

FRAMING OF SCIENCE NEWS: THE PATTERNS OF NEWS COVERAGE OF BIOTECHNOLOGICAL ISSUES¹

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Abstract

. This study examines the patterns of news coverage of biotechnological issues through a theoretical approach based on multidimensional aspects. The study aim is to present a desirable model of the news patterns involved in the reporting of biotechnological matters. The results show that new modes of news coverage have emerged, especially in regards to editorial sections, themes and complexities. Firstly, regarding editorial sections, biotechnological new items were increasingly placed in social and international sections, thereby eroding their predominance in science and technology sections. Secondly, in terms of themes, newspapers started to concentrate on the birth of new life, compared with their earlier focus on the medical treatment of disease. Finally, the complexities of new items were characterized by explanations of biotechnological development when research performance reached its peak.

Keywords: Biotechnology, Science News, Framing, Trend

1. Introduction

News media play a vital role in the formation of public opinion on various issues in science and technology, by serving as a yardstick to examine how scientific evolution is related to society. According to a national opinion survey conducted in 2001, the general public obtains their information on science and technology from the mass media, which indicates its enormous power in the dissemination of science-related news.²

In most cases, we presume that news on science and technology is objective and truthful at our peril because the perspective of knowledge sociology tells us that newly-emerging scientific paradigm or novel technological thoughts are interpreted differently according to the relevant contexts and situations (Nelkin, 1987). A historical trend of science news coverage reveals that the central frame of science news was astronomical science in the 1970s, computer technology in the 1980s, and the Internet in the late 1990s (Ed- not, I suspect, the early 90s. Frankly, few of us had really heard of the Internet in say '93). Meanwhile, biotechnology has emerged as a primary frame of science news in the late 1990s and the early 21st century. In particular, stories of the human genome and stem cells are the major new items that have attracted large audiences.

Given that there have been dominant themes of science news in any specific period, it seems to be academically meaningful to investigate how the mass media cover biotechnology news, one of the most controversial issues in society (Ed- it is not the singular most controversial). In this respect, by analyzing media coverage of science news, this study will explore models of how biotechnology issues are dealt with in the media in an attempt to predict future trends. This research purpose will start by questioning how the achievements of biotechnological investigation are framed by the news media. Furthermore, the question

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² To the question of where knowledge on science and technology is obtained, outside schools and education institutions, 56 % of the respondents reported that they learned from the mass media about science and 71 % of them about technology. Comparatively, only 5 % responded that science museums and exhibitions were the sources of information on science and technology (H. Kim et al., 2000: 124-146).

of which themes, tones and perspectives, among the numerous achievements made by biotechnological endeavors, are emphasized by the news media will be the starting point for this inquiry. Although the modeling of science news is not a theory itself, it has much to offer to the establishment of such a theory (Y. Kim, 2002). By examining news sources, story-building and news coverage patterns, we intend to explore the longitudinal news coverage of biotechnology issues.

2. Elements of science news coverage

Scientific knowledge is often thought of as objective or disinterested truth, but the “sociology of knowledge” perspective on the emergence of a new technological ideas directs our attention in a different way (Nelkin, 1987). The socio-historical context is important to the journalist’s reporting about a segment of new scientific knowledge. The “sociohistorical context,” including directions of governmental science technology policy, industrial interest in the development of science and the public adoption of technology development, shapes the trend of the development (Priest & Talbert, 1994; Tankard & Ryan, 1974).

(1) Definition of science news

Schudson (2003) suggests that journalistic conducts of scientific issues intend to provide regularly the public with information, interpretation, and commentary of science news, which are supposed to be true and sincere. Moreover, science journalism tends to pay greater attention to the development of science and technology (Dahinden, 2002). However, the paradigmatic shift of science news coverage of the mass media has been too rapid to establish a systematic model, at worse without having a central (dominant) theory. The study on coverage of framing approach has been increased for several years. Basically, frame analysis is defined as “the many words of text are classified into fewer content categories” (Pan & Kosicki, 2001). Furthermore, news coverage analysis explores the trend of biotechnology news classifying biotechnology into news category.

(2) The category of news trend

The process of constructional reality news is not a single dimension. News trend is a multidimensional concept with four classifications: 1) news trend as news frequency, 2) news trend as subject and relations, 3) news trend as presentation of symbol, and 4) news trend as presentation of social problem.

(3) The process of news trend constitution

In general, in the process of constructional reality, media news trend has two basic units: 1) text unit and 2) frequency and tone unit. Other factors of media news trend are keyword or theme, symbol, photo, selection and salience in use. Journalists choose a perspective for news text constitution such as angle, focus, theme, viewpoint, and trend. In the next step, they specify the theme in terms of the science news constitution method. This means that journalists use the social context pattern of objectivity when applying a news tool. In this sense, the news media select specific keywords, metaphors and symbols and then repeat the words and tone. A frame is formed through this process.

(4) The current study

The common belief running through various studies is that there is a shared culture between journalists and the news source (Friedman et al., 1985). In other words, the definition of what is news is established between journalists and the news sources. The frame has been applied to related studies as it is a useful theoretical framework in analyzing science news. The concept of frame has been applied to many science news issues such as science (Dunwoody, 1992), biotechnology (Bauer et al., 2001; Priest, 1995), and nuclear energy (Gamson & Modigliani, 1989). The frames are characterized as 1) diffusion of science news, 2) interests between science news and other social news, 3) public recognition about science issues, 4) ambiguity of science news, and 5) effective scientific communication skills.

(5) History of Biotechnology

In the 1970’s, public criticism of science in America began to increase due to the influence of the new social movement established in the ‘60s. As a result, administrative funds for science study decreased dramatically. Nevertheless, the study of genetics continued with promotion for genetic recombinant technology and genetic engineering business. Starting with the establishment of Genetech by the molecular

biologist H. Boyer and the businessman R. Swanson, various genetic engineering businesses appeared such as Biogen, Cetus, Genex, Celltech, Agrigenetics and Calgene.

Table1. History of Biotechnology Development

1950s~1960s	1970s	1980s	1990s	2000s
Early Research	Technical innovation	Utility of Biotechnology	Exploring Genome	Discovery of Gene
△ Discovery of DNA structure	△ Possibility of Genetic Manipulation △ Cell Fusion △ Cell Culture △ Bioreactor	△ Antisense △ Glycotechnology △ Mass Cell Culture	△ Genomics △ DNA chip △ Bioinformatics △ Animal Cloning	△ Discovery of disease-causing gene △ Incurable disease drug research

source: Daewoo Securities Research Center(2000)

3. Research Question and Research Method

1) Research Question

Ghanem (1997) proposed four items and variables for frame analysis: 1) news frequency and presentation, 2) news and article's main information channel, news source, and sub-topics as news complexity, 3) cognitive factors, and 4) effective (emotional) factors.

RQ1. How has the frequency and amount of biotechnology news changed in the process of a study?

RQ2. Where was the prominent news information channel of biotechnology news?

RQ3. Where was the prominent news source of biotechnology news?

RQ4. How has the multiple construct of biotechnology news changed?

RQ5. What are the prominent theme and focus of biotechnology news?

RQ6. How are the development of biotechnology and change of biotechnology news theme correlated?

RQ7. Does the model of biotechnology news exist?

2) Research method

This study explored the media trend in the development of biotechnology and investigated the difference between technology news by frequency through content analysis. To analyze the news trend of biotechnology news, we measured four dimensions (Ghanem, 1997): news frequency, news source, cognitive factor and news direction.

(1) Sample

Chosun, Joongang, and Donga³ were the three daily newspapers selected for this study because they are regarded as the most popular newspapers and they seem to influence people's knowledge of science significantly. National dailies have a tendency to report science-technological knowledge in the public's position with a practical view. (Ed- this deleted sentence is superfluous as you have already stated that these three were selected for this study, and explained why)

4. Results

This research analyzed the change of news theme and news coverage amount by frequency, the change of biotechnology-related news source and editing section, how news changes according to news source of information and journalists, and the difference of perspective on biotechnology while biotechnology develops. Based on the results, this study suggests a model of science news in terms of amount, trend, and theme.

1) The Trend of Biotechnology News Coverage

³ The Chosun, Joongang, and Donga Daily News, the three most population daily newspapers in Korea, also run their respective homepages: <http://www.chosun.com>, <http://www.joins.com>, <http://www.donga.com>. Those three news media offer a traditional and right-oriented news perspective.

The measurements of significant presentation are news item frequency and news length. Frequency and length are barometers of the issue's importance. News volume and length imply the issue's significance.

There are three basic measurements: 1) news frequency, 2) keyword frequency, and 3) format frequency. News frequency measures the number of biotechnology stories by the time and news media's titles. Keyword frequency defines the technological terms throughout biotechnology development. Finally, the format frequency is measured by editorial section differences that provide the degree of association to society. These frequencies are related to the themes and tones. On the other hand, the data shows that the theme of news coverage that creates the public agenda. The broad concepts of the themes are news topics.

The fundamental units that construct the biotechnology news trend are news frequency and news amount. All 2,202 articles were analyzed in terms of the stage of news, as presented in Table 1.

The increasing trend evident in figure 1 is a result of changes in society and policy. As the impact of biotechnology on society expanded, the number of biotechnology news articles increased because such news reflects the society and policy.

Table 4: The amount of biotechnology news coverage by the stage of news.

Table4. News length by news stage (unit: words)

Stages of news	Amount	Average	Standard deviation
The early first stage(1970-1979)	281	743.92	657.43
The late first stage(1980-1989)	295	857.77	808.82
The second stage(1990-1994)	434	1034.67	683.71
The third stage(1995-1999)	511	887.29	696.25
The fourth stage(2000-2004)	673	1128.29	827.89
Total	2194	968.04	759.14

The uneven trend evident in table 4 seems to have resulted from the development of biotechnology. It is thought that new issues of biotechnology which were considered worthy of large newspaper space did not appear in the third stage after biotechnology had been developed from the first to second stages. In the fourth stage, however, the amount of news coverage increased dramatically due to the emergence of genetic engineering and genetic manipulation issues, as well as the expectation of their political, industrial, and economical effects.

2) The Trend of News Section of Biotechnology

It was necessary to analyze news sections (edition) to determine the relationships between biotechnology news and society, economy and culture. First of all, articles were classified into news brief, commentary, feature/special/series, editorial, sketch, photo, and others according to news types. Secondly, biotechnology-related articles were divided again according to thematic category: cover, science-technology, society, economy, culture, politics, international, editorial/column/public opinion, and others. The differences of biotechnology news coverage amount, segregated according to news stage, are shown in Table 5.

Table5. News type by news stages (unit: %)

news type	the stage of news					total (n=2202)
	Early first stage (1970 ~ 1979 년) (n=281)	Late first stage (1980 ~ 1989 년) (n=295)	Second stage (1990 ~ 1994 년) (n=434)	Third stage (1995 ~ 1999 년) (n=511)	Fourth stage (2000 ~ 2004 년) (n=681)	

News/News Brief/ Striate	64.4	66.1	48.6	59.7	56.5	58.0
Commentary	8.9	18.0	22.6	10.0	8.4	12.9
Feature/Special/ Series	17.1	5.1	18.2	20.7	20.3	17.5
Column/	1.4	1.7	2.3	1.6	4.8	2.7
Interview/ Discussion	2.5	3.1	0.7	2.5	4.7	2.9
Editorial/ Editor Memo	0.4	0.7	1.4	0.8	2.8	1.5
Sketch	0.7	2.0	0.0	2.3	0.1	1.0
Photo	3.9	0.7	0.0	0.0	0.1	0.6
Other	0.7	2.7	6.2	2.3	2.2	2.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Although commentary took 22.6% of the total news proportion in the second stage, the proportion of feature went down rapidly after the second stage. Special/Series maintain around 20% over the years.

Features about biotechnology appear following an influence on society. Thus, the highest proportion of features in the second stage indicates that the study on specific biotechnological themes reached a considerable goal with increased influence on society. It is also related to the increasing frequency of news about study of treatments such as for cancer at that stage. Furthermore, special/series in science news is considered to be represented when a new theme emerges. More specifically, the significant increase in special/series is associated with the development of genetic engineering and genetic manipulation as shown in Table 4. Generally, the majority of the articles was in news/news brief/straight (58%), followed by feature, special/series, (Ed- but in the above table you have combined these two categories so it is impossible to know) and editorial/editor memo.

The difference by the stage of news of biotechnology-related articles classified according to section is presented in Table 6.

Table6. News sections by news stages (unit: %)

sections	stage of news					total (n=1803)
	Early first stage (1970 ~ 1979 ㄱ) (n=281)	Late first stage (1980 ~ 1989 ㄱ) (n=295)	Second stage (1990 ~ 1994 ㄱ) (n=174)	Third stage (1995 ~ 1999 ㄱ) (n=372)	Fourth stage (2000 ~ 2004 ㄱ) (n=681)	
Cover	1.8	4.1	6.9	3.5	9.0	5.7
Science & Technology	33.1	48.1	9.8	26.1	18.5	26.3
Society	33.5	16.6	44.8	26.3	20.4	25.4
Economics/Business	0.0	1.0	5.7	3.2	2.6	2.4
Culture	2.5	2.0	2.3	2.2	1.9	2.1
Politics	0.0	0.0	2.3	1.9	0.3	0.7
International	21.4	24.1	17.2	26.1	20.0	21.9
Editor/Column/Opinion	1.8	1.7	1.1	0.8	6.6	3.3
Others	6.0	2.4	9.8	9.9	20.7	12.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

Although only 1.8% of total biotechnology-related news coverage appeared in the cover in the early first stage, it increased continuously after that to 9.0% in the fourth stage. Editor/column/opinion occupied relatively little proportion before rising to 6.6% in the fourth stage. Regarding Science & Technology, many articles (33.1%, 48.1%) were shown in Science & Technology in the first stage, but there was a big decline to 18.5% in the fourth stage.

In general, Science & Technology was the major section of biotechnology-related news, followed by Society and International. The findings indicate that news about biotechnology study results partially relies on international news. Particularly, the changing pattern of the scientific technology section seems to be

related to the pattern (process) of biotechnology development.

Articles on the cover section are likely to be the most controversial and influential among the major daily news items. Consequently, biotechnology-related news was the most controversial and attractive in the second and fourth stages. Genetic engineering started to develop in the second stage, as did genetic manipulation which further flourished in the fourth stage. It is considered that biotechnology-related news had a significant influence on society at that time. While the scientific technology section presented only a small proportion in the second stage, the society section was the major section for publication. This suggests that science-related issues may develop into social issues when they reach maturity. The fact that the international section showed a decline(to 17.2%) in the second stage indicates that national social issues gained greater attention than international issues when the national biotechnology level had reached an international level.

This study analyzed the news frame regarding sub-topics. Table 9 presents the results of differences by the stage of biotechnology news sorted according to information channel.

Table9. News channel by news stages (unit: %)

News Channel	The stage of news					Total (n=2202)
	Early first stage (1970 ~ 1979 年) (n=281)	Late first stage (1980 ~ 1989 年) (n=295)	Second stage (1990 ~ 1994 年) (n=434)	Third stage (1995 ~ 1999 年) (n=511)	Fourth stage (2000 ~ 2004 年) (n=681)	
Reporter or correspondent (cover directly)***	40.9	57.3	53.5	66.7	70.2	60.6
National newspapers*** (including national news agency)	0.0	4.7	2.8	0.4	3.1	2.2
International newspapers***	4.6	11.5	3.7	4.9	3.8	5.2
International news agency*** (AP, AFP, UPI, Reuter etc.)	37.4	20.0	9.2	15.7	10.3	16.1
Professional**	16.7	9.5	12.2	12.9	18.1	14.4
Professional agency***	1.4	6.1	9.0	9.4	5.7	6.7
Database***	6.4	2.0	1.2	3.5	1.6	2.6
Others***	1.4	2.7	13.4	10.2	3.5	6.6

※ The number include all related news.

Similar to the news reporter, most biotechnology-related news was taken from international news agencies due to the lack of news reporting systems in the early days. When the news system had been better organized the number of special reporters increased, biotechnology-related news from international news agency was decreased. However, the rate of reporters and correspondents of news channel increased, as shown in Table 10. Generally, it is considered that the news channel has moved to reporters and correspondents rather than to international news agencies.

3) News trend of cognitive and emotional factors

The cognitive aspect's theme can have several dimensions embedded in the structure of the content. Holsti (1969) stated that a theme "is a single assertion about some subject" (p.116). Therefore, the theme as a part of a frame is an economical way to reduce the variety of text into several distinct categories. Holsti (1969) suggested that news frames and themes are sometimes interchangeable terms and have a "thematic emphasis" as a framing effect. In this study, the central idea of biotechnology news that occur together prominently in text are identified as themes. Furthermore, themes that can be classified by grouping into similar characteristics are used as definitions of media concepts. Frames may encompass several media categories as themes.

News theme by the stage of news was examined in cognitive aspects of the biotechnology news trend. The proportion of biotechnology news themes according to the stage of news is shown in Table 12.

Table12. News theme by news stages (unit: %)

News Theme	The stage of news					total (n=2202)
	Early first stage (1970 ~ 1979 년) (n=281)	Late first stage (1980 ~ 1989 년) (n=295)	Second stage (1990 ~ 1994 년) (n=434)	Third stage (1995 ~ 1999 년) (n=511)	Fourth stage (2000 ~ 2004 년) (n=681)	
Fetus study	11.4	11.9	8.8	31.5	19.7	18.2
Treatment study	86.1	75.3	84.6	58.9	36.1	62.6
Genetic engineering	1.1	0.7	0.9	2.5	21.7	7.7
Genetic manipulation	0.0	0.0	0.2	2.9	8.4	3.3
Politics/industry/economics	0.7	7.5	3.2	2.9	11.2	5.9
Introduction of scientist	0.7	4.7	2.3	1.2	2.9	2.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Treatment study, which was the main theme of biotechnology in the early days, had the highest proportion throughout all stages, although it decreased after the second stage. Fetus study was the second theme of biotechnology in all except the last period when it was passed by genetic engineering. The new themes of genetic manipulation and genetic engineering were hardly reported until the third stage and increased significantly in the fourth stage.

5) News Direction as Tone

Frames create the context cue through combining framing factors and frame methods, including positive or negative tones. The context cues create the overall coverage's tone and orientations of the news coverage. These cues are a key point to the public's perception and evaluation to issues and trends. The tones and orientations of certain issues and objects shift from one time to another time based on the social circumstance or movement.

This study examined the aspects of news with effective factors influencing the news. The aspects of biotechnology-related news by the stage of news are presented in Table 14.

Tabl14. News Perspective by news stages

News	thestageofnews	total
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Perspective	Early first stage(1970 ~ 1979 년) (n=281)	Late first stage (1980 ~ 1989 년) (n=295)	Second stage (1990 ~ 1994 년) (n=434)	Third stage (1995 ~ 1999 년) (n=511)	Fourth stage (2000 ~ 2004 년) (n=681)	
Negative	5.7	4.1	6.5	10.4	6.6	7.0
Neutral	83.8	72.9	85.9	74.6	77.2	78.5
Positive	11.0	23.1	7.6	15.1	16.2	14.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

$\chi^2 = 52.04, d.f. = 8, p < 0.001$

The majority of biotechnology-related news was neutral as biotechnology-related news was based on scientific results. More specifically, however, negative aspect news was highest in the third stage when genetic manipulation emerged and genetic engineering developed more than in any stage. This may have been related to the emergence of study themes (genetic manipulation and genetic engineering) requiring ethnic aspects compared to other biotechnological themes. Otherwise, the highest proportion of positive aspect news in the late first stage was related to the result of a treatment study.

Biotechnology-related news words according to the news aspect are presented in Table 15.

Table15. News length by news perspectives

News perspective	Number	Words average	Standard deviation
Negative	153	1247.51	709.38
Neutral	1725	899.43	732.39
Positive	316	1207.23	844.09
Total	2194	968.04	759.14

$F = 34.10, d.f. = 2, 2191, p < 0.001$

The number of words of neutral news aspect news was the lowest due to the factual nature of the subject.(Ed- this deleted sentence has in effect already been stated with 'neutral words being the lowest' of the previous sentence)

6) Synthetic results

Iyenger (1991) found two types of framing: "episodic and thematic." According to his research, television news provides one or the other of these types of frames of reference when reporting political issues. The episodic news frame is taken from a case study or event-oriented report (accident or crime), whereas the thematic frame places public issues in some more general or abstract context (social welfare or government policy).

The essential difference between episodic and thematic framing is that episodic reports make good pictures, whereas thematic reports feature more talking heads. In practice, little news is purely classified as thematic or episodic, but tends to be a combination of both. Episodic news framing is specific events or particular cases, whereas thematic is political issues and events in some general context (Iyenger, 1991). Furthermore, "episodic framing depicts concrete events that illustrate issues, while thematic framing presents collective or general evidence" (Iyenger, 1991, p.14). The episodic reports of this study's subjects were less likely to consider society responsible for the biotechnology news, whereas the thematic reports were less likely to consider individuals responsible in the biotechnology news.

News trend factors were explored according to the stage of news focusing on the impact of news category and types on the news amount and news length. Prominent items of each news category in biotechnology news are presented in Table 16.

Table 16. Biotechnology-related news trend

Stage of news	Variables			
	Section	Theme	Reporter	Complexity
The early first stage (1970 ~ 1979)	society*	treatment research†	desk***	research result***
The late first stage (1980 ~ 1989)	scientific technology*	treatment research†	desk**	research result***
The second stage (1990 ~ 1994)	society*	treatment research†	reporter***	research comment***
The third stage (1995 ~ 1999 年)	society/scientific technology***	fetus research†	reporter**	research result***
The fourth stage (2000 ~ 2004 年)	Society/ International***	genetic engineering/genetic manipulation**	reporter†	research result**

* p < 0.05, ** p < 0.01, *** p < 0.001, †p = n.s.

※ * & † Mark Regression Analysis to the independent variable of the amount of biotechnology news

Biotechnology-related news, which showed mainly in the scientific technology section in the early days, was found in the Society and International sections “in the fourth stage”, indicating that biotechnology has become an important issue which influences society. Considering the theme, the major theme of biotechnology-related news was treatment in its early stages, but in the later stages this was extended to life itself and birth of new life. Regarding news reporters, although much biotechnology-related news was from the desk, more biotechnology-related news was reported by reporters in the fourth stage. Only few professional reporters for biotechnology-related news existed in the early stages due to the lack of demand on biotechnology-related news and the evaluation of biotechnology for a significant area in society. It can be assumed that biotechnology-related news acquired professionals such as professional reporters as biotechnology became recognized as a socially important area. In complexity, biotechnology-related news was about research comment primarily only in the second stage when study on treatment peaked. This indicates that research comment on treatment research was reported more than new research results in that stage. At this point, the results indicate that the major biotechnology-related news will be about research comment when a research reaches its peak.

5. Conclusions

The purpose of this study was to organize trends in the publication of science news, especially biotechnology news, and to examine the presence of news patterns or model of news source, news construction methods, news trends and news trend construction methods in reporting science news. Consequently, this study examined trends in biotechnology news trend over a 34-year period. The findings showed that a new biotechnological theme was formed gradually in every period with the development of biotechnology news. More specifically, the news trends changed significantly in terms of section (edition), theme, news theme and complexity due to biotechnology development.

Considering the news frequency and amount, the results of biotechnology play important roles in total news frequency and amount, yet when biotechnology news was significantly relevant to social issues (industry, economy, treatment), the biotechnology news frequency and amount increased. The analysis of news amount and news theme as presented in Tables 5, 7, 12 and 14 demonstrated this point.

Various factors affected biotechnology news, in terms of the levels of study. Social section and international section were progressively added in the science-technology section. With regard to theme, starting with disease treatment, the realm of theme was broadened from life itself to the birth of new life. Considering complexity, commentary appeared mainly when the realm of study reached an extreme. This supports the presumption that biotechnology news trend was changed from reporting the results of biotechnology to reporting the advantages of biotechnology involved in industry and the economy.

Based on these results, a model illustrating the prominent biotechnological symbol, theme, cognition and effective factors of trends in biotechnology news with the passage of time according to various sub-factors was constructed and is presented in Figure 3.

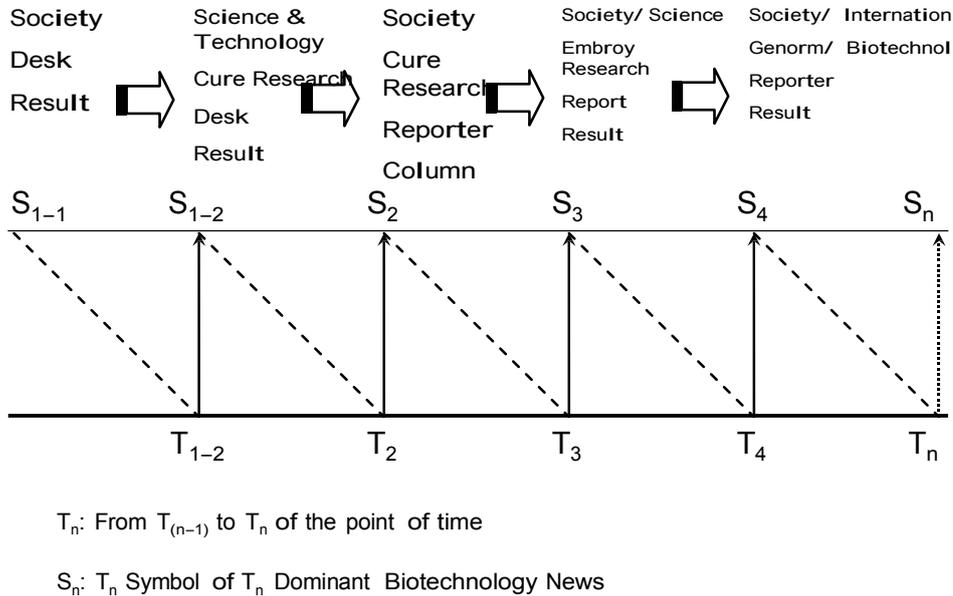


Figure 1 Model of the symbol, theme, cognition and effective factors of Biotechnology News

Prominent biotechnological symbol, theme, cognition and effective factors were shown at every period and are likely to have been reported. However, the past factors were substituted for new and prominent, biotechnological symbol, theme, cognition and effective factors. The news media reported these new factors. The biotechnology news underwent continuous change in both news amount and news contents, according to the study levels.

As apparent from Figure 3, research on embryos and genes emerged in the period of T_3 that started the third period (S_3). The section and complexity changed between T_1 and T_2 , and, furthermore, this pattern was repeated from T_3 . In short, science-technology moved to the society section while the complexity shifted from the results to commentary. Regarding the pattern of change, it is likely that the results could be substituted for commentary when the research on embryos and genes reached the extreme.

This study has provided a model that uses biotechnology news trends and patterns through the application of biotechnology news trend frame. In addition, the research has demonstrated a statistical analysis of news types according to multidimensional aspects of source, news construction method, news trend, and biotechnology construction method. The results showed that a new news mode appeared as biotechnology underwent further development and that the realm was broadened from scientific technology (seriation realm) to skeuomorphs. Finally, the amount, theme, source complexity, news perspective, tone, and paradigm of biotechnology news changed.

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