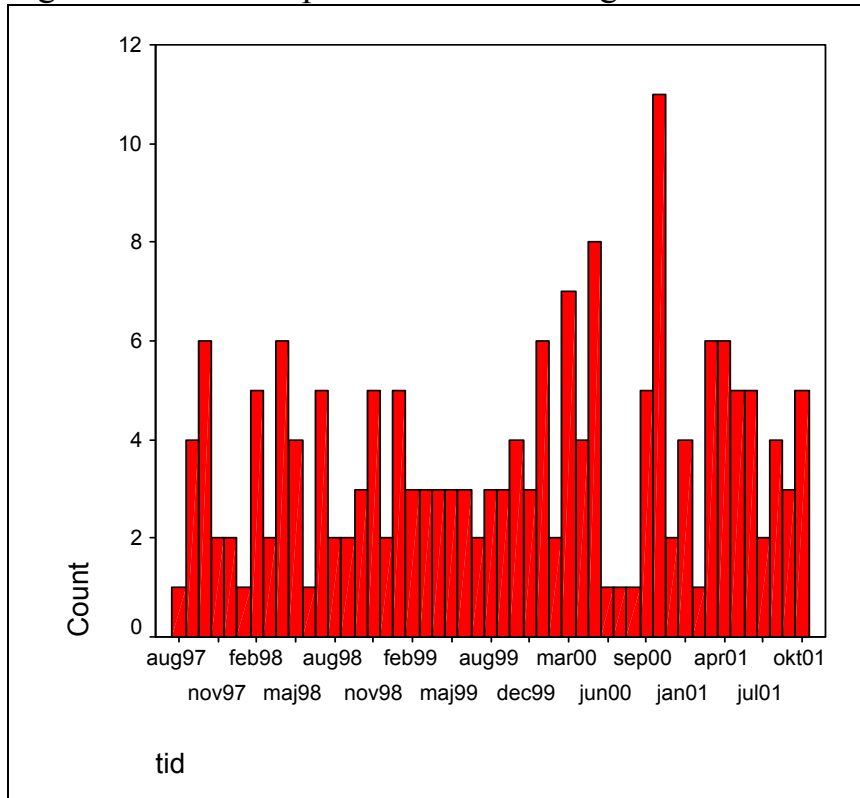


Figure A8: Pharmaceutical production and use

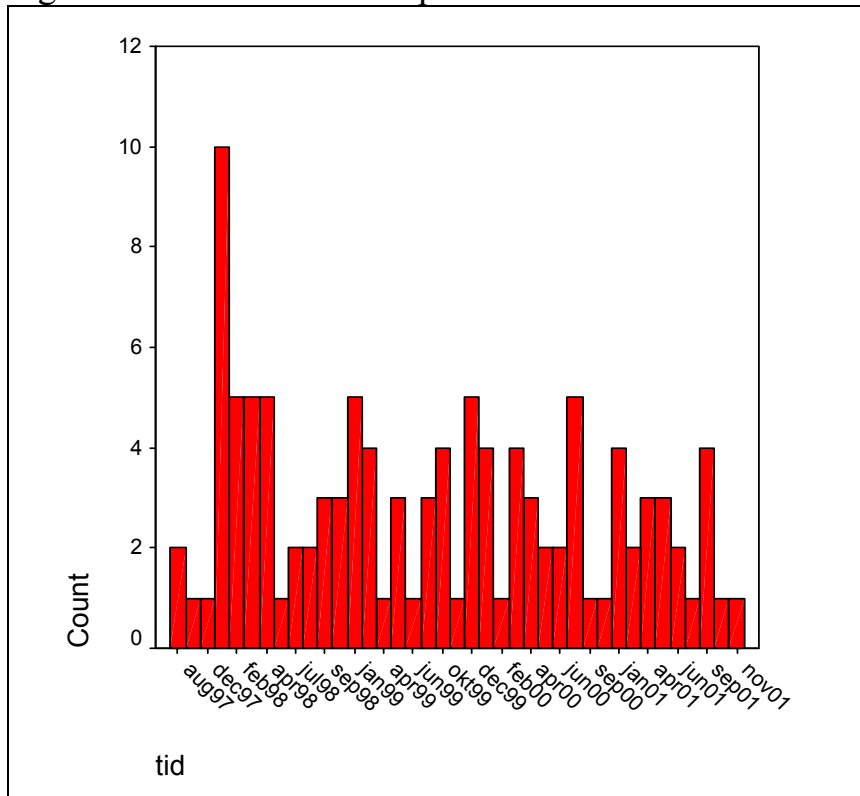




Table B: Associations in fields of application

	Cloning	Genome mapping	Animal experiments	Gene therapy	Prenatal tests	Postnatal tests	Repro-technologies	Pharma use	N
Human cloning		6%	35%	10%	13%	5%	15%	7%	341
Genome mapping	7%		17%	15%	12%	23%	6%	14%	318
Animal experiments	45%	20%		18%	12%	8%	14%	18%	268
Gene therapy	13%	19%	18%		13%	8%	13%	8%	261
Prenatal tests	19%	16%	14%	15%		18%	23%	4%	226
Postnatal tests	10%	42%	12%	12%	23%		10%	11%	177
Reproductive technologies	36%	13%	26%	24%	37%	13%		4%	141
Pharmaceutical use	21%	41%	42%	20%	8%	18%	5%		111

Table C: Associations in fields of application and problems

	Cloning	Genome mapping	Animal experiments	Gene therapy	Prenatal tests	Postnatal tests	Repro-technologies	Pharma use	N
Cancer	13%	28%	11%	52%	8%	24%	6%	12%	289
Inheritable diseases	14%	22%	20%	16%	57%	24%	15%	12%	206
Normality	26%	51%	25%	24%	24%	13%	13%	11%	189
Reproduction	61%	5%	32%	8%	15%	7%	40%	2%	183
Neurology/dementia	55%	27%	39%	15%	21%	20%	12%	22%	100
Heartdiseases	36%	33%	30%	20%	18%	32%	5%	23%	66
Psychiatry	6%	77%	9%	9%	9%	25%	6%	20%	64
Diabetes	44%	37%	31%	26%	21%	24%	13%	27%	62
Infections	18%	46%	28%	38%	14%	24%	6%	22%	50
Rheumatism etc.	39%	33%	39%	12%	21%	24%	9%	21%	33
Asthma/allergies	0%	77%	15%	31%	8%	46%	15%	23%	13
Obesity	8%	83%	17%	25%	17%	50%	25%	33%	12

Figure D:

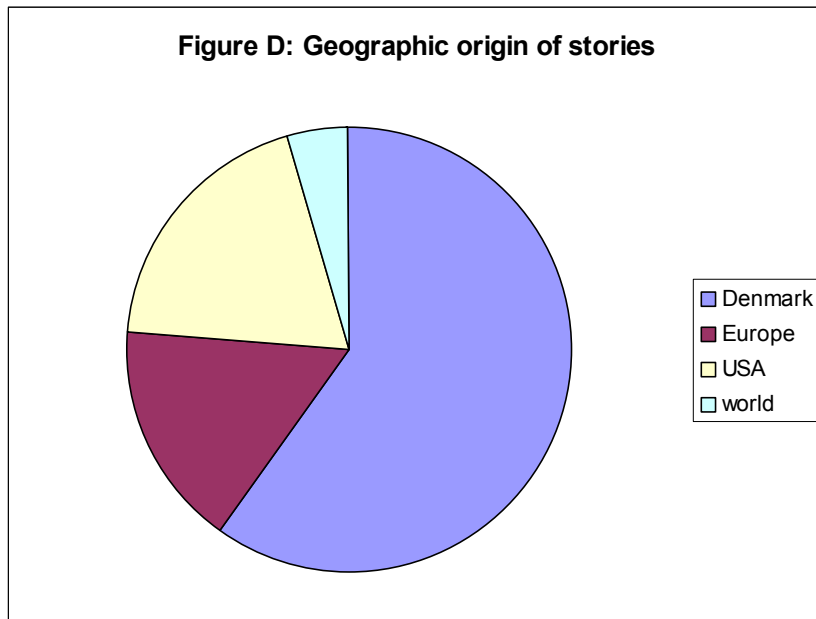


Figure E

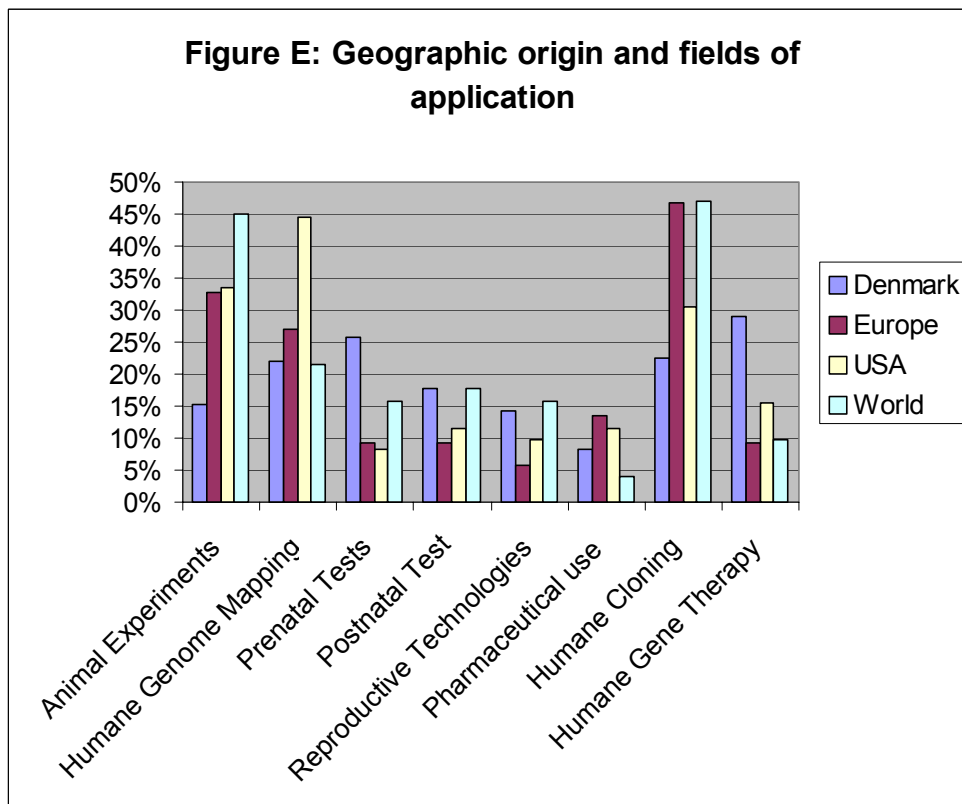


Figure F

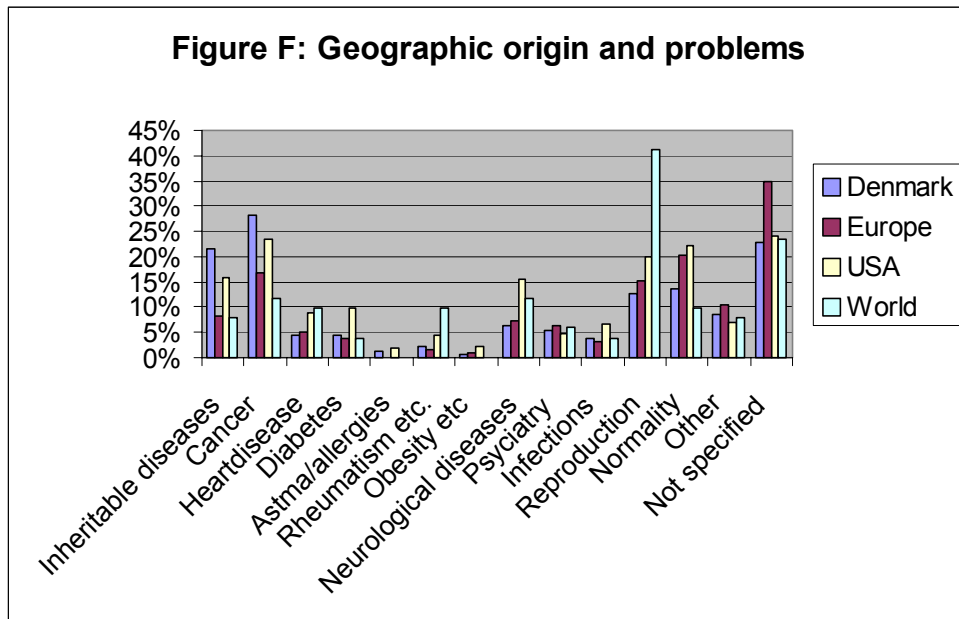


Table G: Actors and genre

				News	Views	Single-actor
<b>Research and health care</b>	<b>759</b>	<b>65%</b>		<b>83%</b>	<b>11%</b>	<b>24%</b>
Danish scientists	427	36%		87%	8%	19%
Danish social scientists	89	8%		58%	36%	39%
International researchers	371	32%		92%	4%	14%
Health care professionals	67	6%		91%	8%	18%
<b>Professionals &amp; citizens</b>	<b>311</b>	<b>27%</b>		<b>53%</b>	<b>30%</b>	<b>42%</b>
Professionals	120	10%		75%	5%	23%
Celebrities	69	6%		61%	7%	30%
Citizens	147	13%		34%	57%	57%
<b>Business and organisations</b>	<b>231</b>	<b>20%</b>		<b>91%</b>	<b>6%</b>	<b>11%</b>
Danish firms	71	6%		92%	3%	13%
International firms	135	12%		94%	6%	7%
Organised interests	63	5%		89%	6%	11%
<b>Politicians</b>	<b>216</b>	<b>19%</b>		<b>89%</b>	<b>8%</b>	<b>13%</b>
Cabinet members	60	5%		92%	4%	8%
Danish MPs	92	8%		87%	9%	15%
International politicians	107	9%		93%	5%	8%
<b>Advisory Boards</b>	<b>139</b>	<b>12%</b>		<b>87%</b>	<b>12%</b>	<b>13%</b>
The Ethical Council	111	9%		85%	14%	14%
Board of Technology	9	1%				11%
Research ethics committees	27	2%		96%	4%	4%
<b>Patients</b>	<b>92</b>	<b>8%</b>		<b>84%</b>	<b>12%</b>	<b>21%</b>
Patient organisations	53	5%		89%	8%	13%
Patients	30	3%		83%	7%	20%
Relatives	25	2%		76%	20%	24%
<b>Administration</b>	<b>61</b>	<b>5%</b>		<b>98%</b>	<b>2%</b>	<b>7%</b>

Besides the categories of news and views there was a third, consisting of reviews, announcements and so forth.

**Table H: Actors and different fields of application**

	Cloning	Human genome map.	animal experiments	Gene therapy	Prenatal tests	Postnatal tests	Reproductive technologies	Pharmaceutical use
Research & health care	52%	76%	68%	71%	65%	75%	57%	70%
Professionals & citizens	35%	22%	26%	17%	29%	25%	34%	20%
Business & organisations	18%	26%	28%	16%	10%	21%	15%	52%
Politicians	30%	12%	17%	18%	11%	18%	18%	13%
Committees	18%	8%	9%	13%	18%	15%	21%	5%
Patients	3%	8%	2%	11%	16%	6%	4%	1%
Administration	3%	2%	2%	8%	8%	8%	4%	3%
N	341	318	268	261	226	177	141	111

The table should be read so that of the 341 articles covering human cloning, 52% feature an actor in the group of research and health care.

**Figure K**

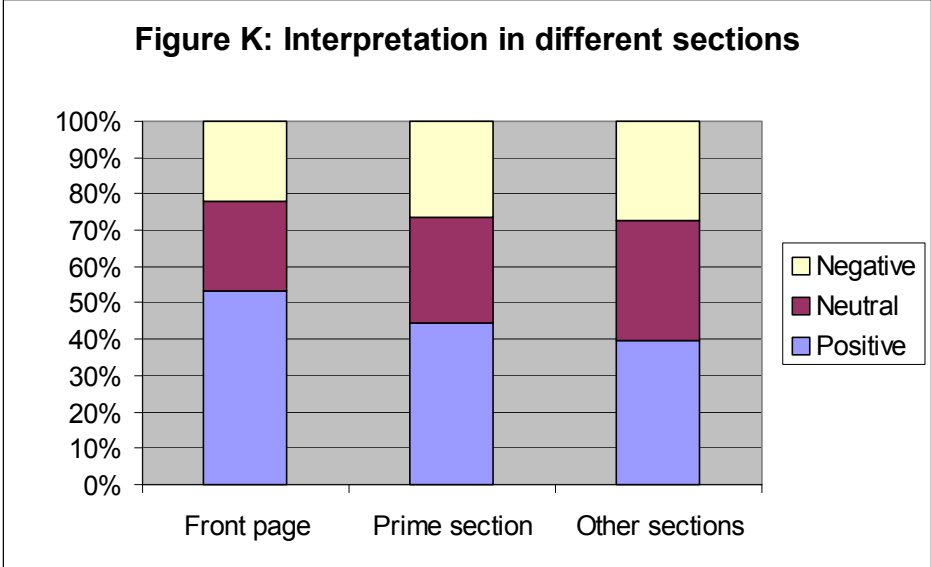


Figure L

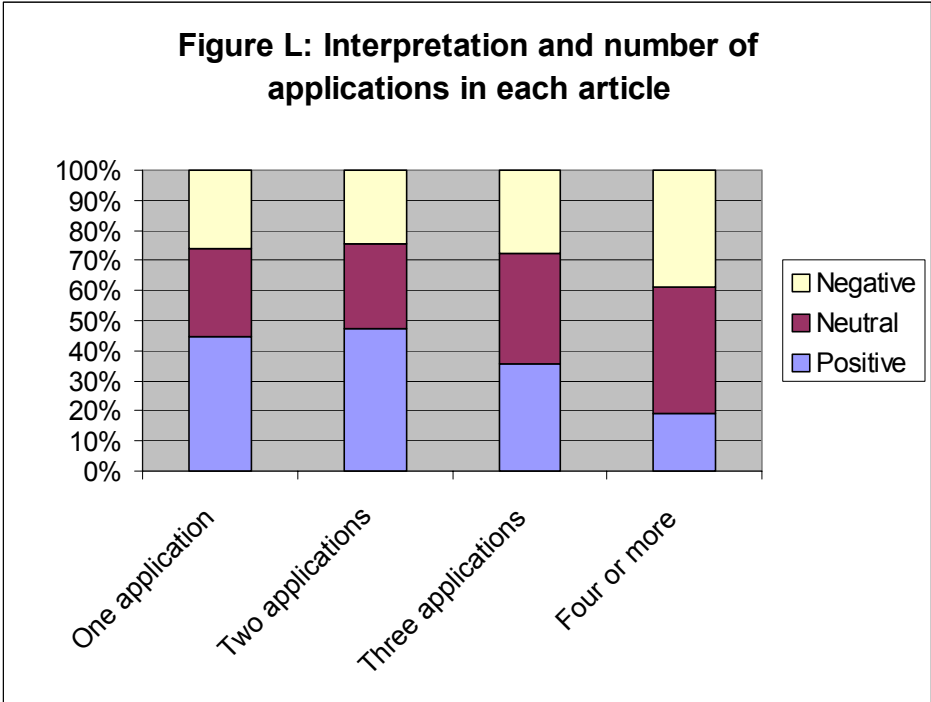


Figure M

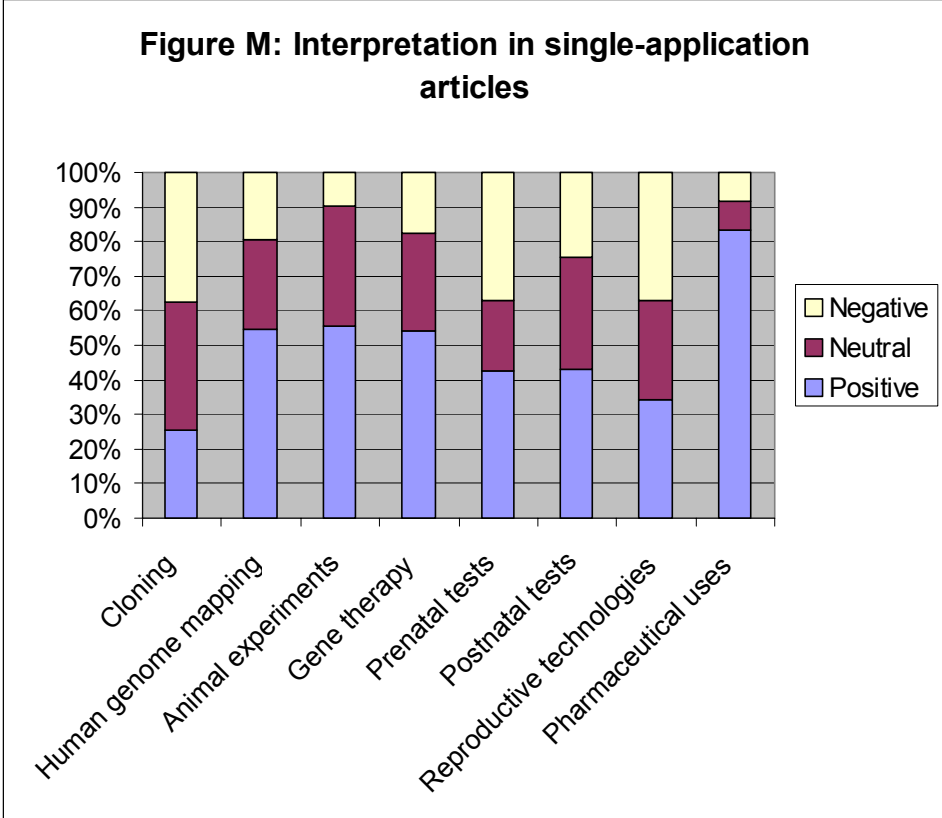


Figure N

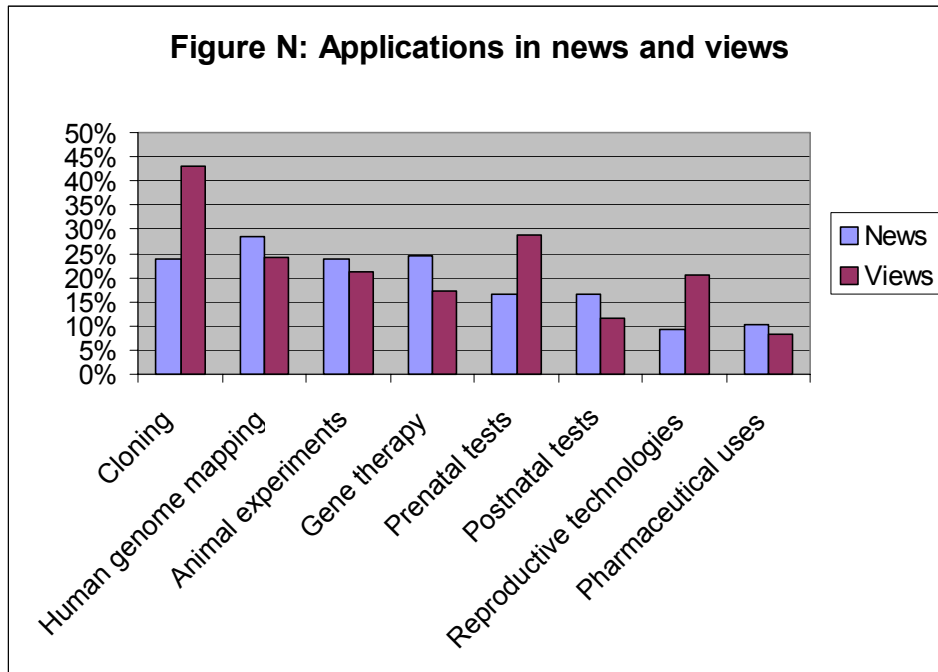


Figure O

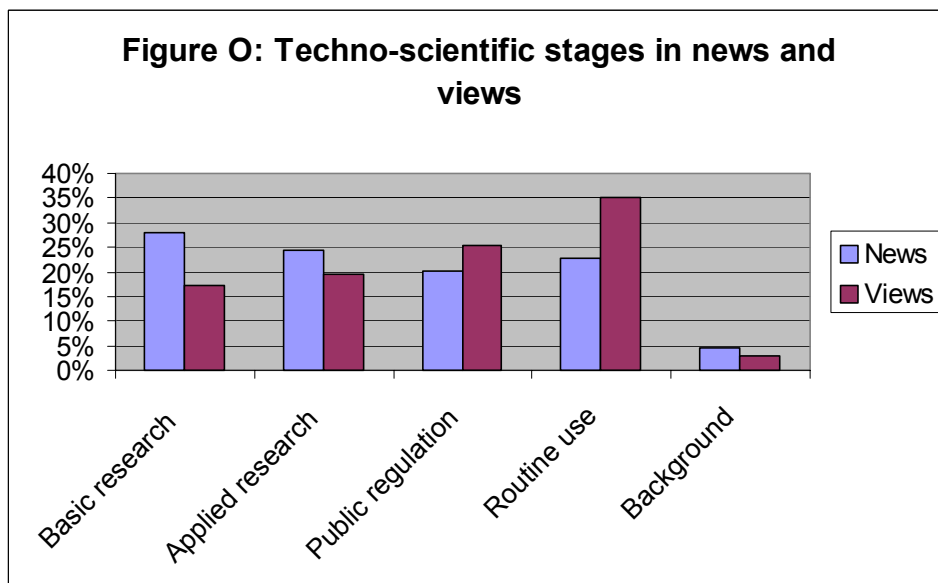


Table P	Positive	Neutral	Negative
<b>Research &amp; health care</b>	<b>49%</b>	<b>30%</b>	<b>21%</b>
Danish scientists	54%	30%	16%
Danish social scientists	20%	42%	38%
International researchers	48%	31%	22%
Health care professionals	48%	27%	25%
<b>Professionals &amp; citizens</b>	<b>34%</b>	<b>33%</b>	<b>33%</b>
Professionals	38%	38%	24%
Celebrities	28%	49%	23%
Citizens	31%	26%	44%
<b>Business &amp; organisations</b>	<b>43%</b>	<b>31%</b>	<b>26%</b>
Danish firms	49%	32%	18%
International firms	50%	29%	21%
Organised interests	33%	29%	38%
<b>Politicians</b>	<b>25%</b>	<b>49%</b>	<b>26%</b>
Cabinet members	23%	48%	28%
Danish MP's	27%	47%	26%
International politicians	23%	50%	26%
<b>Advisory Boards</b>	<b>17%</b>	<b>51%</b>	<b>32%</b>
The Ethical Council	12%	54%	34%
Board of Technology	33%	56%	11%
Research Ethics Committees	30%	44%	26%
<b>Patients</b>	<b>34%</b>	<b>33%</b>	<b>34%</b>
Patient organisations	36%	34%	30%
Patients	27%	30%	43%
Relatives	24%	40%	36%
<b>Administration</b>	<b>33%</b>	<b>54%</b>	<b>13%</b>



Figure Q

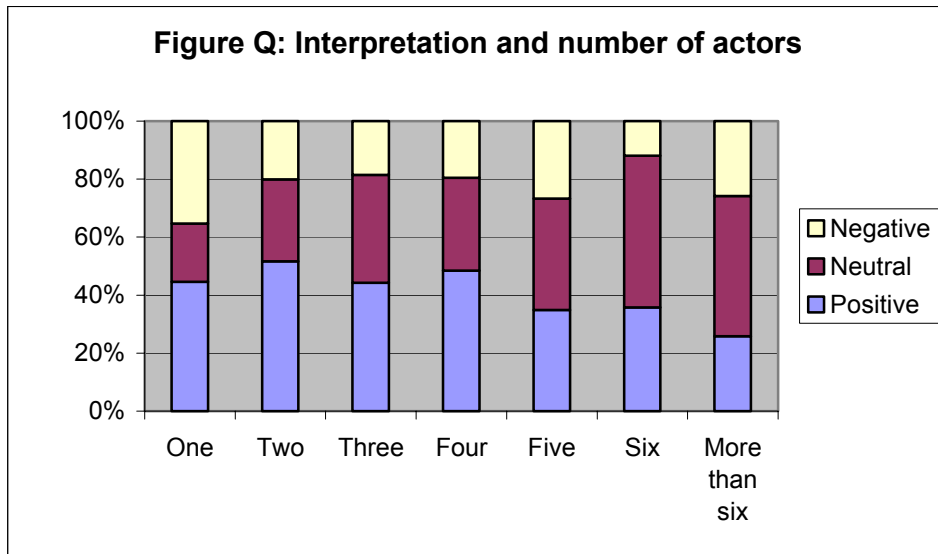
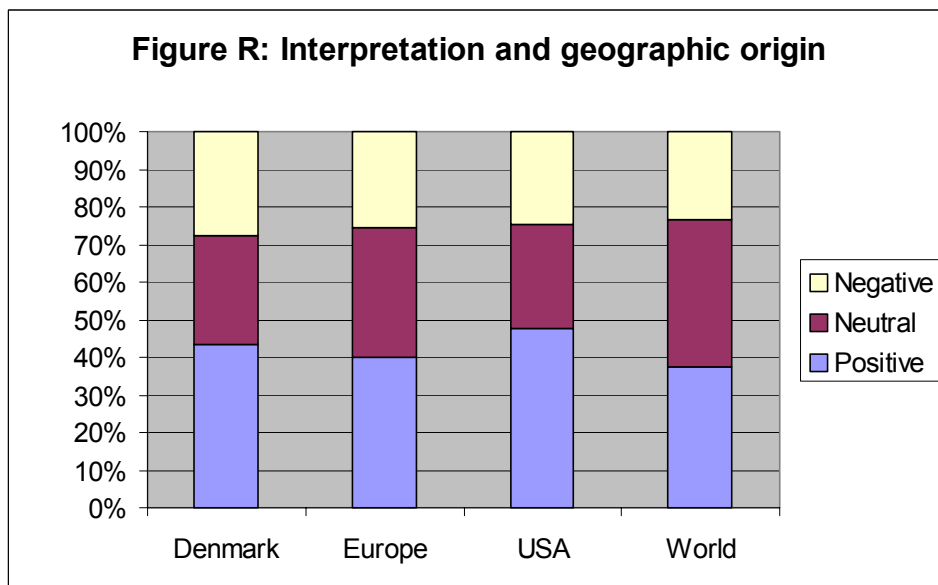


Figure R



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