

## BIOTECH, PUBLIC OPINION AND THE POPULAR PRESS: FRANKENSTEIN'S COPYCAT SOLDIERS AT WAR?

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### Abstract

When looking at opinion polls, one can see a clear distinction between attitudes towards reproductive cloning, green and red biotechnology. Where red biotechnology is considered useful and benevolent, green biotechnology and reproductive cloning are seen as dangerous and unnecessary. With our research, we wanted to find out if there were possible parallels in the popular press. This would also mean that for the first time, data from non-elite press were used in research considering the representation of biotechnology.

In the first stage of our research, we selected all articles within a five-year range from the three most popular Flemish newspapers that dealt with biotechnology, and encoded them. The selection of the newspapers was based on the most recent CIM-numbers. The results indicated a clearly distinct discourse for the green biotechnology, red biotechnology and reproductive cloning-themes. Issues on green biotechnology and reproductive cloning were clearly portrayed in a more negative way than red biotechnology, where the 'good news'-articles clearly outnumbered the rest.

An interesting find however was the fact that the negativity of the articles on green biotechnology and reproductive cloning was not due to the mentioning of risks. Both themes still possessed more benefits than risks, although in smaller amount than with red biotechnology. The negativity thus was not based upon facts.

This led to the second stage of our research: a metaphor-analysis of all the articles. Here we found that for specific biotechnology-terms, like cloning, a specific set of metaphors was almost consequently used. In the case of green biotechnology and reproductive cloning, most of the metaphors used had strong negative connotations, whereas this wasn't the case with red biotechnology

Keywords: biotechnology, metaphor, science communication, public opinion.

### 1. Introduction

Today's hi-tech society is characterised, amongst other things, by rapidly changing science and technology, and policymakers find themselves faced with many daunting challenges as a result. This situation is prompting more and more actors in society to call for a broad debate on the rapid changes currently taken place. Of course, one important question in this connection is what picture the general public gains of science and technology. Over the past few years, we at the Media and Communication Research Centre (OMC) run by the Department of Communication Sciences at Belgium's Ghent University have paid close attention to the scientific and technological dimension of our traditional research into 'media and the transformation of the public sphere', primarily from a 'media-sociological' view (Verstraeten, 1996), whereby media sociology is defined as the relationship between people, the media and society. The specific aim of our research is to gain an insight into this essential, if not all-important, role of the media in shaping the image of science and technology. The core questions in such research are whether there are different representations of science and technology (some overlapping, others maybe conflicting) and how great the actual differences between them really are. The recent headway made in biotechnology is a good example of the rapid progress made in science and technology, where public opinion is undoubtedly shaped by various factors. However, the precise nature of media influence over public opinion (with regard to science and technology in general or biotechnology in particular) remains unknown.

In the past, most studies on biotechnology have focussed on a single aspect of the interaction between the media and public opinion. For instance, there has been a great deal of quantitative research into representation in the printed media (Hagedorn & Allender-Hagedorn, 1997; Durant, Bauer & Gaskell, 1998; Bauer et al., 2001; Priest, 2001; Nisbet & Lewenstein, 2002; Kohring & Matthes, 2002; Ten Eyck and Williment, 2003), a number of metaphorical analyses (Nelkin, 1994; Nelkin & Lindee, 1995; Liakopoulos, 2002; Väliiverronen, 2004; Christidou et al., 2004), one such analysis combined with a (rather limited) reception study (Condit, 1999), and also research into the relationship between public opinion and rule-making (Gaskell et al., 2001; Priest & Ten Eyck, 2003). In addition, a long list of studies has also focussed on specific cases, scrutinising the associated media attention (one example being Larson et al., 2005). By publishing this article, we hope to prompt a more integrative approach to such research and thus ultimately gain a better overall picture of the situation. An

example of this can be found in an only very recently published American study that examined the relationship between the media debate on biotechnology in the elite press and public opinion (Ten Eyck, 2005). Public research in Europe, taking the form of Eurobarometer studies, has shown that European citizens primarily rely on television and the popular press to inform them about science (Eurobarometer 55.2, 2001: 13-15). The design of the study discussed here therefore followed this principle: based on the existence of a systematically differential pattern in public attitudes on various biotechnological topics, we set out to ascertain whether or not there was any reflection of this in the popular press<sup>i</sup>. To this end, by analogy with the aforementioned study, we also undertook a conventional content analysis, but combined it with a rather open metaphor analysis in a bid to reveal and disentangle from each other the objective and subjective elements of the biotech debate.

## 2. Public opinion regarding biotechnology

For the public, biotechnology is shrouded in controversy, so protests have emanated from various quarters, primarily in connection with reproductive cloning and the advent of GMOs. Ten Eyck & Williment (2003: 132-33) attribute this to the fact that both food cultivation and medicine are deeply rooted practices in Western culture. As a result, there is a conflict inherent in these new technologies, for since the technologies in question are new, the public knows very little about them, yet on the other hand, since the issues raised play a prominent role in our daily lives, everyone has pretty fixed opinions about them. However, these opinions vary quite dramatically.

The main aim of medicine is to cure diseases and thus try to induce a direct improvement in people's quality of life and enhance their wellbeing. As a result, people tend to be more prepared to regard the biotech applications under consideration as being ethically acceptable (Devolder & Braeckman, 2001: 34). By contrast, the immediate benefits of applications in the food sector are not entirely clear in many instances, or technological developments are viewed as merely serving the interests of the industry<sup>ii</sup>, so it is hardly surprising that the public's dim view of any 'meddling' with our food by the biotech industry should combine with the existence of conflicting studies on the respective long-term effects of such applications to create 'negative vibes'.

In one survey conducted in 2003, which investigated the attitudes of 10,000 Belgians, the respondents' acceptance of biotech innovations was clearly highest (nearly 75%) for applications of red biotechnology in medicine (Claeys et al., 2004). The participants in the survey were far less favourably disposed towards genetic interference with plants, with fewer than 40% backing such developments. In fact, acceptance was found to be highest for medical applications (e.g. modifying the genes of potatoes to develop a vaccine against diarrhoea), and then to decrease progressively for applications in agriculture (for instance, making crops resistant to herbicides) or luxury applications (for example efforts to create oranges with no pips). The lowest rates of acceptance were recorded for genetic modification for the purposes of reproduction and in manipulations conducted on people for non-medicinal purposes, the tallies here being 8% and 3% respectively.

Another study carried out in 2003 on behalf of the popular science magazine EOS confirmed these tendencies<sup>iii</sup>. An interesting aspect of this research is that it repeated a survey dating from 1993 and thus afforded an insight into the shift in attitudes that had taken place over the intervening decade, a watershed year being 1997, which was when Dolly the cloned sheep was born. However, one major reservation here is that the sample of 1,009 respondents was not representative of the Belgian population, since it consisted entirely of EOS readers. The EOS survey polled the desirability of biotech applications. Two items elicited a significantly higher degree of acceptance, both medical applications, namely 'Preventing and curing hereditary diseases' and 'Detecting genetic defects'. The respective perceived desirability of these applications rose from 82% to 89% and from 75% to 85%. The other items involving medical applications all scored highly, and the level of acceptance rose over the period elapsing between the two studies, albeit not to any significant degree. For example, the percentages from 2003 included 97% acceptance of biotech applications for 'Cancer therapy and vaccines' and 80% for 'Better drugs'. By contrast, there was a decrease in the acceptability of all items associated with the genetic manipulation of organisms or plants (green biotechnology).

So what can we conclude from the findings of the aforementioned surveys? There is a clear dividing line in people's opinions on green and red biotechnology<sup>iv</sup>. Indeed, since data for the second study was collected over an extended period, by comparing the changes over time we can even assume that this fault line is becoming ever clearer. So on the one hand there is great optimism about biotech applications in medicine, and on the other there is a mounting distrust of genetic manipulation and reproductive cloning. Moreover, various foreign studies show that these findings are not limited to Belgium, but apply throughout Europe (for instance, see de Jong, Gutteling et al., 2000; Eurobarometer 55.2, 2001: 40-42).

## 3. Presentation of the question and hypotheses

We took the aforementioned dividing line in Belgian public opinion as our starting point for investigating whether this state of affairs was also reflected in the popular press. To this end, we combined a quantitative

content analysis with a qualitative assessment of metaphor use. The main questions investigated can be summed up as follows:

- By analogy with public opinion, are there also any differences in the image of biotechnology that can be seen to be based on the representation of biotech issues in the popular press?
- If so, how does reporting on various biotech topics differ?
- Are there any differences in metaphor use depending on the topics covered?

## 4. Methodology

### 4.1 Data collection

Based on figures for the last five years published by the Belgian Media Information Centre CIM<sup>v</sup>, we selected the three Flemish<sup>vi</sup> newspapers with the largest circulation for our research, namely *Het Laatste Nieuws* (published by Persgroep), *Het Nieuwsblad* (VUM) and *De Gazet Van Antwerpen* (Concentra). These newspapers are also renowned for their populist character, unlike papers such as *De Morgen* and *De Standaard*, which are classed more as quality press. To avoid any time-consuming physical search through actual newspapers, we opted to seek our newspaper articles using the Mediargus<sup>vii</sup> online databank. This also enabled our analysis to cover a longer period. The terms sought were the Flemish equivalents of "biotech\*", "GMO" and "cloning", and the time span of articles covered extended from 1 January 2000 to 31 October 2004 inclusive. The resulting corpus was fully scanned and filtered. Only articles in which biotechnology played a prominent role were included. In other words, articles that just partly dealt with biotechnology or one of its applications were only retained if they said anything substantial about a technology or application. Purely economic reports on biotech companies, concerning rising share prices or falling sales figures were not retained unless these phenomena were related to specific biotech activities. In addition, articles merely informing readers about lectures or similar activities were not selected for inclusion in the study unless they went into greater detail regarding the respective content. In this way we ended up with a corpus of 506 articles<sup>viii</sup>, published over a period of nearly five years.

### 4.2 Variables

For our classification of articles' contents<sup>ix</sup> we based our approach on two previous studies, firstly the 'code book' (= classification guide) from the comprehensive research work entitled "Biotechnology and the European Public" (Durant, Bauer & Gaskell, 1998: 283-88), to which virtually every study refers, and secondly an American counterpart of that large-scale pan-European research, namely the study conducted by Ten Eyck and Williment (2003: 135-37) into biotech articles published in the *New York Times* and *Washington Post*.

We started off by dividing all the articles into one of three topics: red biotechnology, green biotechnology and reproductive cloning (see above). If the article fell into none of these three categories, it was assigned to a fourth category, dubbed 'general biotechnology'. We then looked at the contents of the article, which we classified into six categories: scientific discovery/research, legislation/violations, public opinion, industry/marketing, training/education and the residual category 'other'<sup>x</sup>.

In addition, we analysed who could be deemed to be the 'main actor' in the article, the actual protagonist of the facts and actions described there. Where articles contained quotations, the main protagonist was deemed to be the most frequently cited source. For both categories we referred to a shortened version of the list of actors used by Durant et al. (1998), divided into six categories: the public sector/government, universities/scientists, private/commercial, citizens/public at large, pressure groups/lobbyists and international regulating bodies/persons<sup>xi</sup>.

Subsequently we looked to see whether the article associated specific 'risks' and/or 'benefits' with a biotech application. These two variables were subsequently reassigned to the 'balance' variable, directly indicating whether or not an article presented only dangers, only benefits, both, or neither of the former two options.

Next, three more subjective variables were assigned, depending on whether an article mentioned any form of 'controversy' and, if so, whether both sides of the argument were conveyed in a balanced fashion or whether the article clearly 'took sides' in the debate.

In the variable 'evaluation', a five-point scale<sup>xii</sup> was used to assess the article's standpoint regarding the described biotech applications. The use of evaluative adjectives and verbs and the use of significant metaphors can be regarded as key factors for the assignment of this variable. If articles merely presented dry facts the neutral option was chosen.

Finally, we looked to see whether an article used 'metaphors' to describe any biotech activities, processes or parts thereof. Attributing this variable enabled our subsequent metaphor analysis.

## 5. Findings and discussion

## 5.1 Frequencies

In terms of the press's attention to biotech issues, 2002 was clearly a top year, accounting for 141 articles, or 28% of all those represented. This statistic is also in line with the anticipated upward trend since 2000. A decrease occurred in 2003, and the figure for 2004<sup>xiii</sup> suggests that biotechnology was some way past its peak as a topic and news item. This drop in media attention appears to be the first of its kind since research into the coverage of biotechnology in the printed media began, because all previous studies had reported a rise in press interest in biotechnology (see, for example, Durant et al., 1998; Nisbet & Lewenstein, 2002; Bauer et al., 2001; Ten Eyck & Williment, 2003).

As it turned out, Het Nieuwsblad seemed to write most frequently about biotechnology, accounting for over 40% of all the articles found. Het Laatste Nieuws came second with 35%, and De Gazet Van Antwerpen clearly provided the least coverage, accounting for just 25% of the articles.

In thematic terms there was a very equal distribution over our three chosen specific categories. Reproductive cloning was the most frequently covered topic, followed by red and green biotechnology respectively. Only a minority (7%) covered biotechnology in general. At the content level we found that almost half the articles covered scientific discoveries. Just under 25% concerned the legislation governing biotechnology. Both public opinion and industrial/marketing accounted for approximately 13% of the articles. Finally, training/education constituted 5% and five other articles that did not fit into the aforementioned categories.

The main actors in the articles we selected were usually scientists (45%). In roughly 20% of cases the main actor was somebody falling into the category of private/commercial/companies. The remaining categories all remained below the 15% barrier. Coverage of pressure groups/lobbyists and public sector/government were clearly evenly balanced at just under 15%. In keeping with this, roughly 60% of articles containing a quotation cited scientists. Unexpectedly, the second place was occupied by the category pressure groups/lobbyists, closely followed by private/commercial/companies.

Just over half the articles (55%) did not cover any controversy, whereas nearly half did just that. In this connection the reporting was more neutral, with various views represented, though 20% of all the articles were not neutral.

Moreover, 55% of the articles mentioned benefits, but most remained rather cautious. Not even 40% of all the articles claimed that there may be benefits associated with biotechnology or a specific biotech application. Another 9% claimed that there definitely were benefits, though they would only become apparent in the future, and just 7% covered benefits that were already apparent.

By comparison with the benefits, far less was said about specific risks associated with biotechnology. Nearly 70% of the articles made no mention of any risks. Just over 25% mentioned possible risks, whereas the two other categories scored somewhat lower, as had been the case where benefits were concerned. The relations between the two were inverted, with over 4% of articles covering risks that were already evident, and the category of definite but only future risks only scored 2%.

The balance of variables, constructed on the basis of the benefits and risks, reflects the extent to which both variables do or do not co-occur. The largest category is benefits only, with 36% of all articles, closely followed by articles in which neither is mentioned (32%). Not even 20% of the articles mentioned both risks and benefits, whereas 13% of articles only reported on risks associated with biotechnology.

Just over half the articles were pretty neutral in the sense that they portrayed biotechnology in neither a positive, nor a negative light. In the remaining articles the balance was slightly in favour of a negative evaluation. The two negative categories taken together accounted for a good 5% more of all articles taken together (over 28%) than the two positive categories combined (22%). Furthermore, we see that the two 'extreme' categories occur relatively rarely, together scoring under 8%.

The metaphor variable was intended to enable subsequent specific analysis of those articles containing them. Of the 506 articles selected, 202 contained a total of 400 metaphors. Thus, 40% of the articles contained one or more metaphors. Consequently, it is fair to say that in popular newspapers the biotech debate is full of metaphors.

## 5.2 Thematic debate

At the same time, a remarkable trend emerged from these general frequencies, with more benefits than risks reported, though leaving aside the high number of 'neutral' articles, more articles were negative about biotechnology than positive. When we broke down these variables by topic, we found that most of the 'benefit only' articles concerned red biotechnology, whereas the majority of 'risk only' articles concerned reproductive cloning and green biotechnology. A similar pattern emerged when evaluating the articles, with articles about red

biotechnology accounting for the lion's share of positively evaluated reports, and green biotechnology and reproductive cloning accounting for most articles classified as negative.

These findings prompted us to conduct a separate analysis per topic (see Figs. 1-4). This would enable us to ascertain whether a differential thematic debate was being conducted. We will discuss the results per topic separately.

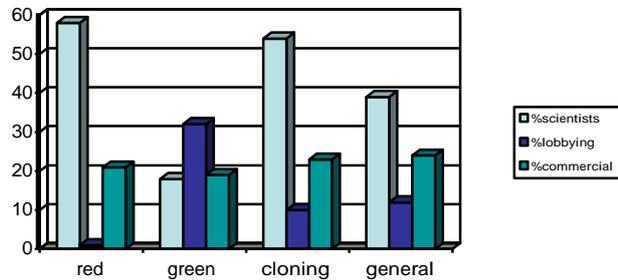


Figure 1: actors within themes

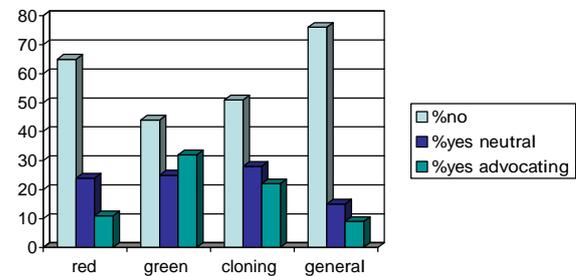


Figure 2: controversy within themes

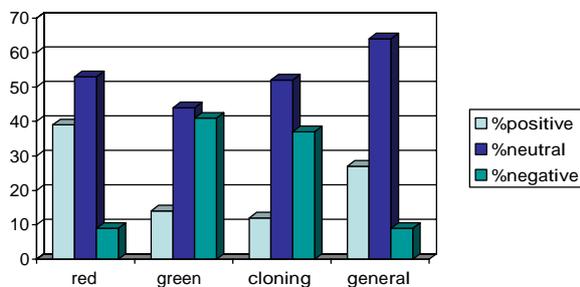


Figure 3: evaluation within themes

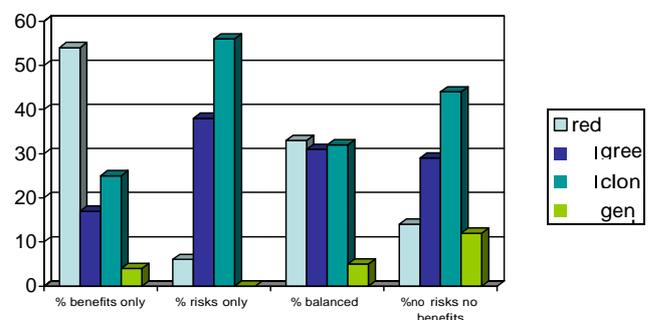


Figure 4: themes within balance-variable

### 5.2.1 Red biotechnology

There were hardly any negative articles about red biotechnology and only few controversial articles. Most articles on red biotechnology were 'benefit only' articles. In about half of the articles scientists were the main factor. In terms of subject matter, more than half the articles covered a scientific discovery.

Consequently, where the debate on red biotechnology is concerned, most articles tended to highlight scientific breakthroughs and discussed the benefits they would bring, as seen through the eyes of the respective researchers and scientists. Generally speaking, this finding was in keeping with the reports on biotechnology found in research covering the period leading up to 1997<sup>xiv</sup> (see, for example, Nisbet & Lewenstein, 2002; Ten Eyck & Williment, 2003).

### 5.2.2 Green biotechnology

In general, green biotechnology was viewed in a slightly more negative light, with a fair number of 'risk only' articles and more mentions of controversy. One striking fact with respect to the controversial articles was that the majority adopted a particular view. The main subjects covered here were legislation/violations and public opinion. Moreover, far fewer scientists were cited in these articles, whereas pressure groups were very often quoted and constituted the main factors in the reports in question.

Thus, the slant of the debate on green biotechnology is very different from its counterpart concerning red biotechnology, with less reporting on the actual underlying science and closer attention paid to both the legislative aspect and the impact of the developments in question on public opinion. The main focus here was on potential problems and their associated disaster scenarios, and it was mainly lobbies raising issues that were allowed to have their say.

### 5.2.3 Reproductive cloning

There were a number of parallels between the debates on reproductive cloning and green biotechnology. The number of articles evaluated as negative was high, as was the number of risk only articles. There was also a higher level of controversy, even though there were more neutral articles on these subjects. In terms of actors and topics, we noted a number of similarities with red biotechnology. For instance, as with red biotechnology, the majority of articles clearly mentioned scientists and covered some scientific discovery.

In short, most articles on reproductive cloning were concerned with scientific progress, as seen primarily through the eyes of scientists, but the optimism associated with red biotechnology was replaced in this context by a negative undercurrent, with articles frequently citing controversy, and the highest number of risk only-articles of all themes.

### 5.2.4 General

Most of the articles in the category 'general', which contained the fewest items, were 'neutral', non-controversial articles, listing neither associated risks, nor benefits. The economic theme here was very strongly represented, with articles highlighting the prospects of profits from biotech research. Mostly this finding applied to the large number of articles covering the Human Genome Project, aimed at mapping out all human genes and ascertaining their functions. Often, these articles reported on issues such as patenting and applications designed to generate profits.

Thus, we found that the debate in the media was clearly differentiated, depending on the topic covered by the articles in question. One striking observation was that even within the areas of green biotechnology and reproductive cloning, more benefits than risks were reported, even though more articles were evaluated as negative than positive. Consequently, such negativity is clearly not based on objective facts, but is actually derived from more subjective, content-related characteristics. One possible key to the solution of this idiosyncrasy may lie in the differential use of metaphors. After all, a metaphor can always be used to imply negative connotations in an insidious manner (see, for example, Lakoff & Johnson, 1980; Schuurman, 2003). To look into this, in a second phase of our study we conducted a metaphor analysis.

## 5.3 Metaphor analysis

When assigning articles to categories we also looked at whether or not articles contained metaphors. All metaphors describing biotech actions, subject matter or material were classified. A fair amount has been written about the occurrence of metaphors in research into the media's representation of science. Hellsten (2002: 8) even maintained that metaphor theory provides the link between research conducted by communication scientists and scientific representation. A great deal of research on this subject states that metaphors play an important role in 'the public's understanding of science' (see, for example, Nelkin, 1994; Liakopoulos, 2002: 8; Christidou et al., 2004: 348-49; Väliverronen, 2004: 363-64; Larson et al., 2005: 245). One very useful conceptual framework associated with the use of metaphors associated with new technologies is that of 'collective symbolic coping'. This theory maintains that when new technologies are developed they pass through four stages in the minds of the general public (Wolfgang, Kronberger, & Seifert: 325-27). During the awareness phase, the public comes into contact with the new technology or application via the usual media channels. The technology in question is thus set within the framework of the public's sphere of knowledge, primarily via the use of imagery and metaphors. In the so-called divergence phase, many different metaphors are used, whereby one will prove more successful than another in conveying the news in question. Next, in the convergence phase, only the most 'successful' metaphors survive, and after such widespread use they become part of the standard debate regarding the technology in question. These final metaphors most closely represent what the general public associates the technology in question with, whereby scientific accuracy is of no consequence. This brings us to the final phase, namely normalisation. Thus, a metaphor analysis covering a specific period can highlight certain 'standard' metaphors that have managed to survive the convergence phase and are therefore encountered frequently, whereas metaphors from the divergence phase may only occur once.

However, since metaphors can easily convey connotations in the target domain, inaccurate or exaggerated descriptions can easily be smuggled into the dominant media debate. Rather than presenting rational arguments, metaphors create images in readers' minds and play on their emotions (Väliverronen, 2004: 364). This prompted us to suspect that the curious finding from our quantitative content analysis - namely the fact that the overriding tone was negative whilst, in objective terms, more benefits than risks were cited - had to do with the negative connotations of metaphors frequently used in the debate on green biotechnology and reproductive cloning in particular.

Accordingly, we decided to use a specific, open system of classification. Previous metaphor studies conducted in connection with biotechnology had always used metaphors categorised on the basis of their source domain<sup>xv</sup> (see, for example, Liakopoulos, 2002; Christidou et al., 2004; Väliveronen, 2004). We opted instead to group them according to their target domain, and thus to consider them in terms of which wide-ranging concepts or source domains were associated with a meaning. Furthermore, we looked into whether the metaphors could be ascribed positive, negative or neutral connotations. This subjective evaluation makes it possible to establish per target domain whether or not the metaphors are biased to a certain degree.

Of the 506 articles selected, 202 contained a total of 400 metaphors. Thus, 40% of the articles contained one or more metaphors. Consequently, it is fair to say that in popular newspapers the biotech debate is full of metaphors. Below we discuss the five distinct target domains that emerged from our analysis of these metaphors: biotechnology in general, genetic manipulation, GMOs, cloning and 'human components'.

#### Biotechnology in general (44 metaphors)

Positive (9%)	Neutral (66%)	Negative (25%)
biotechnology is a weapon or means of defence against disease (4)	biotechnology is agriculture or horticulture (27)	biotechnology is science fiction or a futuristic science whose contents are out of touch with reality (7)
	biotechnology is an existing and pretty well-known technology/science (2)	biotechnology is a nightmare or horror scenario (3)
		biotechnology is a 'slippery slope' (1)

#### Genetic manipulation (34 metaphors)

Positive	Neutral	Negative (100%)
\	\	genetic manipulation is a Nazi practice (10)
		use of the 'makeable' human metaphor (9)
		genetic manipulation is tampering, tinkering or engaging in an illegal activity (8)
		genetic manipulation is "Brave New World" (6)
		genetic manipulation is an activity pursued by Saddam Hussein (1)

#### GMOs (46 metaphors)

Positive (7%)	Neutral (0%)	Negative (93%)
GMOs are a miracle (2)	\	use of the 'Frankenstein' metaphor (22)
GMOs are a dream (1)		GMOs are viruses (7)
		GMOs are pollutants (4)
		GMOs are weeds (2)
		GMOs are a time bomb (2)
		the battle against GMOs is a witch hunt (2)
		the battle against GMOs is a crusade (2)
		consuming GMOs is a dangerous game of chance (1)
		the battle against GMOs is tantamount to pillorying (1)

#### Cloning (196 metaphors)

Positive (50%)	Neutral (17%)	Negative (33%)
cloning prolongs or provides a new lease of life (45)	cloning is something religious or supernatural (13)	a clone is a copy (44)

cloning means eternal life (26)	cloning is Jurassic Park (6)	cloning is described as monstrous and nightmarish (11)
cloning is a way of raising the dead (14)	a clone is not a monster (5)	cloning is unnatural (4)
cloning means turning back the clock or enjoying eternal youth (5)	the doctor who clones is the parent of the clone (3)	doctors who clone are clowns (3)
cloning is an art (4)	a clone is not a copy (3)	doctors who clone are cowboys (2)
a clone is a 'superbeing' (3)	cloning is taking a cutting from a plant (2)	cloning is letting the genie out of the bottle (1)
cloning is an adventure (1)	cloning is a numbers game (1)	

#### Human components (80 metaphors)

Positive	Neutral (100%)	Negative
\	organs are (replaceable) machine parts (23)	\
	genes/cells are machines (16)	
	DNA and genes are a collection of letters from a common code (16)	
	recording genes is making a map (11)	
	genes are the building blocks of life (6)	
	genes are our identity card (2)	
	genes are commodities (2)	
	genetic stock (1)	
	DNA is a musical composition (1)	
	genes are playing cards (1)	
	genes are living beings (1)	

All in all, we can say that few truly original metaphors were used. Most can be summed up in a limited number of categories, and where some topics are concerned we can even talk of 'standard' metaphors. In terms of 'symbolic coping theory' (Wolfgang et al., 2002), most biotech applications would appear to have already reached the convergence phase. A number of very frequently occurring metaphors, like "a clone is a copy" or the Frankenstein metaphor, clearly belong to the debate on biotechnology. If we consider the valency of the metaphors, differential patterns clearly emerge for our four thematic categories. For example, negative metaphors were mostly used in the target domains of genetic manipulation, GMOs and, to a lesser extent, reproductive cloning, which can in turn be associated with the topics of green biotechnology and reproductive cloning.

So it is no coincidence that it was in these two thematic categories that the subjective evaluation was slightly more negative. The use of metaphors like "a clone is a copy", "Frankenstein food" and "Nazi experiments" gave an article a negative undertone without actually explicitly evoking any specific risk. The more negative evaluation of topics to do with green biotechnology and reproductive cloning, despite the fact that the number of 'no risks', 'no benefits' and 'benefit only' articles outweighs the number of 'risk only' articles, may be attributed to this phenomenon.

We can thus draw two conclusions: firstly, that the differential debate of various biotech topics can be explained partly in terms of metaphor use, and secondly that the use of such metaphors induces the mainly negative connotations associated with biotechnology. Again, under symbolic coping theory (Wolfgang et al., 2002), these 'negative' metaphors are survivors of the convergence phase and have become an established feature of the standard debate on specific biotech topics. The fact that precisely these metaphors survived, or are at least the most frequently used metaphors, suggests that they are deemed 'accurate' by the majority of the public and the media, whereby 'accurate' is synonymous with being most compatible with the images people have in their minds of the respective technologies and applications.

## 6. Conclusion

Based on the findings of previous research into public opinion on biotechnology, we conducted a study of its representation in the Flemish popular press. A quantitative content analysis revealed that the four biotech topics - red and green biotechnology, reproductive cloning and biotechnology in general - were dealt with in a clearly differentiated manner with respect to all the main variables. In other words, the debate on each topic differed. Where red biotechnology and biotechnology in general were concerned the debate was positive and forward-looking, with scientists as the main actors. Newspaper articles on reproductive cloning also focussed on scientific breakthroughs and scientists as the main actors, but also considered the risks to a greater extent. In

addition, their tone was slightly more negative and they regularly invoked ethical problems. Reports on green biotechnology shared the same negative evaluation and greater tendency to cover associated risks as reproductive cloning, but displayed a totally different pattern with respect to actors and frames, with mainly pressure groups being allowed to have their say and a conspicuously large number of doomsday scenario frames represented.

However, one notable finding emerged from a consideration of all the articles taken as a whole: despite the occurrence of more benefits than risks, more articles were evaluated as negative than positive. This result can primarily be attributed to articles falling into the categories green biotechnology and reproductive cloning, which include the most negative reports of all. To find an explanation for this observation, we conducted a fairly intuitive metaphor analysis, assessing all the metaphors we came across and dividing them up on the basis of the five main target domains (biotechnology in general, genetic manipulation, GMOs, cloning and human components). As it turned out, a high proportion of negative metaphors in articles covering three target domains, namely genetic manipulation, GMOs and cloning, which were associated with the topics of green biotechnology and reproductive cloning. A number of specific metaphors (e.g. "a clone is a copy" or the Frankenstein metaphor) even reoccurred so frequently that we can consider them to constitute part of the biotech debate on the associated topics. It seems plausible to us that this use of negative metaphors may go some of the way towards explaining the curious finding in the initial phase of the study.

By integrating and coordinating different types of research, on the one hand we uncovered a clear parallelism between public opinion and popular media reporting on biotechnology, and on the other we showed that specific metaphor use may play an important role. Consequently, we believe that more audience-oriented and longitudinal research is required to unravel the interrelationships and likely causality. Meanwhile, Frankenstein and his little army of copycat soldiers are lying in ambush, ready to conquer the world...at least in the popular press.

## 7. Bibliography

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<sup>i</sup> Previous studies targeted only the elite press, this being a failing we set out to redress, since the readership of such publications in Belgium is rather limited.

<sup>ii</sup> Sometimes genetic manipulations can greatly lower costs, for example by developing weed-resistant crops that preclude the need for expensive pesticides.

<sup>iii</sup> [http://www.eos.be/ninter/pics/EOS\\_eng.pdf](http://www.eos.be/ninter/pics/EOS_eng.pdf)

<sup>iv</sup> One fundamental subdivision is the distinction between green and red biotechnology, which depends on the ultimate goal of the biotech activity in question. 'Red' biotechnology concerns the restoration of human health, and the method used here entails therapeutic cloning. 'Green' biotechnology, on the other hand, involves manipulating the genes of plants and organisms to create so-called 'GMOs' (genetically modified organisms). Most green biotech applications concern the food sector. Then there is reproductive cloning, which is what usually springs to mind at the mention of the word 'cloning' and is the term used to describe the creation of genetically identical individuals or specimens.

<sup>v</sup> [www.cim.be](http://www.cim.be), consulted on 10/2/2005.

<sup>vi</sup> Flanders is the northern, Dutch-speaking part of Belgium.

<sup>vii</sup> [www.mediargus.be](http://www.mediargus.be), consulted in December 2004.

<sup>viii</sup> Normally we should have ended up with 516 articles, but 10 of them, though listed in the database, could not be consulted due to copyright problems. Having said that, the articles in question were spread more or less evenly over the analysed period, so their exclusion from our analysis would appear not to pose any insurmountable problems.

<sup>ix</sup> Owing to the problems associated with the reliability of classification systems in previous studies (Ten Eyck & Willimont, 2003, p. 134; Durant, J. et al., 1998, p.9), we opted to have just a single classifier. In our view, our expertise in content analyses, biotechnology and representation research vis-à-vis the classifier and the use of a clear-cut classification guide guaranteed sufficiently reliable attribution to the various categories.

<sup>x</sup> This variable identifies the actual content of the article. Our first category here is 'scientific discovery/research'. So if the main subject of the article is scientific research or a new breakthrough, one article is entered in this category.

The second category, 'legislation/contraventions', includes articles to do with legal aspects of biotech developments. This category concerns both theory and practice.

Our third category is 'public opinion', which was selected if the article primarily contained opinions on biotechnology. This category was selected even if the article reported on protests against some biotech development.

The category 'industry/marketing' was used for articles that clearly focussed on the industrial angle, such as the much-discussed debate about patents on scientific breakthroughs and the marketing of biotech discoveries.

The fifth category, 'education/training' applied to articles reporting specifically on biotech education, without actually covering any new development in the biotechnological sciences.

Lastly, all articles that did not fit into one of the previous categories were entered under the sixth and final variable "other".

<sup>xi</sup>The first category, 'public sector/government (department)', includes all people and institutions belonging within the public sector, except for universities.

Next comes the category 'universities/scientists'. Universities and the researchers affiliated to them were assigned to this category. Researchers also ended up in this category if it was not clear exactly where they were employed or if they were included because they had made a major contribution at the basic research level.

Next comes 'private/commercial'. This category includes companies, commercial businesses and all their staff, except for those falling under the previous category of researchers. So this category also includes journalists and media professionals.

As the category's title 'citizens/population' already suggests, all those included in it were people mentioned in an article in their capacity as citizens selected more or less at random.

The category 'pressure groups/lobbying' includes all organisations (and their members) intent on influencing policy in one way or another. Religions and sects were also included in this category.

Finally comes the category 'international regulatory bodies/persons', which comprises institutions like the European Parliament, the requirement for inclusion in this category being involvement in setting international rules.

<sup>xii</sup> Very positive, positive, neutral, negative and very negative.

<sup>xiii</sup> Only the first 10 months of 2004 are entered because of the research project's deadline. Based on this low figure over 10 months, we can assume that the two remaining months would not have made any major difference.

<sup>xiv</sup> This is the year of birth of Dolly, the cloned sheep, which is generally regarded as a major milestone event in biotechnology.

<sup>xv</sup> In the metaphor 'A is B', A is the target domain into which the meaning of the source domain B is projected. In the phrase 'a clone is a copy', properties of the source domain COPY lend meaning to the concept CLONE. Interested readers are referred to Schuurman D. (2003). *Betoverende beelden* (Enchanting images). Unpublished paper, Ghent University, Department of Communication Sciences.