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Framing the Genetic Engineering Debate: An Examination of Frames and Sources in Local Newspaper Reporting

Catherine Emma Crawley
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Catherine Emma Crawley entitled "Framing the Genetic Engineering Debate: An Examination of Frames and Sources in Local Newspaper Reporting." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Communication and Information.

Edward Caudill, Major Professor

We have read this dissertation and recommend its acceptance:

Paul Ashdown, Suzanne Kurth, Bonnie Parnell Riechert

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Framing the Genetic Engineering Debate:
An Examination of Frames and Sources in Local Newspaper Reporting

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Catherine Emma Crawley
August 2005

DEDICATION

To my parents, with love and gratitude,

Heather Susan Jefford Crawley
and
Michael Federick Crawley

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I would like to thank the many people who have helped in the process of creating this dissertation.

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Despite all the assistance provided by my committee and others, I alone remain responsible for the content of the following, including any errors or omissions, which may unwittingly remain.

ABSTRACT

The study contributes to understanding of how a scientific controversy – genetic engineering – is treated in news stories in local newspapers. The findings provide quantitative evidence that local newspaper coverage of genetic engineering issues is framed in diverse and complex ways. Additionally, the analyses reveal that oppositional viewpoints exist in some local newspapers, perhaps more so than in national news. In contrast to studies of biotechnology news content in the national, elite press, this study suggests that a range of voices and interpretations about biotechnology do in fact exist in news media coverage of biotechnology in the United States, at least in some local newspapers.

The research specifically focuses on news media framing of genetic engineering and how stakeholders in the debate influence those frames. A computer-assisted content analysis was conducted on local newspaper coverage related to agricultural biotechnology. Semi-structured interviews with dominant stakeholders were conducted to augment quantitative evidence of news frames.

Methodologically, the dissertation introduces and elaborates the use of computer-assisted content analysis to determine frames related to biotechnology. The WordStat computer program was employed to systematically identify and analyze frames and frame changes over time. Moreover, unlike previous framing studies that have used cluster analysis, this study details the usefulness of factor analysis in statistically validating frames.

This study identifies and compares news frames in local newspapers in Northern California and in the *St. Louis* (Missouri) *Post-Dispatch*. News articles that contained

keywords pertaining to genetically modified organisms (crops and food) from January 1992 to December 2004 were obtained for the analysis from the Lexis-Nexis Academic database. A total of 1,134 news articles from the *St. Louis Post-Dispatch* was collected; 860 of these news articles were retained for analysis. A total of 508 news articles from four Northern California newspapers was collected; 296 of these news articles were analyzed.

Additionally, quantitative analyses of dominant stakeholders mentioned in both the Missouri and Northern California news articles were conducted. To supplement the quantitative findings, interviews with nine of the dominant stakeholders, or news sources, identified in the news articles investigated the stakeholders' involvement in shaping news media coverage of agri-food biotechnology issues.

Substantively, this study offers some understanding of the place of dissenting voices in localized debates on genetic engineering. The discovery that local news frames stories on biotechnology in greater complexity raises larger questions about the importance and value of local and community news. Thus, the study addresses the vital need for investigating news content in local news media.

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CHAPTER I.

BACKGROUND ON THE BIOTECHNOLOGY CONTROVERSY

Since the early 1970s when scientists discovered how to manipulate the genetic blueprint that is DNA, a revolution in genetic engineering has taken place. This revolution has spawned thousands of new applications of the technology and endless imaginings for future applications. Genetically engineered vaccines and antibiotics, human insulin, research into gene therapy and stem cells, in vitro fertilization – all are applications of medical biotechnology. In agriculture and food production, biotech crops, or genetically modified organisms (GMOs), are transgenic, meaning that the crop bears a gene from a different species or that it over-expresses or under-expresses one of its own genes. GMOs have created crops that are disease and insect resistant, delayed-ripening fruits that stay fresh longer, and hormone supplements that stimulate milk production in dairy cows. In the future, will we be able to replicate ourselves, harvest our organs from cloned tissue, or create semi-intelligent, even partially conscious, machines from advances in biotechnology?

Biotechnology, or the use of recombinant DNA (rDNA) technology to alter the inherited genetic structure of plants, animals, and in some cases, even human beings, is an issue loaded with political controversy and scientific uncertainty. Modern biotechnology has been called “the third strategic technology of the postwar period, following nuclear power in the 1950s and 60s and information technology in the 1970s and 80s” (Gaskell, Bauer, & Durant, 1998, p. 3). Krimsky (1991) explains that by the 1980s, “a great campaign had been started by major corporations, industry trade

associations, state governments, and universities to promote the biotechnological revolution first to the investment community and then to the American people, promising a cornucopia of improvements to civilization" (p. 13). The biotechnology debate has been characterized as "one of the most contentious and important political struggles of the twenty-first century" (Rampton & Stauber, 2001, p. 161). Government policymakers and investors around the world have hailed genetic engineering and other forms of biotechnology as one of the chief strategic technologies for the twenty-first century, along with nuclear power and information technology (Bauer, 2002). Bauer explains further:

> Biotechnology has become more controversial, facing worldwide controversies over genetically modified crops and foods, genetic testing and screening, human cloning and stem cell research, xenotransplantation, biopiracy, and the patenting of genetic materials. All this has implications for international treaties regulating agriculture, food safety, patenting, biodiversity, and world trade (Bauer, 2002, p. 146).

The goals of this research are to determine the frames that appear in local and state news coverage of genetic engineering, to examine how the frames change over time, and to investigate the social actors that influence the frame formation at the local and state level. In order to meet these goals, the objectives are two-fold: first, to conduct a quantitative examination of news media frames in stories about genetic engineering, as well as any shifts in frames over time, and second, to conduct a qualitative investigation of the dominant actors that influence those news frames.

The biotechnology debate typically falls within two different categories in terms of how the technology is used: agri-food (food and crop production) or "green" biotechnology, and biomedical or "red" biotechnology. While applications of red

biotechnology have been around since the discovery of rDNA technology in the early 1970s, applications of agri-food biotechnology began to emerge in the early 1990s. Since then, it has become one of the most controversial biotechnology topics, as countries in Europe, parts of Africa, and Asia have resisted imports of genetically modified (GM) grain, fruits, and vegetable products from the United States (Alvarez, 2003; Becker, 2003). In 1998, with suspicions about the health and safety of GMOs at their height, the European Union banned any new GMOs for planting or use in the EU. The ban was lifted in April 2004 when new rules on labeling and traceability of GMOs were adopted. Yet, in May 2004, the United States filed a $1.8 billion lawsuit to compensate for the loss of exports to Europe during the ban.

Americans have been consuming food with GM ingredients since the early 1990s. The first GM food product to appear on the market was cheese, which is made with a bio-engineered enzyme called chymosin, used to curdle milk. More than 70 percent of the cheese on the U.S. market has been made with chymosin (Agricultural Biotechnology, 2003). The product's introduction went largely uncontested. Biotech opponents gave the bio-engineered chymosin tacit approval as it replaced an animal-derived enzyme. The first controversial GM food product to be sold in U.S. grocery stores was milk made from dairy cows treated with rBST or recombinant bovine somatotropin, a controversial animal drug manufactured by Monsanto to stimulate milk production by as much as 20 percent in diary cows. The drug, known more commonly as bovine growth hormone or BGH, was approved by the Food and Drug Administration in 1993 and was available to consumers in 1994. The notion that milk could be tampered with technologically raised consumers' concerns. Protesters dumped milk into the streets in San Francisco, and in a

spoof of the dairy industry's "Got Milk?" campaign, the Humane Farming Association ran an anti-BGH campaign, which showed a glass of milk and asked "Got Hormone?" The drug was banned in Europe and in Canada.

In 1995, the United States approved the world's first commercially significant bio-engineered crop—Monsanto's "Roundup Ready" soybean, which is genetically engineered to withstand the spraying of Monsanto's Roundup Ready herbicide. The crop was first introduced on the market in 1996. Since then, the percentage of genetically modified (GM) crops grown around the world has increased dramatically. In 2003, it was estimated that 60 to 70 percent of processed foods in U. S. supermarkets contained a GM ingredient, especially soy, corn or canola (Pew, August 2003).

The acreage of GM crops grown worldwide has increased rapidly since the early 1990s (Pew, August 2004). In 1996, 4.2 million acres in six countries were planted with GM crops. By 2003, the numbers had grown to 167.2 million acres in 18 countries on six continents – a 40-fold increase in acreage in eight years. The adoption of GM crops has been the most rapid in the United States, where there has been a 27-fold increase in the area of GM crops planted from 1996 to 2003. Two-thirds of all GM crops in the world are planted in the United States. In 2004, about 85% of soybeans, 76% of cotton, and 45% of corn grown in United States were genetically modified (Pew, August 2004). Monsanto, now the world's largest manufacturer of GM seeds, said in 2004 that the average number of Monsanto traits per acre of crop is 1.5 for cotton and 1.2 for corn in the United States, with its GM corn at nearly full market penetration (Thatcher, 2004).

Critics of green biotechnology contend that the cultivation of GM plants may lead to environmental changes and that human consumption of GM food is unsafe, and at the

very least, should be labeled as containing GM ingredients. In fact, the labeling issue as been described as the most contentious within the agri-food debate (Pew, June 2002). GM foods do not currently require labeling because the United States Department of Agriculture, and the FDA has judged them to have the same nutritional content as similar non-GM foods. Proponents of green biotech argue that there is no solid evidence showing that GM foods are harmful, and they could reduce world hunger. They also argue that agricultural biotechnology is but one of the tools in a farmer's toolbox and that farmers should have access to all available technology.

In 2003 and 2004, surveys of American public opinion indicated a lack of concern or lack of awareness about GMOs. A poll conducted by the Food Policy Institute at Rutgers University in 2003 found that only 12 percent of Americans had heard or read "a great deal" about genetic engineering or biotechnology (Hallman, et. al., 2003). Twenty-seven percent of Americans surveyed by the Pew Center in September 2004 said GM food was unsafe (Pew, November 2004), whereas in Europe, 89 percent in France said GM food was unsafe, 81 percent in Germany, and 74 percent in Italy (Pew, August 2003). In terms of medical uses of biotechnology, cloning and the use of embryonic stem cells raise questions of morality and ethics in the American public, whereas for other uses, such as reproduction and pharmaceuticals, agreement is more widespread.

While the stakes are high in the debate over the revolution in modern biotechnology, the resources and opportunities are not equal among actors (Bauer, 2002). Politicians, scientists, policymakers, corporations, social activists, the food and agricultural industry, and other interest groups seek to influence how the technology will be used. How the technology will be used or how biotechnology policy will be formed

are debates unlike those in other scientific areas where questions of scientific truth or falsehood are primary, such as debates over evolution and creation or debates over the existence of global warning (Priest, Lee, & Sivakumar, 2004). Biotechnology does not always provide a clearly defined scientific or medical position from which opponents can argue. Rather, issues of biotechnology policy are unique in that they involve the application of science by a variety of actors pursuing particular goals and under conditions of scientific uncertainty (Priest, Lee, & Sivakumar, 2004).

Unique State and Local Concerns

Agricultural technology has been a particularly contentious issue at the local and state level as many farmers use the technology as a regular part of farming practices. Although considered among the smallest disciplines of the booming tech industry, "green biotechnology" is arguably one of the chief biotechnology issues debated at the local level in some geographical areas of the United States where the business of cultivating soil, producing crops, and raising livestock is of primary economic importance. Many farmers in these regions have been sowing GM seeds and growing crops since 1996, when Monsanto introduced the world's first bioengineered crop – the Roundup Ready soybean. Dairy farmers too have been injecting their cows with rBST since 1993.

A study conducted by the Pew Initiative for Food and Biotechnology in December 2004 noted that at the state level, much of the concern about biotech crops focuses on issues related to containment of biotech crops and preservation of market access for the state's agricultural producers (Pew, December 2004a). "These concerns are heightened

when the time comes to consider moving from field trials to commercialization of a biotech crop," the study said.

While many farmers have adopted various biotech practices, other farmers and local environmental activists have sought to take a more cautious approach with the technology. Some farmers who don't use GM products contend that they contaminate their non-GM fields. Activists and some politicians in California, North Dakota, Ohio, Oregon, and Vermont have campaigned for anti-GM initiatives, such as banning the planting of GMOs, the right of farmers to save seeds, and laws requiring labeling of food, seeds, and rBST milk. The technology has also been fought at the federal level; in 2004, Sen. Dick Durbin from Illinois introduced legislation for greater federal oversight of GM foods. Yet, if farmers choose not to use GM products, some have reported pressure from Monsanto to adopt their use. Still others have fought Monsanto in the courts for what they say is their right to save seed (Roberts, 2004). Since 1996, Monsanto has sold crop seeds containing a patented gene that protects the growing plant from the effects of herbicides, like Roundup Ready, which Monsanto also sells. Using such Roundup Ready seed allows farmers to spray their fields with the herbicide, eradicating the weeds but not the crop. Seed retailers must collect a technology fee for the manufacturer on each bag of the seed they sell, and then farmers are required to sign a release saying they will not save the seed from one season to another or give it to others. In 2004 in both Ohio and Missouri, state legislation was introduced to allow farmers to save seeds with patented technologies from one year to the next.

News Media and Biotechnology

News media play an important role in both the public arena and the policy arena in debates involving scientific controversy, such as stem cell research, global warming, and partial-birth abortion. Agricultural biotechnology, including genetically modified foods and crops, is also part of the debate. While effects of media messages on public opinion can be overstated, we know that the news draws public attention to some issues at the expense of others (McCombs & Shaw, 1972). News media decide what topics to cover and what to leave out, thereby setting the agenda for public discourse. In fact, much of the information people receive about risks, including information on the food-related risks, comes from mass media (Allan, 2002; Blaine & Powell, 2001; Frewer et al., 1996; Frewer, 1999; Reilly & Miller, 1997; Retzinger, 2001; Ten Eyck, 2000). Indeed, people's knowledge and opinions of science and technology issues is often influenced by mass media content (Einsiedel & Thorne, 1999), and particularly in the case of biotechnology issues (Brossard & Shanahan, 2003; Gaskell et al., 1999; Gunter, Kinderlerer, & Beyleveld, 1999; IFIC, 2001; Logan, Fears, & Wilson, 1997; Marks, 2001; Priest, 2000).

The exact scope of the news media's influence is debatable. Yet, Priest & Ten Eyck (2003) have argued that because the people are generally caught up in more immediate, daily concerns and do not necessarily have many other sources of expert information or interpretation of issues of science and technology policy, it is likely that the power of news – via newspapers, magazines, television, and the Internet – to influence public opinion is stronger for science and technology issues than for other questions. At the same time, the authors acknowledge that media messages do not dictate

public opinion and that the audience is active in selecting and interpreting messages. Yet, media messages influence the "opinion climate in which individuals see themselves," which "has consequences for shaping the course of public debate" (Priest & Ten Eyck, 2003, p. 29).

In addition to the public debate, news media play an important role in the policymaking arena. Stakeholders seek to advance how the issues will be framed in the news and seek to persuade key decision-makers, interest groups, and the public. "Frames" in mass media provide a way to organize news content, suggesting what is really at issue by selecting and emphasizing certain ideas and facts (Entman, 1993; Gamson & Modigliani, 1989). Social and political actors compete to "sponsor" their preferred definitions of issues in news frames via "framing contests" (Carragee & Roefs, 2004). Although the term "sponsor" can imply that a service is being paid for, in this instance, no payment is exchanged. Rather, sponsorship in this sense refers to news sources who are skilled at influencing the news story and who are able to "sponsor" their preferred frames in news media. When a stakeholder succeeds in framing an issue or event in news media, that stakeholder in turn can influence other similarly interested parties, as well as the public (Nisbet & Lewenstein, 2002). In a "mediated democracy," mass media both mirror and shape the events that take place in the public policy arena (Bennett & Entman, 2001). Indeed, understanding more about how the biotechnology story is shaped and reported in news media is a critical topic for communication study because while stakeholders compete to influence news media, the news media itself shape how biotechnology policy gets defined and symbolized (Nisbet & Lewenstein,

2002). News media's ability to influence social behavior, social change, and the policy agenda render them essential to consider in discussions of biotechnology.

Generally speaking, news stories about biotechnology are characterized by a narrative storytelling style, which allows journalists in various media more freedom to explore the nuances of a complex story involving competing interpretations of scientific information in a dynamic political context. This is particularly the case when the issue becomes politically relevant and has a clear beginning to the controversy and a resolution. News coverage in the traditional "inverted pyramid" style of reporting can also be found for such stories, especially in local or state news with breaking news events, such as the passage of state laws or local resolutions that take a more cautious approach toward GMOs.

Media coverage of biotechnology and GMOs has often been polarized: safety versus risk; science moving forward versus science out of control; competitiveness versus safety (Powell & Leiss, 1997). Studies of news coverage, at least in national newspapers, have shown coverage of agri-food biotechnology in particular to be minimal overall (McInerney, Bird, & Nucci, 2004; Retzinger, 2001; Priest, 2001b; Shanahan, Scheufele, & Lee, 2001). Historically, coverage has been episodic, clustering around key events, like the 1997 cloning of "Dolly" the sheep (Nisbet & Lewenstein, 2002; Priest, 2001b, p. 2) or the 1993 FDA approval of rBST. Peak years for news coverage of agri-biotechnology in national newspapers occurred from the mid-to-late 1990s and also 2000, but coverage was said to have dropped off after 2001 when fears of terrorism captured news headlines (McInerney, Bird, & Nucci, 2004).

Early coverage of biotechnology, in the 1970s when rDNA technology was discovered, was characterized by news media in terms of its dangers and uncertainties. In the 1980s and early 1990s, however, most images of biotechnology emphasized its benefits and opportunities. Not until the late 1990s and early 21st century did the debate become broader to consider issues of ethics and accountability. In large part, these competing images of biotechnology are the direct result of efforts of private interests and public officials who seek to define the issues concerning biotechnology. News coverage is largely dominated by spokespeople for the industrial developers of this technology (Nisbet & Lewenstein, 2002; Plein, 1991; Preist & Talbert, 1994).

Biotechnology often presents a host of complex science and social science uncertainties and issues that journalists often don't know how to cover (Friedman, Dunwoody, & Rogers, 1999, p. xii). Where there is a gap in understanding, sources will often provide information necessary to fill it, an indication of the close, sometimes deferential nature, of the relationship between journalists and their sources. In fact, in biotechnology coverage, a source-generated pro-biotechnology bias has been documented on a consistent basis in the scholarly literature, with the exception of a few brief episodes triggering moments of negative GM news (Nisbet & Lewenstein, 2002; Priest, 2001b; Priest & Gillespie, 2000). Priest has argued that mainstream news media with its reliance on large institutional sources has created "a picture of [an American] public tolerant of GM foods…, if not enthusiastic about them, and a world in which criticism and concern [is] confined to a handful of extremists" (2001b, p. 122).

Some biotechnology stories fail to make the national news agenda, but instead capture the attention of more localized news outlets (Priest, 2001b; Priest & Ten Eyck,

2004). In some cases, national news coverage may well follow, rather than lead, public opinion, especially when attitudes begin forming at the local level (Priest & Ten Eyck, 2004, p. 180). Fewer studies of local news coverage have been conducted, so little is known as to the extent or nature of coverage. Yet, the biotechnology story appears to be important at the local level when the story is specifically tied to local community issues (Priest, 2001b, p. 118; Priest & Ten Eyck, 2004, p. 178). For example, in 1993, when the FDA approved rBST, it did not receive a great deal of attention from the elite national newspapers, like *The New York Times*, but it was important for local newspapers (Priest, 2001b, p. 25). Only at local newspapers in dairy states, like Vermont and Wisconsin, where the product was tied to economic concerns, did rBST-related issues receive prominent coverage, and most of the coverage concerned reaction to rBST from the dairy industry (Priest, 2001b, p. 25). In the same study, Priest also found that in the case of "terminator seeds," which become sterile as seed after one growing season, the story appeared first in local newspapers, like the *Wichita Falls Time Record* and the *St. Louis Post-Dispatch,* before breaking into national news media nearly a full year later (p. 117).

Determining why some biotechnology stories finally become national news is difficult to pin to one cause, Priest argues, saying only that, in the case of the terminator seed story, there was "a cauldron that had probably been boiling beneath the surface of mainstream news accounts for some time" (Priest, 2001b, p. 118). Yet, Priest and Ten Eyck (2004, p. 188) point out that some local biotechnology stories never make it to the national news agenda. Those that do must "capture the imagination in unusual ways, whether by introducing new decision-making processes or using high drama in expressions of dissent" (Priest & Ten Eyck, 2004, p. 194).

Purpose and Significance of Study

As stated previously, some local newspapers, rather than the elite national newspapers, lead news coverage of biotechnology issues. Little is known about the nature and extent of coverage at the local level, as few previous studies have examined newspaper coverage in specific communities or in specific states. Most studies examine coverage at national elite newspapers. Yet, broader and more diverse perspectives on biotechnology may exist in local news coverage than at the elite national newspapers (Priest & Ten Eyck, 2003).

Furthermore, given that news stories are often a forum for framing contests between political actors, it is important to understand how these political actors influence news coverage to reflect their preferred frames. Media scholars have argued that it is critical to understand the ways in which journalistic framing of issues occurs because framing influences public understanding and, consequently, policy formation (Gans, 1979, 1983; Gitlin, 1980; Pan & Kosicki, 1993; Tuchman, 1978). Since the 1970s, mass media research has yielded an impressive literature about framing as a research approach that explores why certain ideas, issues, experiences, and events are selected and emphasized over others in news media (D'Angelo, 2002; Edelman, 1993; Entman, 1991, 1993, 2004; Gamson, 1989; Gitlin, 1980; Goffman, 1974; Iyengar, 1991; Price, Tewksbury, & Powers, 1997; Tuchman, 1978; Reese, 2001). Yet, Carragee and Roefs (2004) argue that framing research has neglected the importance of considering the work of political and social actors or news sources who influence the content of frames in news media. Thus, this study draws upon the sociological roots of framing to consider the

contextual relationship between news frames and the influences of news sources on those frames.

Methodological Considerations

While the qualitative study will draw upon many different data sources to construct a picture of the dominant actors, the quantitative study focuses primarily on newspapers for several reasons. Newspapers are readily available and generally consistent data, as they are often archived and indexed in computer databases. Thus, newspapers provide one of the most efficient ways to study a mass medium. Gregory and Miller (1998, p. 105) note that newspapers have been the focus of most studies of science in the media. "This is not because researchers believe that science in newspapers is the most influential or widespread form of mediated science; nor is it because newspapers have large readerships," they write. In fact, newspaper readership has declined precipitously over the last decade (Readership Statistics, 2004). Newspapers are studied because that is often "the most efficient way to study a mass medium" (Gregory & Miller, 1998, p. 105). Broadcast news, from the docudrama to the talk show, is more ubiquitous and arguably influential. Yet it is also much more short-lived and therefore more difficult to explore systematically. Even the Internet, which is beginning to play a larger role in news dissemination, is difficult to analyze as its text continually changes and its archived matter is more incomplete than newspapers. Finally, Pollock et. al. (2004, p. 4) point out that "newspapers merit attention in public controversy because of their authority and capacity to 'frame' some perspectives as more reasonable than others." Furthermore, newspapers tend to set the broadcast news agenda as well.

Certainly, a study of newspaper coverage will not present a complete picture of the news environment, yet it will provide appropriate, measurable, and richly-nuanced data central to that environment.

Local newspapers were chosen for the study over national newspapers for several reasons. First, while there are many studies of public perceptions or attitudes toward GMOs at the local level, only a few studies document the nature of local news media coverage. Furthermore, as stated previously, on some biotechnology issues, local news trumps national news. Although on other issues national news often sets the news agenda at the local level, when genetic engineering matters on a local level, like in the case of rBST milk or terminator seeds, local news sometimes picks up the story first. For example, in 1989, the case of rBST milk, Sen. Patrick Leahy of Vermont, an ardent supporter of biotechnology, succumbed to pressure from the Vermont dairy industry and called for further testing, which delayed the FDA's decision regarding approval of rBST (Larrabee, 1989). Thus, the story appeared to be locally grown. Another reason local news coverage was chosen for analysis was because analyses of content in national newspapers *not* representing specific regions are already well represented in the literature. In fact, Priest & Ten Eyck (2003) argue that studies of mainstream, national newspapers may mask diverse perspectives on biotechnology that may exist in greater degrees at the local level. Noting the geographic and ethnic diversity of the United States, they write, "Stories about local events – especially controversies related to agriculture, which are going to be seen as less compelling to the audiences in major urban centers that produce the elite publications most often studied – only become nationally prominent on rare occasions" (p. 34). With fewer studies noting the extent and nature of coverage of

GMOs in local news, it is difficult to determine how the biotechnology story has been told in towns and communities across the United States.

With the focus of the research questions on issues of genetically modified organisms (GMOs) at the local level, the study necessarily is limited to the debate of agricultural and food biotechnology, not other applications of biotechnology, such as those in the field of medicine. Thus, news articles with the predominant focus on issues such as stem cells, cloning, genetic altering of humans, gene therapy for humans, and other medical biotechnology stories will not be included. Also excluded will be stories on genetically modified animals, unless they are for human consumption, like salmon or poultry.

Structure of the Dissertation

The study encompasses six chapters. Following this introductory chapter, the second chapter discusses the literature that has informed the study and ends with several research questions, which will be answered in the remaining chapters of the dissertation. The literature review provides the theoretical foundation for the study and also examines empirical evidence from previous scholarly studies relevant to the dissertation research. The third chapter details the methodological steps, which will be undertaken as a process of answering the research questions. The fourth chapter explains the analysis and results of the quantitative study, and the fifth chapter explains the findings of the qualitative study. The sixth and final chapter offers discussion, conclusions, and suggestions for future research.

CHAPTER II.

LITERATURE REVIEW

The review of the literature is divided into two main sections. The first section reviews the theoretical foundation for the study. The theoretical basis can be understood by examining framing and its earliest conceptual history. Next, a review of theory related to framing the news will be provided. Framing will also be examined from the theoretical aspect of framing as strategic action, as well as the concept of frame sponsorship in the news. Geographical influences on news content will be considered, as will theories of how frames change over time or frame evolution. The last sub-section of the theoretical foundation section includes a review of the unique properties of the science beat. The second main section in this chapter explores the empirical dimension of framing in terms of biotechnology, which includes sub-sections on studies of media coverage of biotechnology in national and local newspapers and a final sub-section on previous research about the sources or actors that influence news coverage of biotechnology.

Part I: Theoretical Foundation

Framing – Early Conceptions

Framing can be traced to work by Bateson (1972) and then Goffman (1974), who proposed the frame as a construct for how people organize experience and how they determine "what is it that's going on?" Borrowing from Bateson's first use of the term, Goffman applied the concept to human behavior in 1974 in his seminal work, *Frame*

Analysis: An Essay on the Organization of Experience. With a keen interest in an individual's perception of social cues, Goffman suggested that frames point people in certain directions. In other words, frames may direct our attention toward certain aspects or attributes of activity and away from others. Goffman was convinced that daily life is more complicated than people think, and that people's views of situations undergo continual change, based on social cues. In a way, these social cues are the "frames" that shape human experience. Frames, he said, maintain tension or balance between structure and agency. On the one hand, events and experiences are framed; on the other hand, we frame events and experiences. Thus, frames are fragile and vulnerable to manipulation. While the world comes to us framed in certain ways, he said, people decode this perceived reality in different ways.

Since its earliest conceptions, framing has been used in scholarship in the communication field, as well as many other social science disciplines, including sociology, political science, and psychology (Reese, 2001, p. 7). Nevertheless, there is no widely agreed upon definition of frames or the framing process. In psychology, for example, frames might be thought of as a version of cognitive schemas, while in sociology, frames are sometimes viewed as strategic discourse used in social movements. With different operational definitions, the application of the concept also varies widely. Indeed, the concept has been criticized for lacking theoretical clarity and empirical rigor (Scheufele, 1999). Yet, since about 1993, when Entman published an essay addressing the "fractured paradigm" of framing, there has been more agreement in communication studies, which will be explored in further detail in the next sub-section.

Framing the News

Since the 1970s, mass media research has yielded an impressive literature about framing as a research approach that explores why certain ideas, issues, experiences, and events are selected and emphasized in the media over others (D'Angelo, 2002; Edelman, 1993; Entman, 1991, 1993; Gamson, 1989; Gitlin, 1980; Goffman, 1974; Iyengar, 1991; Price, Tewksbury, & Powers, 1997; Tuchman, 1978; Reese, 2001). Entman's definition of framing is most often cited in the communications literature:

> To frame is to select some aspects of a perceived reality and make them more salient in a communication text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation (1993, p. 52).

Frame analysis has proven useful in understanding what factors influence media coverage, what principles dominate public debate, and ultimately, what elements prevail that impact public policy. Frames can be studied "as a strategy of constructing and processing news discourse or as a characteristic of the discourse itself" (Pan & Kosicki, 1993, p. 57). Framing in news media suggests that news texts are "a system of organized signifying elements that both indicate the advocacy of certain ideas and provide devices to encourage certain kinds of audience processing of texts" (Pan & Kosicki, 1993, p. 55-56). As Pan & Kosicki (1993) explain, the language comprising frames "hold(s) great power in setting the context for debate, defining issues under consideration, summoning a variety of mental representations, and providing the basic tools to discuss the issues at hand" (p. 70). A tool for examining discourse, "framing analysis plays close attention to the systematic study of political language, the coin in the realm of political

communication that is often ignored or only dealt with in a highly abstract manner (Pan & Kosicki, 1993, p. 70). For Entman and other scholars, the "frames" or political claims and counter-claims that appear in and dominate the content of public discourse are the "imprint of power" (Entman, 1993, p. 32).

The applicability of the framing process to news work was first established by Tuchman (1978), who used the term "framing" to emphasize the role of the routine "procedures" of news work in the creation of news frames. A journalist's own system of organization influences which elements are either included or excluded from a message. Journalists select whom to quote, what to quote, and where to place the quotations in a story, thereby expressing opinion. Thus, when journalists frame a story, they deploy a structure to the narrative that helps the audience make sense of the events.

A central organizing idea for news context, frames supply content and suggest what the issue is through the use of selection, emphasis, exclusion, and elaboration. According to Gamson (1989), facts alone have no intrinsic meaning, but become meaningful once embedded in a frame or story line. Frames in the news emerge as the presence or absence of keywords, common phrases, images, sources of information as well as sentences that cluster to reinforce certain themes (Entman, 1993). In 2004, Entman further clarified the definition of framing, based on its use in previous research. He said framing is "selecting and highlighting some facets of events or issues, and making connections among them so as to promote a particular interpretation evaluation, and/or solution" (p. 5). Frames not only underscore the importance of select pieces of information through the inclusion of certain text elements and by their placement or repetition, but they also can be defined by what they leave out as well (Entman, 1993).

Notably, frames are "organizing principles that are socially shared and persistent over time, that work symbolically to meaningfully structure the social world" (Reese, 2001, p. 11). In mass media, they can be organized and communicated verbally (e.g., radio, television), visually (i.e., television, newspapers), or in print (i.e., newspapers, the internet). Framing occurs at the policy-level, the media-level, and/or at the public level (Scheufele, 1999). At the media level, "frames may best be viewed as an abstract principle, tool, or schemata of interpretation that work through media texts to structure social meaning" (Reese, 2001, p. 14).

Journalists and news organizations are not the only groups who influence the construction of frames. Shoemaker and Reese (1996) proposed a concentric circle model that comprises five different levels of influence. This " hierarchical model of influences" offers perhaps the richest elaboration to date of influences on media content. Drawing on the gatekeeping model, which examines how news is rejected or accepted in the newsmaking process, the hierarchical model places the individual journalist or media worker at the first or micro-level of influence. The journalist's influences involve his or her personal attitudes and orientation. The next level of influence is the routines of media work, e.g., deadlines, the beat system, official sources. A third influence is organizational, e.g., corporate policies, political endorsements, and editorial positions. The next broader category in the model includes extra-media influences, like the effect of the economic environment, the marketplace, cultural and national variables, and public relations activities. The broadest level is the influence of ideology and societal-level factors, such as societal definitions of deviance and normalcy or the influence of power centers within society. Shoemaker's and Reese's hierarchy of influences suggests a

cohesive theory of news content, one that synthesizes "what is already known about the influences on media content into a more systematic set of interrelated statements about the relationships between media content and the influences on it" (1996, p. 261). They also suggest analyses that offer multiple perspectives of the influences of content, such that each level of influence is linked to or combined with another level of influence. Combining all the influences on content in media studies research offers a richer, more complete picture of the role of mass media in society (1996, p. 271).

In mass communication research, frames are studied as independent or dependent variables. Studies of frames as dependent variables have examined the role of various factors in influencing the creation or modification of frames, while studies of frames as independent variables are usually concerned with the effects of media framing on audiences. The process that influences the creation or changes of frames is what Scheufele (1999) calls "frame building" – an area of research often neglected in framing research. Scheufele likens frame building to Cobb and Elder's (1972) model of agenda building, whereby organizational and structural factors in media are analyzed to determine their impact on news content. Case studies have demonstrated the success of interest groups, for example, in setting the media's agenda (Huckins, 1999), and in other cases, special interest magazines setting the agenda for the mainstream press (Denham, 2004). Not to be confused, however, with the agenda-setting model (McCombs & Shaw, 1972) in which news media suggest to the public what issues are salient. Frame analysis moves beyond agenda setting to consider not just what news organizations deem worthy of attention, but how problem selection, emphasis, and definition helps some issues appear more salient that others.

In mass media scholarship on science communication, framing has been used to study news media coverage of nuclear energy (Gamson & Modigliani, 1989), stem cells (Nisbet, Brossard, & Kroepsch, 2003), and risk stories in general (Dunwoody, 1992). It has also been used to study news coverage of biotechnology in European countries (Durant, Bauer, & Gaskell, 1998; Bauer et al., 2001), specifically in Greece (Boudorides, Kalamaras, & Eleftheriadis, 2004), Switzerland (Dahinden, 2002), India (Yamaguchi & Harris, 2004), and the United States (Gaskell et. al., 1999; Lundy & Irani, 2003; Nisbet & Lewenstein, 2002; Ten Eyck, Thompson, & Priest, 2001).

Framing As Strategic Action

Framing can also be viewed in terms of a strategic action. Gamson said that framing is a part of a discursive process in which strategic actors use symbolic resources to participate in collective sense-making about public policy issues (1992, 1996). Pan and Kosicki (2001) defined strategic actors as political actors who use framing to "weave a web of subsidies and build a discursive community" (p. 59). Strategic action is not limited to influencing news texts, they say, but it also influences public deliberation and the policy debate. Framing news texts is but one part. "Building a discursive community requires searching for and creating a frame that binds diverse interests and actors together," they write (p. 59). Framing is used strategically to attract supporters, to mobilize collective actions, to broaden an actor's influence, and to increase chances of winning (Snow & Benford, 1988, 1992; Snow et. al., 1986; Zald, 1996). Pan and Kosicki (2001) assert that a frame is strategic when it helps configure desired social and political forces.

Another form of strategic action via framing was suggested by Benford and Snow who assigned the label, "collective action frames," to describe "sets of action-oriented beliefs and meanings that inspire and legitimate the activities and campaigns of a social movement organization" (2000, p. 614). During cycles of protest, collective action frames attribute blame for certain social problems and suggest culpable parties (Snow & Benford, 1992, p. 137). Snow and Benford (1992, p. 138) also introduced the concept of "master frames," which work on an even broader, generalized level than collective action frames to mobilize potential constituents, to garner wider public support, and to demobilize opponents. As examples, Snow and Benford suggested the nuclear-freeze master frame (1992, p. 143) that shaped the U.S. peace movement of the 1980s and the civil-rights master frame (1992, p. 145) that elaborated the civil rights movement of the 1960s.

In viewing framing as strategy, Oliver and Johnston (2000) point out that there is a tendency to think of frames or "master frames" as ideology, but they caution against this characterization. Although framing and ideology are related concepts, they say, each points to different dimensions in social construction. "Framing points to process, while ideology points to content," they write (p. 47). They argue that a master frame "lacks the elaborate social theory and normative and value systems that characterize a full-blown ideology, but instead is a signifier that points to a general category of socially-recognized instances" (p. 48). So, for example, the feminist movement cannot be reduced to simple terms as a "feminist frame." A frame in this sense would be instead an "angle or perspective on a problem" (p. 48), like fighting for rights such as equal pay. The feminist rights frame pointed many women in the direction of feminist ideology, "but one can

apply the rights frame without having a feminist ideology…which in the last two centuries has evoked a wide variety of ideologically disparate movements," such as both sides of the debate over abortion (Oliver & Johnston, 2000, p. 50). Benford and Snow (2000) confirm that framing, in contrast to ideology, can be more readily observed and explored empirically.

Frame Sponsorship in News

Tuchman (1978) and Gitlin (1980) linked Goffman's focus (1974) to broader ideological and structural processes, which are influenced by journalists, their news organizations, and their sources. As Shoemaker and Reese (1996) suggest in their hierarchical model of influences, journalistic framing of news events does not happen in a political vacuum. Rather, multiple social actors – politicians, organizations, and social movements – work to "sponsor" the frames that appear in the news (Carragee & Roefs, 2004; Gamson & Modigliani, 1989). Again, "to sponsor" in this sense refers to news sources who are skilled at influencing the frames that appear in the news story. It is widely viewed that news sources have a profound influence on news production (Berkowitz, 1992; Gans, 1979; Sigal, 1986). Yamaguchi & Harris (2004, p. 469) write:

> Social actors do not passively and unconsciously act in accordance with externally imposed structures and systems: they are active agents who, through the use of interpretations and claims making, succeed in creating, contesting and recreating social reality.

When sources strategically cultivate resources to influence frames, this process is what Gamson (1988) termed "frame sponsorship." So while journalists and journalistic routines influence the formation of frames, so do stakeholders who seek to influence the

frame before it reaches the printed page or the electronic screen. News media can be viewed "as a symbolic site on which various stakeholders contend" (Miller, 1997, p. 373). Thus, framing is part of the "ongoing process by which ideological interpretive mechanisms are derived from competing stakeholder positions" (Miller & Riechert, 2001b, p. 109). With different groups competing for sponsorship, conflict, then, becomes the common characteristic at the heart of most frames (Hertog & McLeod, 2001, p. 147). Gamson (1998) points out that a frame usually implies a number of different positions, not just one (1988). Gamson (1988, p.167) found that conflict in framing manifests in "counterthemes," which are "adversarial" to the "conventional and normative" theme, while Hertog and McLeod (2001, p. 148) observed that conflict was evident by "the choice of actors presenting information, ideas, positions within a text." In news stories, sources tended to structure the discussion (Hertog & McLeod, 2001). Hertog's and McLeod's (2001) study of frames used in media coverage of the Cold War, for example, found that "the choice of actors" who presented the information and ideas ended up structuring the discussion and defining the conflict. Andsager (2000) found similar results in her study of the rhetoric and frames used in the abortion debate. Her study showed how the language used by sources can influence the language that appears in news stories.

Social and political actors compete to sponsor their preferred definitions of issues in news frames via "framing contests" (Carragee & Roefs, 2004). The term, "framing contest," was first put forth by Ryan (1991) to explain the square-off that takes place between social movements and their opponents. A source has successfully "framed" a situation or issue in news media when it has defined the issue in its preferred terms and

has also characterized alternative explanations, which helps to delimit arguments from the opposition (Berkowitz, 1992). Furthermore, once an issue is framed at the early stages of media exposure and discussion, policymakers and other interests run into difficulty trying to shift the image of the issue to alternative perspectives (Linsky, 1986; Schon & Rein, 1994).

A frame's ability to dominate news discourse depends on a number of different factors, including "its sponsor's economic and cultural resources, its sponsor's knowledge of journalistic practices, these practices themselves, and a frame's resonance with broader political values" (Carragee & Roefs, 2004, p. 216). Sources provide information subsidies (Gandy, 1982) that account for the large proportion of the news that is reported (Berkowitz, 1987; Brown, Byee, Weardon, & Straugham, 1987; Sigal, 1973; Soloski, 1989). Gandy described the relationship between sources and journalists as a "dance" and explained further that "although it takes two to tango, either sources or journalists can lead, but more often than not, sources do the leading" (1982, p. 10). Information subsidies are "attempts to produce influence over the actions of others by controlling their access to and use of information relevant to those actions" (Gandy, 1982, p. 61). Still, in framing contests, activists working in grassroots organizations are not often the winners (Entman & Rojecki, 1993). Furthermore, they rarely exercise control over the topics that news organizations cover or how the activists' claims are interpreted (Baylor, 1996; Gamson & Modigliani, 1989).

Framing contests typically favor political elites (Carragee & Roefs, 2004; Gitlin, 1980; Kellner, 1990; Tuchman, 1978). Political players, such as interest groups and politicians, employ several interpretative issue frames and work hard to put their

preferred themes on the agenda (Callaghan & Schnell, 2001; Popkin, 1991). One group usually emerges as the dominant group with the dominant frame. Because groups with established leaders and formal organizations have greater access to media, their cultural power and credibility legitimizes certain facts as being more believable (Entman, 1989, p.49). Certain actors are favored within the political system over others, and these inherent biases serve to maintain the balance of power in the system (Cobb and Elder, 1972; Schattschneider, 1960).

Further, relying on "legitimate political elites" is one of the least expensive ways for journalists to gather information (Gandy, 1982; Pan & Kosicki, 2001). It also has the feel of credibility because elites share the same social class as most readers and journalists (Entman, 1989, p.49). They have "cultural legitimacy" and can provide ready and believeable "facts" (Entman, 1989, p.49). Another reason that political elites dominate framing contests is because they can mobilize economic and social resources (Pan & Kosicki, 2001). These resources can be material, social structural, institutional, and cultural – anything that influences the language, context, and atmosphere of public deliberation of an issue (Pan & Kosicki, 2001). Of course, different actors have different resources. For example, elected officials have the ability to stage newsworthy events. Appointed officials in the executive branch can do the same, and they can also leverage the relationships they have with elected officials. Pan and Kosicki further point out that political actors sponsor a frame by "adjusting the ratio of the value of their information to the cost for another actor to use the information" (2001, p. 46). In other words, information delivered via an actor's staged event might be seen as having value if it is constructed using journalists' professional standards of news values.

Pan and Kosicki (2001) describe three ways actors frame strategically. First, they subsidize news media, thus influencing media discourse, by lowering the cost of news gathering and by generating cultural resonance of their frame with the news values held by journalists. Second, actors can subsidize policymakers, thus influencing elite discourse, by reducing costs for policymakers in processing information and by reducing "perceived political risks" for policymakers to take a stand on an issue. Three, actors also subsidize the public, thereby influencing public opinion, by creating "ideologically toned and emotionally charged catchphrases or labels," like pro-life vs. pro-choice, and by linking a political icon or group to a particular position (2001, p. 46).

While one group, or groups, often emerges as the dominant group with dominant frame, less dominant groups – grassroots or dissenting groups – have been successful in exploiting news values in order to create and promote particular frames (Benford & Hunt, 1992; Page, 1996; Ryan, 1991). American history provides evidence of this. The women's movement, civil rights, the Vietnam War, and radical environmentalist groups – all have provided instances where issues were framed or re-framed in order to garner media attention. In the biotechnology movement, for example, GE-free activists like Jeremy Rifkin and his Foundation for Economic Trends have used several strategies since the late 1970s to win media attention (Krimsky, 1991, p. 109). Rifkin has gained publicity via well-time lawsuits and by staging political protests at various science conferences and events (Krimsky, 1991, p. 170). On one occasion in 1983, he sent out a scathing ten-page letter on the moral arguments against genetic engineering and was able to gather 64 signatures from supporters from a broad political spectrum, including religious leaders and several scientists. Rifkin's campaign made front page headlines in

The New York Times (Briggs, 1983). So, while less dominant groups may not have the economic power to dominate news frames, for some groups "on the fringe" their skill lies in their knowledge of journalistic practices and in their awareness of what makes an issue newsworthy. The political and social zeitgeist of the time can also provide opposition groups some momentum. For example, in the early 1970s, anti-nuclear power discourse became part of the mainstream in terms of the news agenda (Gamson & Modigliani, 1989). Around the same time, questions were also being raised and legitimized in news media about the risks involved with gene-altering technology. In Gamson & Modigliani's study, challengers to the status quo were actually helped by the media (1989). The meanings preferred by the industrial and corporate actors for the technology proved to be vulnerable, and, to a certain extent, professional journalistic norms and practices worked against the industry's preferred interpretations (Gamson, et. al., 1992).

Geographic Factors in Framing

Although news sources can exert great influence on what becomes news and how it gets framed, the degree of news source influence is not constant, but changes depending on the nature of the geographic community (Berkowitz & TerKeurst, 1999). Works by Tichenor, Donohue, and Olien (1973, 1980; Olien, Donohue, & Tichenor, 1978) have influenced scholarship that explores how the community's power structure affects news media processes. The general thrust of their research views news media as an organic sub-system of larger social systems. The news from various geographic locales varies according to the plurality (or social power structure) of the community where the news is produced. Operationally, pluralism refers to community size, but other

factors are also considered, such as the community's economic base and its proximity to major metropolitan areas (Tichenor, Donohue, & Olien, 1980; Dunwoody & Griffin, 1999). More pluralistic communities tend to be larger or have a more diverse social power structure, providing more leeway for journalists to choose which subgroups' interpretations dominate the news (Tichenor, Donohue, & Olien, 1980, p. 40). Homogenous communities tend to be smaller with less diversity of viewpoints, and in these situations, journalists often face one dominant, preferred meaning shared by both community power structure and its media organizations. Thus, their ability to introduce alternative journalistic interpretations is limited (Donohue, Olien, & Tichenor, 1989). In 1995, Donohue et. al. used the metaphor of a "guard dog" to portray the influence of geographic community on local news media. In this manner, news organizations act as a sentry, not for the community as a whole, but for the dominant group(s) of power and influence. Thus, news organizations in effect maintain the balance of power in the community where interpretations by dominant groups are preferred and alternative views are considered deviant. This becomes more evident in less pluralistic communities (Donohue, Olien, & Tichenor, 1989).

Empirical evidence to support these theories on community structure was found by Berkowitz and TerKeurst (1999) in a qualitative study of journalists in several small to mid-size Midwest communities. Other studies have confirmed the hypothesis that the more homogenous the community the more likely newspapers are to report favorably on issues pertinent to the dominant groups (McLeod & Hertog, 1999). In numerous studies beginning in the late 1970s, Pollock and colleagues have also tested the community structure approach in studies that link demographic characteristics of communities to

both the amount and direction (positive, negative, or balanced/neutral) of media coverage of critical issues. Pollock and colleagues created what they call a "buffer hypothesis," whereby the larger proportion of privileged groups in a community "buffered" from economic uncertainty (privileged defined as portion of those with college educations, family incomes of more than $100,000, or professional/technical occupational status) the more favorable the media coverage of technological advances, like genetic engineering (Pollock, Shier, & Slattery, 1995; Pollock et. al., 2004). Pollock et. al. (2004) applied the "buffer hypothesis" to a study of newspaper coverage of genetically modified foods:

> Privileged individuals are aware of America's technological proficiency; therefore, it is logical to assume that these individuals have confidence in technology and in American engineers and should have an optimistic view regarding new technologies such as genetically modified foods (p. 10).

The study of newspaper coverage of GM foods in 21 U.S. cities, however, disproved the buffer hypothesis (Pollock et. al., 2004) In "buffered" communities, or those where a greater proportion of people in a community were privileged economically, educationally, and professionally, newspaper coverage of genetically modified foods was found to be more *unfavorable*. Specifically, the three newspapers reporting the most unfavorable coverage were respectively the *Albuquerque Journal*, *The* (Cleveland) *Plain Dealer*, and the *San Diego Union Tribune*. Furthermore, the larger the "vulnerable" population in a community, the more favorable was the coverage of GM foods. The three newspapers reporting the most favorable coverage were the *Fresno Bee*, the (Dubuque, Iowa) *Telegraph Herald*, and the *Omaha World Herald*. The study also determined that coverage in the Midwestern United States generally favored GM foods, while coastal newspapers opposed their development, growth, and consumption. While the study does

not provide causality, the researchers suggested that the findings supported a "violated buffer hypothesis," which states that the larger the proportion of privileged groups in a community, the more unfavorable the coverage of biological threats or threats to a cherished way of life (Pollock et. al., 2004). In this case, then, genetically modified foods appeared to fall into this category of threat.

One other aspect of the influence of geographic factors needs to be explored. In the case of biotechnology, controversy or resistance to the technology may initially emerge at the local or regional level (Priest, 2001b; Priest & Ten Eyck, 2004). One of the most prominent frames of biotechnology at the local level has been the frame of the "risks" as associated with biotechnology, which has been promulgated by local opposition groups (Priest & Ten Eyck, 2004, p. 194). Certain "breakthrough" events, those that involve high drama or new decision-making, often capture the attention of local news media. Priest and Ten Eyck (2004, p. 180) call these events "lightning rods" for suggesting potential environmental and health risks not yet fully articulated at the national news level. An example is the case of bovine somatotropin, or bovine growth hormone, a Monsanto product approved by the FDA in 1993 to be used to stimulate milk production in dairy cows. The controversy first arose at the local level, particularly in Wisconsin and Vermont, where objections were tied to economic concerns that the product would provide advantages to larger farms over smaller ones. In other cases, protests or other activities related to biotechnology research are regularly reported at the local level. "Local struggles may involve themes, frames, and actors that are distinctly different from those prominent at the national level," write Priest and Ten Eyck (2004, p. 188).

Frame Evolution

Frames evolve over time because sponsors often restructure the frames based on the changing political climate (Carragee & Roefs, 2004). Particular frames may gain or lose prominence in the news. As Carragee and Roefs explain, "these transformations highlight the construction of meaning over time and the framing contests that shape this construction" (2004, p. 216). Miller and Riechert (2001b, p. 111) proposed a "framing cycle" whereby competing frames among stakeholders shift over time in the public arena and in news media. In "the emergence phase," news content focuses on the event itself, leaving out any definition of issues. In the second phase, "the definition/conflict phrase," events have driven issues onto the public agenda, and stakeholders begin now to define them. "The resonance phase" is marked by one frame resonating more with the public than other frames. The last phase, "equilibrium or resolution," occurs when the resonance process is complete and one frame dominates the debate, influencing policymakers.

Futhermore, Entman (2004, pp. 47-8) depicts framing evolution over a period along a continuum from total dominance by one frame to a complete standoff between competing frames (see Figure 2.1). Occasionally, one frame can so dominate that it completely eclipses alternative views. This type of dominant frame can produce extremely one-sided opinion poll results, such that dissenting politicians are discouraged from speaking out. Thus, the one frame is cemented in place. Entman cites media coverage of the 1983 incident in which a Soviet Air Force fighter jet shot down Korean Air Lines Flight 007, killing all 269 aboard. He contrasts the sharply different frames

Figure 2.1 Entman's Frame Continuum

used in that story with the coverage of the 1988 incident where an Iranian airline carrying 290 people was shot down by a U.S. Navy ship, the Vincennes. "For KAL, the news emphasized the moral bankruptcy of the guilty nation; for Iran Air, coverage de-emphasized moral judgment and focused on the complex problems of operation military high technology" (Entman, 2004, p. 29). Entman points out that frame contests typically occupy the left end of the frame contestation continuum, falling somewhere between complete frame domination and frame contestation. Frame parity, on the extreme right side of the continuum, in which two or more interpretations or "counterframes" receive equal play, is rarely achieved (Entman, 2004, p. 49).

Snow et. al. (1986) call changes in frames over time "frame transformation." The concept of a frame is not static, they argue, but a process of constructing meaning that changes over time. This is especially the case where there is a contest. Thus, Snow et. al. (1986) suggest frames are more like narratives and follow storytelling lines whereby conflict is manifest. Focusing on frame transformation is important because it draws attention to the social actors who compete to sponsor their preferred frames. The mass media become one of the arenas in which these symbolic contests are carried out, and the media discourse itself is the outcome or dependent variable (Gamson, et. al., 1992).

Unique Properties of the Science Beat

In both the policy arena and the public arena, news media have played an important role in debates involving scientific controversy, such as biotechnology. The importance of media coverage in relation to science and technology controversy can be

understood from a theoretical understanding of science communication and the ways in which the science beat is unique to other journalism beats.

Coverage of science is often conducted by regular staff writers, or at larger media organizations, by specially designated "science writers." Still, a lot of science in the news appears not just in science stories, so science news is not necessarily written by a science journalist (Gregory & Miller, 1998, p. 108). Yet, those who cover science exclusively possess some unique characteristics. Many science writers view themselves as conduits between scientists and the public, with the goal to deliver a scientist's research results accurately so as to increase public understanding (Goodell, 1986; Nelkin, 1995). Furthermore, because of the sometimes collaborative relationship of science reporters and scientists, science coverage has been described as more deferential to its subject matter and constituency than would be acceptable in other fields (Dornan, 1990). Nelkin (1995) further asserts that because of the close allegiance between science journalists and scientists, science news sometimes fails to provide an accurate representation of science – one that includes the notion of its contingent nature and its social and political contexts. In addition, in the "shared culture" of scientists and journalists, scientists more than journalists control the content and direction of a science story that involves a high level of uncertainty (Dunwoody, 1999, p. 76). On the one hand, this is helpful to journalists when they have a limited understanding of the topic, but at the same time, "journalists must take care to avoid letting a shared culture submerge their ability to see scientists' use of uncertainty as a rhetorical or political tool" (Dunwoody, 1999, p. 76).

In coverage of biotechnology, the topic often presents a host of complex science and social science uncertainties that journalists often don't know what to do about

(Friedman, Dunwoody, & Rogers, 1999, p. xii). Thus, coverage of genetic engineering in particular would be vulnerable to it being controlled and directed by the scientists involved in it. In fact, local news coverage of biotechnology has been dominated by university sources, as well as the industrial sources that have a vested interest in how the technology is portrayed (Priest & Talbert, 1994). More will be said in the next section about the empirical evidence on news coverage of biotechnology.

Political reporters sometimes cover science news, especially when science issues become politically relevant. The likelihood a science story, like biotechnology, would be covered by a political reporter increases because there are more political reporters and because newspapers typically devote far more space to political news. Because smaller newspapers at the local level don't often have paid staff writers covering the science beat exclusively, the biotechnology story, for example, might be under-reported until it becomes more of a political issue in the community. When an issue becomes politically relevant, the potential volume of coverage about a topic increases (Kepplinger, 1995). Other writers covering the science beat include food, agricultural, and business writers, especially in stories about agri-food biotechnology (Logan, 2001).

Finally, an enduring focus of mass media research in the field of science communication has been the extent to which news coverage reports science findings accurately. There is certainly evidence that the coverage of specific topics, such as the alleged finding of the "gay gene," has been less than ideal (Caulfield, 2004). However, in some circumstances, news media reporting of science is surprisingly accurate and portrays a message created by the scientific community (Caulfield, 2004). One concern is that in terms of coverage of genetic research, some have suggested that "genohype" – the

inaccurate portrayal of genetic research – is having an adverse impact on the public understanding of science (Bubela & Caulfield, 2004). Furthermore, Caulfield (2004) suggests that the hyping of research results might be part of a more systemic problem related to the increasingly commercial nature of the research environment. In another study of the accuracy of science reporting, respondents in a survey of agricultural scientists were more negative of national news coverage of general scientific topics and topics from their agricultural disciplines, but more positive about local news and agricultural news coverage of science and agricultural stories (Ruth et. al., 2004).

Part II: Empirical Dimension

Applications of biotechnology have inspired a great many speculations about both the possibilities for advancing science and improving life on the one hand and the possibilities for creating havoc and destruction on the other. Journalists have written about the dangers of "frankenfoods" and "killer tomatoes"; they've also written about biotechnology as "the engine of human progress" and "the wonder of science." Different images of biotechnology abound in news media and vary according to the zeitgeist of the times. Some of the more dominant biotechnology frames evidenced in studies of news media coverage are the progress or progressive frame (its efficiency and effectiveness); economic (financial developments); ethical (role of humans developing new species or role of church in such debates); Pandora's Box (such technology if released into the environment will only wreck havoc); runaway technology (technology won't be stopped); nature/nuture (concerns about designer babies or other plant or animal species); public accountability (who is responsible for errors?); and globalization (questions concerning

dependency of some nations on the nations where the technology is developed) (Bauer et. al., 2001, p. 41).

Many systematic surveys have been conducted on American public perceptions and attitudes about GMOs and other biotechnology issues (Hallman et. al., 2003; Sawicka & Peters, 2004; Pew, August 2003). Yet, fewer studies have been conducted on the content of biotechnology coverage including source influence, at least in terms of coverage in the United States. More mass media scholarship on content has taken place in Europe (Bauer, et. al., 2001; Boudorides, Kalamaras, & Eleftheriadis, 2004; Cataldi & Paes, 2004; Dahinden, 2002; Durant, Bauer, & Gaskell, 1998; Gunter, Kinderlerer, & Beyleveld, 1999; and Kepplinger, 1995). In fact, in a study of 20 years' worth of news items on GM foods, Retzinger found that there were four times as many news items in English-language international news sources as in the U. S. press (2001). This might be explained by the fact that outside the United States, public awareness and attitudes to GMOs have been more regularly measured in surveys, particularly in Europe, than in the United States. In Europe, public opposition to GMOs and other food safety issues is more visible and has influenced more restrictive public policies, which is perhaps not surprising given the bovine spongiform encephalopathy (BSE) or "mad cow disease" scares in the 1990s and concerns about dioxin found in chicken and pork in Belgium in the late-1990s. In fact, news coverage in Britain linked the potential risks of GM foods as a repeat of the UK experience with BSE (Marks & Kalaitzandoakes, 2001). Indeed, biotechnology has never been as controversial in the United States as it has been in Europe (Ten Eyck, Thompson, & Priest, 2001, p. 307).

The following section describes the events that took place in the early years of the modern revolution of genetic engineering beginning with the discovery of rDNA in the 1970s until the introduction of GM agri-foods in the 1990s. The section then reviews mass media research into the news coverage of those events. The review does not specifically examine news coverage of the stem cell controversy because although this topic would fall under the heading of biotechnology, the topic is too narrow and has limited relevance in a discussion of biotechnology coverage in general. The section also includes a review of the research on the sources or actors in the biotechnology story.

The Biotechnology Story – The Beginnings

The year 1973 marks the discovery of gene splicing and the beginning of the heightened news media coverage of the biotechnology. The following year, at the recommendation of Stanford University biologist Paul Berg, the National Institutes of Health established the Recombinant DNA Advisory Committee (RAC) to assess the risks involved in rDNA research. Based on Berg's plan, an international meeting of scientists was held in January 1975 in Asilomar, California, to set the principles for safe handling of rDNA molecules. Those principles would then be used by the advisory committee in all genetic experiments involving splicing. From the international Asilomar conference came an explosion of media attention (Krimsky, 1991, p. 161). Only 16 journalists were allowed to cover the proceedings, and during the weeks leading up to the conference, no information was released to the media, which led to wild speculation in the press about the potential for harm in using technology to manipulate genes. The conference organizers' intent to control press coverage had the opposite and unintended effect of

heightening fears. The controversy was also played out at the local level when the following year, in 1976, in Cambridge, Massachusetts, a moratorium was issued against universities conducting rDNA research. A local citizen jury panel was established to weigh expert testimony from both sides of the issue. The board was directed to focus on threats to local public health. The deliberations resulted in the ban being lifted, and the case has often been cited as one of the most successful in terms of public involvement in setting science policy (Woddell, 1990).

In terms of news coverage of the early years of the rDNA controversy, mainstream scientists played a much greater role in setting the media agenda than did community leaders or scientific outsiders (Pfund & Hofstadter, 1981). Altimore (1982) found that media coverage generally emphasized rDNA as a scientific or technical challenge, not a philosophical one, while Goodell (1986) argued that scientists were eventually able to move news accounts away from the issue that started the controversy – safety – toward a focus on the developing biotechnology industry. Other scholars found that coverage of biotechnology in the 1970s was characterized by an "awe-and-mistrust" style of reporting (Nisbet, Brossard, & Kroepsch, 2003, p. 45; Van Dijck, 1998, p. 188). In this manner, the technical authority of the scientist as source mingles with the horrors of the potential public health risks associated with the technology (Nelkin, 1995; Van Dijk, 1998). While media coverage during the initial years of rDNA development in the early 1970s was characterized by a focus on risks and potential threats to public health, by the late 1970s and early 1980s, media coverage became more positive, as industry began to promote biotechnology development (Altimore, 1982; Goodell, 1986; Krimsky, 1991).

Biotech became fashionable in the late 1970s and in the 1980s, which according to Krimsky, was due in part to the climate created by the Reagan administration with its emphasis on de-regulation (1991, p. 42). During this time, there were no products of agricultural or food biotechnology that were actually on the market. In 1986, a "Coordinated Framework" of laws to regulate biotechnology products was established and administered by three agencies—the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), and the U.S. Department of Agriculture (USDA). The central premise of the Coordinated Framework is that the process of biotechnology itself poses no unique risks and that products engineered by biotechnology should therefore be regulated under the same laws as conventionally produced products with similar compositions and intended uses.

Sheldon Krimsky in his book, *Biotechnics and Society: The Rise of Industrial Genetics*, documents the first ten years of the industrial revolution in biotechnology (1991). In the early 1980s during the period of de-regulation, federal funding for academic research increased, and new incentives were offered to scientists at universities whose research had commercial applications (Krimsky, 1991, p. 67-68). As industry became more concentrated, there was a trend toward product homogeneity in order for business to capitalize on economies of scale (Krimsky, 1991, p. 52). So, for example, in terms of agricultural biotechnology, there were fewer transgenic seed varieties. Market demands for new biotechnology applications increased. Thus, industry began to focus on efficiency of operations and economic productivity. De-regulation made it possible for companies to move forward quickly, where questions of ecological impact and human health effects became less important (Krimsky, 1991, p. 14). The onus was on regulators

to provide reasons why the technology should be regulated. Press coverage reflected this emphasis. “In the late 1970s and the early 1980s, newspapers and magazines helped construct an image of biotechnology as a revolution with enormous potential for improving the human condition,” Krimsky writes (1991, p. 28). Indeed, biotech had become fashionable.

The Mid-1990s: Agri-Food Biotechnology Enters the Market

While patents were first granted to U.S. companies for GM plants in 1983, agri-foods did not enter the market until the mid-to-late 1990s. At this time, news coverage of agricultural biotechnology began to increase in terms of frequency of stories reported, and news coverage appeared to become broader to consider issues of ethics and accountability (Nisbet & Lewenstein, 2001; Shanahan, Scheufele, & Lee, 2001). The following section describes some of the agri-food products that sparked the most substantial press coverage.

The first significant and wide-reaching food product that had been genetically engineered was milk. In 1993, the FDA approved a controversial animal drug made by Monsanto called recombinant bovine somatotropin, or rBST, which stimulates milk production in cows. The drug is also commonly called bovine growth hormone or BGH. But, the industry prefers the term rBST rather than BGH out of concern that the word “hormone” will raise public alarm (Priest, 2001b, p. 17). When rBST was first brought to market in the United States in 1994, a spate of demonstrations erupted across the United States. Priest has called the fight over rBST “one of the most acrimonious propaganda wars of the twentieth century” and one that “set the stage for subsequent public reactions

to other products of biotechnology" (Priest, 2001b, p. 18). The product has been banned in Europe and also in Canada. Canadian food authorities banned it after reviewing the same U.S. FDA studies that were used to approve it in the United States.

In 1995, the Flavr Savr tomato was the first genetically engineered produce to appear in supermarkets. It was also the first genetically modified fruit to be approved by the FDA. Produced by genetic engineers at Calgene, a small biotechnology company in Davis, California, the Flavr Savr contained an anti-ripening gene and thus had a longer shelf life. Although the law did not require a safety assessment of the tomato, Calgene asked the FDA to review its safety anyway. After more than three years of studying Calgene's tests and information about the Flavr Savr, the FDA in 1994 approved the tomato as safe for people to eat. Once Calgene was introduced to the market, it immediately encountered a number of problems. The tomato tended to bruise easily, making it hard to pick, pack, and ship. Biotechnology critics capitalized on the debate, and soon the tomato became fodder for journalists who began calling it "frankenfood" and "killer tomato" (Nelkin, 1995, p. 59). Within a year of its introduction, the first gene-altered whole food could scarcely be found in U.S. produce aisles.

StarLink corn was engineered by the biotechnology company Aventis to produce a toxic protein that kills insects – a built-in pesticide that would save farmers the trouble and expense of spraying their crops. The corn was meant only for animal feed. The EPA banned StarLink from the food supply in May 1998 because the toxic protein in the corn is nearly indigestible, and some allergy experts feared it could trigger allergic reactions in susceptible people. In fact, StarLink was first detected in taco shells in the summer and fall of 2000. Later, several people testified before an EPA advisory panel that they had

become sick after eating food containing StarLink corn. A substantial amount of news coverage has been devoted to StarLink since September 2000, when the story first broke (Marks & Kalaitzandonakes, 2001). On October 12, 2000, Aventis voluntarily asked the EPA to cancel its license to sell StarLink corn in the United States.

In 2000, Golden Rice was to be the miracle cure for the problem of malnutrition in some regions of the world heavily dependent on rice, which contains no vitamin A. The little yellow grain even made the July 2000 cover of *Time* magazine. Vitamin A deficiency has been a continuing public health problem in countries in Sub-Saharan Africa and South-East Asia where, in 2003, it was estimated that 250,000 to 500,000 vitamin A-deficient children become blind every year, half of them dying within 12 months of losing their sight (Micronutrient Deficiencies, 2003). Discovered at a lab in Zurich, Switzerland, Golden Rice was created with the promise that it would provide the necessary vitamin A. However, what the rice is enriched with is beta-carotene, a precursor to vitamin A, which can only be converted to the vitamin in the body of an already well-nourished person. Furthermore, claims were made that a person would have to consume unreasonably large quantities of the rice per day to meet the recommended daily amount of vitamin A.

Another specific issue in the debate over agricultural biotechnology was maize treated with a protein, Bacillus thurigiensis, known commonly as Bt maize, which was genetically engineered to produce a toxin in plant tissues making it resistant to certain pests. In 1999, a group of Cornell scientists announced that the pollen produced by the plant could threaten Monarch butterflies. While the intent of the toxin was to control butterflies and moths in their larval stage, there was some question as to whether the

Monarch in particular could really be considered a crop pest. The story, however, appeared disturbing enough to the public and suggested that regulatory monitoring of transgenic crops was inadequate (Ten Eyck, Thompson, & Priest, 2001). Subsequent research showed that the Bt maize did not pose a significant threat to the Monarch, but research also showed that the risk assessments had failed to identify pollen drift as a possible source of exposure to non-targeted insects, which suggested a "significant failing" of the regulatory system (Ten Eyck, Thompson, & Priest, 2001, p. 310).

Figure 2.2 shows a timeline indicating the significant news events in agricultural biotechnology. It begins in 1992 as companies were working through the regulatory agencies to bring their GM products to market. In 1993, the FDA declared that GM foods are "not inherently dangerous" and do not require special regulation. Milk produced from cows treated with rBST was the first significant GM food product to come to market, which occurred in 1994 after FDA approval in 1993. In 1995, aside from the appearance of the Flavr Savr tomato, the FDA also approved Monsanto's mainstay GM product, Roundup Ready soy, which was first exported to Europe in 1996. In 1997, Dolly was successfully cloned. In 1998, the European Union banned any new GMOs for planting or use in the EU. Also in 1998, StarLink corn was banned from the human food supply, and in 2000, it contaminated the human corn supply. In 1999, Cornell University's study on Bt maize was published. In 2000, Golden Rice was hailed as a miracle cure, and in 2002, the first U.S. shipments of GM food were refused in several North African countries. The U.S. government filed a complaint with the World Trade Organization against Europe over its moratorium on GMOs in 2003. By 2004, the ban was lifted. Also in 2004, several counties in Northern California voted to limit or ban the growth of GM crops.

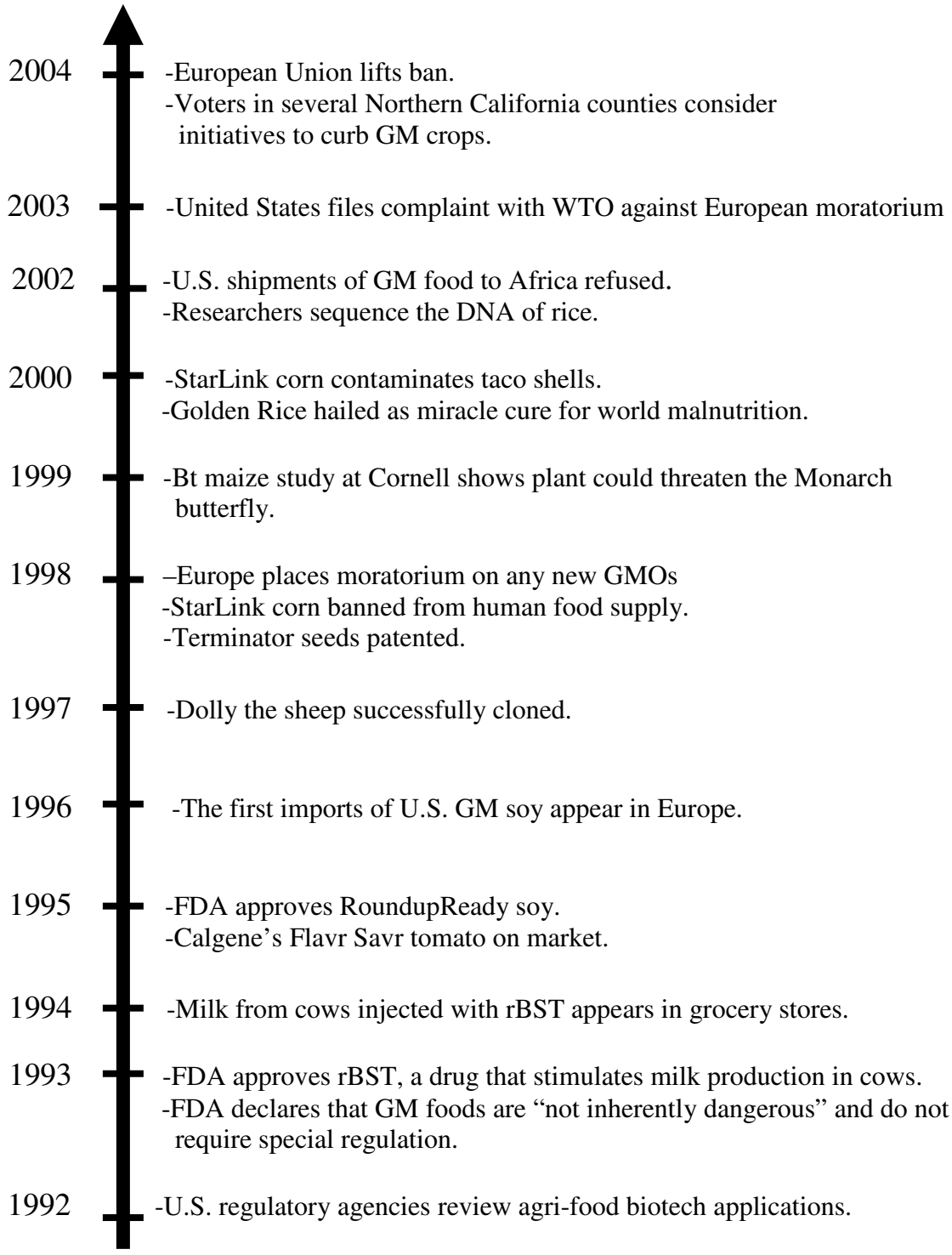

Figure 2.2. Timeline of Significant Events in Agricultural Biotechnology

Empirical Studies of News Coverage

McInerney et. al. (2004) provide a note of caution in considering the results of content analyses of biotechnology food coverage. Studies on the extent of news coverage of biotechnology can be inflated, especially when using electronic databases to gather materials. For example, wire stories are often included in electronic databases, yet newspapers do not always publish wire stories. The existence of them in an electronic database, if counted, could give a false impression of the extent of newspaper coverage. Also, because biotechnology stories can contain a variety of different terms to discuss biotechnology, search strategies should include a comprehensive list of all possible keywords and terms used in discourse about biotechnology. Finally, like in many studies that rely on electronic gathering, the stories retrieved may not always be "on topic" and also may appear in duplicate in the database. Thus, care should be exercised in gathering and interpreting data (McInerney et. al., 2004).

One of the largest studies examined biotechnology and the American media in terms of the elite media and the policy process from 1970 to 1999 (Nisbet & Lewenstein, 2002). In part, this quantitative study was intended to redress the gap in the dearth of systematic studies of biotechnology-related media coverage in the United States. Content was analyzed in *The New York Times* and *Newsweek* from 1970 to 1999 using the keywords or parts of key words "biotech*," "clone," "cloning," "genetic enginner*," "gene manipulat*," "gene technolog*," "gene therap*," or "recombinant DNA." The study found that although GMOs in particular were given little coverage, coverage of

biotechnology in general exhibited a positive tone, was found to be episodic or event-centered in nature, and was framed in terms of scientific progress and economic prosperity. With the exception of the mid-1970s during the initial discovery of rDNA technology, coverage was characterized as having "an overwhelming absence of reporting on controversy" (p.379). The one episodic exception was the controversy surrounding cloning in the 1990s, and then to an even lesser extent, circumstances surrounding GM agricultural issues and gene therapy in 1999.

The peak year of news coverage of biotechnology is classically considered as 1997 with the announcement of Dolly, the cloned sheep (February 1997) and the first imports of GM soybeans (from late autumn 1996) (Bauer et. al., 2001, p.35; Nisbet & Lewenstein, 2002). Shanahan et. al. (2001) noted an increase in the frequency of U.S. newspapers publishing articles in which agricultural biotechnology was the main topic around 1998, while McInerney et. al. (2004), whose study included a larger number of major U.S. newspapers overall, showed it to be the years 1999 and 2000.

News furor over the Dolly episode in 1997 found that the story altered the news frame of the biotechnology debate to one that began to incorporate ethical considerations (Nisbet & Lewenstein, 2002; Priest, 2001a). Ethical considerations emerged in mainstream media discourse in ways previously not seen. "The cloning debate may even have diverted public attention from some aspects of the biotechnology controversy at the same time as it created new public space for ethical debate over others," Priest concludes (2001a, p. 69). However, while U.S. news coverage may have considered the ethical implications, U.S. news coverage was not nearly as dire as some reports in the British press and focused more on the scientific accomplishment of the cloning experiment

(Conrad, 1997). “Serious criticism in the U.S. press was short-lived and rather quickly set aside in favor of stories that marveled at pseudoscientific attempts to duplicate individual humans…effectively marginalizing the whole subject by relegating it to crackpot status,” write Priest and Ten Eyck (2003, p.32).

The findings of Nisbet’s and Lewenstein’s pivotal study mirror similar findings in other studies of mass media coverage of biotechnology. A study of coverage in *The Washington Post* from 1984 to 1990 also found a more positive tone (Gaskell, et. al., 1999). In this study, a follow-up to a study of public opinion and biotechnology in the European Union, articles pulled from elite national newspapers in 12 European countries were compared to *Washington Post* stories. The researchers found that from 1984 to 1990, dominant frames in *The Washington Post* were those of progress and economic prospect. From 1991 and 1996, the frame of “economic prospect” dominated even more than that of “progress.” Similar frames of progress and economic benefits were found to be dominant frames in another study of newspapers considered “opinion leaders” in the 1990s, which included *The Washington Post* and *The New York Times* (Ten Eyck, Thompson, & Priest, 2001, p. 315). A study of news articles in *The New York Times* from 1997 until 2000 found that while certain events triggered some negative coverage (Dolly the sheep, Starlink corn, the Monarch butterfly study), the overall tone of GMO coverage was found to be positive (Abbott, et. al., 2001). Another study of *USA Today*, *The Washington Post*, and *The Wall Street Journal*, from 1990 to 2001, also found some negative coverage, but again it was triggered by episodic stories highlighting risks (Marks & Kalaitzandonakes, 2001).

One study of *The New York Times*, spanning 20 years of coverage from 1980 until 2000, showed news coverage of biotechnology appearing to change very little, as the same types of experts and stakeholders were quoted (Ten Eyck & Williment, 2004). "The contest over biotechnology involves similar rhetoric, with some groups arguing that flora and fauna developed through biotechnology will threaten our delicate ecology, and others saying it will save the world," the researchers wrote (p. 42).

A study of the editorials and the op-ed pages at some of the nation's largest newspapers and news magazines also found a largely positive tone toward agricultural biotechnology (Parker, 2002). Although editorials and op-ed commentary are more subjective than news stories, they provide further insight into what issues are deemed salient in the debate on GMOs. The study examined 10 newspapers and three weekly news magazines between September 1999 and August 2001. The results determined an "overwhelming bias" in favor of GM foods in editorial pages and also on op-ed pages. In a total of 72 "opinion pieces," 82 percent were found to favor genetically modified crops and foods. Among the arguments utilized in the editorials to bolster support were GM crops are good for the environment and will create a world free of pesticides; they help feed the poor in the Third World; there are no viable alternatives; they are here to stay and so must be accepted; the public already accepts GM; and scientists can be trusted (Parker, 2002).

Two studies did not follow the trend toward more positive coverage and found instead that news media coverage exhibited a more negative tone. However, one study drew news articles from a population spanning a smaller time frame, three months, than in other studies of content, and the second study sampled a smaller number of news

articles, fifty. The first study, commissioned by the International Food Information Council and conducted by the Center for Media and Public Affairs, analyzed three months of coverage from May to July 2001 (Food for Thought, 2002). The study was replicated at two-year intervals (1997, 1999, and 2001) to create a series of snapshots portraying both the consistencies and changes in media coverage about diet, nutrition, and food safety issues, including biotech food. The analysis included 40 local and national news outlets from May through July 2001. Among the 2001 findings were that coverage of biotech doubled in 2001 (over the 1999 study) and was notably lopsided toward possible risks. Known or possible negative health consequences of biotech food outpaced benefit claims by eight to one. The news in the sample period covered the claims of allergic reactions to StarLink corn that was accidentally mixed into the food supply, as well as the increasing controversy over biotech food in Europe, which could account for the emphasis in coverage on the dangers of GM food and crops. In fact, 73 percent of the stories that extensively discussed biotech food mentioned StarLink corn.

The other study compared coverage of agricultural biotechnology in the U.S. and British national print media and also found the overall tone of the coverage to be negative (Lundy & Irani, 2003). However, like the previous study in which only three months of coverage was analyzed, in this study, only 50 articles from 2002 were analyzed to determine patterns of coverage, uses of sources, and use of frames. The sample was drawn from a population of 317 articles, including news, feature, opinion, and editorial copy, in *The Washington Post*, *The New York Times*, and *The Guardian.* One of the study's main objectives was to help determine what may be causing public resistance to biotechnology, particularly in Britain. The study found there were more biotech articles

in the London paper than in the two U.S. papers, which the authors attributed to certain legislative activity garnering media attention at the time in Britain. Frames in the U.S. and British papers included "GM contamination" of the food supply, human risk, environmental risk, scientific progress, and world hunger. Overall, the most balanced coverage was found in *The Washington Post.*

News at the Local Level

In terms of the non-elite newspapers, a few studies specifically examined news content at the local or state level (Doefert, et. al., 2003; Miller, Annou, & Wailes, 2003; Priest & Talbert, 1994). Yet, in two of the three studies, content was analyzed from a broad spectrum of papers from across the United States and not aggregated to a specific state or local region. One study specifically examined Oregon and that state's 2002 vote to label GM foods. Part of the analysis included news media messages designed to influence voters, including various campaign literature and print, audio, and video advertising available from both sides of the campaign (Doefert, et. al., 2003).

One study drew news articles from the Newsbank newspaper index, which contains a broad variety of articles from various regions and from small, medium and larger papers throughout the United States (Priest & Talbert, 1994). The focus of this study was specifically on agricultural biotechnology. In general, media coverage was characterized as failing to report on political controversy. Instead, journalists depended mainly on information from industry and university public information officers, who had a pro-biotechnology bias. Thus, coverage lacked details about social, political, environmental, regulatory or ethical issues. Furthermore, industry sources appeared to be

shaping media coverage; university sources tended to focus on the benefits as opposed to either risks or costs; and the tone of media coverage was predominantly positive.

The findings were congruent with another content analysis of national, regional, and trade publications, which found that they were more likely to publish agricultural-biotechnology related articles with positive or at least neutral tones (Miller, Annou, & Wailes, 2003). For this study, 137 articles from between January 1, 2000 and July 1, 2002 were analyzed from *The Washington Post*, *USA Today*, and *The New York Times*; one regional news publication--*The Des Moines Register*; three national agricultural trade publications--*Farm Journal, Progressive Farmer*, and *Soybean Digest*; one regional agricultural trade publication--*Delta Farm Press*; and one agricultural marketing trade publication--*Agri Marketing*.

In reviewing the 1994 Priest and Talbert study again in 2001, it was determined that biotechnology was covered in local newspapers more so than in the national newspapers, specifically in the case of the rBST hormone used to stimulate milk production in dairy cows (Priest, 2001b). During the early 1990s' debate over the marketing of rBST, opposing interests launched intensive propaganda campaigns. Yet, the elite press including *The New York Times* paid little attention to the issue, likely considering rBST of lesser interest to their broad national audience. Only at local newspapers in dairy states, such as Vermont and Wisconsin, did rBST-related issues receive prominent coverage, and most of the coverage concerned reaction to rBST from the dairy industry. Priest also found that in the case of "terminator seeds," which were created to become sterile as seed after one growing season, the story appeared first in

small, local newspapers and in the alternative press before breaking into national news media.

Another study examined Oregon's 2002 vote to label GM foods and news media messages designed to influence voters (Doefert, et. al., 2003). For the first time in the United States, on Nov. 5, 2002, Oregon voters were asked to weigh in on the risks associated with agricultural biotechnology and the use of genetically engineered ingredients in their food. Passage of Ballot Measure 27 would have required labeling on all foods and beverages sold or distributed in or from Oregon derived from or processed using genetically engineered ingredients. The ballot initiative failed by 70 percent of the votes cast. In examining print and broadcast feature stories and editorials, letters to the editor, campaign advertising, public presentations and personal interactions, the researchers found that news media did not pay much attention to the debate until after the ballot initiative failed. They also found that the story was not only covered locally but was covered in surrounding states, in national newspapers and in international news publications. In addition, news media paid little attention to the petition drive to gather signatures to get the issue on the ballot, but when Paul McCartney's voice could be heard in a *Vote Yes* radio ad, news media attention to the campaign increased. Furthermore, the amount of campaign money appeared to be the dominant focus of news stories, which was pitched as a "David vs. Goliath" battle between the different sides. Based on the final vote, the *Vote NO* campaign spent 10 times more money for each vote received than did the *Vote YES* campaign. The *Vote NO* campaign had $5,396,650 in expenditures (or $6.08 spent on each of the 886,806 "no" votes cast), while the *Vote YES* campaign spent $238,768. There were 371,851 "yes" votes cast (Doefert, et. al., 2003).

Previous Research on Sources/Actors

A few studies have specifically examined the sources or actors named in news media coverage of biotech coverage and how these sources try to influence the debate in the public debate via news media. These sources represent the various stakeholders or social actors involved in biotechnology issues and include industrial representatives, environmental activists, farmers, scientists, government officials, consumer groups, and other public policy groups.

Generally speaking, news coverage of biotechnology has been found to be heavily dominated by industrial-commercial interests and scientists (Nisbet & Lewenstein, 2002; Plein, 1991; Priest, 2001b). Other dominant sources have been government agencies as well as scientists, who are widely considered credible and authoritative in most matters of scientific uncertainty (Nisbet & Lewenstein, 2002). Furthermore, the scientists were most often associated with frames of progress (Nisbet & Lewenstein, 2002; Ten Eyck, Thompson, & Priest, 2001). Interestingly, one study of news stories about GM food from 1990 to 2000 in four major U.S. newsmagazines found that no specific sources were referenced in almost one-fourth of the 125 stories analyzed (Whaley, 2002).

One way that stakeholders try to maintain control over public opinion about biotechnology is by relying heavily on science data and science spokespersons (Priest, 2001b). In early coverage of biotechnology, the scientists most often quoted were those most willing to speak to the media (Goodell, 1986). Aside from university researcher perspectives and mainstream industrial sources, news coverage rarely incorporated other points of view (Priest & Talbert, 1994). Another source for journalists was the clergy, the

appointed moral guardians of society, whose voices were pitched against promoting the development of science (Van Diijk, 1998).

In a qualitative study, Plein (1991) looked at how the issues defined as biotechnology were becoming popularized early on among various stakeholders and in the public arena. The study explored *what or which stakeholders* may have influenced media coverage and also examined the content of early media coverage. The actors, or sources, within the biotechnology debate sought to frame public perceptions of policy issues in ways that were to their advantage (Plein, 1991). In the 1970s, anti-biotechnology interests were effective at creating images of biotechnology as being environmentally risky and as lacking in certainty of its social benefits. Yet, beginning in the late 1970s and early 1980s, industry, policymakers, and scientists as a group were able to re-frame the biotechnology issues in a more positive light. This confirms what Nelkin (1995, p. 36) asserts, that biotechnology, once viewed as "a runaway science of genetic engineering," evolved to one that heralded a new "technological frontier."

Plein (1991) identified four methods that the pro-biotechnology lobby used to define the biotechnology issue as it moved away from questions of risk: interest group formation, issue association, alliance building, and discrediting opponents. The methods do not necessarily work in a linear fashion, but each method was found to be evident in the public policy campaign to win approval for biotechnology. Interest group formation involved establishing the "biotechnology industry" as a collective voice of shared interests. From about 1968 to 1980, members of the scientific community formed this group, but this group was poorly organized and "were exposed to a hostile climate of opinion nurtured by the environmental movement" (Plein, 1991, p. 476). In the early

1980s, a coalition of interests from agriculture, industry, and medicine joined to advance the development of biotechnology. “Scientific advances, policy decisions, and a changing climate of public opinion coalesced to provide support for biotechnology while eroding the position of opponents,” Plein explains (1991, p. 476).

Using “issue association,” pro-biotechnology stakeholders joined forces to create a “collective” voice of shared support and were successfully able to link biotechnology with more established and desirable cultural norms, like economic development and international American competitiveness (Plein, 1991, p. 480). The coalition of voices, scientists, business entrepreneurs, biotech firms, and agribusinesses, once firmly established in their group identity, were able to promote themselves as playing a role in addressing the nation’s economic problems (Plein, 1991).

Another method of winning approval was to forge alliances. As issues such as patenting, research funding, competition, and regulatory review began to dominate the policy debate, the pro-biotechnology lobby allied themselves with the “established (political) actors,” including Congressional lawmakers as well as policymakers at the federal level, such as the U.S. Department of Agriculture (USDA), the Food and Drug Administration (FDA), and the National Institutes of Health (NIH) (Plein, 1991). Officials within the USDA and Congressional lawmakers and staffers publicly embraced the promise of biotechnology as an effective tool for America’s economic competitiveness in the world (Plein, 1991). Plein (1991, p. 480) writes, “It was the promise of economic development that attracted allies and formed the bonding of the biotechnology coalition.” Such a broad pro-biotechnology coalition of established private and public actors was able to do what Schattschneider (1960, p. 7) has called the

"privatization of conflict." By masking dissent through networks and links within the coalition, "the coalition was able to maintain its image as a force for economic development in the public's eye" (Plein, 1991, p. 480).

The last method identified was "discrediting opponents and critics" (Plein, 1991, p. 482). The pro-biotechnology coalition was successful in discrediting opponents as extremists, led by a few radical, anti-capitalist voices. By focusing on the fringe, proponents were successfully able to minimize mainstream critics, such as environmental and farm groups. Extremists like Jeremy Rifkin were singled out and exaggerated, thereby casting doubt on the arguments of all opponents (Plein, 1991).

One other study is worth mentioning as it provides insight into how one of the major industrial players tries to shape public opinion and the terms of the debate in the controversy of biotechnology (Kleinman & Kloppenburg, 1991). Researchers examined a specific set of discursive products developed by Monsanto, the world's largest manufacturer of genetically engineered crops. The products included a widely distributed booklet, *Genetic Engineering: A Natural Science,* and a film, *Genetic Engineering: The Nature of Change*. From the booklet's initial release in 1984 to the end of 1985, about 100,000 copies were printed, while by mid-1986, the film had been seen by about 5 million people around the United States (Kleinman & Kloppenburg, 1991; cf Klausner, 1986). The analysis of the booklet and related television and newspaper advertisements form the empirical focus of the study. In examining the discursive products, the researchers found that Monsanto promoted technology as independent from human affairs and always beneficial. Other discursive components were a faith in science and scientists, meaning that only experts are in a position to assess the dangers and benefits,

experts (scientists) are objective, and that public intervention in science is inappropriate. Monsanto also claimed biotechnology as a *natural* science, as an extension of nature, and in some cases, an improvement upon nature. "The chemicals we make are no different from the ones God makes," said one advertisement (Kleinman & Kloppenburg, 1991, p. 433), and in another, "biotechnology, an extension of nature's genius." In some cases, like the portrayal of the genetically engineered bovine growth hormone, rBST, Monsanto's advertisements, aimed at the farming community, align the product as a part of nature and as something that has always existed in cows, but now can be created more efficiently. "You've had BST and cookies all your life," said one ad, which continued, "it'll cost the farmer less to produce milk" (Kleinman & Kloppenburg, 1991, p. 443). Monsanto also portrayed its activities as being in the national interest, so any regulation is seen as hurting not only the company's interests but also the welfare of the national economy.

Although the study does not specifically examine news coverage, its findings provide an understanding about what constitutes Monsanto's arguments for pursuing biotechnology research and development and how the company attempted to achieve its preferred meanings. The author's note that the ideological elements of the debate established by Monsanto are carried out in news media, particularly in the case of the promotion of the technology as useful and benefit. The authors conclude that by focusing on "narrow technical questions of the safety and health risks posed by genetic engineering research," Monsanto is able to restrict resolution of the debate in the hands of the experts. This narrowing of the debate thus leaves out larger questions of its political

nature as well as the potential socio-economic implications of the technology (Kleinman & Kloppenburg, 1991).

Another study examined how "GM-supportive" and "GM-skeptical" groups used arguments regarding the labeling of GM food products to bolster their positions (Klintman, 2002). The stakeholders' written statements revealed that when the discussion of GM foods turned to labeling, both sides of the debate used opposing arguments. For example, GM advocates firmly believe in the potential of science to produce a safe technology. Yet, despite their strong beliefs in the possibilities of knowledge, on the issue of labeling, they question whether the labeling could provide any valid information at all. GM opponents point to the subjectivity and imperfection of knowledge, but view labeling as objective. Another argument that GM opponents use is that labeling would empower consumers. Yet, this is free market ideology, which GM opponents, who are in part represented by radical environmental activists and market skeptics, traditionally oppose. On the other hand, GM advocates in their criticism of labeling site the fragile character of the marketplace. The study did not determine if these arguments were a part of the frames in newspaper coverage.

Introduction to Research Questions

The preceding sections have explained the theoretical foundations and empirical studies, which have informed this study. Given that news stories are often a forum for framing contests between political actors, it is important to understand how these political actors influence news coverage to reflect their preferred frames. Thus, this dissertation research draws upon the sociological roots of framing to consider the contextual

relationship between news frames and the influences of news sources on those frames. The research examines the frames that appear in local and state news coverage of genetic engineering, how the frames change over time, and the social actors that influence the frame formation at the local and state level.

The study draws upon theoretical discussions of framing and frame sponsorship, as well as empirical studies of biotechnology news frames and sources. However, there exists no clear theoretical basis to suggest hypotheses that link the study's variables (the frames themselves) to the influence of social actors upon those frames. Thus, the study is exploratory in nature, focusing on a series of research questions rather than specific hypotheses.

Research Questions

Research Question 1: Content of News Frames

What are the news frames in coverage of genetically modified organisms (crops and food) in local newspapers in U.S. states with high socio-economic interest in genetically modified organisms?

Research Question 2: Frame Changes Over Time

How do the news frames change over time?

Research Question 3: Frame Sponsors

Who are the dominant sponsors (the actors/sources) shaping news frames of stories on genetically modified organisms in local newspapers in the United States, and how do these sponsors appear in the frames?

The research will add to knowledge about news media coverage of debate on genetically modified organisms in several ways. First, little is known about the nature and extent of news coverage at the local or state level, as few previous studies have examined newspaper coverage in specific communities or in specific states. Yet, agri-food biotechnology issues are important at the local level – to local economies, to local farming communities, to local environmental activists, and to local consumers. Indeed, it has been suggested that broader and more diverse perspectives on biotechnology may exist more in local news coverage than in the national, elite press (Priest & Ten Eyck, 2003). Furthermore, the research will add to knowledge about how sources influence the way issues are written about in print news media. Given that news media often provide a forum for framing contests between social and political actors, it is important to understand how these actors influence news coverage to reflect their preferred frames. Media scholars have argued that it is critical to understand the ways in which journalistic framing of issues occurs because framing influences public understanding and, consequently, policy formation (Gans, 1979, 1983; Gitlin, 1980; Pan & Kosicki, 1993; Tuchman, 1978). It has also been suggested that framing research in communication scholarship has neglected the importance of considering how news sources influence the

content of frames in news media. Drawing upon the sociological roots of framing, this study considers the contextual relationship between news frames and news sources.

CHAPTER III.

METHODS

To address the research questions, this study will use a variety of analytic techniques, which are reviewed in this section. The technical methods principally derive from two research approaches: first, quantitative content analyses of news frames and second, a qualitative examination of frame sponsorship. This section on methods begins with a discussion of methodological approaches to measuring frames. Next, an elaboration of research questions one and two will be provided. These questions will be answered with quantitative methods, including computer-assisted content analysis and factor analysis. Next, research question three will be elaborated, as will the qualitative study, which will be used to answer this question. The qualitative study involves the results from the quantitative study, which will suggest who are the dominant sponsors of frames. But, in order to more fully expand the framing concept to consider the contextual relationship between media frames and social and political processes, these dominant frame sponsors will be investigated in greater detail via a detailed analysis of news stories, public documents, interview data, and other sources.

Frame Measurement

"Frame analysis is no longer Goffman's frame analysis," writes Koenig (2004a), arguing that frame analysis is now only loosely connected to Goffman's original conception. Koenig and others (Maher, 2001, p. 84) have suggested that the greatest difficulty in the analysis comes with the identification and measurement of frames

because frames consist of tacit rather than overt conjectures. Goffman said that frames are not consciously manufactured but are unconsciously adopted in the course of communication. Snow and Benford (1988) call frames "conceptual scaffolding." So, if indeed frames are more conceptual than concrete, how then do we measure them?

In previous research, frames have typically been determined through content analysis conducted by researchers who manually code text for specific frames. For example, content was manually coded to find the frames in news coverage about the launch of the common European currency, the euro (de Vreese, et. al., Peter & Semetko, 2001), about gun ownership (Downs, 2002), about the Million Man March protest (Watkins, 2001), and about the war on terrorism in Afghanistan (Ryan, 2004), among many other studies.

In other research, computer content analysis has been utilized to determine frames (Andsager & Powers, 1999; Cowart, 2003; Koella, 2001; Lind & Salo, 2002; Miller, Andsager, & Riechert, 1998; Riechert, 1996). However, in all the framing studies of U.S. news content about biotechnology mentioned in Chapter II: Literature Review (Gaskell et. al., 1999; Lundy & Irani, 2003; Nisbet & Lewenstein, 2002; Ten Eyck, Thompson, & Priest, 2001), none used computer-assisted content analysis to determine the news frames. In measuring frames, frames can be studied as independent or dependent variables. Studies of frames as independent variables are usually concerned with the effects of framing on audience, while studies of frames as dependent variables examine the role of various factors in influencing the creation or modification of frames. In this study, frames will be studied as a dependent variable as it examines the influence of various stakeholders or actors on the frames used in news coverage of biotechnology.

Computer –Assisted Content Analysis

For purposes of this research, a computer-assisted content analysis program, WordStat 4.0.21 version will be utilized. Relationships between words appearing in text can be mapped using this program (Provalis Research, 1998), which assists in the study of patterns of co-occurrence within texts. Once content has been analyzed via WordStat, latent semantic analysis will be conducted to determine the frames that dominate the news texts. In computer-assisted content analysis, the most important words in a text are identified and patterns of similarity are determined based on the way the words are used in the text. Latent semantic analysis, via a factor analysis method, allows for a quantitative examination of precise comparisons to determine the frames in texts and to determine which frames dominate within news coverage.

To begin determining news frames, the first step is to determine frequencies of words that appear in the text, which can be done by the WordStat computer software. The dataset of articles, which should be kept as one file in a word processing program, such as Microsoft Word, must be prepared for submission to WordStat. Each news article is given a unique numerical identifier, a code to signify the newspaper in which the article appeared, and also the day/month/year of the article. The entire dataset of news articles, stored as a word processing file, is then submitted to WordStat's QDAMiner text analysis program. Joint software, QDAMiner and WordStat work together to analyze text – QDAMiner prepares and stores the text file, and WordStat mines the data to determine frequencies, ranks, clusters, and the like.

The researcher first opens QDAMiner and then imports the word processing file into the program, which then uses the Document Conversion Wizard to prepare the file for submission to WordStat. The wizard walks the user through each step of the conversion process. At the "Variables Extraction" window, the user must define the variables to be extracted. At this step, the user names the variable and provides a starting and ending delimiter, so that each news article is separated by the unique numerical identifier set by the researcher.

Once the document is stored in QDAMiner, from that program, the reseacher can open the document and, with one click of the mouse, analyze the text via WordStat. WordStat counts and sorts for frequency of occurrence of words. WordStat also ranks all words appearing in the text in order of descending frequency. The program can also sort and rank phrases of any user-designated length. The program screens out semantic clutter and non-content-bearing words, such as articles, prepositions, or verbs of being. The user can also create dictionaries of specific words to be sorted and ranked.

From the frequency ranks, the researcher selects unique keywords, which later become the terms associated with each news frame or "frame terms." These keywords are stored in a WordStat dictionary and can used to analyze the text further. Uniqueness of the keywords or "frame terms" is an important determinant for the later identification of news frames. The researcher selects "frame terms" based on several criteria, including but not limited to, frequency of occurrence, meaningfulness or substantive interpretability, including the absence of ambiguity (Andsager, 2000; Andsager & Powers, 1999; Andsager & Smiley, 1998; Miller, 1997; Miller, Andsager, & Riechert, 1998; Miller & Riechert, 2001a, 2001b; and Riechert, 1996).

This method of selecting frame terms, which later group to form the frames themselves, aligns with Entman who said that words that comprise the frame can be distinguished from the rest of the news by their resonance and magnitude (2004, p. 6). Culturally resonant words or images are identified "by their capacity to stimulate support or opposition to sides in a political conflict" (Entman, 2004, p. 6). These would be words that are highly "salient" in the culture, meaning that they are more noticeable, understandable, or emotionally charged – in other words, they have cultural resonance and thus also have the greatest likelihood to influence (Entman, 2004, p. 6). Magnitude refers to the "prominence" and/or "repetition" of the words (Entman, 2004, p. 6). Again, the determination of "frame terms" allows for the subsequent investigation of the frames in the news texts.

Computer-assisted content analysis has several advantages, which are explained succinctly by Murphy (2001), who used the method in framing research on Congressional testimony on nicotine and public health. First, in contrast to traditional content analysis that manually codes for content, the researcher does not specify the categories, terms, or words to be sought in the text. Instead, words are selected based on their frequency. Such a method reduces the chances that researcher presuppositions intentionally or unintentionally have infected the analysis. Furthermore, context is supplied as words are chosen based upon their relation between all the words in a text. Thus, frames are never reduced to "simple researcher-designated labels" (Kosicki, 1993, p. 112), such as *genetic engineering* or *anti-GM activists*. Some scholars have argued that researcher-generated labels "obscure the fundamental issue of framing research, which is the effort to define the issues by subtly shaping their presentation in ways that highlight some aspects while

excluding others" (Murphy, 2001; see also Entman, 1993; Kosicki, 1993). Another advantage of computer-based text analysis is that it enables the researcher to analyze large sets of data, probably more than would be feasible through manual coding (Murphy, 2001).

Determining News Frames

Once keywords are chosen, latent semantic analysis is conducted to determine the news frames in the text. "Latent Semantic Analysis (LSA) is a method of extracting and representing the contextual-usage meaning of words by statistical computations applied to a large corpus of text," explain Landauer, Foltz, and Laham (1998, p. 2). The basic concept is that "the aggregate of all the word contexts in which a given word does and does not appear provides a way for determining the similarity of meaning of words and sets of words to each other" (Landauer, Foltz, & Laham, 1998, p. 2).

LSA has been likened to factor analysis (Landauer, Foltz, & Laham, 1998; Koenig, 2004b). It is a form of factor analysis in which relationships between variables are summarized and reduced to a smaller set of variables called factors (Bryman & Duncan, 2004, p. 28). The factor analysis technique allows the text to systematically speak for itself as it constructs categories or factors. Unlike more inductive methods, this approach reduces the risk of drawing circular inferences by keeping the researcher out of the frame construction process (Simon & Xenos, 2004).

To determine how the frame terms group together to form the frames, factor analysis is conducted using SPSS 13.0 statistical software package. The factors are comprised of the words that co-occur most often and form a frame. In WordStat, the data

is appended to include the percentage of a term's appearance out of all the other terms and then is exported to SPSS to be factor-analyzed.

Factor analysis reduces the number of variables (the newspaper articles and the frame terms) to detect structure in the relationships between the variables. Using SPSS, principal components analysis with a varimax rotation will be performed to determine the relationship of the frame terms to their appearance in the news texts. In so doing, multiple variables can be expressed by a single factor. In principal component analysis, all the variance (the extent to which the values of a variable differ from the mean) in a variable is analyzed. The number of factors initially extracted in analysis is always the same as the number of variables, and the first factor has the highest loadings (or correlation) and extracts or indicates the greatest amount of variance in the variables. Smaller factors that account for very little variance should be ignored, as the larger ones account for most of the variance (Bryman & Cramer, p. 28). The factor analysis shows what words appeared together most consistently and with the widest range of occurrence – some articles having none of the words and quite a few having most of them.

A scree plot will be used to suggest the number of factors to retain for rotation. On the scree plot, the eigenvalue (the amount of variance) of each factor is represented by the vertical axis of the graph while the factors are arranged in order of decreasing size of eigenvalue along the horizontal axis. A geographical term for explaining the rubble at the bottom of a rocky slope, scree hides the true base of a slope (Bryman & Cramer, p. 29). In a scree graph, the factors forming the slope itself indicate the most relevant factors and the ones that should be kept, while factors that form the scree near and at the bottom are considered "small error factors" (Bryman & Cramer, p. 29).

Aside from the scree plot, interpretation of meaningful and relevant factors will also rely upon the factors' eigenvalues. Only factors with eigenvalues of 1.00 or higher will be considered. While this approach introduces some subjectivity, nevertheless it aligns with the recommendations of factor analysis methodologists (Gorsuch, 1983; Hair, Anderson, Tatham, & Black, 1995; SAS/STAT software, 1990). For purposes of interpretation, only factor loadings exceeding a threshold of +0.30 or -0.30 were considered meaningful. For variables that loaded on more than one factor, only the highest loading (without regard for negative or positive value) will be used in computing factor scores.

Thus, the first and most meaningful or relevant factor will be the one that explains the most variability. It will be the most consistent and will have the widest range of usage of the frame terms. The next factor will have quite a bit of range, but less than the first "set" or factor, and so on until all relevant factors are extracted.

Factor analysis is similar to hierarchical cluster analysis, which has been a frequently used method for the statistical validation of frames (Andsager, 2000; Andsager & Powers, 1999; Andsager & Smiley, 1998; Koella, 2003; Koenig, 2004a; Miller, 1997; Miller, Andsager, & Riechert, 1998; Miller & Riechert, 2001a, 2001b; and Riechert, 1996). The results of a hierarchical cluster analysis usually appear in the form of a dendrogram, which provides a visual representation of the clusters or frames. The words *cluster* and *frame* have been used interchangeably in framing research (Andsager, 2000; Andsager & Powers, 1999; Andsager & Smiley, 1998; Miller, 1997; Miller, Andsager & Riechert, 1998; Miller & Riechert, 2001a, 2001b; and Riechert, 1996).

Although frequently used, cluster analysis appears to have limitations that can be overcome by using factor analysis. Cluster analysis does not make very restrictive assumptions (Hagenaars & Halman, 1989) and so does not offer any real goodness of fit tests (Aldenderfer & Blashfield, 1984). Another limitation is that it is difficult to choose an optimum number of clusters on an empirical basis (Miller & Riechert, 2001b, p. 116). In this way, the researcher then must select the number of clusters. As Koenig points out, researcher fiat is again introduced (2004b). "(A)ny number of frames could be posited throughout the texts, without any possibility to falsify any frame model," Koenig writes (2004b, p. 17). Furthermore, hierarchical cluster analysis suggests that texts belong to either one frame or the other. "But it is entirely reasonable, and even likely, that speakers use any number of frames in a given text," Koenig says (2004b, p. 17).

Factor analysis seems to provide a better measurement. "It knows well-established goodness of fit criteria, it assumes a measurement model that does justice to the latency of frames, and it can decide on an empirical basis, which frame model is more adequate" (Koenig, 2004b, p. 17). Yet, it appears that only a few studies have used factor analysis to examine news coverage (Risse & Van de Steeg, 2003 as cited in Koenig, 2004b; Kiousis, 2004).

Methodological Limitations to Quantitative Analysis

Statistical programs allow for perhaps the most precise methods to determine frames and shifts in frame dominance. However, the quantitative foundation does offer a limitation. First, the quantitative analysis is founded on the repetition of certain words or phrases in order to determine frames. Yet, many powerful concepts central to frames do

not necessarily have to be repeated often to have a great impact. In addition, like qualitative textual analysis, quantitative analysis relies on the selection of appropriate keywords or frame terms, which necessarily introduces "researcher fiat" (Tankard, 2001, p. 98). Furthermore, keywords do not necessarily distinguish between a frame and its counter-frame. Also, no coding can adequately capture the importance of text passages, which might carry more significance than the remainder of the text. Finally, sources cited within news stories could use many different and over-lapping frames.

These limitations underscore the importance of the researcher to conduct a separate interpretative analysis of the texts, which will be done in this study. While frequency counts suggest possible frame terms, in the end an interpretive identification of relevant keywords seems to be the more appropriate and more common route recommended by framing researchers (Andsager, Austin, & Pinkleton, 2001; Miller, 1997, p. 369). Reading "over a reasonable amount of data" should allow for a framing researcher to uncover frames and their corresponding terms hermeneutically (Koenig, 2004b, p. 4). Furthermore, after the factor analysis is conducted, frames will be reviewed within the text to confirm the presence of one or more frames and to confirm any overlap of the frames by one or more frame sponsors.

In sum, computer-based content analysis can only be taken as a first step to explore the homogeneity and differences across groups. Factor analysis cannot determine causality. It serves as a grouping tool that is useful in determining frame dominance within a set of text. At best, such analysis can only describe frames that are present within a set of text and which frames are more dominant.

Design of the Quantitative Study

This section explains the first two research questions in further detail, as these first two questions will be answered quantitatively.

Analysis of Research Question 1: Content of News Frames

What are the news frames in coverage of genetically modified organisms (crops and food) in local newspapers in U.S. states with high socio-economic interest in GMOs?

In order to address Research Question 1, quantitative content analyses of frames in local newspapers will be conducted.

The Lexis-Nexis Academic database will be utilized to select news sources. The unit of analysis is the individual news article or report, but editorials, opinion pieces, and letters to the editor will also be part of the material retrieved. They will not excluded in the sample because such texts reflect current news discourse on the topic and such articles also contribute to salience.

Care will be exercised in determining the search strategy for gathering news content on agricultural biotechnology, based on previous recommendations by McInerney et. al. (2004), who in their study assert that "false results are easy to come by, and researchers should be cautious and conservative when estimating how much a story is covered in the popular press by relying on electronic information searching" (p. 68). In order to address these concerns, several steps will be taken. First, because biotechnology stories can contain a variety of different terms to discuss biotechnology, the search strategy will encompass a comprehensive list of keywords and terms used in previous studies of coverage of agricultural biotechnology (McInerney et. al., 2004; Retzinger,

2001). The following keyword or parts of keywords will be used to collect the population of articles: “agricultural biotech*,” “BGH,” “bovine growth hormone,” “bovine somatotropin,” “BST,” “Bt corn,” “Bt maize,” “food biotech*,” “frankenfood,” “genetic engineer*,” “gene manipulat*,” “gene technolog*,” “GM crop,” “GM food,” “GMO,” “genetically modified*,” “GM seeds,” “plant biotech*,” “starlink,” and “recombinant DNA.”

Second, GM agri-food stories are not always “on topic” and may appear in duplicate in the database used to retrieve materials (McInerney et. al., 2004). To address this issue, each article once retrieved from the database will be reviewed by the researcher to make sure the article appropriately addressed issues of agricultural biotechnology.

Third, the Lexis database also offers the Associated Press and Wire as a news source, but the wire service will not be included in the analysis because it could give a false impression of the number of stories published about GMOs. Wire stories are not always picked up by newspapers and, therefore, are not always available to readers.

Decision rules for deletion of certain articles will apply to all the articles downloaded from the Lexis database. The following categories of articles are specified as inappropriate for this analysis:

(1) Articles with the predominant focus either/or stem cells, cloning, genetically modified bacteria, genetically modified animals (unless they are for food purposes, like salmon or poultry), genetic altering of humans, gene therapy for humans, and other medical biotechnology stories.

(2) Reader quizzes.

(3) Obituaries.

(4) Different definition of search term, e.g., (The acronym for one of the largest advertising agencies in San Francisco is Goldberg Moser and O'Neill, or otherwise referred to as GMO).

(5) Duplicate articles – the sample will also be checked to assure that duplicate articles are not included in the count, so as not to inflate numbers.

The time period chosen for analysis includes the population of news articles published from January 1992 until December 2004. This range of time represents the period in which agri-food and crops began to enter the market and draw attention from the public and the press (Nisbet & Lewenstein, 2002; Priest, 2001b; Shanahan, Scheufele, & Lee, 2001). In 1993, the FDA approved rBST, used to stimulate milk production in dairy cows; rBST milk first appeared on grocery store shelves in 1994, and it is widely considered to be the first GM food product. During the early 1990s' debate over the marketing of rBST, opposing interests launched intensive propaganda campaigns (Priest, 2001b). Also during the mid-1990s, Monsanto focused on developing biotechnology products that would provide greater weed control for farmers – especially soybeans, but also in canola, corn and cotton (Krueger, 2001). The peak year of news coverage of biotechnology is considered as 1997 with the announcement of Dolly, the cloned sheep (February 1997) and the first imports of GM soybeans (from late autumn 1996) (Bauer et. al., 2001, p.35; Nisbet & Lewenstein, 2002). Shanahan et. al. (2001) noted an increase in the frequency of U.S. newspapers publishing articles in which agricultural biotechnology

was the main topic around 1998. In another study, the peak years of coverage were 1999 (n = 1,513 news articles) and 2000 (n = 2,042) (McInerney, Bird, & Nucci, 2004).

The Lexis database includes many news sources, which are listed on a state-by-state basis. Thus, specific states or geographical regions within a state will be chosen to represent the different locations. A separate quantitative content analysis will be conducted for each location in order to assess similarities and differences in news frames between the different locations. Overall, the aim of choosing different geographical locations will be to provide a broad representation of geographical diversity.

Because it is beyond the resources of this study to include all 50 states, the analysis will necessarily be limited to only those locations that meet specific selection criteria. The criteria for selecting the specific regions will be based on one or more of the following factors: consistently high socio-economic interest in GMOs, percentage of acreage of GM crops, and involvement in GM crop or food debates whether via local government, state legislative activity, and/or concentrated interest group activity.

Another important requirement is the availability of material from the Lexis database. For example, the top GM corn and soybean producing state is South Dakota, but the Lexis database does not provide a newspaper for that state. Other states like Hawaii, Kansas, North Dakota, and Vermont, also would meet the selection criteria, but in these cases, the database provides only one or no newspapers, and in some cases, the newspaper provided is not the state's largest or the one providing the most local and state news about agri-food issues. For this study, the news sources selected from the Lexis database will be those that best represent the state in terms of widest circulation,

assuming that the larger papers of the state would print more news about agri-food biotechnology issues than smaller papers.

Based on the selection criteria described above, Northern California and Missouri were chosen for analysis. Northern California was chosen because of its economic reliance on agriculture. California is the number one agricultural U.S. state, producing 75% of the fruits, vegetables and nuts consumed (California State Profile, 2002), and the Northern California economy is particularly invested in agricultural production. In addition, large concentrations of biotech firms are located in Northern California. It was also the location for the development of the first genetically engineered crop to appear in supermarkets—the FlavrSavr tomato. Furthermore, the use of rBST in milk production was a major issue because the state is the number one milk producer. The battle of biotech foods and crops reached a fever pitch in November 2004, when three Northern California counties voted on initiatives to curb or ban GMOs. One measure—to ban the growth of GM plants and animals—passed in Marin County, while initiatives in two other counties, Butte and Humboldt, failed. In March 2003, Mendocino County in Northern California was the first county in the United States to ban growing GM crops. Trinity County, also in Northern California, also banned GM crops in 2004, as did the city of Arcata. Also in 2004, activists in Sonoma County in Northern California began gathering signatures to place an anti-biotech measure on the ballot. In Sutter County in the northern Sacramento Valley, 80 acres of an experimental form of rice engineered to produce commercial quantities of prescription drugs was being tested in field trials in 2003 and early 2004. The company, Ventria Bioscience, appealed to the California Rice Commission in March 2004 to grow an additional 120 acres, according to a March 29,

2004, article in the *San Jose Mercury News*, but the request was turned down. The company relocated to Missouri in late 2004.

The newspapers selected to examine local news in Northern California are *The Oakland Tribune* (available from November 2001 until the end of the time period, December 2004), *The San Francisco Chronicle* (available for complete time period), *San Jose Mercury News* (available from October 1996 until December 2004), and *San Mateo County Times* (available from November 2001 until December 2004).

With Monsanto headquartered in St. Louis, Missouri also has a high socio-economic interest in GMOs. Missouri has consistently been one of the top GM-crop producing states. In 2004, 87% percent of Missouri soybean was GM, making it the 5th largest producer in the United States, while 49% of corn was GM, which also made it the 5th largest producer of GM corn (Pew, August 2004). Further, Ventria Bioscience, the company spearheading efforts to grow GM rice for pharmaceutical purposes, announced in November 2004 that it was moving from California to Missouri. It was speculated that the move was in part prompted by Missouri's "gentler regulatory climate" (Lambrecht, December 2004, p. B01). Missouri has no state law governing biotechnology, and Missouri agencies are not known for aggressive regulation of genetically engineered crops.

For the Missouri newspapers, only the *St. Louis Post-Dispatch* was used in the analysis, as this was the only paper available for the entire time period. The *Post-Dispatch* is also the most widely circulated paper in the state.

Analysis of Research Question 2: Frame Changes Over Time

How do the news frames change over time?

In order to determine how the frames changed over time, the news frames will be compared for similarities and differences, as well as frame dominance. In order to conduct such an analysis, it is necessary to have content that covers an adequate length of time. The Lexis database provides 13 years' worth of content, from 1992 until December 2004, for the Northern California and Missouri newspapers. In the space of 13 years, it is possible that frame changes can be observed. Thus, analyzing frame changes over time can be conducted.

The thirteen-year time period will be analyzed on a year-by-year basis by averaging the occurrence of each term in the frame by the time period measured. A bar graph will provide a visual understanding of what frames dominated in each year and how the frames changed over time.

To summarize this section, two analyses will be conducted.

(1) A comparison of frames used in each year from 1992 to 2004 for the Northern California newspapers.

(2) A comparison of frames used in each year from 1992 to 2004 for the Missouri newspapers.

Design of the Qualitative Study

Analysis of Research Question 3: Frame Sponsors

Who are the dominant sponsors (the actors/sources) shaping news frames of stories on genetically modified organisms in local newspapers in the United States, and how do these sponsors appear in the frames?

To complete the qualitative analysis, the third research question – who are the dominant sponsors (the actors/sources) shaping news frames of GMO stories in regional newspapers in the United States – will be answered qualitatively. Once the quantitative content analyses are complete, the results should suggest who are the dominant sponsors of the news frames. However, in order to more fully expand the framing concept to consider the contextual relationship between news frames and the social and political processes influencing the frames, these stakeholder groups, or frame sponsors, will be investigated in greater detail. The emphasis will be on *dominant* frame sponsors, defined as those groups or individuals identified most frequently in the time period or those groups whose frame or frames are most often used.

The research conducted in this section aims to complement early sociological research on framing (Gitlin, 1980; Tuchman, 1978), which offered a more comprehensive perspective of the influence of social and political contexts on news. Using news stories, public documents, interview data, and other sources, an in-depth contextual and historical study will be conducted in order to provide an understanding of how the dominant sponsors mobilize to shape the construction of news frames. Taking cues from Goffman (1974) and Berger and Luckmann (1967), this qualitative study takes a more social-constructionist approach to view framing as a way of constructing meaning.

Based on a review of the literature about frame sponsorship and framing as strategic action, among the questions driving this investigation are:

- What resources are available to sponsors and how are they mobilized to impact media coverage?
- What do sponsors know about journalistic routines and practices?
- How do political elites (industry sponsors) absorb frames advanced by challengers?
- How do marginalized groups influence or fail to influence news coverage?
- How do inequitable distributions of access to news affect frame sponsorship?

CHAPTER IV.

ANALYSIS AND RESULTS OF QUANTITATIVE STUDY

In the quantitative study, a computer-assisted content analysis was conducted to determine the frames used in local or regional newspaper coverage of "green" biotechnology. Articles were included that focused on GM crops and food either from a local, national, or international standpoint. Thus, articles that may have been written by a Washington correspondent, for example, or those with an international or out-of-state dateline are included because selection of such articles by newspaper editors indicates their relevance to local or regional news. Inclusion of these articles is necessary because to leave them out would likely shade the analysis toward the radically local, and the issue of GMOs is clearly national and global. Although inclusion may dilute the local context slightly, inclusion is important because local editors select and package the stories. Thus, decisions about a story's newsworthiness for a local audience is made at the local level. Inclusion of such stories provides for a broader context to consider the scientific, economic, and social issues surrounding GMOs. As stated previously, editorials, letters to the editor, and other opinion pieces were also included because such texts reflect current news discourse on the topic and also contribute to issue salience.

Research Question 1: Content of News Frames

Research Question 1 asked what the news frames are in coverage of genetically modified organisms (crops and food) in local newspapers in U.S. states with high socio-economic interest in GMOs. In order to answer this question, quantitative content

analyses of frames in local newspapers were conducted. The analyses and results are explained below.

Missouri News

Using the Lexis database, the population of articles from the *St. Louis Post-Dispatch* (available for the complete time period, 1992 to 2004) was retrieved using the following keyword or parts of keywords: "agricultural biotech*," "BGH," "bovine growth hormone," "bovine somatotropin," "BST," "Bt corn," "Bt maize," "food biotech*," "Frankenfood," "genetic engineer*," "gene manipulat*," "gene technolog*," "GM crop," "GM food," "GMO," "genetically modified*," "GM seeds," "plant biotech*," "starlink," and "recombinant DNA."

The search was conducted on December 7, 2004 and resulted in a total population of 1,134 articles. Each article was carefully analyzed to make sure it was appropriate to the study. After applying the rules for deletion as specified in Chapter III, the total number was reduced to 860 articles (listed in Appendix A). All of the 860 articles were saved as one text document in Microsoft Word. This document contained a total of 495,903 words.

The document was then submitted to WordStat for content analysis to determine frequency of words. As explained in Chapter III, the WordStat program enables the researcher to begin with a large list of high-frequency terms that represent the overall discussion of an issue then to identify from among them those terms best representing the issue definition or specific frame or frames. WordStat's Keyword-in-Context feature, which displays specific words in their context, was helpful in determining the different

uses of a word as well as its appropriateness to the study. An example of the KWIC feature, using the word *ban* in the Missouri newspapers, is shown in Table 4.1. The word *ban* was used a total of 184 times in the Missouri dataset, and a total of 178 times in the California dataset.

Any number of terms can be used in the analysis. For this study, a total of 128 terms were chosen. This number seemed to be a sizeable number to substantively represent the issue. In previous studies, a similar number of terms were chosen for analysis. In Riechert's study of the wetlands debate, 123 substantive terms were selected (Riechert, 1996, p. 121). In a study of news media representation of 1996 Republican presidential candidates, 110 substantive terms were chosen (Miller, Andsager, Riechert, 1998).

Table 4.2 lists a number of substantive high-frequency terms from the news articles in the *St. Louis Post-Dispatch*. The terms are displayed by absolute frequency of occurrence in the 860 Missouri news articles, shown in column 2 of the table. Also displayed are the number of cases (news articles) in which the term appeared (Column 3) and the percentage of cases (Column 4). The most frequently occurring terms in the *St. Louis Post-Dispatch* were *Monsanto*, 3,280; *food*, 3,207; *genetically*, 2,392; *corn*, 2,154; and *company*, occurring 2,035 times. The prominence of the term *Monsanto* in the *St. Louis Post-Dispatch* is to be expected as the company has its headquarters there.

The 128 terms and the percentage of each term's use in each of the 860 news articles were submitted to SPSS for factor analysis. Factor analysis then reduced the data to detect the structure in the relationships between the variables. Based on the scree plot (shown in Figure 4.1) as well as the principal-factors analysis of the frame terms, the first

Table 4.1. Selected Examples of Occurrences of the Word *Ban* in Missouri Newspaper

Date	Case #	Key Word in Context
5/15/04	31	"The commission announced its intention to lift the **>ban<** last month after EU governments failed to agree on Bt11, a strain developed by Syngenta AG of Switzerland."
12/7/03	63	"California is the only state with a **>ban<** on genetically engineered species, and the Fish and Game Commission said Wednesday it would not exempt the zebra fish from the law even if escaped fish would not pose a threat to the state's waterways."
9/10/03	87	"EU gives nod to **>ban<** on genetically modified food."
7/8/03	104	"So since they can't **>ban<** our food, the Europeans now plan to hog-tie our food exports in ridiculous red tape."
7/8/03	104	"The United States and other countries that grow genetically modified crops have long complained that fears over safety are unfounded and that the European **>ban<** constituted unfair trade practices."
7/8/03	104	"The freeze was intended to give the EU time to study the issue and put in a system of traceability and labeling; the **>ban<** did not affect crops such as certain types of modified soybeans that already were being imported."
5/18/03	139	"Irrational fear and crass protectionism - not sound science – caused the European Union to **>ban<** the import of most genetically modified crops from the United States."
5/16/03	144	"American farmers are losing $300 million a year in potential exports due to the unjustified **>ban<**."

Table 4.2. Selected High-Frequency Terms from the Missouri Newspaper

	TERM	FREQUENCY	NO. CASES*	% CASES**
1.	MONSANTO	3280	586	68.1%
2.	FOOD	3207	635	73.8%
3.	GENETICALLY	2392	726	84.4%
4.	CORN	2154	406	47.2%
5.	COMPANY	2035	527	61.3%
6.	CROP	1941	505	58.7%
7.	FARMER	1860	443	51.5%
8.	MODIFY	1651	506	58.8%
9.	PLANT	1613	443	51.5%
10.	ENGINEER	1453	491	57.1%
11.	SEED	1342	329	38.3%
12.	LABEL	1168	263	30.6%
13.	MILK	1127	188	21.9%
14.	BST	1065	135	15.7%
15.	BIOTECHNOLOGY	1064	383	44.5%
16.	BIOTECH	1014	327	38.0%
17.	TECHNOLOGY	968	336	39.1%
18.	CONSUMER	933	355	41.3%
19.	DRUG	922	292	34.0%
20.	PEOPLE	826	334	38.8%
21.	SOYBEAN	821	241	28.0%
22.	GENETIC	733	286	33.3%
23.	AGRICULTURE	762	329	38.3%
24.	FARM	728	276	32.1%
25.	INDUSTRY	718	289	33.6%
26.	RESEARCH	701	292	34.0%
27.	EUROPEAN	693	254	29.5%
28.	UNITE	655	301	35.0%
29.	TEST	643	245	28.5%
30.	GOVERNMENT	642	333	38.7%
31.	SELL	628	291	33.8%
32.	SCIENTIST	619	250	29.1%
33.	PUBLIC	610	298	34.7%
34.	ISSUE	605	326	37.9%
35.	SCIENCE	589	262	30.5%
36.	FDA	575	149	17.3%
37.	GENE	571	213	24.8%
38.	BUSINESS	552	236	27.4%
39.	CONCERN	529	316	36.7%
40.	DAIRY	511	134	15.6%
41.	ENVIRONMENTAL	498	273	31.7%
42.	STUDY	478	188	21.9%
43.	HEALTH	463	270	31.4%
44.	ROUNDUP	457	146	17.0%
45.	EUROPE	456	207	24.1%
46.	PRESIDENT	436	268	31.2%

Table 4.2. continued

	TERM	FREQUENCY	NO. CASES*	% CASES**
47.	APPROVE	421	245	28.5%
48.	AMERICAN	414	229	26.6%
49.	UNIVERSITY	411	194	22.6%
50.	SAFETY	395	220	25.6%
51.	BUY	386	201	23.4%
52.	COTTON	376	136	15.8%
53.	PROBLEM	367	203	23.6%
54.	ORGANIC	362	93	10.8%
55.	ALTER	353	202	23.5%
56.	AGRICULTURAL	345	207	24.1%
57.	RISK	313	194	22.6%
58.	SAFE	299	191	22.2%
59.	HERBICIDE	299	173	20.1%
60.	ADMINISTRATION	290	229	26.6%
61.	FEAR	283	183	21.3%
62.	FEDERAL	283	177	20.6%
63.	MISSOURI	273	127	14.8%
64.	SCIENTIFIC	262	171	19.9%
65.	POLICY	256	150	17.4%
66.	BENEFIT	245	164	19.1%
67.	NATION	245	135	15.7%
68.	ENVIRONMENT	241	161	18.7%
69.	SUPPORT	240	165	19.2%
70.	PEST	235	138	16.0%
71.	HORMONE	231	114	13.3%
72.	TOMATO	224	62	7.2%
73.	PESTICIDE	221	124	14.4%
74.	PROTEST	207	109	12.7%
75.	HOPE	204	150	17.4%
76.	WHEAT	203	50	5.8%
77.	ACTIVIST	199	98	11.4%
78.	FIRM	187	107	12.4%
79.	BAN	184	107	12.4%
80.	BOVINE	179	128	14.9%
81.	RICE	169	51	5.9%
82.	FIGHT	161	113	13.1%
83.	CAMPAIGN	160	86	10.0%
84.	NATURAL	159	113	13.1%
85.	PROTESTER	158	65	7.6%
86.	DISEASE	156	104	12.1%
87.	TACO	151	65	7.6%
88.	ECONOMIC	149	98	11.4%
89.	EXPERT	143	103	12.0%
90.	POLITICAL	142	97	11.3%
91.	OPPOSE	141	113	13.1%

Table 4.2. continued

	TERM	FREQUENCY	NO. CASES*	% CASES**
92.	BUTTERFLY	128	35	4.1%
93.	HARM	117	96	11.2%
94.	OPPONENT	105	76	8.8%
95.	TOXIN	104	44	5.1%
96.	THREAT	96	76	8.8%
97.	CORPORATE	95	71	8.3%
98.	CORPORATION	95	68	7.9%
99.	GREENPEACE	95	49	5.7%
100.	FISH	94	24	2.8%
101.	ATTACK	83	64	7.4%
102.	CONTROVERSY	80	63	7.3%
103.	TRANSGENIC	80	35	4.1%
104.	NATURE	79	54	6.3%
105.	THREATEN	74	66	7.7%
106.	SUPPORTER	71	60	7.0%
107.	ALLERGY	71	32	3.7%
108.	SUPERMARKET	68	46	5.3%
109.	ECONOMY	66	47	5.5%
110.	MEAT	65	47	5.5%
111.	USDA	64	29	3.4%
112.	EARTH	62	50	5.8%
113.	HEALTHY	62	41	4.8%
114.	TRUST	59	42	4.9%
115.	ENVIRONMENTALIST	53	41	4.8%
116.	CRITICIZE	52	51	5.9%
117.	AGRIBUSINESS	52	43	5.0%
118.	TASTE	52	34	4.0%
119.	CONTAMINATION	46	34	4.0%
120.	CANCER	45	32	3.7%
121.	NUTRITIONAL	44	32	3.7%
122.	CONTROVERSIAL	42	39	4.5%
123.	VEGETABLES	38	33	3.8%
124.	DANGEROUS	33	29	3.4%
125.	PROFITABLE	24	21	2.4%
126.	FLAVOR	15	12	1.4%
127.	FRANKENFOODS	14	13	1.5%
128.	FRANKENFOOD	4	4	0.5%

*The number of articles in which the term appeared
**The percentage of cases in which the term appeared.

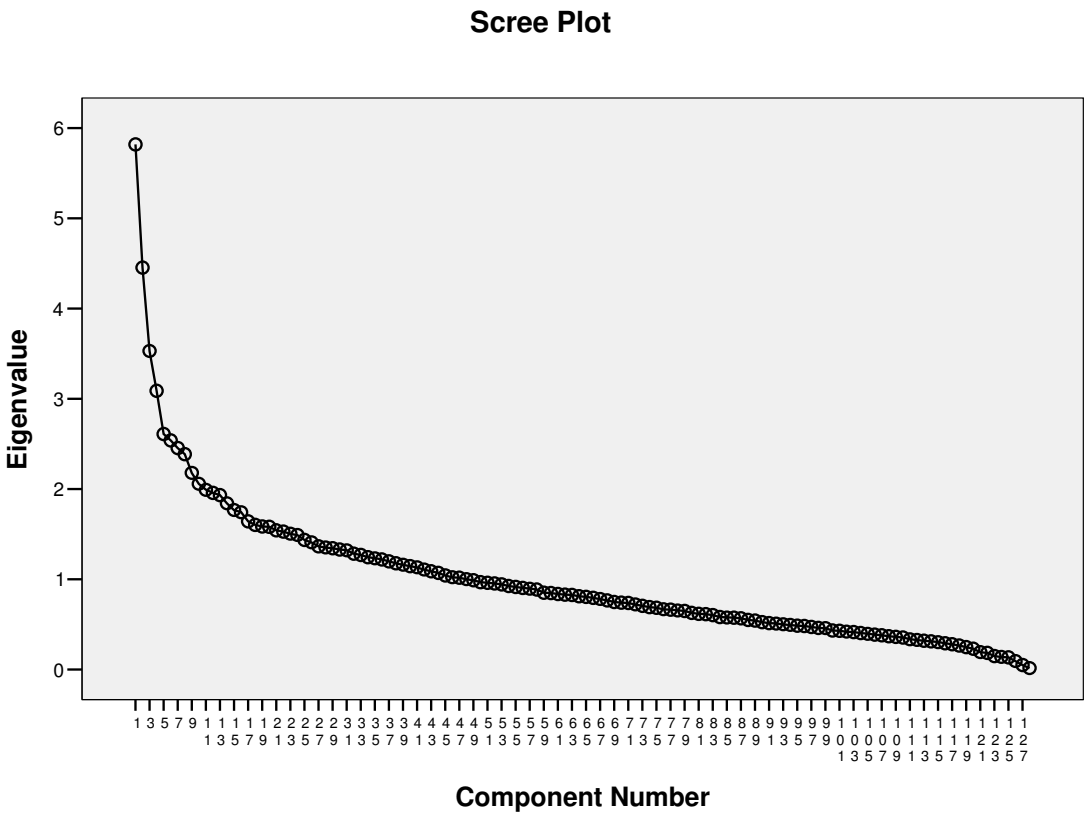

Figure 4.1. Scree Graph for the Missouri Newspaper

were the most meaningful, and thus were extracted. The first factor is the most meaningful or relevant because it shows what words appeared together most consistently and has the most variability, or widest range of usage – some articles had none of the words, while quite a few had most of them. The next factor has some consistency and quite a bit of range, but less than the first "set" or factor, and so on until the eighth factor. These eight factors accounted for 21% of the total variance. They represent “frames” used in the news articles of the *St. Louis Post-Dispatch* from 1992-2004. Table 4.3 shows the eight factors or frames and how each variable, or “frame term,” loaded on each factor. The factors are composed of the words that co-occur most often and form a frame. The table shows the variables loading at 0.30 or higher, the eigenvalues for each factor, and the variance.

The first factor, the BST frame, obtained high loadings (greater than 0.40) from ten terms, explained 4.5% of the variance, and had an eigenvalue of 5.82. This frame included terms focusing mainly on the use of BST to increase milk production in cows. Also present in this frame were the terms *FDA, administration,* and *safe* suggesting the regulatory concerns of the BST with respect to safety and health. In addition, appreciable loadings (>0.30) were obtained from two variables, the terms *health* and *federal.*

The second factor, which was labeled the science frame, obtained high loadings (>0.40) from four terms, *study, scientist, butterfly, and toxin.* This factor accounted for 3.5% of the variance, and had an eigenvalue of 4.45. Appreciable loadings (>0.30) were obtained from five terms, *university, risk, science, nature,* and *pesticide.* Aside from the science dimension associated with this frame, the other dimension appeared to be the Bt corn controversy. In 1999, Bt corn was at the center of controversy when scientists at

Table 4.3. The Factors or News Frames in the *St. Louis Post-Dispatch*

Term	Factor 1	Factor 2	Factor 3
Factor 1: BST Frame			
milk	0.76		
BST	0.75		
drug	0.64		
FDA	0.61		
bovine	0.61		
dairy	0.58		
hormone	0.47		
label	0.47		
administration	0.46		
safe	0.44		
health	0.38		
federal	0.33		
Explained Variance	4.5%		
Eigenvalue	5.82		
Factor 2: Science Frame			
study		0.56	
scientist		0.54	
butterfly		0.52	
toxin		0.43	
university		0.35	
risk		0.32	
science		0.32	
nature		0.31	
pesticide		0.31	
Explained Variance		3.5%	
Eigenvalue		4.45	
Factor 3: Roundup Frame			
soybean			0.56
Roundup			0.55
herbicide			0.53
seed			0.44
cotton			0.40
plant			0.40
Monsanto			0.39
crop			0.36
engineer			0.32
pest			0.31
people			-0.31
Explained Variance			2.8%
Eigenvalue			3.53

Table 4.3. continued

Term	Factor 4	Factor 5	Factor 6	Factor 7
Factor 4: Europe Frame				
European	0.60			
modify	0.55			
Europe	0.51			
genetically	0.47			
unite	0.46			
ban	0.36			
nation	0.33			
government	0.31			
fear	0.31			
Explained Variance	2.4%			
Eigenvalue	3.09			
Factor 5: Safety Frame				
food		0.53		
biotechnology		0.49		
public		0.39		
consumer		0.39		
policy		0.35		
industry		0.33		
safety		0.32		
Explained Variance		2.0%		
Eigenvalue		2.61		
Factor 6: StarLink Frame				
taco			0.66	
corn			0.64	
approve			0.55	
test			0.41	
allergy			0.36	
biotech			0.35	
contamination			0.32	
Explained Variance			2.0%	
Eigenvalue			2.54	
Factor 7: Environment Frame				
environment				0.75
environmental				0.68
earth				0.53
criticize				0.42
environmentalist				0.30
Explained Variance				1.9%
Eigenvalue				2.46

Table 4.3. continued

Term	Factor 8
Factor 8: Agriculture Frame	
agriculture	0.67
agricultural	0.65
farmer	0.39
USDA	0.33
farm	0.30
Explained Variance	1.9%
Eigenvalue	2.39

Cornell University concluded that the Monarch butterfly could be harmed by Bt corn because the genetically engineered corn produces pollen poisonous to moth and butterfly larvae.

The third factor, the Roundup frame, obtained high loadings from six terms, including s*oybean, Roundup, herbicide, seed, cotton,* and *plant.* This factor accounted for 2.8% of the variance and its eigenvalue was 3.53. Appreciable loadings were obtained from five terms, including *Monsanto, crop, engineer, pest* and *people*. The terms in this frame were mainly related to the business of Monsanto, who has its headquarters in St. Louis.

The fourth factor was labeled the Europe frame as the terms in this frame appeared to refer to the European ban GM foods and crops. This factor obtained its highest loadings from five terms, *European, modify, Europe, genetically,* and *unite.* It accounted for 2.4% of the variance and had an eigenvalue of 3.09. Appreciable loadings were obtained from four terms, *ban, nation, government,* and *fear*. In 1998, the European Union adopted a "de facto" moratorium on all new introductions of GM foods and crops. The GMO ban was made official in June 1999 when five "Member States" of the European Union – Denmark, France, Greece, Italy, and Luxembourg – issued a declaration that they would effectively block new GMO approvals until the European Commission proposed legislation for traceability and labeling of GMOs and products made from them. The United States filed suit against the European Union under World Trade Organization rules in May 2003. The suit was intended to force open the European market to imported modified food. In 2004, the EU lifted the ban, but implemented stringent new laws for the labeling and tracing of genetically modified food, feed, and

ingredients, making it difficult for the United States and other nations to import GM food and seeds into the EU. In this factor, the term *unite*, refers to the word *United* as in United States. This was determined by using the Key-Word-In-Context feature of WordStat and searching for the uses of the word. The word appeared in 35% of the 860 Missouri news articles.

Interestingly, the term *fear* loaded on this factor. KWIC was used to analyze uses of the word. Overall, the term appeared in 21.3% of the 860 *St. Louis Post-Dispatch* news articles and had a frequency of 283. In many cases, the word appeared in articles referring to Europeans' fears over the safety of GMOs. For example, a July 2, 2003, article stated: "The EU imposed its moratorium on new genetically modified foods in 1998, responding to mounting fears of European consumers about health risks" (U.S. opposes). A June 5, 2002, article noted, "The technology is used widely in the United States, but European countries have been reluctant to embrace it because of fears of unknown health and environmental consequences." One article from July 25, 1999 even noted in its headline that "Fear is growing; England is the epicenter." The lead read, "It is not known whether there are health threats from genetically modified foods. But in England, children debate whether genetic engineering is the worst thing since nuclear weapons."

The fifth factor obtained high loadings from all of its seven terms, *food, biotechnology, public, consumer, policy, industry,* and *safety,* explained 2.0% of the variance, and had an eigenvalue of 2.61. The factor was defined as the safety frame, as many of its terms referred to consumers' concerns over the safety of biotechnology and GM foods.

The sixth factor also obtained high loadings from all of its seven terms, *taco, corn, approve, test, allergy, biotech,* and *contamination*. It explained 2.0% of the variance and had an eigenvalue of 2.54. The factor was named the StarLink frame, as the terms were those associated with StarLink corn. The corn, which was genetically engineered to produce its own pesticide, had been approved only for animal feed and industrial use out of fear it might cause severe allergic reactions. But, in 2000, traces of it were found in taco shells and other foods, causing large recalls and severely hurting American corn exports.

Four of the five terms loaded highly on the seventh factor, the environment frame, and they included *environment, environmental, earth,* and *criticize*. The last term, *environmentalist,* loaded at 0.30. This factor explained 2.0% of the variance and had an eigenvalue of 2.46. Based upon a KWIC search, the term, *criticize,* referred in many articles to the various criticisms of GMOs from environmental activists. For example, a March 10, 2004, article about British approvals to commercialize a GM corn crop referred to the environmental groups that criticized the maize study used in approval. Criticism from environmental groups in 2002 helped bolster southern African nations' refusal of GM food shipments. The USDA blamed environmental groups and biotech opponents for influencing southern African countries' decision to refuse the aid. Overall, the term, *criticize*, was mentioned in 5.9% of the 860 *St. Louis Post-Dispatch* articles.

The last factor was labeled the agriculture frame, explained 1.9% of the variance, and had an eigenvalue of 2.39. Terms, which loaded highly on this factor, included *agriculture* and *agricultural*. Appreciable loadings were the terms, *farmer, USDA,* and

farm. Inclusion of the term *USDA* likely suggests the regulatory climate associated with agricultural biotechnology.

Northern California News

Using the Lexis database, the population of articles from *The Oakland Tribune* (available from November 2001 until the end of the time period, December 2004), *The San Francisco Chronicle* (available for complete time period, 1992-2004), *San Jose Mercury News* (available from October 1996 until December 2004), and *San Mateo County Times* (available from November 2001 until December 2004) was retrieved.

The search was conducted on December 1, 2004, resulted in a total population of 508 articles. After applying the rules for deletion as specified in Chapter III, the total number was reduced to 296 articles (listed in Appendix B). All of the 296 articles were saved as one text document in Microsoft Word. This document contained a total of 215,673 words.

The same list of substantive terms used in the Missouri dataset was appropriate to the Northern California newspaper coverage of GMOs. However, the word *Missouri* was dropped from the list, and the word *California* was added. Table 4.4 lists a number of substantive high-frequency terms from the Northern California news articles. The terms are displayed by absolute frequency of occurrence in the 296 Northern California news articles, shown in column 2 of the table. Also displayed are the number of cases (news articles) in which the term appeared (Column 3) and the percentage of cases (Column 4). As expected, the WordStat analysis revealed that some of the most frequently-used

Table 4.4. Selected High-Frequency Terms from Northern California Newspapers

	TERM	FREQUENCY	NO. CASES*	% CASES**
1.	FOOD	1667	252	84.8%
2.	GENETICALLY	881	263	88.6%
3.	CROP	637	147	49.5%
4.	BIOTECH	589	146	49.2%
5.	ENGINEER	560	157	52.9%
6.	PLANT	526	130	43.8%
7.	COMPANY	483	153	51.5%
8.	INDUSTRY	476	162	54.5%
9.	CORN	475	112	37.7%
10.	MODIFY	440	203	68.4%
11.	ORGANIC	420	80	26.9%
12.	PEOPLE	384	144	48.5%
13.	CALIFORNIA	381	152	51.2%
14.	FARMER	370	130	43.8%
15.	GENE	352	110	37.0%
16.	LABEL	341	99	33.3%
17.	CONSUMER	335	126	42.4%
18.	BIOTECHNOLOGY	332	139	46.8%
19.	SCIENTIST	306	112	37.7%
20.	FARM	274	93	31.3%
21.	GENETIC	270	112	37.7%
22.	RESEARCH	265	108	36.4%
23.	DRUG	254	105	35.4%
24.	MILK	254	49	16.5%
25.	ISSUE	250	124	41.8%
26.	PUBLIC	247	112	37.7%
27.	TECHNOLOGY	234	104	35.0%
28.	ENVIRONMENTAL	231	104	35.0%
29.	SEED	228	70	23.6%
30.	AGRICULTURE	222	111	37.4%
31.	HEALTH	210	112	37.7%
32.	UNIVERSITY	200	109	36.7%
33.	SCIENCE	185	95	32.0%
34.	TEST	185	95	32.0%
35.	FDA	181	45	15.2%
36.	BAN	178	66	22.2%
37.	CONCERN	172	108	36.4%
38.	GOVERNMENT	171	100	33.7%
39.	ALTER	171	83	27.9%
40.	ADMINISTRATION	170	101	34.0%
41.	UNITE	168	90	30.3%
42.	RICE	167	27	9.1%
43.	STUDY	165	89	30.0%
44.	PRESIDENT	164	102	34.3%
45.	AGRICULTURAL	162	96	32.3%
46.	POLICY	155	67	22.6%
47.	FIRM	153	76	25.6%

Table 4.4. continued

	TERM	FREQUENCY	NO. CASES*	% CASES**
48.	TOMATO	151	45	15.2%
49.	SAFETY	146	86	29.0%
50.	FEDERAL	143	87	29.3%
51.	SELL	143	82	27.6%
52.	AMERICAN	142	90	30.3%
53.	PESTICIDE	142	74	24.9%
54.	NATURAL	140	77	25.9%
55.	MONSANTO	138	57	19.2%
56.	PROBLEM	135	79	26.6%
57.	SCIENTIFIC	135	69	23.2%
58.	NATION	135	65	21.9%
59.	BUSINESS	129	75	25.3%
60.	DISEASE	128	66	22.2%
61.	RISK	125	73	24.6%
62.	ACTIVIST	124	52	17.5%
63.	APPROVE	119	72	24.2%
64.	BUY	119	68	22.9%
65.	SUPPORT	117	78	26.3%
66.	PROTEST	117	55	18.5%
67.	HOPE	114	77	25.9%
68.	BENEFIT	114	75	25.3%
69.	HORMONE	114	40	13.5%
70.	SAFE	112	77	25.9%
71.	ENVIRONMENT	108	79	26.6%
72.	CAMPAIGN	102	55	18.5%
73.	EUROPEAN	102	50	16.8%
74.	DAIRY	102	29	9.8%
75.	PROTESTER	99	38	12.8%
76.	SOYBEAN	98	46	15.5%
77.	FEAR	88	63	21.2%
78.	FISH	86	22	7.4%
79.	OPPONENT	83	55	18.5%
80.	NATURE	81	46	15.5%
81.	FIGHT	76	56	18.9%
82.	USDA	73	25	8.4%
83.	CORPORATE	70	41	13.8%
84.	CORPORATION	67	48	16.2%
85.	MEAT	67	29	9.8%
86.	ALLERGY	66	20	6.7%
87.	ECONOMIC	65	43	14.5%
88.	EUROPE	65	42	14.1%
89.	HERBICIDE	59	32	10.8%
90.	TACO	59	20	6.7%
91.	EXPERT	57	39	13.1%
92.	BOVINE	57	33	11.1%
93.	OPPOSE	55	43	14.5%
94.	BUTTERFLY	55	21	7.1%

Table 4.4. continued

	TERM	FREQUENCY	NO. CASES*	% CASES**
95.	CONTROVERSY	53	34	11.4%
96.	POLITICAL	52	32	10.8%
97.	SUPERMARKET	52	31	10.4%
98.	PEST	50	37	12.5%
99.	THREATEN	50	37	12.5%
100.	TRANSGENIC	48	19	6.4%
101.	ENVIRONMENTALIST	46	32	10.8%
102.	TASTE	46	30	10.1%
103.	FLAVOR	46	19	6.4%
104.	CANCER	45	31	10.4%
105.	EARTH	45	25	8.4%
106.	CONTAMINATION	43	20	6.7%
107.	COTTON	41	27	9.1%
108.	NUTRITIONAL	38	23	7.7%
109.	VEGETABLES	37	23	7.7%
110.	ATTACK	36	25	8.4%
111.	THREAT	35	27	9.1%
112.	SUPPORTER	35	23	7.7%
113.	GREENPEACE	35	19	6.4%
114.	WHEAT	34	17	5.7%
115.	CONTROVERSIAL	31	26	8.8%
116.	ECONOMY	31	21	7.1%
117.	HEALTHY	29	22	7.4%
118.	HARM	26	21	7.1%
119.	TOXIN	26	16	5.4%
120.	AGRIBUSINESS	25	22	7.4%
121.	TRUST	22	19	6.4%
122.	DANGEROUS	21	21	7.1%
123.	CRITICIZE	20	19	6.4%
124.	PROFITABLE	14	13	4.4%
125.	FRANKENFOODS	14	12	4.0%
126.	FRANKENFOOD	12	12	4.0%
127.	ROUNDUP	12	7	2.4%
128.	BST	2	2	0.7%

*The number of articles in which the term appeared
**The percentage of cases in which the term appeared.

substantive terms were *food*, 1,667; *genetically*, 881; *crop*, 637; *biotech*, 589; and *engineer*, occurring 560 times.

A total of 296 articles were analyzed from the Northern California newspapers. Based on the scree plot (shown in Figure 4.2) as well as the principal-factors analysis of the frame terms, the first eight factors were determined to be the most meaningful, and thus were extracted. The first factor is the most meaningful or relevant because it shows what words appeared together most consistently and has the most variability, or widest range of usage – some articles had none of the words, while quite a few had most of them. The next factor has some consistency and quite a bit of range, but less than the first "set" or factor, and so on until the eighth factor. These eight factors accounted for 22.7% of the total variance. Table 4.5 shows the factors and how each variable, or "frame term," loaded on each factor. The factors are comprised of the words that co-occur most often and form a frame. The table also provides the eigenvalues for each factor and the corresponding percentage of total variance explained.

The first factor, the safety frame, obtained high loadings (greater than 0.40) from six terms, explained 4.0% of the variance, and had an eigenvalue of 5.13. Those terms were *safety, food, FDA, engineer, administration,* and *safe.* Appreciable loadings (>0.30) were obtained from four terms and included *consumer, label, policy,* and *test.* The terms in this frame suggested a primary focus on issues of safety, particularly as it pertained to food and consumers or the public. The FDA, which tests the safety of GM foods, has also been involved in the debate over labeling of GM foods.

The second factor, the BST frame, obtained high loadings from four of its five terms including *hormone, milk, bovine*, and *dairy* – all terms related to the BST issue.

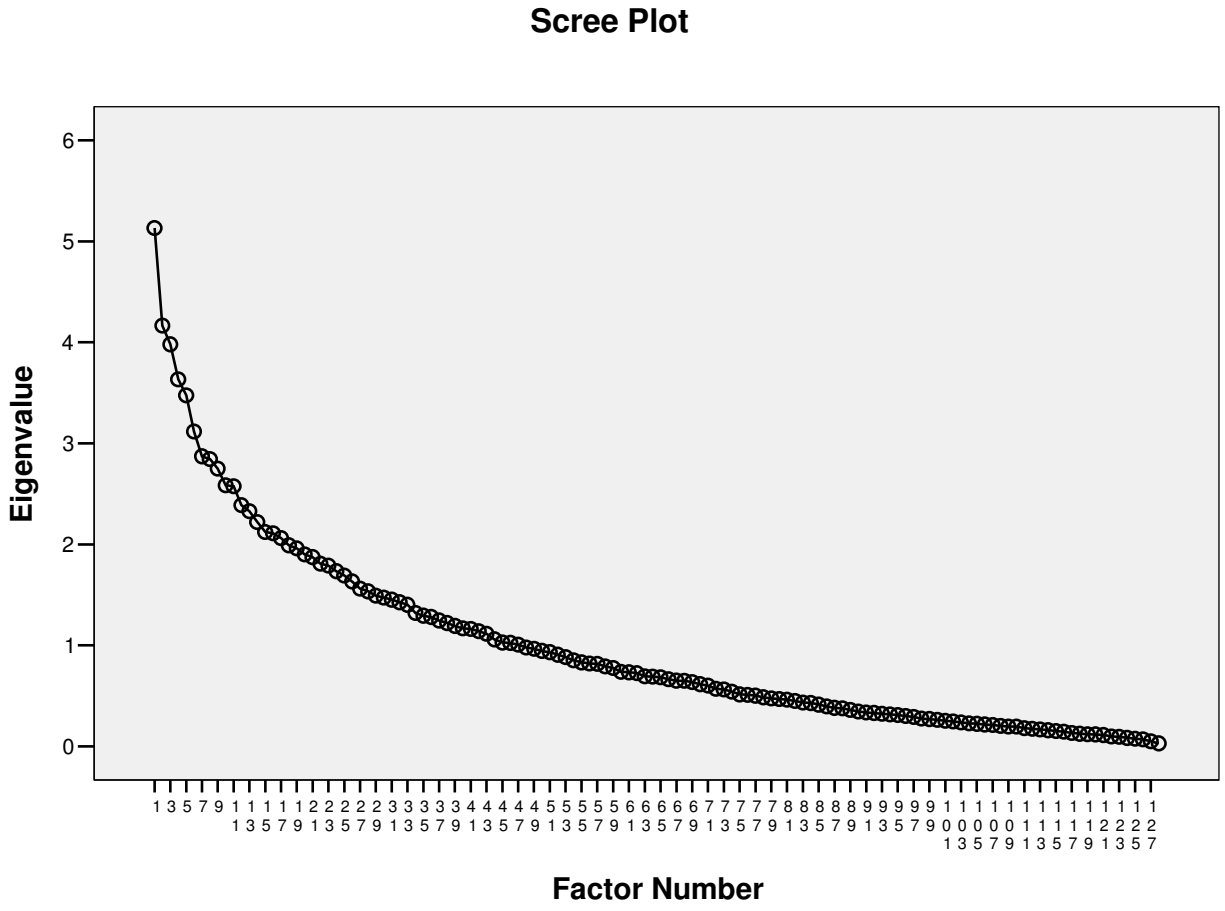

Figure 4.2. Scree Graph for Northern California Newspapers

Table 4.5. The Factors or News Frames in the Northern California Newspapers

Term	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1: Safety Frame				
safety	0.51			
food	0.51			
FDA	0.46			
engineer	0.44			
administration	0.41			
safe	0.41			
consumer	0.39			
label	0.31			
policy	0.31			
test	0.31			
Explained Variance	4.0%			
Eigenvalue	5.13			
Factor 2: BST Frame				
hormone		0.91		
milk		0.76		
bovine		0.70		
dairy		0.56		
dangerous		0.30		
Explained Variance		3.3%		
Eigenvalue		4.17		
Factor 3: Campaign Frame				
genetically			0.68	
ban			0.63	
alter			0.54	
campaign			0.51	
modify			0.39	
supporter			0.38	
approve			0.37	
opponent			0.30	
Explained Variance			3.1%	
Eigenvalue			3.98	
Factor 4: Frankenfoods Frame				
Frankenfoods				0.85
economy				0.68
herbicide				0.66
environment				0.61
natural				0.55
pesticide				0.54
Explained Variance				2.8%
Eigenvalue				3.63

Table 4.5. continued

Term	Factor 5	Factor 6	Factor 7	Factor 8
Factor 5: Europe Frame				
European	0.52			
unite	0.45			
Europe	0.45			
nation	0.42			
corn	-0.36			
gene	-0.32			
Explained Variance	2.7%			
Eigenvalue	3.48			
Factor 6: Agriculture Frame				
crop		0.52		
agricultural		0.45		
farmer		0.42		
agriculture		0.42		
plant		0.39		
environmental		0.31		
Explained Variance		2.4%		
Eigenvalue		3.11		
Factor 7: Science Frame				
scientist			0.48	
sell			-0.42	
science			0.38	
supermarket			-0.37	
research			0.37	
scientific			0.37	
university			0.33	
nature			0.32	
agribusiness			-0.31	
Explained Variance			2.2%	
Eigenvalue			2.87	
Factor 8: Roundup Frame				
Roundup				0.84
wheat				0.67
Monsanto				0.63
controversy				0.52
Explained Variance				2.2%
Eigenvalue				2.85

This factor explained 3.3% of the variance and had an eigenvalue of 4.17. Interestingly, this frame also included the word *dangerous,* which had an appreciable loading of 0.30. A KWIC search showed that the word was used in some of the stories related to rBST issues, such as its potential hazards and the debate raised by activists in Northern California to label milk produced from cows treated with rBST. However, the analysis of this word's inclusion necessarily takes a cautious approach, as the word itself appeared in only 21 of the 296 Northern California news articles, and not all of those stories discussed rBST. Furthermore, the term loaded at a lower value than the other terms. The KWIC search suggested the word's range of meaning in contributing to the BST frame. For example, a July 28, 1994, article in *The San Francisco Chronicle* about a proposal from consumer groups to track sales of rBST was strongly criticized by a milk industry official. "A list of who buys and uses it is useless information at best, and a dangerous invasion of privacy at worst," the official said.

The third factor, the campaign frame, involved words related to the various Northern California campaigns on GMO issues. Numerous campaigns to limit GM crops began in Northern California in 2003. Four of the seven terms obtained high loadings, including *genetically, ban, alter,* and *campaign*. The remaining three terms obtained appreciable loadings and included *modify, supporter,* and *approve*. The factor explained 3.1% of the variance and had an eigenvalue of 3.98.

The fourth factor, the *Frankenfood* frame, obtained high loadings on all of its six terms, including *Frankenfoods, economy, herbicide, environment, natural*, and *pesticide.* It accounted for 2.8% of the variance and had an eigenvalue of 3.63. With the inclusion of the word Frankenfoods, this frame highlighted the controversial aspects of GMOs. An

example of this frame appeared in a December 14, 1999 *The San Francisco Chronicle* news article (Protest in Oakland). Reporting on biotech protests in Oakland, the article noted that "opponents raised fears that the technique might create mutant foods capable of causing allergies in humans, or harming beneficial insects and plants….Several hundred protesters carrying butterfly posters and munching organic salads chanted, "Hey, hey, ho, ho, Frankenfoods have got to go."

The fifth factor was named the *Europe* frame, as it contained terms related to European discussions on GMOs. The factor obtained high loadings on four of its six terms, including *European, unite, Europe,* and *nation.* Appreciable loadings were obtained on the terms *corn* and *gene.* The EU ban on GMOs was of particular concern to Californians, as the state had $7.8 billion in export revenue in 2001 for agricultural products according to a May 25, 2003, article in the *San Francisco Chronicle*. Inclusion of the term *corn* further suggested the European controversy surrounding GMOs, as the issue of Bt corn was one of the most contentious in the EU debate. The GM corn is known as Bt corn for a bacterium gene that makes it toxic to the European corn borer. In 2003, it was reported in a September 16 article in the *San Jose Mercury News* that the moratorium in Europe had cost American corn growers $100 million to $300 million a year in sales. This factor accounted for 2.7% of the variance and had an eigenvalue of 3.48

The agricultural frame was the sixth factor, which obtained high loadings on four of its six terms, including *crop, agricultural, farmer,* and *agriculture.* The terms, *plant* and *environmental,* gained appreciable loadings. The factor explained 2.4% of the

variance and had an eigenvalue of 3.12. As California is the number one agricultural U.S. state, the relevancy of this frame is not surprising.

The seventh factor, the science frame, obtained high loadings on the first two of its terms, *scientist* and *sell.* This factor accounted for 2.2% of the variance and had an eigenvalue of 2.87. Appreciable loadings were obtained on the remainder of the terms, including *science, supermarket, research, scientific, university, nature,* and *agribusiness*. The inclusion of the words related to agri-business suggested the commercialized nature of science, particularly the science of biotech. As more and more university research has been funded by industry, research itself has become more commercialized, and research scientists serve multiple, sometimes competing interests (Krimsky, 1991, p.78). "It is no longer possible to draw clear lines of distinction between academic, government, and industry scientists," Krimsky observes (1991, p. 78).

The last factor, the Roundup frame, obtained high loadings from all of its four terms, including *Roundup, wheat, Monsanto,* and *controversy*. It explained 2.2% of the variance and had 2.85. The Roundup frame appeared to refer to the business of Monsanto. Interestingly, the term *controversy* appeared in this frame. In May 2004, Monsanto decided to halt plans to sell its controversial GM wheat, citing business reasons. A May 11, 2004, article in the *San Jose Mercury News* reported: "The decision follows the company's failure to introduce genetically modified wheat to Europe, Australia, Japan and elsewhere. The Canadian National Farmers' Union campaigned hard against such wheat, arguing it would destroy the market for conventional wheat across the world." As evident in some of the frames in the Northern California newspapers,

GMOs appeared to have drawn controversy in other ways, whether in ballot initiatives to ban them, or in their derogatory Frankenfood label.

Comparison of Regional Results

The results were analyzed to determine similarities and differences in how the news was framed in the different geographic regions.

First, both the Missouri newspaper and the Northern California newspaper shared a similar Safety frame. The frame in both regions comprised very similar terms. However, based on the factor analysis, the Safety frame in the Northern California news was the most relevant frame of all eight frames in the Northern California newspapers, suggesting perhaps heightened consumer concerns of GMOs existing in Northern California. In the Missouri news, it explained less variance and thus was less meaningful.

The BST frame also appeared in both the Missouri and the Northern California newspapers. The frame shared similar terms, but with one key difference. The term *dangerous* appeared in the Northern California BST frame, and in examining the news texts, the word referred in part to potential risks of the drug, which had been suggested by biotech opponents. However, the low frequency of the word's occurrence overall, as well as its lower loading, made it difficult to draw any firm conclusions. This frame was the most relevant of the all the frames in the Missouri newspaper. Indeed, BST was particularly critical to the St. Louis region, as it was Monsanto's first GM food-related product. In the Northern California news, it was less meaningful and contained fewer terms.

Another common frame was the science frame. In the Missouri newspaper, this frame was clearly more focused on the Cornell butterfly study that reported the toxin in Bt maize. Unlike the science frame in the Missouri newspaper, this frame in the Northern California newspapers included business-related terms, like *supermarket, sell,* and *agribusiness,* perhaps suggesting commercialization of scientific research.

The Roundup frame was another common frame. In the Northern California news, this frame was the least relevant but contained two terms, *wheat* and *controversy,* which did not appear in the Missouri newspaper. The Missouri newspaper included more terms overall. For Missouri, the business of Monsanto (one term used in the Missouri Roundup Frame) was of primary importance to the local economy.

The Europe frame was another common frame, but this frame contained differences between the two geographic locations. For St. Louis, the European story was framed in part with the word *fear*, which referred to European consumers' fears about the safety of GM foods and possible environmental damage that could occur from GM crops contaminating GM-free ones. *Fear* was not evident in the Northern California Europe frame.

The agriculture frame appeared in both the Missouri and Northern California newspapers. For the Northern California news, the term *environmental* was included, perhaps suggesting environmental concerns related to agriculture. Those concerns might not have been as prominent in the Missouri news, as the term was not included in how the Missouri newspaper framed agricultural issues.

Frames unique to the Northern California newspapers were the campaign frame and the Frankenfoods frame. GMO campaigns particularly dominated 2004 when voters

in several Northern California counties considered ballot initiatives to ban GM crops. Another frame unique to the Northern California news was the Frankenfoods frame, which although not particularly dominant, reflected the more controversial nature of GM foods in Northern California.

Frames unique to the Missouri newspaper were the StarLink frame and the environment frame. The StarLink frame referred to the contamination of the GM corn in the human food supply. The StarLink debacle was a setback for the biotechnology industry, which might explain why the story received attention in the Missouri news media. The StarLink corn episode may have been one of the "breakthrough" events that Priest and Ten Eyck (2004, p. 180) describe as specifically capturing local news media, at least in Missouri.

Also unique to the Missouri newspaper was the environment frame, which included the word *criticize*. Although weak overall, this frame reflected the activities various environmental groups, who criticized U.S. shipments of biotech foods to Africa and who criticized various approvals of GMOs.

Research Question 2: Frame Changes Over Time

Research Question 2 asked how the news frames change over time. In order to determine if the frames changed over time, news frames for the time period, from 1992-2004, were analyzed to determine what frame dominated the different years. The analysis also provided the number of articles on GMOs for each year in both of the geographical locations. In addition, the results indicated what frames dominate news coverage over the time period.

Northern California News

Figure 4.3 shows the number of the articles on the GM debate per year for the Northern California newspapers. Of the 296 articles, the most articles, 56 or 18.9 percent, appeared in 2004. The year 2000 was second with 47 articles or 15.9 percent. In fact, according to the table, the GMO topic increased steadily in news coverage beginning in 1999. From 1992 until 1998, only 54 articles appeared, while the 242 articles appeared from 1999 onward. In one previous study – this one of national newspaper coverage, however – peak years for news coverage of agri-biotechnology occurred from the mid-to-late 1990s and also 2000 (McInerney, Bird, & Nucci, 2004). Coverage was said to have dropped off after 2001 when fears of terrorism captured news headlines. This study presents contradictory findings with the peak year being 2004. However, previous studies were conducted before 2004 and so did not include news from about 2002 and beyond.

Only one article appeared in 1997, which in two previous studies was labeled as the peak year of coverage (Bauer et. al., 2001, p.35; Nisbet & Lewenstein, 2002). Yet, the heightened news coverage was attributed in part to the event of Dolly, the cloned sheep, which occurred in 1997. In this study, references to cloning were not included in the search terms.

Overall, the most dominant frame throughout the time period was the safety frame, followed by the agriculture, campaign, Europe, science, BST, frankenfood, and Roundup frames. The most dominant frame is the frame with the highest average occurrence of frame terms associated with the frame in the news articles across the 13-year time period. Table 4.6 illustrates the Northern California frames from most dominant

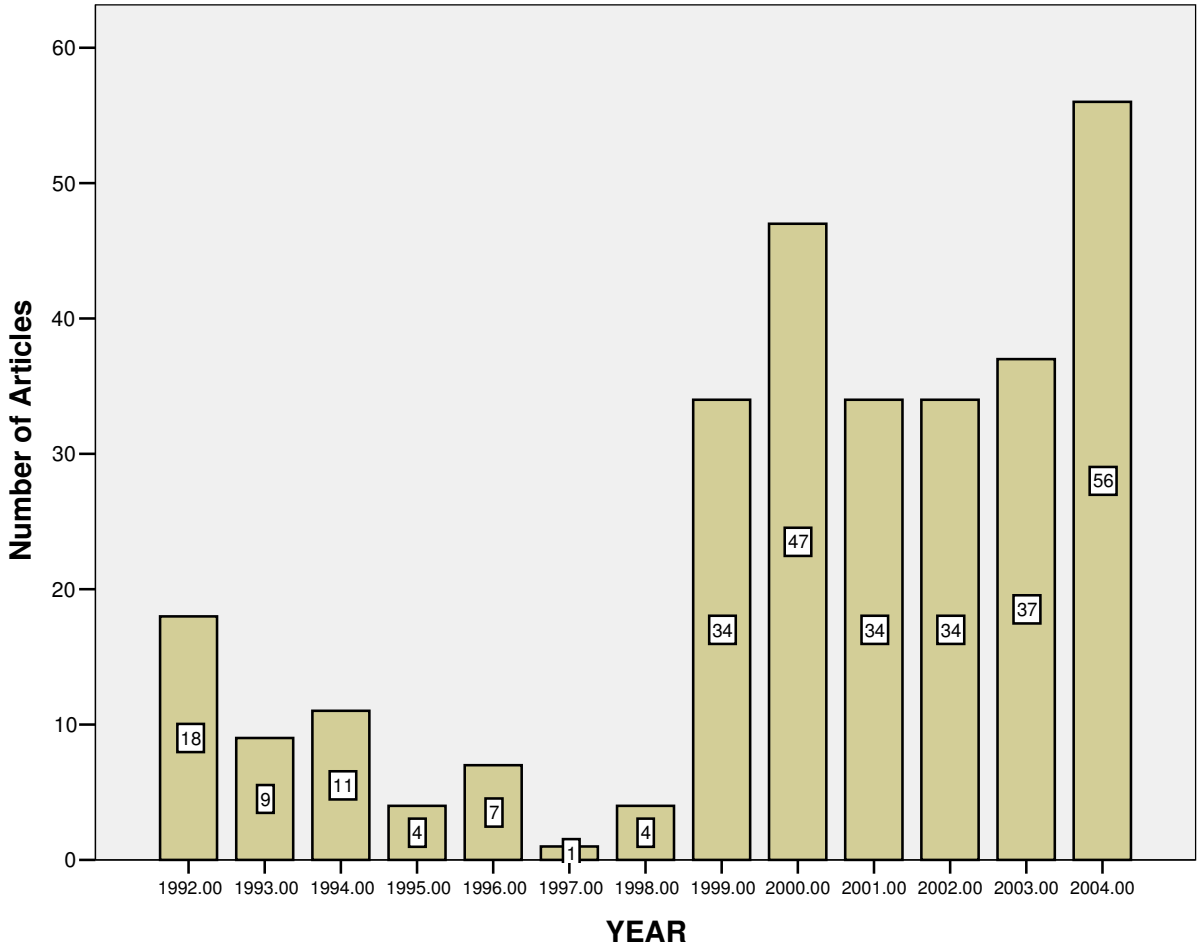

Figure 4.3. Total Number of Northern California News Articles by Year

Table 4.6. Frame Dominance in the Northern California News

Frame	Mean Occurrence
Safety	11.50
Agriculture	7.29
Campaign	5.32
Europe	4.67
Science	4.21
BST	1.86
Frankenfoods	1.67
Roundup	.73

to least dominant. The second column shows the mean occurrence of each frame in the Northern California news articles.

To determine how the frames changed over the course of the 13-year period, the frequency of the terms for each of the eight frames for the time period was obtained. Each frame was then examined by year – with the exception of the years 1992 through 1998. Because so few articles appeared from 1992 until 1998 in the Northern California news coverage, the total number of articles for that period (N=54) were grouped together to examine frame changes for that seven-year period.

The following tables and figures illustrate the frame changes. The first column in each table shows the year analyzed. The second column shows the number of GMO articles for each year. The third column shows the average frame terms occurrences per article each year. At the bottom of the third column is the total average occurrence of the frame over the 13-year period. The fourth column lists the total frequencies of term occurrence for the particular frame analyzed.

The figure, which accompanies each table, provides a graphic representation of the mean frequency of each frame in the Northern California news articles by year or year periods.

Based on the mean occurrence of the frame, the most dominant frame in the Northern California news over the 13 years was the Safety Frame, which had an average occurrence of 11.50. Table 4.7 shows how the Safety Frame changed over the course of the time period. For example, in the years 1992-1998, the 54 news articles included 906 safety frame terms. The average occurrence per news article was 16.80. Figure 4.4 provides a graphic illustration of how the safety frame changed over the 13 years.

Table 4.7. Summary Descriptive Statistics for Occurrences of Safety Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	16.80	906
1999	34	10.60	359
2000	47	14.49	681
2001	34	13.15	447
2002	34	9.80	333
2003	37	10.10	374
2004	56	5.41	303
Total	296		3403
Average		11.50	

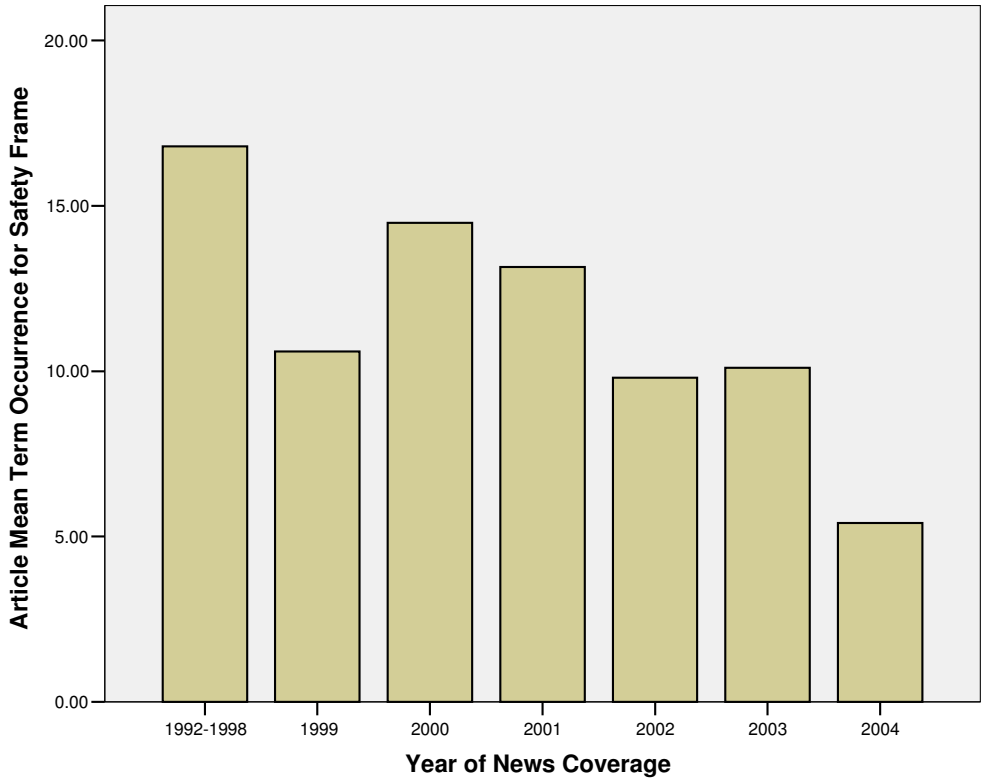

Figure 4.4. Mean Frequency Per Article of Safety Frame Terms in Northern California Newspapers By Year

However, the analysis also indicates that the safety frame seemed to dominate most in the early years of news coverage, more so than in the latter half of the time period. This finding might seem at odds with previous studies that have indicated a predominance of the economic prospect frame or a more positive tone, especially in the early years of news coverage (Gaskell, et. al., 1999; Nisbet & Lewenstein, 2002; Ten Eyck, Thompson, & Priest, 2001). Yet, the findings in this study might be the first indication of what Priest and Ten Eyck suggest in their 2003 study: that diverse perspectives on biotechnology may exist in greater degrees at the local level than what is reported in national newspapers. Priest (2001b) and Priest and Ten Eyck (2004) further suggest that controversy or resistance to the technology may initially emerge at the local or regional level. Thus, perhaps the prominence of the safety frame in the Northern California newspapers suggests that consumer concerns and questions about the risks involved with GM food and crops were important issues to readers in the Bay area and in nearby communities.

The next most dominant frame overall was the agriculture frame. Table 4.8 shows the agriculture frame and its changes over the years. A graphic representation of the frame appears in Figure 4.5. This frame showed consistency in appearance over the course of the 13-year time period, perhaps indicating the importance of agriculture to the state of California. During the entire period, the average occurrence of the frame per news article was 7.29. While this frame was the second most dominant overall, this frame was less meaningful according to the factor analysis.

Table 4.8. Summary Descriptive Statistics for Occurrences of Agriculture Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	8.15	440
1999	34	7.21	245
2000	47	6.02	283
2001	34	7.06	240
2002	34	7.06	240
2003	37	7.81	289
2004	56	7.50	420
Total	296		2157
Average		7.29	

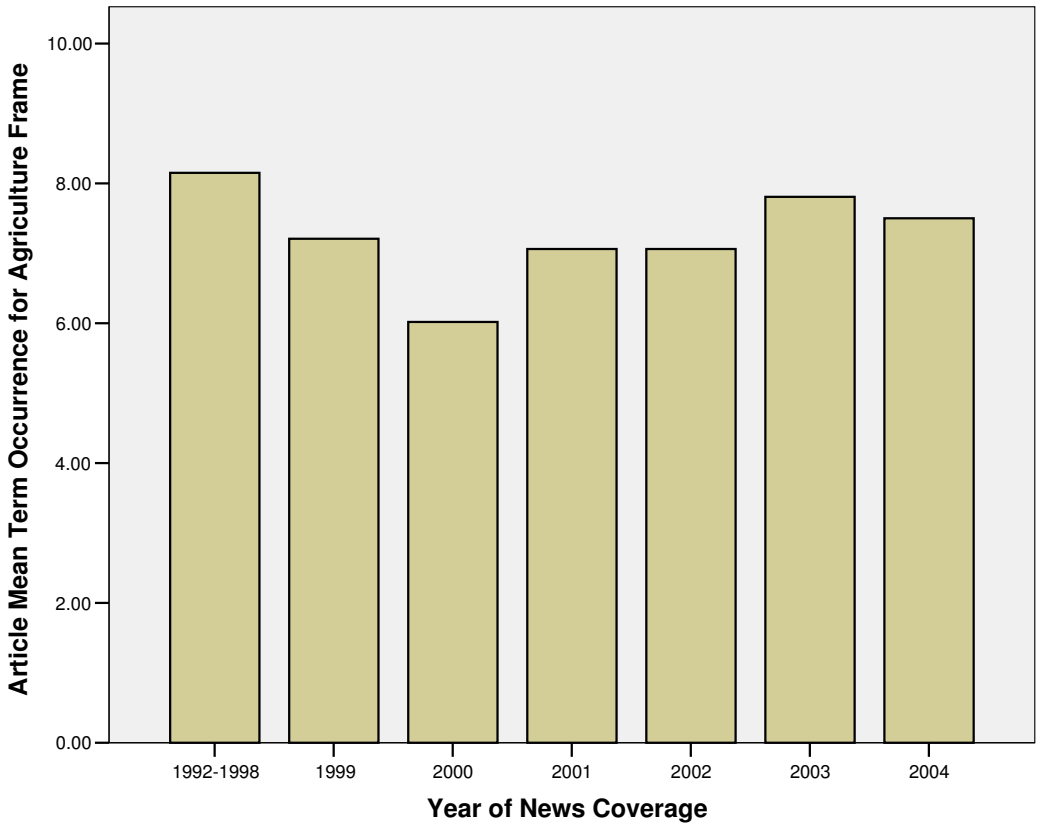

Figure 4.5. Mean Frequency Per Article of Agriculture Frame Terms in Northern California Newspapers By Year

The next most dominant frame was the campaign frame, which had an average occurrence of 5.32. Most of this, however, appeared to have occurred in 2004. That year, the 56 news articles included 412 campaign frame terms for an average occurrence of 7.36, the highest of all the years analyzed. The results indicate the impact of the large number of campaign events in Northern California in 2004 related to GM issues, including the ballot initiatives to ban GM crops. This frame was also the second strongest based upon the variability scores in the factor analysis. Table 4.9 and Figure 4.6 show how the campaign frame changed over the course of the 13-year time period

The Europe frame was the next most dominant frame overall, with a mean occurrence of 4.67. Like the Frankenfoods frame, the Europe frame showed consistency in terms of its occurrence across the time period, with peaks in 1999, 2001, and 2003. The "de facto" moratorium on GMOs was made official in June 1999 when five "member states" of the European Union – Denmark, France, Greece, Italy, and Luxembourg – issued a declaration that they would effectively block new GMO approvals until the European Commission proposed legislation for traceability and labeling of GMOs and products made from them. The United States filed suit against the European Union under World Trade Organization rules in May 2003. The suit was intended to force open the European market to imported modified food. In April 2004, the EU ban was lifted. The ban was a concern for California, as the state had $7.8 billion in export revenue in 2001 for agricultural products, according to a May 25, 2003, article in the *San Francisco Chronicle*. Table 4.10 shows the Europe frame over the 13-year time period. A graphic representation appears in Figure 4.7.

Table 4.9. Summary Descriptive Statistics for Occurrences of Campaign Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	3.92	211
1999	34	5.53	188
2000	47	6.11	287
2001	34	4.18	142
2002	34	4.38	149
2003	37	5.00	185
2004	56	7.36	412
Total	296		1574
Average		5.32	

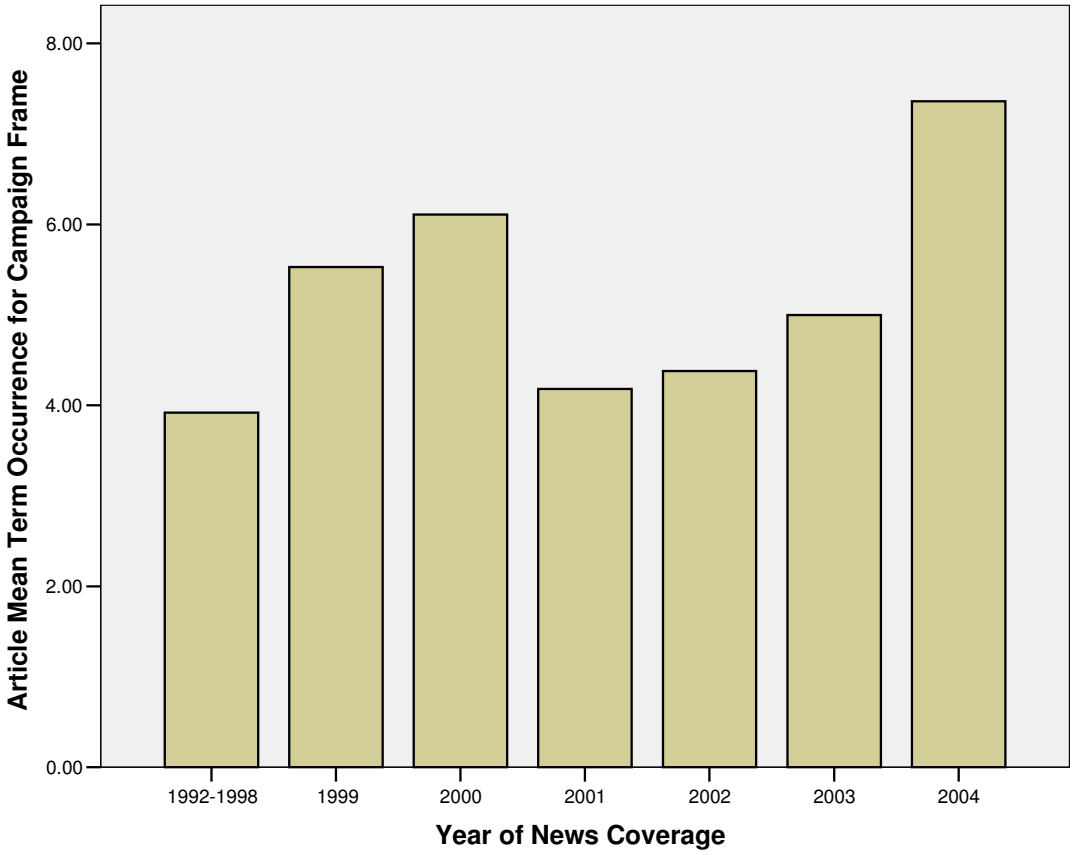

Figure 4.6. Mean Frequency Per Article of Campaign Frame Terms in Northern California Newspapers By Year

Table 4.10. Summary Descriptive Statistics for Occurrences of Europe Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	3.24	175
1999	34	6.53	222
2000	47	5.13	241
2001	34	6.68	227
2002	34	3.79	129
2003	37	6.65	246
2004	56	2.54	142
Total	296		1382
Average		4.67	

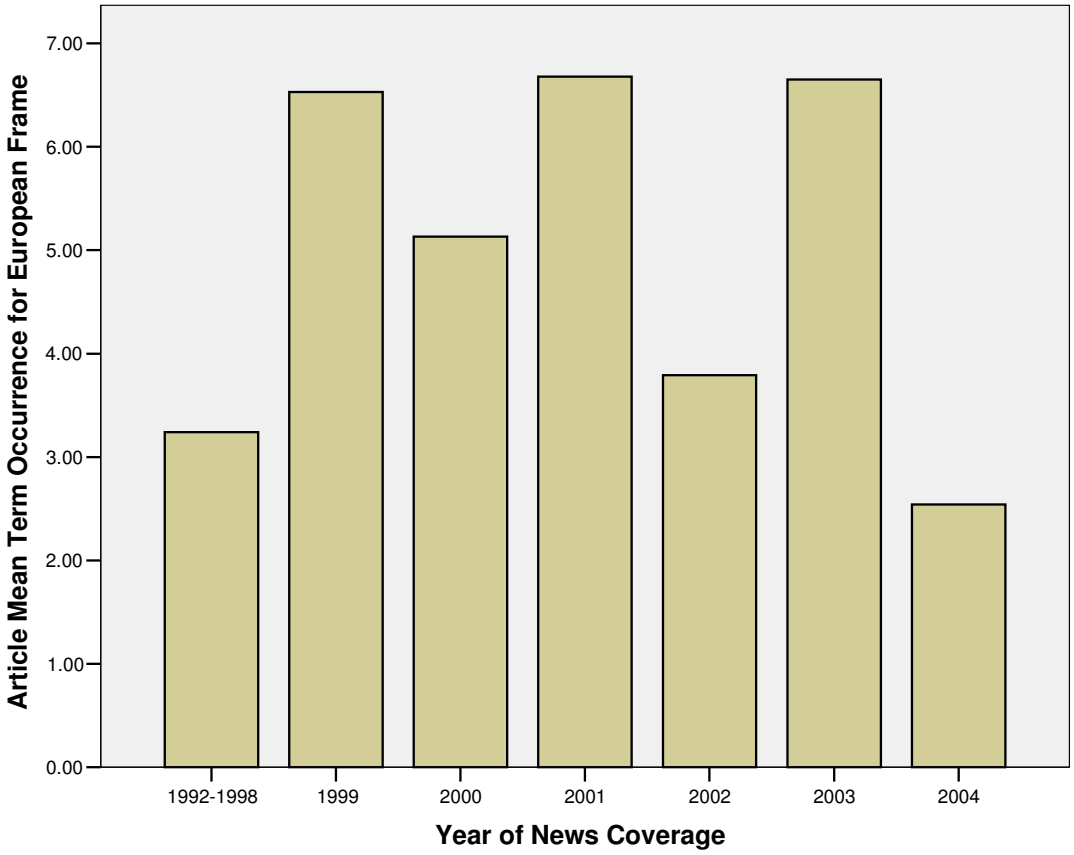

Figure 4.7. Mean Frequency Per Article of Europe Frame Terms in Northern California Newspapers By Year

The science frame closely followed the Europe frame in dominance, with an average occurrence of 4.21 overall. Table 4.11 shows the science frame over the 13-year time period. A graphic representation of this appears in Figure 4.8. This frame was consistent in terms of its occurrence across the time period. However, 2001 saw the highest average occurrence of new articles with the science frame. In other words, of the 34 news articles in 2001, the average occurrence of the frame per news articles was 7.35. This may reflect a reaction to the StarLink corn contamination of taco shells in 2000 and hence a greater public demand in Northern California, at least, for higher science standards to play a role in biotech issues. Further, recalling that the science frame in the Northern California newspapers contained a commercial angle with words like *supermarket* and *sell*, it may reflect the retail response to the StarLink episode, as retailers pulled taco shells and corn chips from supermarket shelves. The StarLink corn episode may have been one of the "breakthrough" events that Priest and Ten Eyck (2004, p. 180) describe as specifically capturing local news media.

Table 4.12 and Figure 4.9 show how the BST frame changed over the 13-year period. After the science frame, the BST frame was the next most dominant frame with an average occurrence of 1.86. In the years 1992-1998, the 54 news articles included 331 BST frame terms. The average occurrence per news article for those years was 6.12, the highest of all the time periods. The 1992-1998 time period represents the time when the growth hormone was introduced to farmers as a way to increase milk production in dairy cows. In 1995, the milk was made available to consumers.

After the BST frame, the Frankenfoods frame was the next most dominant with an average occurrence of 1.67. Based on the analysis, the appearance of the Frankenfoods

Table 4.11. Summary Descriptive Statistics for Occurrences of Science Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	4.26	230
1999	34	5.26	142
2000	47	5.21	245
2001	34	7.35	250
2002	34	4.97	169
2003	37	4.41	163
2004	56	3.50	196
Total	296		1395
Average		4.21	

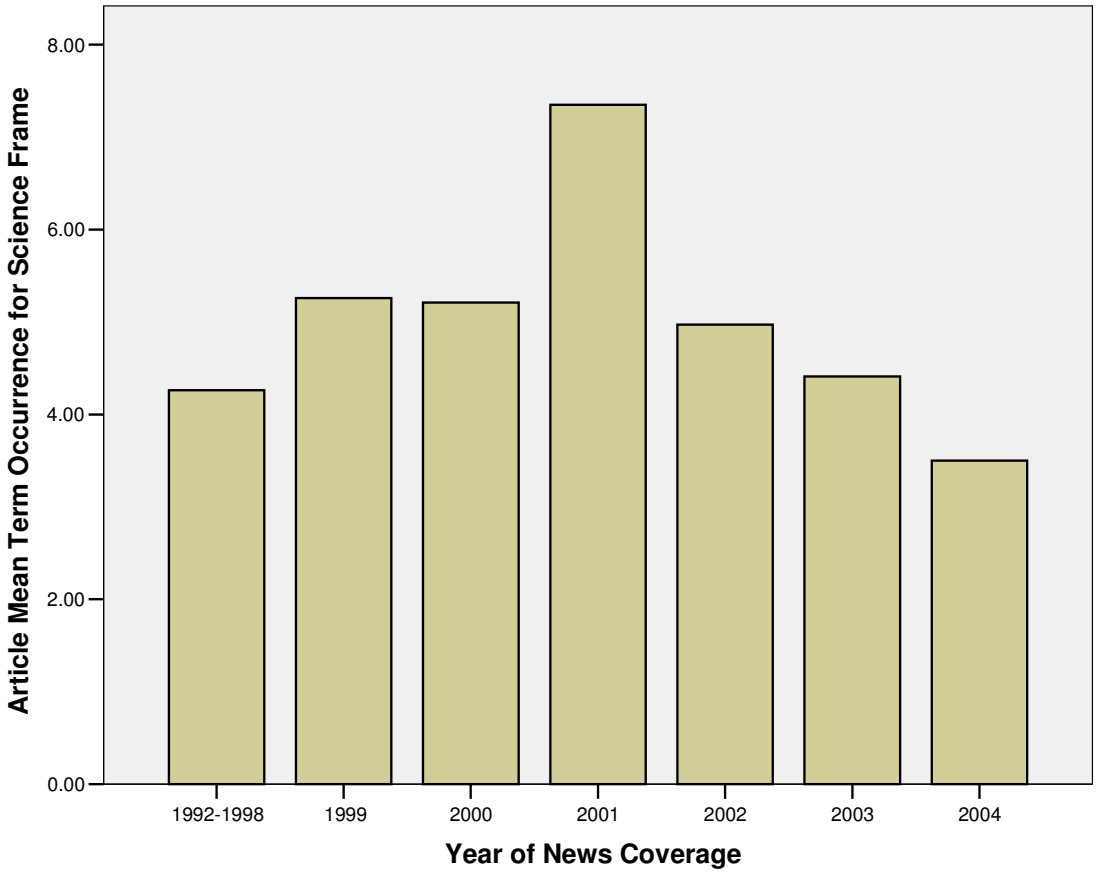

Figure 4.8. Mean Frequency Per Article of Science Frame Terms in Northern California Newspapers By Year

Table 4.12. Summary Descriptive Statistics for Occurrences of BST Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	6.12	331
1999	34	1.68	57
2000	47	.60	28
2001	34	1.06	36
2002	34	.38	13
2003	37	.38	14
2004	56	1.27	71
Total	296		550
Average		1.86	

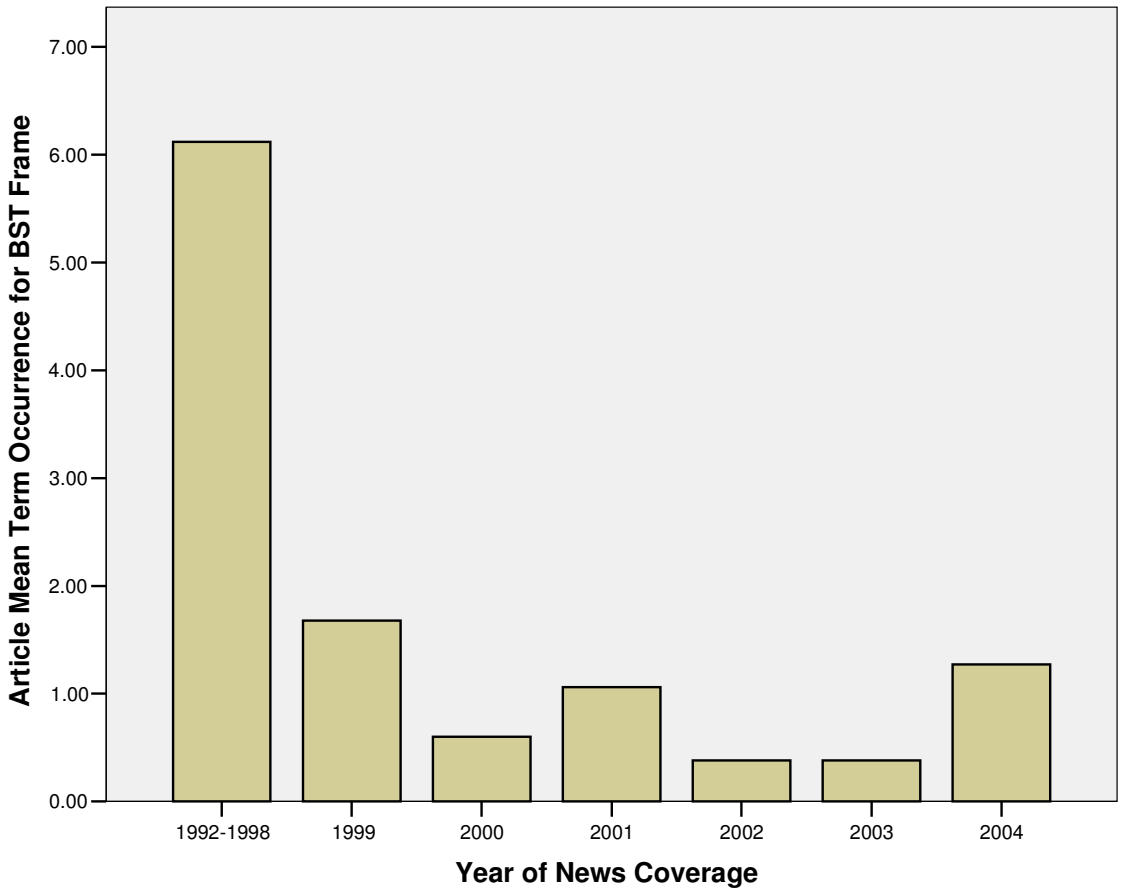

Figure 4.9. Mean Frequency Per Article of BST Frame Terms in Northern California Newspapers By Year

Frame remained fairly consistent across the time period. The peak years of this frame were 1992 to 1998, which compares favorably with the peak of the safety frame during this time period. Table 4.13 and Figure 4.10 illustrate how the Frankenfoods frame changed over the time period.

The least dominant frame was the Roundup frame, with an average occurrence of only .73. This aligns with the factor analysis wherein this frame or factor explained the least amount of variance overall. According to the analysis, the year 2004 saw the most news articles containing the Roundup frame, but it occurred an average of only 1.16 times. Again, the results of the analysis – both factor and frame changes – suggest this frame consisting of the business of Monsanto is the weakest of all the frames in the Northern California news stories. Table 4.14 and Figure 4.11 illustrate the Roundup frame over the 13-year time period.

To summarize the frame changes in the Northern California newspapers, the most dominant frame – the frame that appeared the most throughout the 13-years – was the safety frame. This frame was most evident during the 1992-1998 time period and also in 2000 and 2001. The agriculture frame was the next most dominant, followed by the campaign frame. The Europe frame and the science frame followed next. The least dominant frames were the BST frame, which showed the most evidence during the period from 1992 to 1998 when BST was the focus of federal regulators, consumers, and the producers of BST; and the Frankenfoods and Roundup frames, which both remained at consistently low levels throughout the 13-year period of news coverage.

Table 4.13. Summary Descriptive Statistics for Occurrences of Frankenfoods Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	2.16	117
1999	34	1.71	58
2000	47	1.36	64
2001	34	1.94	66
2002	34	1.47	50
2003	37	1.86	69
2004	56	1.25	70
Total	296		494
Average		1.67	

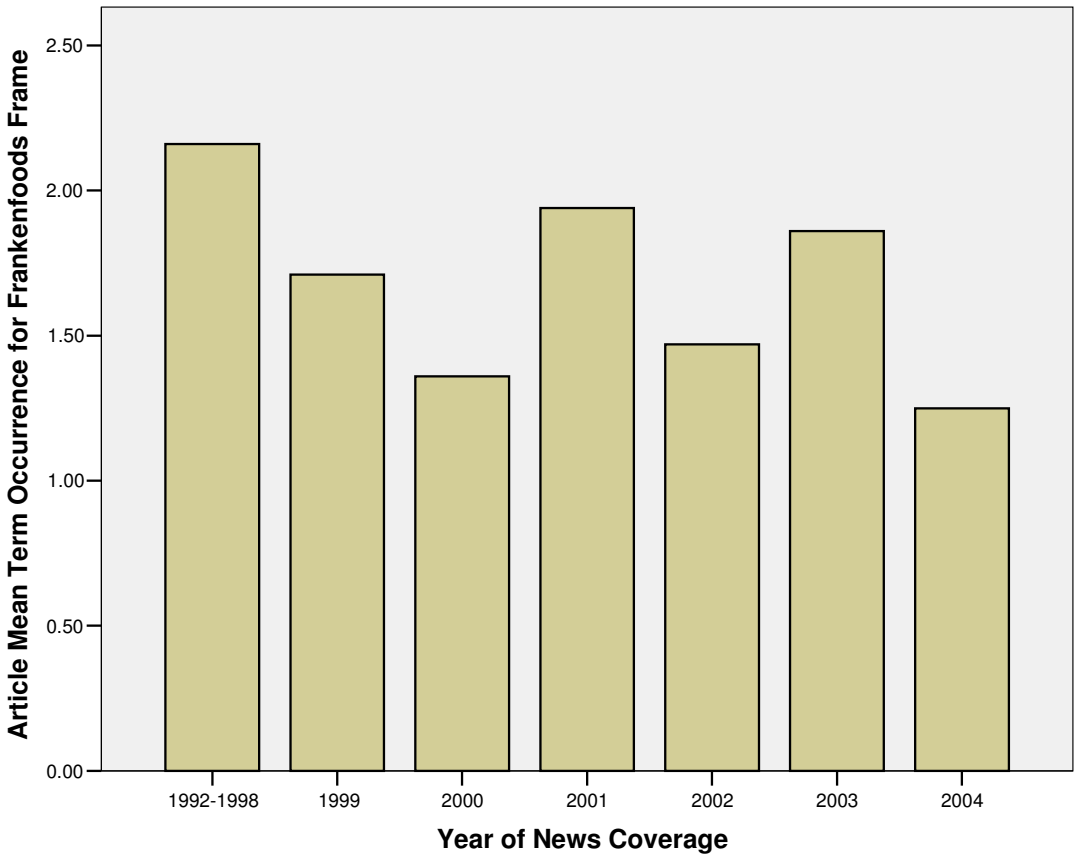

Figure 4.10. Mean Frequency Per Article of Frankenfoods Frame Terms in Northern California Newspapers By Year

Table 4.14. Summary Descriptive Statistics for Occurrences of Roundup Frame Terms in Northern California Newspapers

Year	*n*	Mean/Article	Sum
1992-1998	54	.67	36
1999	34	.65	22
2000	47	.45	21
2001	34	.59	20
2002	34	.76	26
2003	37	.70	26
2004	56	1.16	65
Total	296		216
Average		.73	

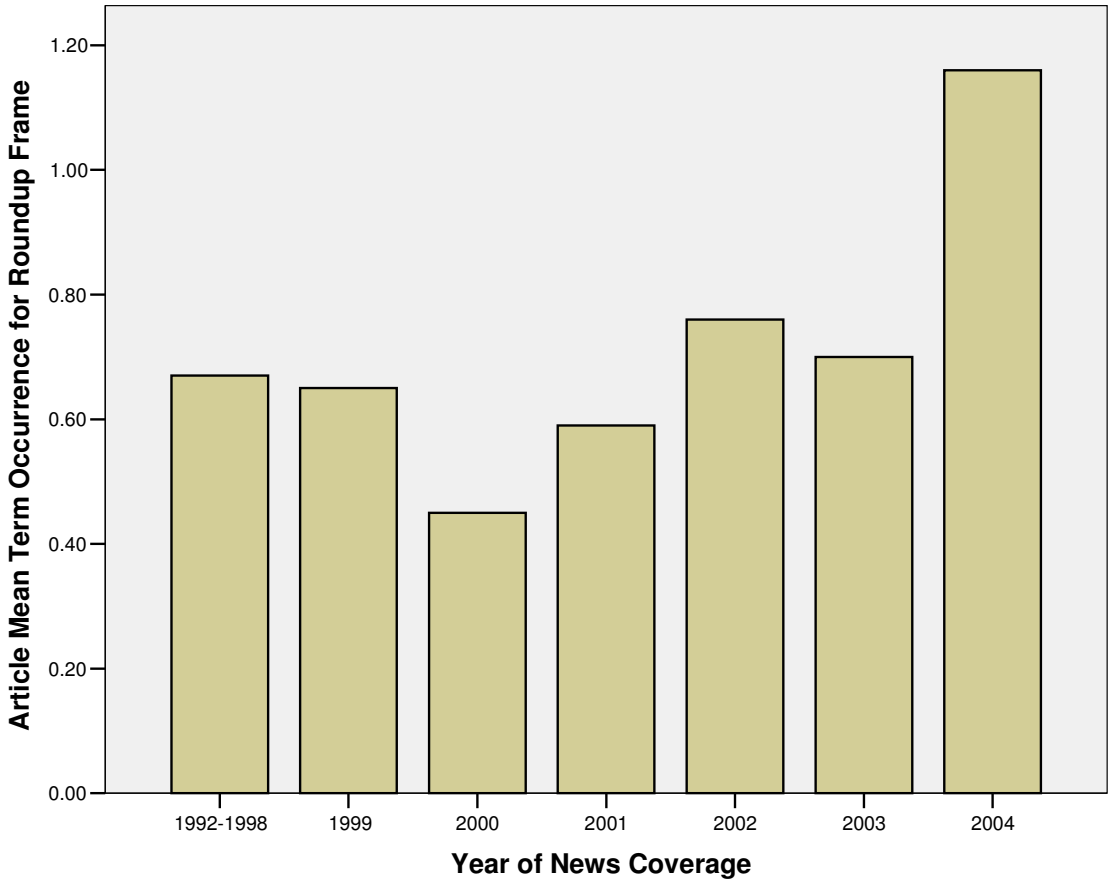

Figure 4.11. Mean Frequency Per Article of Roundup Frame Terms in Northern California Newspapers By Year

Missouri News

Figure 4.12 shows the number of the articles on GMOs per year for the *St. Louis Post-Dispatch*. Of the 860 articles, the most articles, 156 or 18.1 percent, appeared in 2004, like in the Northern California newspapers. The year 2000 was second with 137 articles or 15.9 percent. In fact, according to the table, the GMO topic increased steadily throughout the 13-year period. The fewest articles appeared in 1992.

Frame changes were analyzed for the 13-year time period. The years 1992 and 1993 were combined, as 1992 had only 13 articles and 1993 had only 16 articles. Thus, a total of 29 articles were examined for these years. Also combined were the years 1996 and 1997 because 1997 had only 18 articles. The year 1997 was combined with the closest corresponding year with the fewest articles. Thus, 1997 was combined with 1996, which had 46 articles, instead of 1998, which had 65 articles.

Overall, the most dominant frame throughout the time period was the roundup frame, followed by the Europe, safety, BST, StarLink, agriculture, science and environment frames. The most dominant frame is the frame with the highest average occurrence of frame terms associated with the frame in the news articles across the 13-year time period. Table 4.15 illustrates the Missouri frames from most dominant to least dominant. The second column shows the mean occurrence of each frame in the *St. Louis Post-Dispatch* news articles.

Table 4.16 and Figure 4.13 show the Roundup frame, which of all the eight frames, appeared to dominate the most throughout the 13-year time period, with a total mean occurrence of news articles of 14.70. This frame appeared to refer specifically to the business of Monsanto: Roundup Ready soybean, Roundup Ready herbicide, seeds,

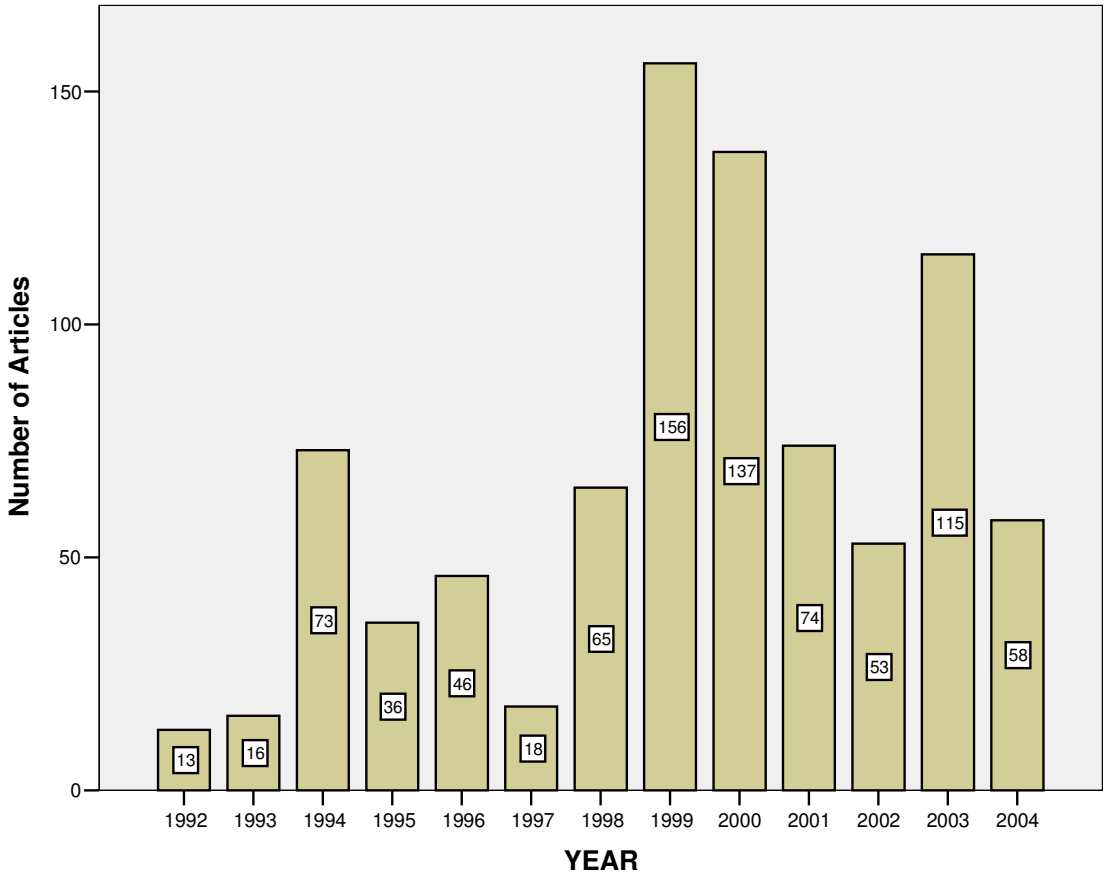

Figure 4.12. Total Number of Missouri News Articles by Year

Table 4.15. Frame Dominance in the Missouri News

Frame	Mean Occurrence
Roundup	14.70
Europe	8.37
Safety	8.35
BST	8.27
StarLink	5.23
Agriculture	4.30
Science	3.24
Environment	1.05

Table 4.16. Summary Descriptive Statistics for Occurrences of the Roundup Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	9.86	286
1994	73	7.58	553
1995	36	12.92	465
1996-1997	64	18.98	1215
1998	65	29.08	1890
1999	156	13.98	2181
2000	137	11.62	1592
2001	74	15.80	1169
2002	53	12.57	666
2003	115	13.09	1505
2004	58	19.33	1121
Total	860		12643
Average		14.70	

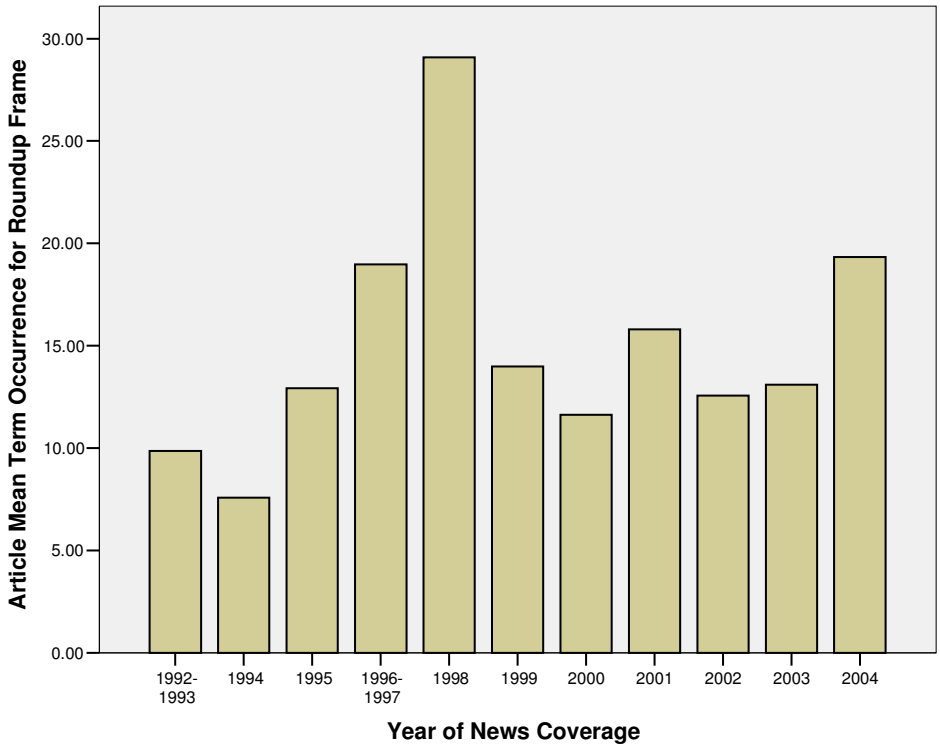

Figure 4.13. Mean Frequency Per Article of Roundup Frame Terms in Missouri Newspaper

crops, cotton, plants, and the term *Monsanto* itself. The dominance of this frame in news coverage is perhaps not surprising given that Monsanto has its headquarters in St. Louis; clearly, the business of Monsanto is important to readers there. This frame appeared to dominate most in 1998 with an average occurrence of 29.08. Also dominant were the years 1996 and 1997, suggesting the effects of Monsanto's introduction of Roundup Ready soybean. In contrast, the Northern California Roundup frame was less dominant than the Missouri Roundup frame. Further, it did not specifically refer to Monsanto and included the word *controversy*.

The Europe frame was the next most dominant, with a mean occurrence of 8.37. This frame appeared to dominate 1998, with an average occurrence of the news articles of 12.97. This corresponds with the 1998 European moratorium on GMOs. In fact a December 27, 1998, article in the *St. Louis Post-Dispatch* called 1998, "a watershed in biotechnology's global march." Also dominant were 2003, with an average of 10.29, and 1999, with an average of 10.25. These findings are illustrated in Table 4.17 and Figure 4.14. For the *St. Louis Post-Dispatch*, the European frame included the word *fear*, while the frame in the Northern California news did not. Perhaps more than any other area in the country, the St. Louis area had a vested economic interest in seeing favorable acceptance of GMOs in Europe, as Monsanto had an obvious stake in the outcome of the European situation.

The safety frame was the third most dominant frame, with a mean occurrence of 8.35, which follows very closely to the Europe frame. According to Table 4.18 and Figure 4.15, the safety frame was most dominant in 2002 and in 1999, with mean occurrences of news articles of 11.32 and 10.84, respectively. In fact, since 1998, the

Table 4.17. Summary Descriptive Statistics for Occurrences of the Europe Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	4.45	129
1994	73	2.00	146
1995	36	2.47	89
1996-1997	64	5.13	328
1998	65	12.97	843
1999	156	10.25	1599
2000	137	8.69	1190
2001	74	8.04	595
2002	53	9.79	519
2003	115	10.29	1183
2004	58	9.98	579
Total	860		7200
Average		8.37	

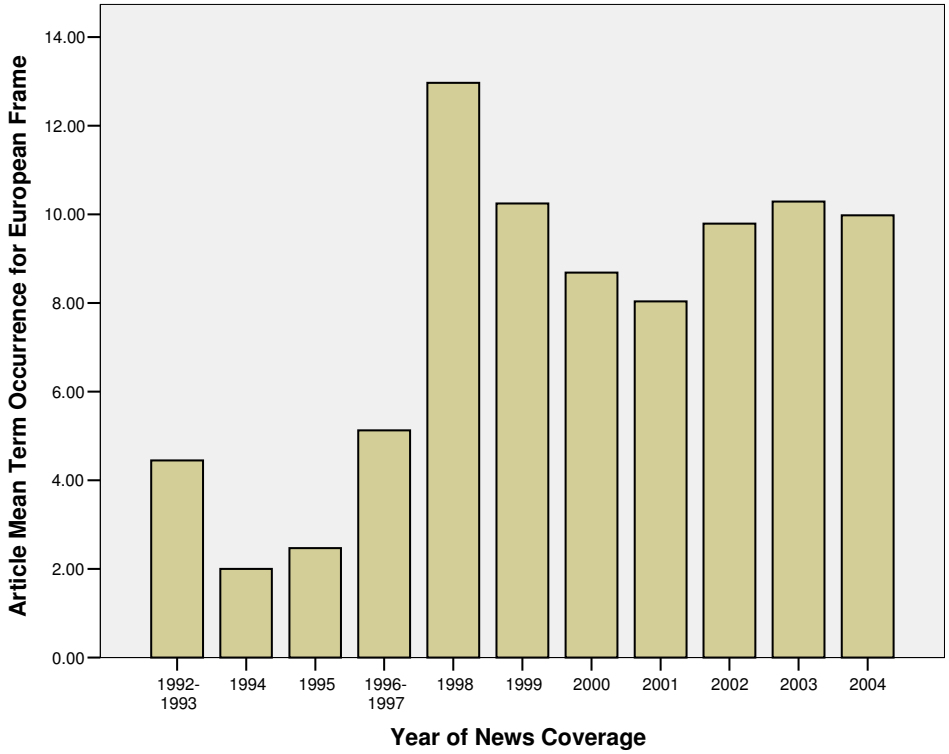

Figure 4.14. Mean Frequency Per Article of Europe Frame Terms in Missouri Newspaper

Table 4.18. Summary Descriptive Statistics for Occurrences of the Safety Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	9.17	266
1994	73	6.45	471
1995	36	4.56	164
1996-1997	64	5.11	327
1998	65	8.52	554
1999	156	10.84	1691
2000	137	9.03	1237
2001	74	9.70	718
2002	53	11.32	600
2003	115	7.68	883
2004	58	4.69	272
Total	860		7183
Average		8.35	

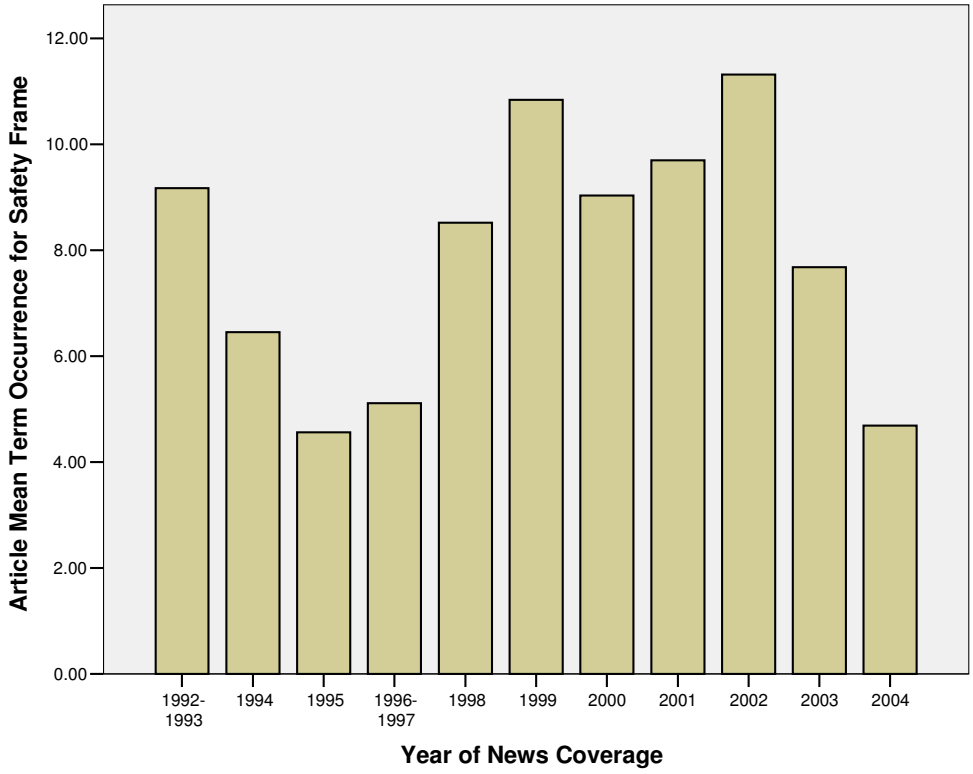

Figure 4.15. Mean Frequency Per Article of Safety Terms in Missouri Newspaper

frame appeared to increase in prominence until 2004, when it dropped off again. These findings are at odds with the safety frame in the Northern California newspapers, where safety appeared to dominate most in the early years. Yet, the findings are similar to findings in studies of national newspapers, where concerns about safety were raised in the late 1990s after the cloning of Dolly the sheep and when the initial early furor of biotechnology's economic prospect died down (Nisbet & Lewenstein, 2002; Priest, 2001a).

The next most dominant frame was the BST frame, which occurred an average of 8.27 times in the Missouri newspaper. In analyzing the frame changes, the dominant years for the frame were from 1992-1994, which coincides with the 1993 FDA approval of BST to be used in milk production. Clearly, biotech news coverage at the *St. Louis Post-Dispatch* during those years focused primarily on the developments related to BST. The year 1995 was also prominent for the BST Frame, but thereafter, the frame was less evident in GMO news coverage. Table 4.19 and Figure 4.16 show the changes of the BST Frame over the 13-year time period.

The StarLink Frame had an average occurrence of 5.23 in the Missouri newspaper. The frame is illustrated in a Table 4.20 and Figure 4.17. The dominant years appeared to be 2000 and 2001, with mean occurrences of news articles of 9.72 and 8.65, respectively. During 2000, traces of the Starlink corn were found in taco shells and other foods, causing large recalls and curtailing American corn exports. This specific frame did not appear in the Northern California newspapers. Clearly, the StarLink controversy was important to the St. Louis biotech region.

Table 4.19. Summary Descriptive Statistics for Occurrences of BST Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	29.00	777
1994	73	36.01	2633
1995	36	19.30	696
1996-1997	64	11.00	704
1998	65	4.42	287
1999	156	4.31	673
2000	137	3.18	436
2001	74	2.97	220
2002	53	5.45	289
2003	115	2.70	311
2004	58	1.55	90
Total	860		7116
Average		8.27	

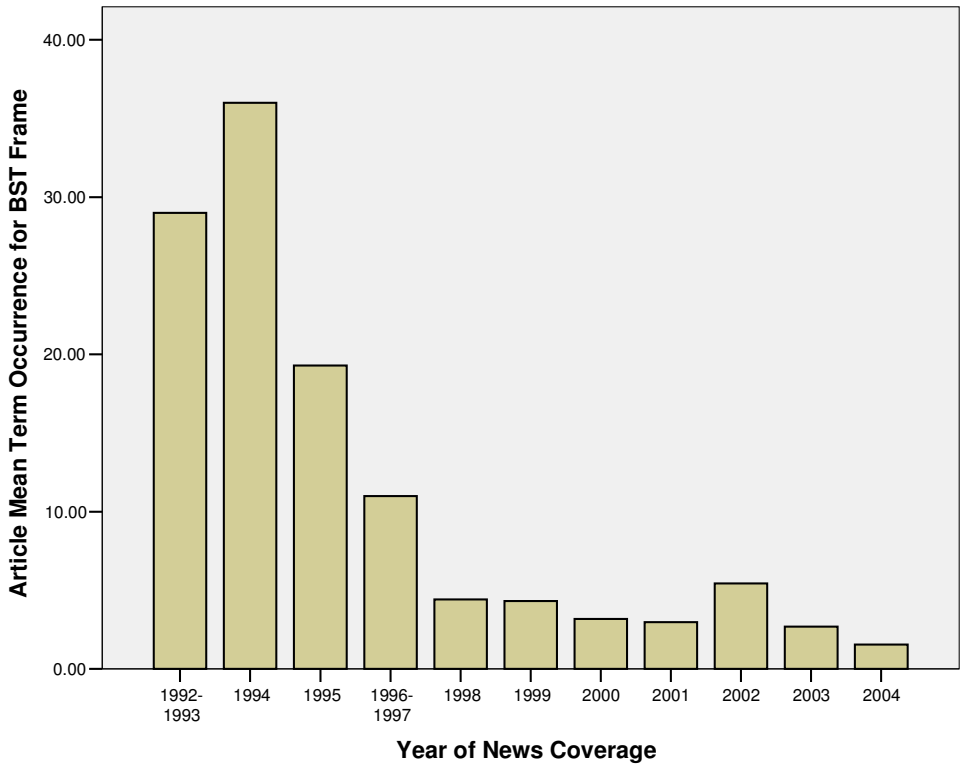

Figure 4.16. Mean Frequency Per Article of BST Frame Terms in Missouri Newspaper

Table 4.20. Summary Descriptive Statistics for Occurrences of the StarLink Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	2.66	77
1994	73	1.53	112
1995	36	1.83	66
1996-1997	64	4.92	315
1998	65	4.60	299
1999	156	4.25	663
2000	137	9.72	1332
2001	74	8.65	640
2002	53	5.24	278
2003	115	3.41	392
2004	58	5.62	326
Total	860		4500
Average		5.23	

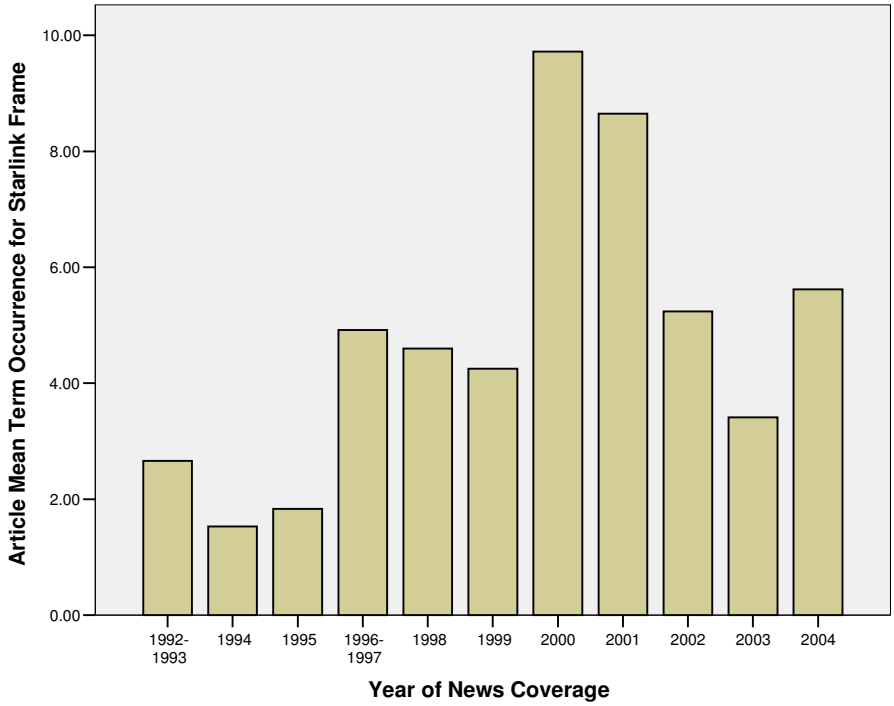

Figure 4.17. Mean Frequency Per Article of StarLink Terms in Missouri Newspaper

Table 4.21 and Figure 4.18 show how the agriculture frame operated throughout the time period in the Missouri newspaper. This frame had an average occurrence of 4.30 overall. Its appearance was fairly consistent across the period, with the highest mean occurrence, 7.37, occurring in 1998. Clearly, agriculture is an important topic to the state of Missouri, so it is not surprising that the frame is evident throughout the period. In 1998, specifically, organic farmers and supporters led a revolt against the U.S. Agriculture Department's allowing modified foods to be labeled organic. Later the USDA backed down, saying GM foods cannot be labeled organic. Also in 1998, the USDA patented the terminator seed technology, which renders the seeds of crops sterile so that they can't be collected and saved. These events might have triggered the spike in the agriculture frame in 1998. The agriculture frame included the term *USDA*, suggesting the focus of this particular frame might have been the activities of the Agriculture Department.

The science frame was near the bottom of the list in terms of frame dominance, with an average occurrence overall of 3.24. According to Table 4.22 and Figure 4.19, the science frame shows fairly consistent evidence throughout the time period. The frame was most dominant, however, from 1998-2002. This time period coincides with the 1999 Monarch butterfly study conducted by Cornell scientists. The study found that Bt corn produces pollen poisonous to moth and butterfly larvae. While the science frame in the Northern California newspapers contained a commercial angle, the science frame in the *St. Louis Post-Dispatch* did not, but instead included terms related to the Bt corn study, such as *butterfly*, *toxin*, and *study*.

Table 4.21. Summary Descriptive Statistics for Occurrences of the Agriculture Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	3.93	114
1994	73	4.48	327
1995	36	3.47	125
1996-1997	64	4.10	260
1998	65	7.37	479
1999	156	3.54	552
2000	137	3.93	539
2001	74	4.35	322
2002	53	4.64	246
2003	115	4.85	558
2004	58	3.05	177
Total	860		3699
Average		4.30	

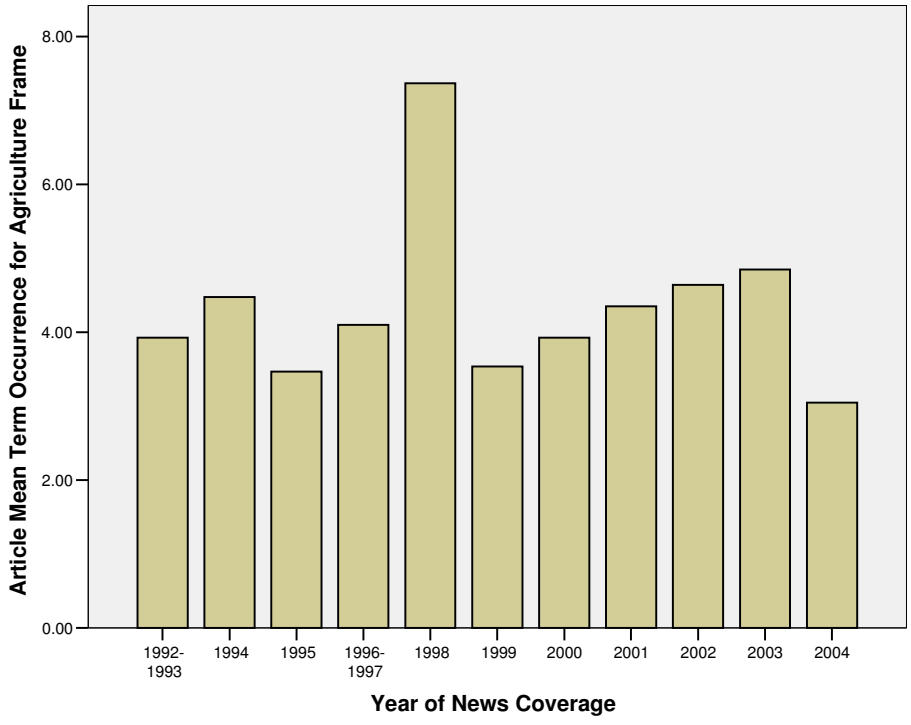

Figure 4.18. Mean Frequency Per Article of Agriculture Terms in Missouri Newspaper

Table 4.22. Summary Descriptive Statistics for Occurrences of the Science Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	2.10	61
1994	73	1.60	114
1995	36	1.89	68
1996-1997	64	1.81	116
1998	65	3.57	232
1999	156	4.70	732
2000	137	4.60	630
2001	74	4.01	297
2002	53	4.42	234
2003	115	2.68	309
2004	58	2.57	149
Total	860		2942
Average		3.42	

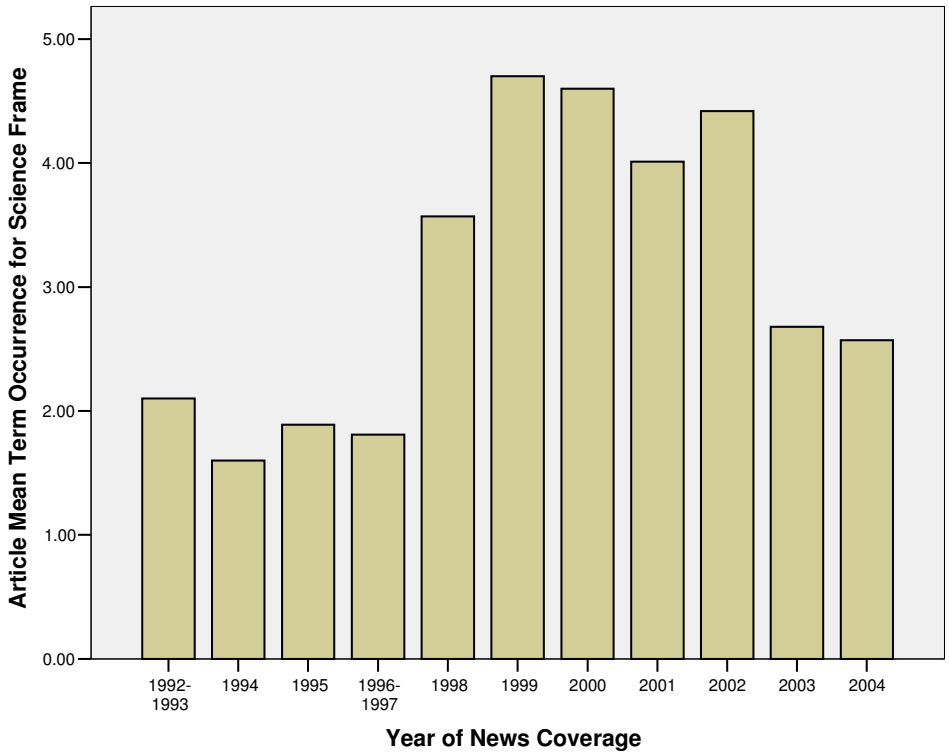

Figure 4.19. Mean Frequency Per Article of Science Frame Terms in Missouri Newspaper

The least dominant frame was the environment frame, with an average occurrence overall of 1.05. Table 4.23 and Figure 4.20 illustrate the frame changes over time. The frame's occurrence in news coverage in the *St. Louis Post-Dispatch* does not appear to be particularly significant overall. The highest mean occurrence of news articles with the frame was only 1.87, which was in 2002. The other dominant years were 1999 and 2000. This frame included the word *criticize*, suggesting environmentalists' criticism of GMOs. In an August, 31, 2002, article it was reported in the *St. Louis Post-Dispatch* that some African nations were not accepting shipments of biotech foods because of the concerns of the safety of GM foods. The USDA blamed environmental groups and biotech opponents for influencing southern African countries' decision to refuse U.S. aid. In 1999, the Cornell study on Bt maize was released drawing heavy criticism from environmental groups. A March 1, 1999, editorial in the *St. Louis Post-Dispatch* said: "As the forces driving the biotechnology revolution advance upon the citizens of the world, they are being thwarted by powerful counter-forces: ignorance, fear and legitimate skepticism." In 2000, the StarLink corn case drew criticism from environmental groups.

To summarize the frame changes in the Missouri newspaper, the most dominant frame – the frame that appeared the most throughout the 13-years – was the Roundup frame, suggesting the dominant focus on the work of Monsanto. This frame, and the agriculture frame, was most evident in 1998, a year that has been referred to as a "watershed" for the biotechnology. The early years of the "green" biotechnology story in the Missouri area were dominated by the BST story, until at least 1995. The mid-to-late 1990s focused on the issues associated with the introduction of GMOs in the

Table 4.23. Summary Descriptive Statistics for Occurrences of the Environment Frame Terms in the *St. Louis Post-Dispatch*

Year	*n*	Mean/Article	Sum
1992-1993	29	.55	16
1994	73	.41	30
1995	36	.64	23
1996-1997	64	.50	32
1998	65	1.11	72
1999	156	1.33	208
2000	137	1.38	189
2001	74	.96	71
2002	53	1.87	99
2003	115	.90	104
2004	58	1.05	61
Total	860		905
Average		1.05	

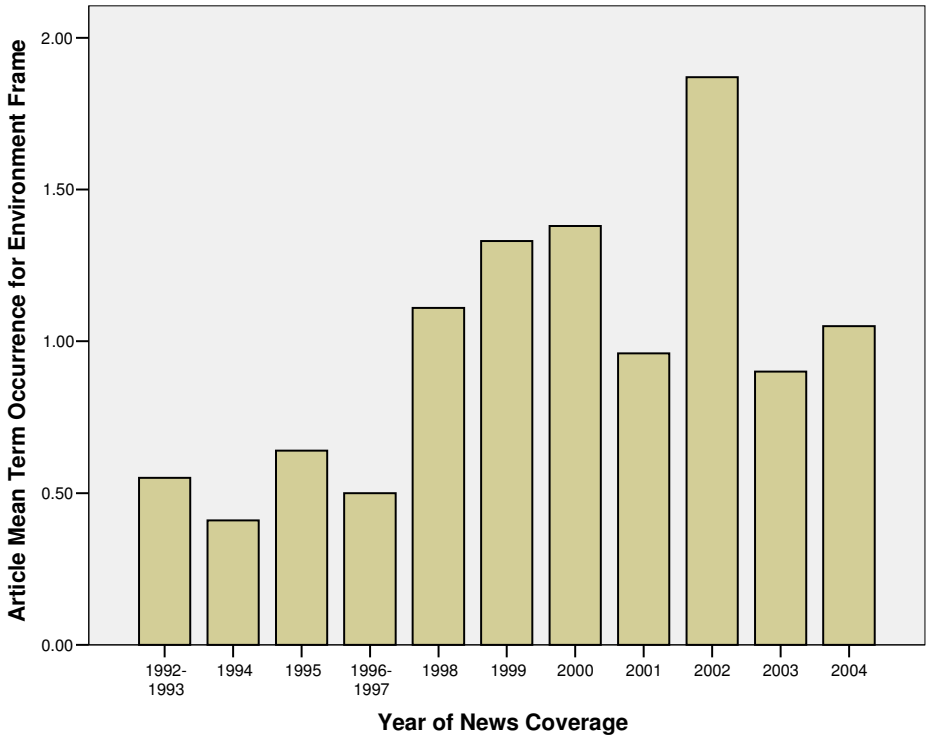

Figure 4.20. Mean Frequency Per Article of Environment Terms in Missouri Newspaper

European Union. The frame of safety appeared to increase in the late 1990s until 2003. The StarLink controversy dominated 2000 and 2001. The science and environment frames remained relatively constant throughout the period, although both were weakest in evidence overall.

Comparison of Frame Changes

Investigating the changes further, the researcher found some changes were similar across frames, while some changes offered contrasts among the frames. For example, the BST frame in both the Missouri and Northern California news appeared to dominate early on and then decline over time. The frame seemed to follow the course of the events surrounding BST, which occurred mainly during the early to mid-1990s when the drug was approved. Figure 4.21 illustrates the commonalities. In the following figures, the solid black line represents the Northern California news, while the dashed black line represents the Northern California news. In Figure 4.21, in both regions, the BST story dropped in prominence after 1999.

Caution must be taken when using visual illustrations to compare frame changes. Because the average occurrence of the frame is different for each frame, when comparing frame changes, it is important to keep in mind each frame's average occurrence. For example, two frames may have appeared to peak in the same years, but the measure of the frame's average occurrence could be quite different – one could be much higher or lower. In addition, the reader is asked to keep in mind the frame's overall meaningfulness according to its factor scores. Therefore, a comparison provides only a nascent understanding of changes across frames.

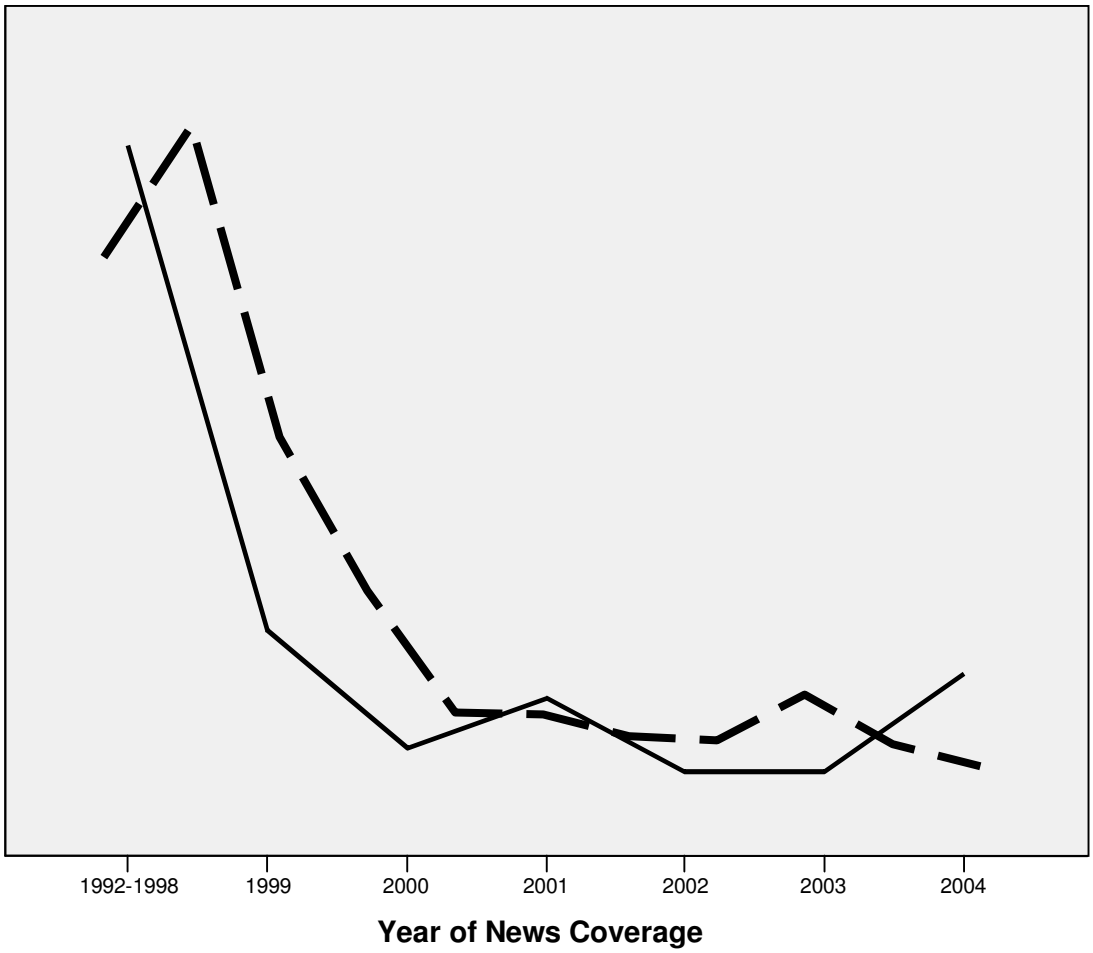

Figure 4.21. Comparison of BST Frame in Northern California News and Missouri
(Solid line is Northern California; dashed line is Missouri news;)

A comparison of the Frankenfoods frame and the Europe frame in the Northern California news provides an example of the preceding note of caution. The comparison is displayed in Figure 4.22. The solid black line represents the Frankenfoods frame; the dashed black line represents the Europe frame. Certainly, beginning in 2000, both frames increased. The frames also shared a similar drop in appearance in 2002. The frames peaked again in 2003 and then dropped off in 2004. The life cycle of this frame suggests that the derogatory, and more sensational, Frankenfoods label for GMOs worked hand-in-hand with news coverage of the European moratorium on GMOs. It is interesting to note also the differences of these frames in the early years of coverage; Frankenfoods were part of the GMO story in the early years of coverage, while the European concerns were not. This might be explained by the fact that the GMO story supported a more sensational news frame early on, at least in the more politically liberal Northern California where it might have had more immediate appeal. Yet, in terms of staying power as a news story, the Frankenfoods label appeared to have little. These findings must also be considered with the fact that overall the Frankenfoods frame had a smaller average occurrence than the other frames in news articles in Northern California. It was the fourth most relevant factor in the factor analysis.

A comparison of changes in the safety and science frames in the Northern California news provide some interesting contrasts. Figure 4.23 illustrates the comparison. The solid line represents the safety frame, while the dashed line represents the science frame. Based on the comparison, it appears that when the safety frame peaked (from 1992-1998), the science frame was at one of its lowest points. Thus, it would appear that in Northern California at least, the issue of safety, rather than scientific

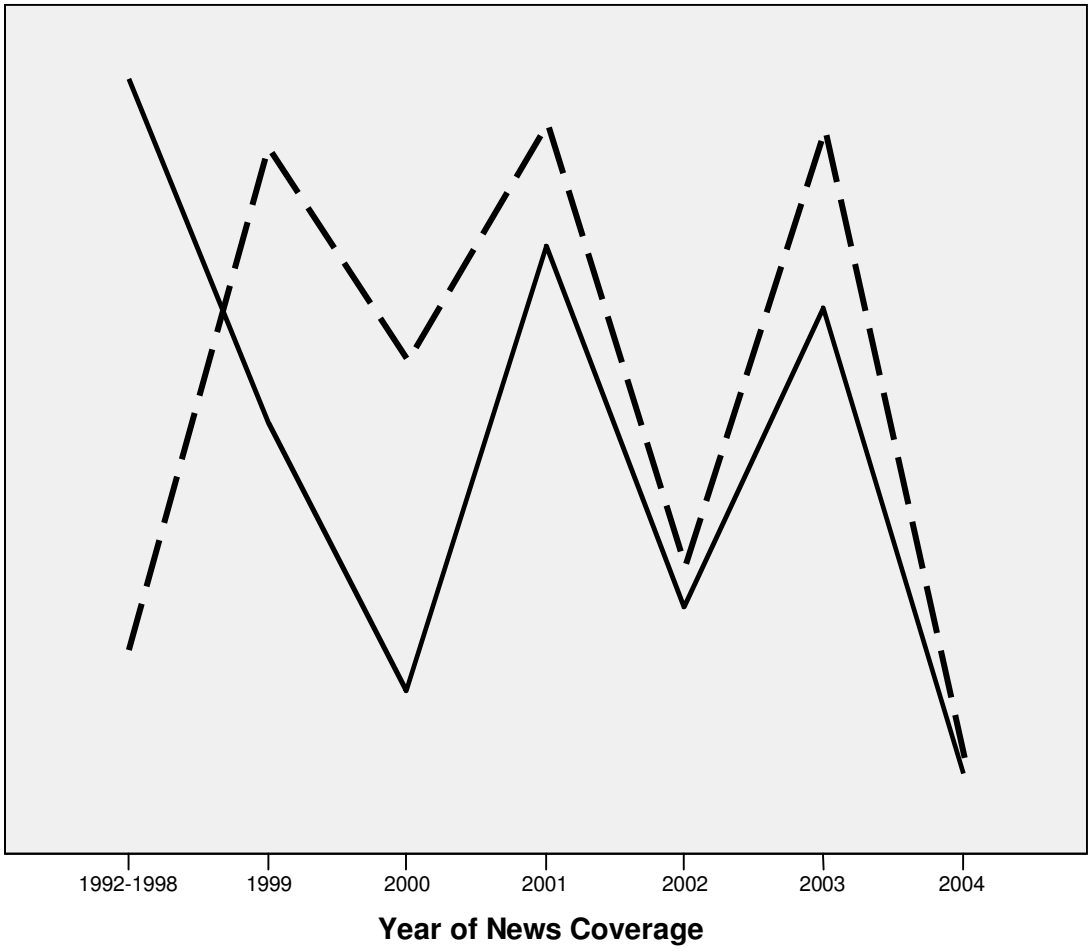

Figure 4.22. Comparison of Frankenfood and Europe Frames in Northern California News
(Solid line is Frankenfood Frame; dashed line is Europe Frame)

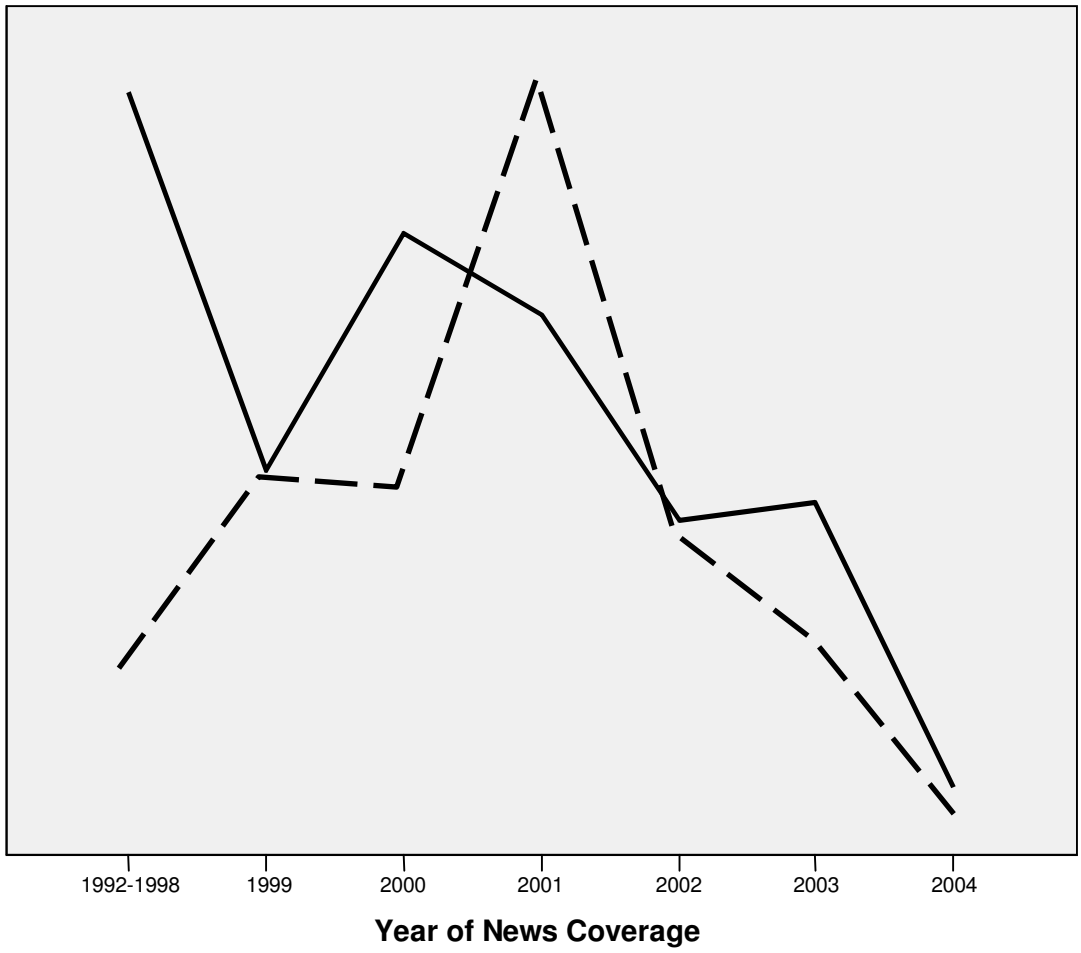

Figure 4.23. Comparison of Safety and Science Frames in Northern California
(Solid line is Safety Frame; dashed line is Science Frame)

progress, was paramount in stories about the newly emerging products related to agri-food biotechnology. The safety frame also peaked at the same time in the early years of news coverage with the peak of the Frankenfoods frame. This finding is at odds with previous studies of biotechnology, which have said that the coverage has been overwhelmingly positive, with negative moments related to specific episodes like the cloning of Dolly the sheep (Abbott, et. al., 2001; Gaskell, et. al., 1999; Nisbet & Lewenstein, 2002; Priest & Talbert, 1994). Only in the early to mid 1970s during the early development of rDNA technology did the news have a more negative or skeptical tone (Krimsky, 1991; Nisbet, Brossard, & Kroepsch, 2003; Van Dijck, 1998). Thus, this finding may confirm what Priest and Ten Eyck (2003) have suggested – that broader, more diverse perspectives on biotechnology may exist more in local news than in the elite, national press. Other scholars (Priest, 2001b; Priest & Ten Eyck, 2004) have suggested that controversy or resistance to technology may initially emerge at the local or regional level. Yet, because of the dearth of studies of local news on biotechnology, these assumptions have not yet been tested. In this study, the safety frame in the Northern California news was the most relevant factor and was the most dominant frame throughout the 13-year period. The science frame was the second to last factor and was the fifth most dominant.

In Missouri, similar peaks in frames were observed in the most dominant news frame, the Roundup frame, and the second most dominant frame, the Europe frame. Figure 4.24 illustrates the similarities. The solid black line represents the Roundup frame, while the dashed line represents the Europe frame. The Roundup frame and the European frame both seemed to peak from 1996 to 1998, which was during the time that Roundup

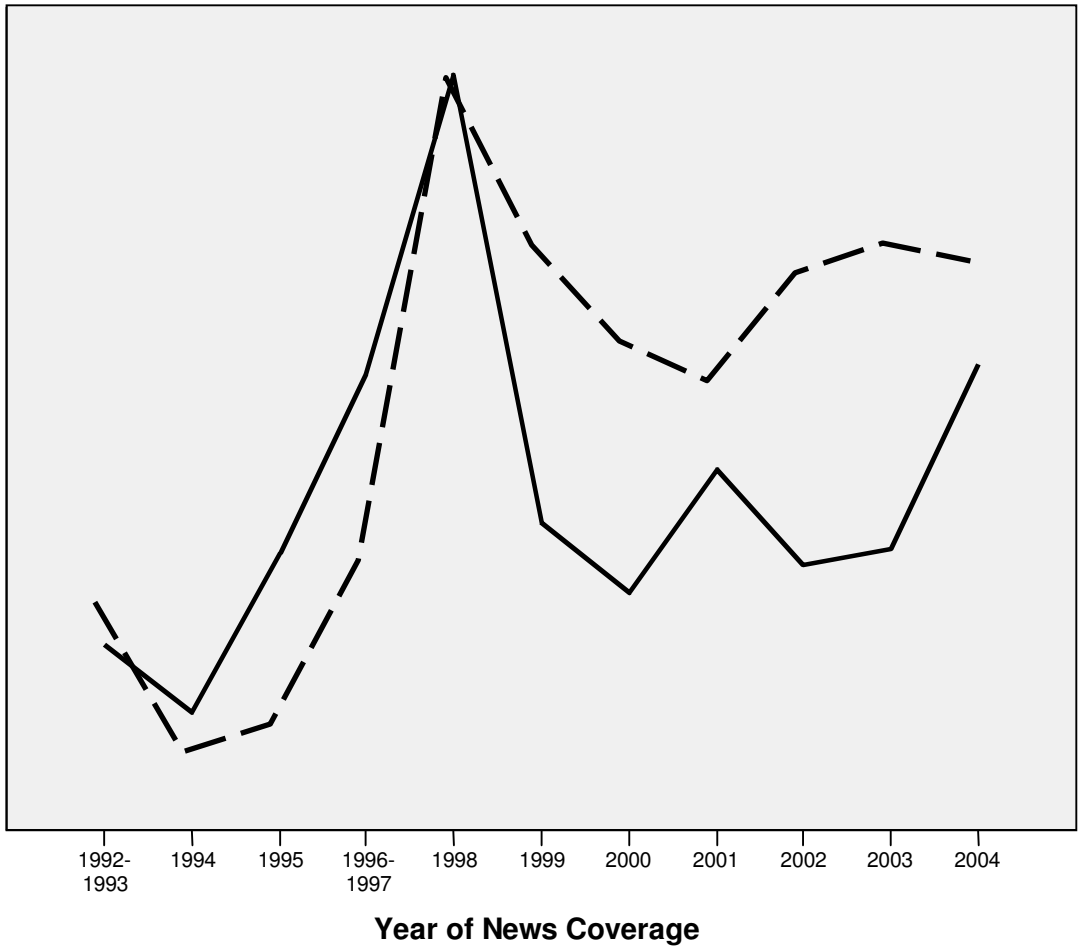

Figure 4.24. Comparison of Roundup and Europe Frames in Missouri News
(Solid line is Roundup Frame; dashed line is Europe Frame)

Ready soybean was exported to Europe. In 1998, with suspicions about the health and safety of GMOs at their height in Europe, the European Union banned any new GMOS for planting or use in the EU. After 1998, the Roundup frame decreased, as did the Europe frame but not as intensely.

The science frame and the safety frame also share some interesting similarities. Figure 4.25 illustrates the frames' similarities. A solid black line represents the science frame, and a dashed line represents the safety frame. Recalling that the science frame in the Missouri news focused in part on the Cornell butterfly study related to Bt corn, the science frame peaked in 1999 and 2000. The study was released in 1999. The science frame was the second most meaningful factor in the factor analysis, but was nearly at the bottom on the range in terms of dominance of appearance overall. The safety frame's highest peaks were from 1999 to 2002. Thus, it would appear that in part issues of safety correlated with issues surrounding Bt corn in the Missouri news. The safety frame was the fifth out of the eight factors, and it was the third most dominant frame. The science frame was the second factor and the near the bottom of the range in terms of its appearance overall.

Summary

This chapter has focused on the analysis and results of the quantitative study of news coverage in Northern California newspapers and in the Missouri newspaper, the *St. Louis Post-Dispatch.* While framing analysis cannot answer questions of causality, the analysis has provided informed speculation as to the reasons for the differences in

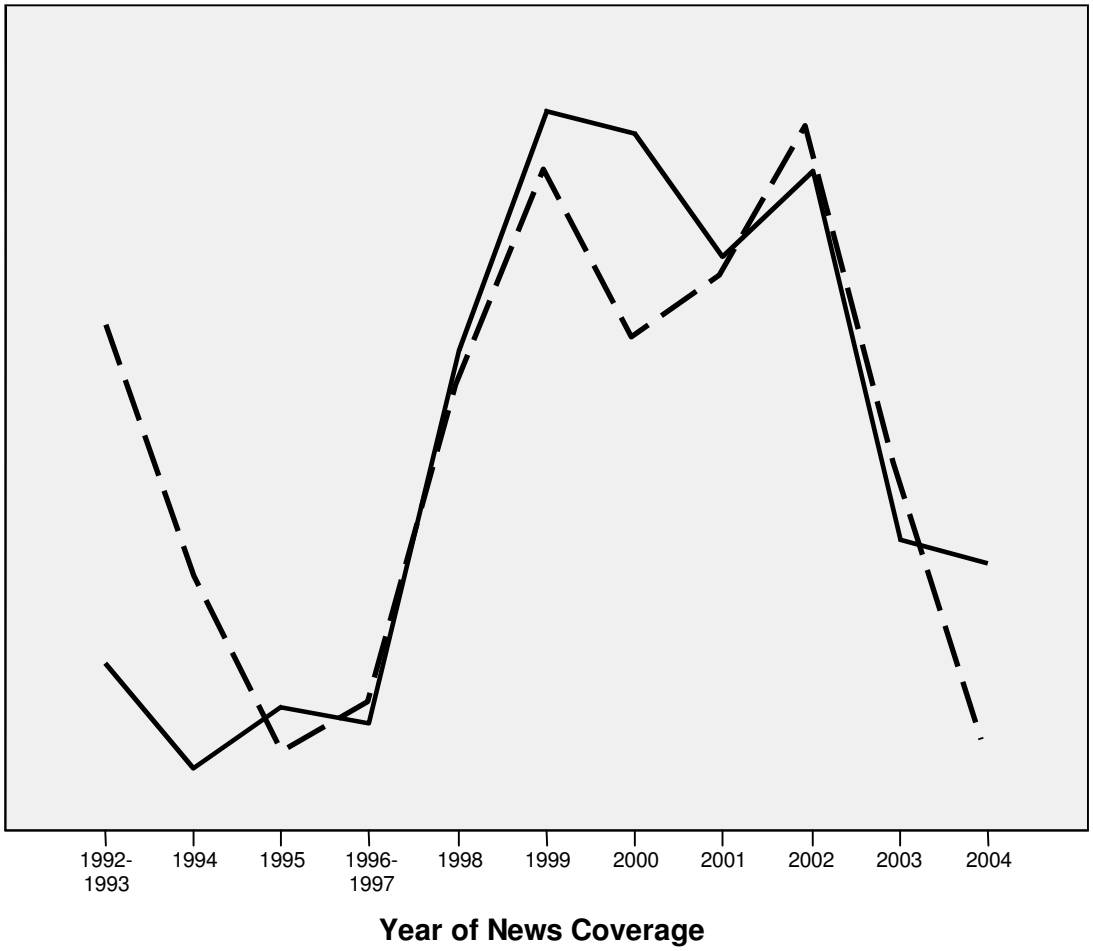

Figure 4.25. Comparison of Science and Safety Frames in Missouri News
(Solid line is Science Frame; dashed line is Safety Frame)

framing the genetic engineering debate in the newspaper content from Northern California and Missouri.

The first research question asked what are the news frames in local newspaper coverage of genetic engineering in terms of agricultural biotechnology. Based on the factor analysis, it was found that in the 296 Northern California news articles, the frames, listed from most to least variability of the terms' occurrence, addressed the topics of safety, BST, campaigns, Frankenfoods, Europe, agriculture, science, and Monsanto GM products like Roundup Ready soybean. In the 860 Missouri news articles, the frames, also listed from most to least variability of the terms' occurrence, covered the topics of BST, science, Roundup, Europe, safety, Starlink corn, the environment, and agriculture.

In Missouri, the story was framed in terms of biotechnology's economic importance to the region, while in Northern California, news articles framed biotechnology in terms not only of its economic importance but also in terms of the controversies surrounding it. In Northern California, GM foods were framed as Frankenfoods; GM crops were framed as something to be contested in political campaigns; and the science research related to agri-food biotechnology was characterized in terms of its commercial applications. In Missouri, frames focused on the business of agri-food biotech: BST, StarLink, and Roundup Ready products.

The second research question examined how the frames changed over time. For purposes of comparison, in the Northern California newspapers, the most news articles appeared in 2000 and in 2004, while the most news articles in the Missouri newspaper appeared in 1999 and 2000. The least number of articles appeared in 1997 in both states. The most dominant frame in the Northern California newspapers was the safety frame,

while the Roundup frame dominated the Missouri newspaper the most. The environment frame was the least dominant overall in the Missouri newspaper, while the least dominant frame in the Northern California newspapers was the Roundup frame.

A comparison of frame changes found that in both Missouri and Northern California, the BST frame peaked at the same time, during the early years of news coverage of agricultural biotechnology. In the Northern California, the Frankenfoods label matched the height of the European controversy over GMOs, while in Missouri the European controversy was more closely related to Roundup Ready soybean. In Northern California, stories framing the science of GMOs were at odds with stories framing issues of safety; the safety frame peaked in the early years, while the science frame was at its lowest ebb. By contrast, in Missouri, the science frame, which was focused on the controversies about Bt corn, peaked at the same time as stories with frames concerning the safety of GMOs.

The next chapter discusses the results of the qualitative analysis, examining the dominant news sources, or stakeholders, in the GMO story.

CHAPTER V.

ANALYSIS AND RESULTS OF QUALITATIVE STUDY

The qualitative study answers the third research question: Who are the dominant sponsors (the actors/sources) shaping news frames of stories on genetically modified organisms in local newspapers in the United States, and how do these sponsors appear in the frames? In effect, the question asks *who is quoted* most often in news articles on agricultural biotechnology and how is their perspective presented or *framed*.

The qualitative study is informed in part by the results of the quantitative study discussed in Chapter IV. The quantitative analysis of news articles revealed the dominant stakeholders in the debate on agricultural biotechnology. Using the computer assisted content analysis program WordStat, the total population of news articles for Missouri (N=860) and for Northern California (N=296) were analyzed to determine the dominant stakeholders. The emphasis is on *dominant* frame sponsors, defined as those groups or individuals quoted most frequently in the 13-year time period or those groups whose frame or frames are most often used. Results are detailed in the following sections.

Taking cues from Goffman (1974) and Berger and Luckmann (1967), this qualitative study takes a social-constructionist approach to view framing as a way of constructing meaning. Thus, news stories, public documents, interview data, and other sources were used to conduct an in-depth contextual and historical study in order to provide an understanding of how the dominant sponsors mobilize to shape the construction of news frames. Questions concerned stakeholders' experiences of working with news media; stakeholders' knowledge of journalistic practices and routines; media

strategies employed to publicize activities, respond to arguments from challengers or address inaccuracies in news stories; resources used for media activities; and stakeholders' assessment of news coverage of agricultural biotechnology issues associated with their organizations.

Semi-structured interviews were conducted with key stakeholders. In most cases, interviews were conducted via the telephone; one interview was conducted in person. A copy of the interview guide is provided in Appendix C.

Participants included public figures associated with agricultural biotechnology, such as representatives from government, non-governmental organizations, regulatory agencies, public interest groups, and private industry. The criteria for determining which stakeholders would be interviewed included high frequency of appearance as a news source; representation of a specific and unique role or perspective on agricultural biotechnology; and accessibility. For example, regulatory agencies, such as the Food and Drug Administration or the U.S. Department of Agriculture, were included as they represent specific roles, while the World Trade Organization or the National Institutes of Health was not, as both entities represent a range of perspectives.

Consent to participate in the study was obtained orally. Participants were told that granting the interview constituted their consent to participate in the study. Participants were also informed that their responses to the questions and their name and official title would be identified and attributed in the research. Participants were further informed that their participation was voluntary and that they could decline to participate without penalty.

Results of Missouri Analysis

Table 5.1 lists a range of stakeholders mentioned in the 13 years of news coverage of agricultural biotechnology in the *St. Louis Post-Dispatch*. The table is ordered from the highest percentage of news articles containing the name of the stakeholder to the lowest percentage. The stakeholders listed in the table provide a broad representation of the most dominant to least dominant stakeholders mentioned in the 860 news articles. The table also lists the stakeholders in terms of frequency of appearance and number of news articles in which the name of the stakeholder appeared.

As stated previously, the focus of this study is *dominant* frame sponsors, which has been defined as those groups or individuals identified most frequently in the 13-year time period. As such, only those groups or individuals mentioned in 4% of the news articles or higher were included in the analysis and discussion. The 4% cutoff was selected because it appeared to capture the top range of dominant stakeholders and because stakeholders below the cut-off were mentioned with much smaller differences in frequency. Furthermore, a higher cutoff would have unnecessarily excluded some of the major industrial companies and non-governmental organizations whose involvement in the GMO debate in Missouri are critical to understanding their influence there.

Industry As Dominant News Source

According to the Table 5.1, the most dominant stakeholder as a news source was Monsanto, which appeared in more than two-thirds (68.1%) of the 860 Missouri news articles. In fact, industrial stakeholders dominated the list overall (Aventis, Bayer

Table 5.1. A Range of Stakeholders in Missouri Newspaper Coverage

	STAKEHOLDER	FREQ.	No. CASES*	% CASES**
1.	MONSANTO	3280	586	68.1%
2.	FOOD AND DRUG ADMINISTRATION	194	189	22.0%
3.	U.S. DEPARTMENT OF AGRICULTURE	106	97	11.3%
4.	ENVIRONMENTAL PROTECTION AGENCY	95	90	10.5%
5.	WORLD TRADE ORGANIZATION	105	72	8.4%
6.	GREENPEACE	95	49	5.7%
	DONALD DANFORTH PLANT SCIENCE CENTER	65	49	5.7%
7.	AVENTIS	114	41	4.8%
	NATIONAL CORN GROWERS ASSOCIATION	47	41	4.8%
8.	BAYER CROPSCIENCE	45	38	4.4%
9.	BIOTECHNOLOGY INDUSTRY ORGANIZATION	39	36	4.2%
10.	DUPONT	66	31	3.6%
	PIONEER HI-BRED INTERNATIONAL	39	31	3.6%
11.	NATIONAL ACADEMY OF SCIENCE	46	30	3.5%
	UNION OF CONCERNED SCIENTISTS	31	30	3.5%
12.	CALGENE	116	29	3.4%
13.	AMERICAN SOYBEAN ASSOCIATION	37	28	3.3%
	GROCERY MANUFACTURERS OF AMERICA	30	28	3.3%
14.	DOW AGROSCIENCES	40	19	2.9%
	SYNGENTA	37	25	2.9%
15.	MISSOURI BOTANICAL GARDEN	28	23	2.7%
	CORNELL UNIVERSITY	24	23	2.7%
	JEREMY RIFKIN	23	23	2.7%
16.	ARCH DANIELS MIDLAND	26	22	2.6%
17.	FRIENDS OF THE EARTH	22	21	2.4%
18.	DEKALB GENETICS CORPORATION	18	18	2.1%
19.	WORLD AGRIGULTURAL FORUM	26	16	1.9%
20.	AMERICAN MEDICAL ASSOCIATION	18	15	1.7%
21.	CENTER FOR FOOD SAFETY	16	14	1.6%
22.	PURE FOOD CAMPAIGN	17	13	1.5%

*The number of articles in which the term appeared.
**The percentage of articles in which the term appeared.

CropScience, DuPont, Pioneer Hi-Bred, and the Biotechnology Industrial Organization, BIO, a trade group representing industry). Nearly 98% of the news articles mentioned one or more of the industrial stakeholders on the list in Table 5.1, including BIO.

Led by agribusiness giant Monsanto, Missouri businesses and life sciences institutions have worked hard to build the area as a regional "Bio-Belt." In 2002, the last year for which data was available, the St. Louis region ranked in the top 20, out of 361 metropolitan areas, in its number of life-science employers and employees, according to a study conducted by Battelle Memorial Institute in 2005 (Missouri Bioscience Initiatives 2004). The employment was diversified, the study said, ranking in the top 25 in agricultural feedstock and chemicals; pharmaceuticals; medical devices and equipment; and research and testing. Local academic life-science research and development investment grew by 57 percent from 1998 to 2002, faster than all metro areas but Seattle and Baltimore. Further, more than $400 million in venture capital was raised since 1996. More than 3,200 bioscience degrees were awarded by Missouri colleges and universities in 2002, and more than 80,000 people worked in biosciences in 2003.

Biotechnology efforts in the region have been further supported by elected officials. In 2003, Sens. Christopher "Kit" Bond, R-Mo., and Dick Durbin, D-Ill., secured about $10 million in federal funding to support biotechnology research and development.

Reporter Rachel Melcer wrote in a August 27, 2004, *St. Louis Post-Dispatch* news article that, early on, the agricultural biotech industry was focused on traits to help improve yields or to reduce the need for pesticides and herbicides. But, beginning in 2004, the focus for industry was on crops engineered for a particular purpose, including canola with higher levels of healthy oils, easy-drying cotton, and more digestible corn for

animal feed. More advanced products in the pipeline included crops with active ingredients for pharmaceuticals or polymers for plastics.

With its headquarters in St. Louis, Monsanto is the world's leading developer of biotech crop traits, which are used to modify corn, cotton, canola and soybeans to resist insects as well as applications of glyphosate herbicide. The company sells glyphosate branded as Roundup. It also licenses biotech traits to hundreds of seed companies and uses the traits in its own Dekalb and Asgrow brand seeds. In 2004, Monsanto's net sales were $5.5 million, up 11 percent from 2003 (Monsanto 2004 Annual Report). In 2004, seeds with Monsanto traits accounted for more than 90 percent of the 175 million acres worldwide planted with herbicide-tolerant or insect-resistant crops.[1]

Monsanto declined to participate in the study, and directed questions to the biotechnology industry's nonprofit trade association, BIO – also identified in the study as a dominant stakeholder (mentioned in 4.2% of the news articles). Began in 1993, BIO had 1,131 member companies in 2004. According to BIO's website, the organization's mission is "to advocate the industry's positions to elected officials and regulators and inform national and international media about the industry's progress and contributions to quality of life, goals and positions, and to provide business development services to member companies, such as investor and partnering meetings."

While Monsanto may be the world's largest maker of GM seeds, global companies like Syngenta AG, DuPont's Pioneer Hi-Bred International division, Dow

[1] The *St. Louis Post-Dispatch* reported erroneously in a February 23, 2003, news article that Monsanto's annual net sales for 2002 were $5.46 *billion* (they were $4.9 million according to the company's annual report).

AgroSciences LLC, and Bayer CropScience also dominate the ag-biotech business. These companies are also represented by BIO. Quoted in an August 27, 2004, *St. Louis Post-Dispatch* news article is Pete Siggelko, vice president of plant genetics and biotechnology at Dow AgroSciences. “From a crop biotech standpoint, Monsanto got there first. But we don't see the game as being over," Siggelko said.

Swiss company Sygenta AG’s U.S. headquarters is located in Delaware. Pioneer Hi-Bred’s world headquarters is in Iowa. Dow AgroSciences is based in Indiana, and German company Bayer CropScience’s U.S. office is in North Carolina. All companies were mentioned in news coverage in the *St. Louis Post-Dispatch*, according to Table 5.1. Another company, Aventis, was one of the dominant stakeholders, mentioned in 4.8% of the 860 news articles. Aventis was the company that made StarLink corn, the insect-resistant corn that was approved only for animal feed but was found in human food in 2000. The corn was eventually pulled from the market, and more than 300 food products containing the corn were recalled. In 2001, the company agreed to pay up to $1 billion in compensation to farmers and grain elevators who bought the corn, according to a January 24, 2001, news article in the *St. Louis Post-Dispatch*. In 2002, Aventis was acquired by Bayer CropScience, also a dominant company mentioned in 4.4% of news articles in the study.

In Missouri, a regional biotechnology group (MOBIO) was founded in 2001 to help galvanize the agricultural biotechnology sector in the Missouri-Illinois region. Travis Brown, who was a founding member and served as chairman of the board from 2002-2003, said that in the mid-1990s, private companies perceived news coverage as being more negative toward agricultural biotechnology (personal communication,

February 18, 2005). “It was more negative than it should have been. They were less interested in the positive, long-term implications about what ag-biotech would mean to society at large,” he said.

Recalling the results of the quantitative study on frames from the previous chapter, the analysis did not specifically measure positive or negative tones in news coverage. However, some of the frames, based on the terms included in them, suggested positive or negative characteristics. For example, the Europe frame in the Missouri newspaper, which contained the word *fear*, could be interpreted as expressing resistance or opposition to the technology. Indeed, Brown said European resistance to GMOs was a great part of the negative coverage. Industry representatives expressed concern that negative coverage in Europe would influence the U.S. market. The Europe frame in the Missouri news peaked in 1998, at the height of European resistance to GMOs. The safety frame also peaked at this time.

To counteract opposition in Europe and its feared influence on American public opinion, BIO began spending about $50 million annually on a public information campaign to boost support for agricultural biotechnology, according to Dan Eramian, BIO’s vice president of communications (personal communication, March 8, 2005).

The campaign included television and print advertisements in media outlets across the country as well as regular media events and meetings with reporters and editors at local, regional, and national news media organizations. BIO also specifically targeted women’s magazines and met with editorial staff at those magazines to appeal to them to print stories about the latest food technology because “the truth is most of the food shopping done in this country is done by women,” Eramian said.

More positive news stories began appearing in the late 1990s and in 2000 as interest increased in the technology itself, Brown said. From about 2001 to 2004, Brown described news coverage in local and national press as being generally fair toward industry's position. But prior to that time, news coverage had been more negative and less balanced.

Eramian said BIO stopped spending huge sums of money on the consumer and media campaign in the late 1990s as BIO found in surveys that most Americans were not concerned about GM ingredients in their food.

One media strategy that MOBIO has used, Brown said, is to speak about biotechnology in very specific terms and with some sense of urgency behind it. "The positive stories successfully placed are those that say biotech improves human life and here's one example and we're just going to focus on this particular technique and what it does," he said, adding that stories about regulations and approvals usually fall flat in terms of generating news media interest.

Brown said that defending biotechnology has proven to be a difficult challenge against opponents of the technology. "The magnitude of the challenge is much harder in defending the technology and industry, in my view, than if you're challenging [biotechnology] on philosophical grounds.

"You can't combat news articles and story-lines with anything but the facts. You have to acknowledge what you don't know and what you've failed to prove," he explained.

Eramian, who worked as a print journalist for seven years before joining BIO, where he has been for 12 years, attributed the quality and accuracy of biotech news

coverage to the level of science knowledge of the reporter, as well as his or her understanding of local farming communities.

"The problem is a lot of people end up covering these stories by general assignment reporters who don't have a science background, and so are easy prey to people who are opposed to the technology. They're subject to scare tactics and a lot of unnecessary lies and misinformation spread by people who have an interest in stopping the technology," he said.

BIO's news media strategy is to "anticipate what the issues are going to be," Eramian said. BIO's primary target audiences are news media that cover agricultural issues and members of the U.S. Congress who represent farming constituencies, he said.

Regulatory Agencies As Dominant News Source

Aside from industry, other dominant stakeholders as news sources are the regulatory agencies, including the U.S. Food and Drug Administration, the U.S. Department of Agriculture, and the U.S. Environmental Protection Agency. Together, the three federal agencies regulate the production and consumption of biotech foods and crops.

The FDA, which focuses mainly on the regulation of GM food, was mentioned in 22% of the news articles. The FDA does no specific media strategy for influencing news coverage of FDA activity or the biotechnology story, said FDA press officer Michael Herndon (personal communication, March 22, 2005). "We're the federal government, and FDA's mission is to provide food and drug safety, not try to influence the news," he said.

Herndon is the sole press officer who deals specifically with media queries about GM food. The agency is more responsive than pro-active in terms of dealing with the press, he said. Occasionally, the FDA will distribute a press release in response to a food scare. Herndon said he recalls one of the busiest times occurred during the StarLink corn case when media requests for information were particularly high.

Herndon described three types of media that his office deals with. The national press, like *The New York Times*, *Los Angeles Times*, and *The Washington Post*, Herndon described as being "more open, more fact-finding, less opinionated." The foreign press, like the BBC, French newspapers, or Japanese news media, he described as more biased. "Many of these countries don't have biotech food, so they are surprised we have it and we're eating it," he said. The third category of news media is the trade press, like the agricultural trade journals or consumer watchdog groups like the Center for Science in the Public Interest. He described this media category as looking for a balanced story. "They can be very good in a lot of ways in terms of making sure FDA is doing the right thing when dealing with consumers on these issues," he added.

Herndon assessed news coverage of the FDA as being generally accurate. "For the most part, we feel we are given a fair shake in terms of accuracy."

The USDA, which was mentioned in 11.3% of new articles, also has no media strategy for shaping the biotechnology news story, said Jim Rogers, who coordinated the USDA's media activity for biotech issues from 1996 to 2005 (personal communication, February 24, 2005). He said that as a neutral body, the agency responds to media requests and maintains a database of the department's regulatory activity, which is available to the

media and the public. They occasionally distribute press releases "if there is a massive violation of compliance."

Rogers, who has a journalism degree and worked in the television and radio industry before joining the USDA, acknowledged that the accuracy of news coverage depends upon the reporter's understanding of science, and he said, he prefers working with reporters who understand the issues. If a story contains inaccuracies about the department's activities, Rogers said, he might respond and request a correction.

The EPA was mentioned in 10.5% of news articles. EPA officials declined to participate in the study. The agency regulates pesticides and herbicides, which are often used in the cultivation of GM crops. The EPA is also involved in the approval process of outdoor "field tests" for GM crops, as well as the regulation of GM plants.

For industrial stakeholders of agricultural biotechnology, Missouri is often viewed as having a gentler regulatory climate than others states such as California and Colorado, where regulations are viewed as more rigorous (Pew, December 2004b). While the Pew Initiative report did not include Missouri in the states it analyzed, the article explained that "Missouri has no state law governing biotechnology, and Missouri agencies are not known for aggressive regulation of genetically engineered crops."

One Northern California biotech company, Ventria BioSciences, re-located to the Missouri bootleg in late 2004, triggered in part by public opposition in California to its rice product with a seed that contains human proteins usually found in breast milk and tears. The rice is engineered to produce the proteins for use in manufacturing anti-microbial and anti-diarrhea drugs.

Ventria needed state and federal approval to produce the drug, but was unsuccessful in getting approval. The approval would have been California's first commercial planting of a genetically engineered "pharm" crop.

Bill Lambrecht, a long-time *St. Louis Post-Dispatch* reporter on the agricultural biotechnology beat, reported in a news article in December 2, 2004, that Ventria received $5 million in operating capital from Northwest Missouri State University as a part of the deal to re-locate headquarters.

Although genetic engineering is primarily regulated at the federal level, some states are playing a larger role in regulation, which, Lambrecht wrote, Ventria experienced with the California Rice Commission.

The article continues:

> Food companies, farmers and advocacy groups raised concerns about so-called "pharm crops" contaminating crops grown for food. Those sentiments were expressed strongly in California, where some rice growers worried that Ventria's rice would have a negative effect on the state's $500 million rice industry.
>
> In March [2004], Ventria narrowly won approval from the California Rice Commission in its bid to become the first company to commercialize a pharmaceutical plant. But the commission restricted production to parts of California that don't grow rice to avoid contaminating rice grown for food.

Quoting Peter Hofherr, director of the Missouri Department of Agriculture, as a source, the Lambrecht article further states that Missouri was training specialists to assist in field inspections. This was part of a plan to have "a pretty secure safety net" for the new generation of crops.

Donald Danforth Plant Sciences Center

In 2003, the Donald Danforth Plant Sciences Center committed $117 million for biotech research aimed at creating commercial opportunities and jobs in plant science and the biomedical industry. One of the dominant stakeholders in news coverage, the Center was mentioned in 5.7% of the article in the study.

Dr. Roger Beachy, who has been president of the Center since its inception in 1998, has been involved in the biotechnology as an academician for 20 years. Beachy described news media response in the mid-1980s to biotechnology as mainly positive (personal communication, February 15, 2005). He recalled being interviewed by Jane Pauley on NBC's TODAY television show in 1987, which also included Dr. Margaret Mellon from the Union of Concerned Scientists as a counterpart to Beachy's support of the technology. "When Dr. Mellon attempted to brand [biotechnology] as patently unsafe, Ms. Pauley asked the question – are you trying to scare people from even thinking about the technology?" he said.

Through the nineties, Beachy recalled that news coverage took a negative turn, and like Eramian from BIO and Brown from MOBIO, blamed the negativity on actions in Europe when the Green Party and Greenpeace began successful opposition campaigns. Again, Beachy's observations compare favorably to the dominant Missouri newspaper frames at the time, when the safety and Europe frames were most evident in coverage.

During the negative coverage, Beachy noticed a change in the nature of the questions. "They became much more virulent and not open. The questions often came as an accusation, not as a question," he said. "Many of the journalists at that time didn't know the science, nor did they care to learn about it."

Beachy eventually stopped giving interviews, unless he knew the background of the reporter. “I became very frustrated. No matter what I said, it would be misquoted,” he said. “There were those who regardless of how I answered the question, had their spin on what my comments were.”

From 2000, however, Beachy found less bias in the reporting. “The questions that I was asked in the late 80s and early 90s are substantially unchanged from the ones one is asked today.” Mostly, he is asked to comment about the effect of the technology on the environment and about its safety. “I present what I know from the perspective of a scientist and someone who is knowledgeable about agriculture,” he explained.

When addressing arguments advanced by challengers, he tries to learn the questioner’s biases, so that he can tailor the response accordingly, he said. Beachy said:

> If a questioner is from a background of philosophy and knows no science, I don’t respond well. I’m not a passive person, I’m relatively emotional. I try to avoid that, but it’s hard for me. Our rationale for being in this 20 years ago was to clean up the environment, remove the use of agricultural chemicals and make it genetic. That’s the driver. Early on, I was accused of being unethical. At several seminars in Europe, I was outright attacked on my ethical and moral standards.

Beachy said that the more informed the journalist is about the science, genetics, and agriculture, then the more accurate the news story.

As a part of the Center’s media strategy, Beachy prefers to accompany Science Center faculty to interviews with news media, especially when a faculty member has had no media training. Further, the Center tries to respond to all media requests and tries to respect media deadlines. The Center budgets one staff person for media affairs.

Beachy characterized local news media in St. Louis as "responsive and responsible" to the Center's activities and positions, which he credited in part to the region's long history of science research.

Greenpeace

Like the Donald Danforth Plant Sciences Center, Greenpeace was mentioned in 5.7% of the articles, making it a dominant news source. In contrast to the Plant Sciences Center, Greenpeace represents opposition to agricultural biotechnology. Its appearance in the Missouri news coverage was not as high as that of news coverage in Northern California, which aligns closely with how the story was framed in Northern California with a greater emphasis on safety and the more controversial aspects of genetic engineering. Yet, by criteria set by this study, Greenpeace qualified as a dominant newsmaker.

Recalling from the framing study that the Europe frame suggested the fears and resistance of the European public, articles mentioning Greenpeace in the Missouri newspaper specifically involved the group's activities in Europe, such as Greenpeace protests of new GM food labels at European supermarkets. Other news stories focused on Greenpeace's activities in Washington, D.C. when they organized to oppose GM food shipments to Africa, and in St. Louis when they attended Monsanto's annual shareholder meetings to warn that their GM products could expose the company to legal liability if GM crops proved to harm human health. "We want to make Monsanto's shareholders aware of the risks," said Lindsay Keenan, a Greenpeace campaigner from Berlin, who

attended the April 2003 meeting, as reported in an April 25, 2003, *St. Louis Post-Dispatch* article. “And we want to make Monsanto aware that Greenpeace is watching.”

As Greenpeace dominated the Northern California news coverage more than in Missouri, the results of an interview with a Greenpeace representative appears in the section on Northern California stakeholders.

Non-Governmental Organizations

Another dominant newsmaker was the National Corn Growers Association, mentioned in 4.8% of the articles.

Mimi Ricketts, who is the director of communication for the Missouri-affiliate member of the National Corn Growers Association, said her organization has had difficulty getting stories about Missouri corn growers’ concerns into the press, at least in terms of national news media (personal communication, February 15, 2005). “Agriculture is a subject that fewer papers especially in urban areas or media outlets in urban areas have an understanding of. It takes on less importance in their immediate community,” Ricketts said.

Ricketts’ assessment appears to counter the results of the framing study, which found agriculture to be a dominant frame. However, Ricketts also added that news media response to agriculture concerns has been better regionally and in specialist publications and radio stations. Thus, the organization specifically targets smaller markets and the farm press. They subscribe to the National Association of Farm Broadcasters, which broadcasts farm news to agricultural regions, like the Corn Belt states. This might explain

in part how agriculture came to be one of the dominant frames in the *St. Louis Post-Dispatch.*

The best reporting has been done by news outlets that target farmers and by journalists who have an agriculture background, she said. "I think we've been successful with agricultural media in understanding our positions on biotech. The ag media really understands agriculture because they've worked in those communities.

"In the news world, it isn't just news that sells, it's reader interest. News has to fit the interest of the readership of the publication or outlet," said Ricketts, who has worked in media for more than 20 years and was once a newspaper reporter.

In 2004, the Missouri Corn Growers had a media staff of five, including one press officer in Washington, D.C., and budgeted roughly $80,000 for media, Ricketts said. "In some ways, we've failed to influence news media coverage based on sheer numbers – we're a non-profit, grassroots organization and don't have a large budget to throw after an issue."

Still, Ricketts underscored the importance of reaching out to national media markets as well. "It's a necessary fight to get urban press because it's important to educate consumers, not just on biotech, but issues of agriculture that ultimately affect them," she explained.

The National Corn Growers Association's main priority is to represent the growers' interest, not drive news media campaigns, explained Hayden Milberg, who was the organization's director of public policy from 2001-2005 (personal communication, February 15, 2005). In February 2005, Milberg joined the senior staff of the U.S. Senate Committee on Agriculture.

"There is a constant flow of information and communication between the media on a broad spectrum of issues. But our basic core issue is to influence public policy. A media strategy is built into that mission, but has a secondary role in terms of our lobbying strategies," Milberg said.

Milberg said the organization offers a "growers' perspective" on news stories about green biotechnology issues, and believes the organization has had some success in influencing news stories about GM crops and in being able to "dispel some of the myths." Indeed, as stated previously, one of the dominant frames concerned agriculture.

But, he said, it depends on who is writing the story. "With something as highly charged as biotech, it really does depend on who's writing the story. It depends on the news outlet. Some are better than others," he said. "Generally, this is as controversial as you get on an issue. You just have to make sure you present the information in the best way possible."

Results of Northern California Analysis

Table 5.2 lists a range of stakeholders mentioned in the 13-years of news coverage of agricultural biotechnology in the Northern California newspapers, which included *The Oakland Tribune*, *The San Francisco Chronicle*, *San Jose Mercury News*, and *San Mateo County Times*.

Like the table covering the Missouri news stories, the table for Northern California news is also ordered from the highest percentage of news articles containing the name of the stakeholder to the lowest percentage. The stakeholders listed in the table

Table 5.2. A Range of Stakeholders in Northern California Newspaper Coverage

	STAKEHOLDER	FREQ.	No. CASES*	% CASES**
1.	FOOD AND DRUG ADMINISTRATION	67	64	21.6%
2.	MONSANTO	139	57	19.3%
3.	UNIVERSITY OF CALIFORNIA	66	52	17.6%
4.	U.S. DEPARTMENT OF AGRICULTURE	54	46	15.5%
5.	BIOTECHNOLOGY INDUSTRY ORGANIZATION	31	28	9.5%
6.	CALGENE	45	20	6.8%
7	GREENPEACE	35	19	6.4%
	ENVIRONMENTAL PROTECTION AGENCY	20	19	6.4%
8.	WORLD TRADE ORGANIZATION	18	18	6.1%
9.	JEREMY RIFKIN	17	14	4.7%
10.	NATIONAL INSTITUTES OF HEALTH	12	12	4.1%
11.	CALIFORNIA FARM BUREAU	14	11	3.7%
12.	CHEZ PANISSE	16	10	3.4%
	UNION OF CONCERNED SCIENTISTS	11	10	3.4%
	ORGANIC CONSUMER ASSOCIATION	11	10	3.4%
	AVENTIS	33	10	3.4%
13.	CENTER FOR FOOD SAFETY	9	9	3.0%
	ENVIRONMENTAL DEFENSE FUND	9	9	3.0%
	CORNELL UNIVERSITY	9	9	3.0%
14.	NATIONAL ACADEMY OF SCIENCE	8	8	2.7%
15.	CONSUMERS UNION	14	7	2.4%
	UKIAH BREWING COMPANY	10	7	2.4%
	VENTRIA	38	7	2.4%
	DOW AGROSCIENCES	9	7	2.4%
	PURE FOOD CAMPAIGN	8	7	2.4%
	BAYER CROPSCIENCE	7	7	2.4%
16.	GROCERY MANUFACTURERS OF AMERICA	6	6	2.0%
	DUPONT	6	6	2.0%
	FRIENDS OF THE EARTH	6	6	2.0%

*The number of articles in which the term appeared.
**The percentage of articles in which the term appeared.

provide a broad representation of the most dominant to least dominant stakeholders mentioned in the 296 Northern California news articles. The table also lists the stakeholders in terms of frequency of appearance and number of news articles in which the name of the stakeholder appeared. As the focus of the study is *dominant* frame sponsors, only those groups or individuals mentioned in 4% of the news articles or higher are included in the analysis and discussion. Like in the Missouri news articles, the 4% cutoff was chosen for the Northern California news coverage because it also appeared to capture the top range of dominant stakeholders and because stakeholders below the cutoff were mentioned with much smaller differences in frequency. Furthermore, a higher cutoff would have unnecessarily excluded some of the major non-governmental and activist organizations whose involvement in the GMO debate in Northern California are critical to understanding their influence in news coverage there.

As stated previously, while groups like the World Trade Organization and the National Institutes of Health appeared in the list of dominant stakeholders, they were not included in the discussion as they represent a range of perspectives and do not play a specific and unique role in the debate over GMOs. The WTO was mentioned in 6.1% of the Northern California news stories, and the NIH was mentioned in 4.1% of the articles.

The Regulatory Agencies

The most dominant news source in the Northern California news was the FDA, mentioned in just over one-fifth (21.6%) of the news articles. The frequency of its appearance almost matched that of its appearance in the Missouri news stories (22%). In fact, the other federal regulatory agencies also were dominant sources in the Northern

California news stories. The USDA was mentioned in 15.5% of news coverage, slightly higher than that of Missouri news, at 11.3%. The EPA was mentioned in 6.4% of the news articles, slightly less than in the Missouri news, at 10.5%.

As explained in the previous section, California is viewed as having more rigorous state regulations for agriculture than in Missouri (Pew, December 2004a). In 2003, the California Secretary of Food and Agriculture blocked a permit sought by Ventria Biosciences to grow up to 120 acres of its genetically engineered rice, saying that he wanted more time to hear from the public. The company narrowly won approval in March 2004 from the California Rice Commission to commercialize the pharmaceutical rice, but the commission restricted production to parts of the state that don't grow rice to avoid cross-contamination. Conventional farmers, represented by the California Farm Bureau, fiercely opposed the county-by-county initiatives to block GM crops, saying that federal oversight is enough. Yet, the California Farm Bureau, nor the groups supporting the measures, were not dominant as news sources, according to the analysis. Ventria BioSciences eventually relocated to Missouri in late 2004.

Industrial Stakeholders

As was the case in the Missouri news, private industry also appeared to play a dominant role in news coverage of agricultural biotechnology in California, but much less so overall. This matches the findings of the framing study, which found that safety concerns and the other more controversial issues associated with agricultural biotechnology took precedence in the Northern California news.

Monsanto was the second most dominant stakeholder, mentioned in 19.3% of the 296 Northern California news stories. Calgene, the small biotech company in Davis, California that manufactured the short-lived Flavr Savr tomato, also made the list, with 6.8% of the stories. In 1995, the Flavr Savr tomato, which contained an anti-ripening gene, was the first genetically engineered produce to appear in supermarkets, but Calgene ceased production of it within a year due to manufacturing problems. In 1996, Calgene's chief executive officer left the company, and Monsanto gained majority ownership.

Again, BIO, the non-profit trade association representing industry, was a dominant news source, appearing in 9.5% of news articles, slightly higher than in the Missouri news – 4.2% of articles. Yet, overall, industry sources were not as dominant in the Northern California news stories, as they were in the Missouri news. In fact, to a certain degree, oppositional groups to green biotechnology were used more as news sources than in the Missouri news, which again follows the results of the framing study where the more controversial side to the story received greater play in Northern California.

BIO's Dan Eramian characterized the news coverage in Northern California as "less balanced" because of the opposition there. "I find with what the activists say about the technology is generally inaccurate and reporters just write what they say," he said. "It's part of their job to provide both sides of the story, but because they don't have a science background, they're not in a position to filter out what's true and what's not true."

Eramian also blamed the "less balanced" reporting on the state's numerous anti-GM ballot initiatives. In 2003, Mendocino County in Northern California was the first

county in the United States to ban growing GM crops. Trinity County, also in Northern California, also banned GM crops in 2004, as did the city of Arcata. Other Northern California counties voted on initiatives in 2004 to curb or ban GMOs. The campaign frame was a dominant frame in the Northern California news.

The Research Scientists

The University of California system was mentioned in nearly one-fifth (17.6%) of all news stories on GMOs, making it the third most dominant stakeholder, after the FDA and Monsanto. Clearly, research activity at institutes of higher learning has high news value in the San Francisco Bay Area. In fact, a 2004 report noted one in three California biotech firms was founded by UC scientists, and one in four public biotech firms nationwide was located within 35 miles of a UC campus (California Bioscience Initiatives 2004, 2005).

The science frame was found to be a dominant frame in the Northern California news. However, unique to the science frame in this geographic region were terms with a more commercial or business focus, such as *sell, supermarket,* and *agribusiness*. To promote commercial applications of the biosciences, the California state government has continued to provide extra funding to the state university systems, both the University of California and California State University, to develop bioscience initiatives "considered of strategic economic importance to the state" (California Bioscience Initiatives 2004, 2005, p. 85). Cal Institutes is one example of the state and university specially-funded partnerships. Funded at $100 million over several years, this partnership begun in 2000 intended to establish "major new facilities that conduct interdisciplinary and intercampus

research, targeting those emerging fields considered likely to have an impact on the state's economy" (California Bioscience Initiatives 2004, 2005, p. 85). One such facility is the California Institute for Bioengineering, Biotechnology and Quantitative Biomedical Research, established in 2004, which links the science and engineering programs at UC Berkeley with the biomedical programs at the UC San Francisco campus.

The Environmental Activists

To a certain degree, views from oppositional groups were slightly more dominant in the Northern California news compared to the Missouri news, which matched the overall findings of the framing study. Like in the Missouri news, Greenpeace was a dominant stakeholder, mentioned in 6.4% of news stories, slightly more than in the Missouri news, at 5.7%. Also, Jeremy Rifkin, who has been at the forefront of the anti-GM movement since the 1970s with his organization the Foundation for Economic Trends, was a dominant stakeholder with 4.7% of news articles. Rifkin was mentioned in 2.7% of Missouri news articles.

The Bay Area has a history of drawing protests in the name of environmental activism, world trade, and biotechnology. In June 2004, when BIO held its annual world conference in San Francisco, the organization was prepared to respond to protesters. Quoted in a June 9, 2004, *Oakland Tribune* article, BIO's Eramian said, "We expect San Francisco to have more than [the mass protests outside the 2000 conference in Boston or the 2003 conference in Washington, D.C.]. But the police have taken all the necessary precautions, and the BIO meeting will go on."

An estimated 133 protesters were arrested, according to a June 10, 2004, article in

the *Oakland Tribune*. Those arrested were cited for blocking traffic or throwing food and bottles at police or upending newspaper racks. About 17,000 biotechnology backers attended the conference, while an estimated 500 people joined protests, according to a June 8, 2004, *Oakland Tribune* article.

Greenpeace has been involved in anti-GM activities in California. In 2003, Greenpeace activists picketed a rice field in Sutter County where Ventria was growing test-fields of its pharma rice.

Greenpeace takes issue with certain aspects of green biotechnology, including the refusal of industry and government authorities to require that GM foods be labeled. During BIO's 2001 World Conference in San Diego, Greenpeace activists stormed groceries stores and stuck "hazardous" labels on foods that containing GM ingredients. In 1999, Greenpeace joined other activist groups in protests in California urging the FDA to require labels on GM food.

In 2001, Greenpeace activists protested outside Trader Joe's stores in California. Known for its inexpensive items and "all natural" food products, Trader Joes was accused of selling a line of bread that contained GM corn.

In 2000, Greenpeace petitioned San Francisco officials to reject GM food at public events and favor organic food vendors instead. The city's Commission on the Environment unanimously passed a resolution urging all city departments to give preferential treatment to organic food vendors when the city awards catering contracts for special parties and events. Local Greenpeace representatives helped shape the language of the proposed resolution.

Craig Culp, who directed Greenpeace's "GE-free" (genetic engineering) campaign from its beginning in 1999, said the organization's greatest challenge in the United States was to be taken seriously by news media. "There was always a hurdle to overcome about the perception of the organization as banner hangers, people getting arrested," he said (personal communication, April 5, 2005). Establishing credibility on the organization's own scientific studies on GMOs was especially difficult. Journalists, he said, liked using scientists as sources on biotechnology stories, but were leery of scientists doing research funded by Greenpeace. It was "as if the cult had painted the credentials of the scientists," he said. "It was very hard for Greenpeace to say we have an entire scientific body that does research on this stuff. [And we're] not just a couple of banner-hanging guys in the backroom that have decided they don't like GE foods."

The reception in Europe, however, was much different. "It is a completely different world in Greenpeace offices in Europe than in this country. Greenpeace is invited to the table on policy discussion and consulted. Not so here….There's a lot more skepticism about Greenpeace in this country," he said.

Still, Culp said Greenpeace was successful in influencing the story in the United States in some ways by creating powerful images "impossible to ignore," such as one image in its pharmaceutical rice campaign that read, "This Rice Is On Drugs."
One campaign strategy that worked best for Greenpeace was to target small communities, such as farming communities, educating them on the specifics of GMOs, rather than blanketing messages in national campaigns, he said. Greenpeace often found a more receptive press at weekly and small community newspapers, he said, citing pressures at national newspapers like *The New York Times* and the *Los Angeles Times* to not appear

too left-leaning. “There’s an interest [at these newspapers] to say you are a liberal activist organization and we can’t give you a free ride or we’re going to play into our critics and hand them ammunition. They’d be really tough on us and then they’d go and give six quotes to somebody from a far-right wacko think-tank. It was a way for them to show that their paper is fair and balanced,” he said.

Culp also characterized *The San Francisco Chronicle* as being “tough” on Greenpeace, but found a more receptive ear at the *St. Louis Post-Dispatch*, particularly with longtime reporter Bill Lambrecht. “We were able to find some very sympathetic ears, Bill Lambrecht has been a great voice for reason on the issue of GE foods. But Jane Kay at the *Chronicle* could be as tough as nails,” he said.

Greenpeace ended its GE-free campaign in 2003, which is when Culp moved over to the Center for Food Safety in Washington, D.C. as media director. The reasons why Greenpeace ended its campaign are unclear to Culp, who blamed it on “fatigue” within the organization after its enormous efforts to establish a network of activists campaigning across the country. Culp said he felt that the campaign ended prematurely. “I thought they killed the campaign right when it had reached a critical mass stage when it had enough contact points on the issue to really begin to effect change. It takes a long time to build a grassroots network and it takes a long time to get strategies in place that are localized enough to be effective,” he said. “Unfortunately I think that they killed right when it was ready to go to another level.”

For 30 years, Jeremy Rifkin and his organization, the Foundation for Economic Trends, have also tried to influence how the biotechnology is shaped, but they’ve not always been successful, he said (personal communication, February 3, 2005). “They’re

always going to try to discredit you. They've been doing that for years," he said. "Look at editorials and what they've said about me in the last 30 years. It'll make your hair rise on your head."

One challenge, he said, has been the shortened, fast-pace news cycle, especially for television, which does not allow enough time to explain the complexities of biotechnology. "Every time I've done an interview on this in the last ten years, they put down the camera because it takes more than seven seconds to explain," he said. Rifkin says now many times he won't consent to interviews if they don't give him more time to explain.

Rifkin said oppositional groups must do several things to push to get their viewpoints heard. "Creating the framework for discussing the issue" is one strategy, he said, explaining that activist organizations must know what their message is, stick to it, and believe in it fully. Furthermore, messages have to be repeated for generations before they take hold, so patience is key, he said.

"Human beings make movements, and it takes a long, long time, and careful preparation and credibility," he said. "Make sure you believe in what you are saying and that you can back it up."

He continued, "It is important to know what you're against, but it is also important to know what you're for.

"To blindly say you're opposed to every new development in science is not effective. The question is not the science and technology itself, but how it's applied," he said.

Summary

The research conducted in this section aims to complement the quantitative study on framing from the previous chapter. Taking a social-constructionist approach, a variety of different materials – news stories, public documents, interview data, and other sources – were used to conduct an in-depth contextual and historical study to glean an understanding of how dominant sponsors mobilize to shape the construction of news frames.

The regulatory agencies (FDA, USDA, and the EPA) were dominant news sources used in news coverage in both geographic areas. In adhering to publicly stated missions of regulating the industry to protect consumers or the environment, these agencies prefer to be viewed as taking a neutral, objective role in debates over biotech. Officials from the FDA and the USDA assessed media coverage of their organizations as being fair and mostly accurate.

In the Missouri newspaper, sources from private industry tended to dominate the coverage of GMOs, more so than in Northern California. The dominance of industrial stakeholders closely resembles the results of the quantitative framing study, in which dominant frames focused on the business of agri-food biotechnology firms, particularly Monsanto. Biotech products like BST, StarLink corn, and Roundup Ready soy appeared frequently in the dominant Missouri news frames.

Perhaps the dominance of private industry is to be expected, as Monsanto, which was mentioned in two-thirds of the Missouri news articles, is headquartered in St. Louis. In the late 1990s, BIO (Biotechnology Industry Organization) worked hard to shape biotech as a positive story, spending roughly $50 million in media campaign efforts in the

late 1990s. BIO believed its efforts paid off. Certainly, they did in Missouri, a state whose economic livelihood depends largely upon the successes of Monsanto and other biosciences companies there.

Opposition groups appeared to gain more ground in news coverage of biotech in Northern California. Greenpeace was a dominant news source in Missouri, but more so in Northern California where it was joined by longtime activist Jeremy Rifkin. Rifkin's campaign has extended over 30 years, and his viability as a new source, as well as Greenpeace's, was accepted more in the Northern California newspapers.

The findings of the Northern California stakeholder study also match the results of the quantitative study of news frames in the Northern California news. Frames in the Northern California newspapers addressed the more controversial issues surrounding GMOs, which have been raised by oppositional groups. Furthermore, the research activities of science centers in Northern California also dominated the news there. The University of California was a dominant newsmaker, which aligns with the science frame that appeared in Northern California news coverage.

Carragee and Roefs (2004) explain that a frame's ability to dominate news discourse depends on the news sources' resources, knowledge of professional journalistic processes, as well as the ability to offer a frame that resonates with broader political values. The dominant news sources or frame sponsors for the agricultural biotechnology story appeared to have the financial resources to devote to their various media campaigns. Furthermore, many of those interviewed had previous media experience in print or broadcast media. They also had a unique understanding of the differences in media outlets and in reporters. Whether talking to a reporter on the farm beat or the business

beat, or a reporter from the national press or foreign press, the press officer could anticipate potential problems in comprehension or accuracy and so knew to tailor the message, or frame the story, accordingly. The dominant groups were also successful at offering frames that resonated with the broader political values in each region. Missouri's more industry-oriented frames resonated with its more conservative leanings, while Northern California's more oppositional frames resonated with its more liberal leanings.

CHAPTER VI.

DISCUSSION

Framing suggests that news media play an important role in making certain public issues more salient than others while also providing a specific news angle that characterizes those events (Entman, 1993, 2004; Gitlin, 1980; Iyengar, 1991; Shoemaker & Reese, 1996; Tuchman, 1978). Thus, in the case of a scientific controversy such as GMOs, news media can select to focus on the dangers of "frankenfoods" as opposed to the promise of new technologies to fight hunger and disease, can frame the issue as a risk or as a scientific opportunity, can emphasize cross-pollination of GM crops versus reductions in pesticide use, and can highlight a positive or negative stance toward agri-food biotechnology. In so doing, news media can also use as news sources the industrial developers with a vested interest in the technology or the environmental activists with a publicly-stated interest in protecting the environment.

Effective science journalism is one important way for people to learn about fast-breaking events and new developments in science that could affect them. While the exact scope of the news media's influence is debatable, some scholars have suggested that the power of media to influence public opinion on issues of science and technology may be stronger than on other issues because, on a day-to-day basis, many people do not have other sources of expert information or interpretation of scientific issues (Priest & Ten Eyck, 2003). Of course, media messages do not dictate public opinion; audiences are active in selecting and interpreting the news. Still, media messages about science can help create favorable attitudes toward certain science issues or more negative opinions.

These attitudes can in turn affect the policymaking climate and the view of the costs and benefits of government expenditures on science. Indeed, media imagery can play a symbolic role in how the public views new technological advances. Once a new technology becomes more familiar, the degree of media attention will likely decrease over time (Priest & Ten Eyck, 2003).

The purpose of this study was to investigate the portrayal of a scientific controversy in the news media in order to gain a deeper understanding of mass media interpretations of a specific scientific debate, especially at the local level. The study examined how local news frames the controversies surrounding genetic engineering of food and crops, and how the frames change over time. The purpose was also to investigate the dominant stakeholders in the debate and how they appear in the news frames. This chapter discusses the findings of these analyses and considers the contributions of the study to the scholarly literature, as well as the study's limitations. Opportunities for future research are also discussed.

The research adds to knowledge about news media coverage of the debate on GMOs in several ways. First, little is known about the nature and extent of news coverage at the local or state level, as few previous studies have examined newspaper coverage in specific communities or in specific states. Yet, it has been suggested that broader and more diverse perspectives on biotechnology may exist more in local news coverage than in the national, elite press (Priest & Ten Eyck, 2003). Agri-food biotechnology issues are important at the local level – to local economies, to local farming communities, to local environmental activists, and to local consumers. Certainly, some agricultural issues at the local level would likely seem mundane to urban audiences

of national news media. Numerous studies of national news have suggested that news stories from the mainstream press interpret or frame biotechnology issues in a rather similar, uniform way, leading one to believe that perhaps U.S. public opinion also reflects this monolithic view. Yet, the results of this study suggest that a range of voices and interpretations do in fact exist in the United States, at least in local news media and perhaps even more so than in national news media.

Furthermore, the research offers insight into how frames can change over time. Snow et. al. (1986) offered that frames have a dynamic life-cycle and construct meaning over time. In focusing on frame changes, the research highlights not only the life-cycle of the GMO story, but also the way sources have worked to sponsor their preferred frames in the news.

The research also adds to knowledge about how sources influence the way issues are written about in print news media. Given that news media often provide a forum for framing contests between social and political actors, it is important to understand how these actors influence news coverage to reflect their preferred frames. Media scholars have argued that it is critical to understand the ways in which journalistic framing of issues occurs because framing influences public understanding and, consequently, policy formation (Gans, 1979, 1983; Gitlin, 1980; Pan & Kosicki, 1993; Tuchman, 1978). It has also been suggested that framing research in communication scholarship has neglected the importance of considering how news sources influence the content of frames in news media. Drawing upon the sociological roots of framing, this study considers the contextual relationship between news frames and news sources.

Further, because it examines local news, the study contributes to understanding of how news sources in different types of communities can influence news coverage. Tichenor, Donohue, and Olien (1980) have suggested that more pluralistic communities tend to have more diverse social power structure, which provides more leeway for journalists to choose which news sources' interpretations dominate news. In more homogenous communities, they posit, journalists often face one dominant, preferred meaning shared by both the community power structure and its media organizations. Through an exploration of local news, this study investigates the frequency and range of news sources to determine the degree of diversity in perspectives. Attitudinal research has shown that news that offers a diversity of information sources and viewpoints, at least on issues related to agricultural biotechnology issues, leads to greater tolerance of different points-of-view in audiences (Brossard & Shanahan, 2003).

Methodological Advances

This framing analysis represents an important contribution to framing research by quantitatively examining and comparing frames over a period in local newspaper coverage of agri-food or "green" biotechnology. It does so by utilizing factor analysis to determine news media frames.

Previous quantitative research of frames has been done using a cluster analysis method, and no previous framing studies of U.S. news content about biotechnology have utilized computer-assisted content analysis. This study breaks new ground by, first, conducting a computer-assisted content analysis to examine biotechnology frames, and, second, by employing factor analysis to determine frames utilized in several newspapers

across multiple years. According to the literature, only two studies have utilized factor analysis. Risse and Van de Steeg (2003) used factor analysis to study frames used within European public debates. Kiousis (2004) also conducted a factor analysis of frames to determine the salience of issues related to the 2000 U.S. presidential election as covered in *The New York Times*.

Computer-assisted content analysis has several advantages beyond the typical method of extracting frames manually. In computer-assisted content analysis, the researcher does not specify the categories, terms, or words to be sought in the text. Instead, words are selected based on their frequency of occurrence in the text as well as their meaningfulness or substantive interpretability. This leads eventually to the frames, which emerge out of the textual data, and not as a result of researcher selection. Thus, this approach reduces the chances of arbitrary results due to researcher fiat. Furthermore, unlike more inductive methods, the factor analysis technique systematically constructs the frames, thereby keeping the researcher removed from the frame construction process (Simon & Xenos, 2004).

The factor analysis method shares a great many similarities with hierarchical cluster analysis, which has been used frequently to statistically validate frames. However, cluster analysis appears to have some limitations that can be overcome using factor analysis. Unlike factor analysis, cluster analysis does not make very restrictive assumptions and so does not offer any real goodness of fit tests (Aldenderfer & Blashfield, 1984; Hagenaars & Halman, 1989). Furthermore, in cluster analysis, it is difficult to choose an optimum number of clusters on an empirical basis (Miller & Riechert, 2001b, p. 116), which factor analysis is able to do empirically.

Finally, this study offers a unique contribution to the study of biotechnology news coverage because it targets for analysis only those stories specifically focused on issues related to "green" biotechnology. The search strategy was limited to only those articles containing words related to GM crops and foods and excluded "red" biotechnology issues like cloning or stem cells. Previous studies on agricultural biotechnology have included news related to cloning or stem cells, which can obscure more precise readings on the characteristics and frames specific to news coverage on agricultural biotechnology.

Review

Substantively, the results of the analysis indicate what Priest and Ten Eyck (2003) have suggested that news about biotechnology at the local level offers a broader, more diverse range of perspectives than news from the elite, national press. The study has demonstrated that subtle but unique differences exist in how the green biotechnology story has been told in Missouri and in Northern California. Instead of reporting the tone of news reporting (positive, negative, or neutral) or reporting the frames as having a dual, "either/or" nature, the results of this framing analysis offer a greater degree of description and detail. In Missouri, the story has been framed in terms of biotechnology's economic importance to the region, while in Northern California, news articles have framed biotechnology in terms not only of its economic importance but also in terms of the controversies surrounding it. In Northern California, GM foods were framed as Frankenfoods; GM crops were framed as something to be contested in political campaigns; and the science research related to agri-food biotechnology was characterized

in terms of its commercial applications. In Missouri, frames focused on the business of agri-food biotech: BST, StarLink, and Roundup Ready products.

The results have also confirmed what Snow and others (Snow, et. al., 1986) have suggested – that frames change over time. In the Northern California newspapers, the most dominant frame throughout the 13-year time period was the safety frame, and it was most evident during the 1992 to 1998 time period and also in 2000 and 2001. This finding appears to contradict previous studies that have indicated a predominance of the economic prospect frame or a more positive tone in the early years of news coverage. Yet, these findings might also confirm what some scholars (Priest, 2001b; Priest & Ten Eyck, 2004) have suggested – that controversy or resistance to technology may initially emerge at the local or regional level. Concerns about BST as well as the Frankenfoods frame were also more prominent in the early years of news coverage in the Northern California news.

In Missouri news coverage, the most dominant frame throughout the 13-year time period was the Roundup frame, suggesting the dominant focus on the work of Monsanto. The appearance of this frame was consistent throughout the time period. Other frames appeared to peak based on the breakthrough events that occurred in agri-food biotechnology. For example, the early years of the "green" biotechnology story in the Missouri area were dominated by the BST story, until at least 1995. The mid-to-late 1990s focused on the issues associated with the introduction of GMOs in the European Union. The StarLink controversy dominated 2000 and 2001. The safety frame, which so dominated the Northern California news, appeared to peak in the late 1990s until 2004, when it dropped off in appearance – these findings appear to match those in studies of

national newspaper coverage where the initial furor over biotechnology's economic promises died down in later years (Nisbet & Lewenstein, 2002; Priest, 2001a).

A comparison of frame changes revealed that the European controversy as told in the Northern California news was different than the one told in the Missouri news. In Northern California, the Frankenfoods label was strongly associated with the European controversy over GMOs, while in Missouri the European controversy was more closely related to Roundup Ready soybean. News in the different regions also framed issues of safety differently. In Northern California, the safety issue was more closely associated with the early years of news coverage and had little connection to frames about science. In Missouri, issues of safety peaked in stories with a strong science frame, particularly in 1999 when the Cornell butterfly study on Bt corn was released.

The results of the study also indicate the degree and frequency of involvement of the various biotechnology stakeholders in news media coverage. Sources from private industry tended to dominant the Missouri news coverage of GMOs, more so than in Northern California. Perhaps not surprisingly, Monsanto was mentioned in two-thirds of the Missouri news articles. In Missouri and in the rest of the nation, the Biotechnology Industry Organization worked hard to shape biotech as a positive story, spending roughly $50 million in media campaign efforts in the late 1990s. BIO believed its efforts paid off. They appeared to in Missouri, a state whose economic livelihood depends largely upon the successes of Monsanto and other biosciences companies there. The dominance of industrial stakeholders closely resembles the results of the quantitative framing study, in which dominant frames focused on the business of agri-food biotechnology firms, particularly Monsanto. Biotech products like BST, StarLink corn, and Roundup Ready

soy appeared frequently in the dominant Missouri news frames. Based on the results of the study, the Missouri newspaper, at least, appeared to protect the interests of the dominant power structure, which corresponds to one theory of community news which says that in less pluralistic communities, news media aligns with existing power structures and more often displays a homogenous view.

Opposition groups appeared to gain more ground in news coverage of biotech in Northern California. Greenpeace was a dominant news source in Missouri, but more so in Northern California where it was joined by longtime activist Jeremy Rifkin. Rifkin's campaign has extended over 30 years, and his viability as a new source, as well as Greenpeace's, was accepted more in the Northern California newspapers. The findings of the Northern California stakeholder study also match the results of the quantitative study of news frames in the Northern California news. Frames in the Northern California newspapers addressed the more controversial issues surrounding GMOs, which have been raised by oppositional groups. Furthermore, the research activities of science centers in Northern California also dominated the news there. The University of California was a dominant newsmaker, which aligns with the science frame that appeared in Northern California news coverage. These results also support the community news theory, which says that more dissenting voices are heard in news in more pluralistic communities.

The study also contributes to mass media research on news sources and the behavior of stakeholders in the news. A source's ability to frame the news depends on its resources, its knowledge of the journalism profession, as well as its ability to offer a frame that resonates with broader political values (Carragee & Roefs, 2004). In this study, the dominant news sources for the agricultural biotechnology story appeared to

have the financial or staff resources to devote to their various media campaigns. Furthermore, many of those interviewed had previous media experience in print or broadcast media, and understood the differences in media outlets and in the reporters who represented different types of media. Whether talking to a reporter on the farm beat or the business beat, or a reporter from the national press or foreign press, the press officer could anticipate potential problems in comprehension or accuracy and so knew to tailor the message accordingly. Finally, these dominant groups were successful at offering frames that resonated with the broader political values in each region. Missouri's more industry-oriented frames resonated with its more conservative leanings, while Northern California's more oppositional frames resonated with its more liberal leanings.

Implications of the Research

The findings suggest that a diversity of viewpoints may exist in local news media coverage of agricultural biotechnology more so than in national news media. This diversity of viewpoints was most evident in news from the pluralistic communities of Northern California, less so in news from the more homogenous communities of the St. Louis, Missouri region. Studies of news coverage of biotechnology issues in Western Europe, where opposition is much more widespread, have also shown news coverage to offer a broader range of perspectives. The results reported in these studies, however, may in part reflect the more analytical, and thus more subjective, nature of Western European media. Previous studies of U.S. news, on the other hand, have indicated a more homogenous view of biotechnology issues. This study, however, suggests that subtle differences may exist in U.S. news, but are more evident in news at the local level.

The discovery that local news frames the GMO story in greater complexity raises larger questions about the importance and value of news stories told in the pages of local daily and weekly newspapers across the United States. While frequently dismissed as a sideshow to the real journalism taking place in national news media, perhaps the local "rag" does indeed have a significant place in social discourse, or at the very least, provides a meaningful site to study how news media construct social reality. Journalistic routines and conventions have taken years to establish at the national, elite newspapers, where often their credibility relies upon these tried-and-true ways of gathering and producing the news. These established news-gathering routines may leave little room for dissenting voices. For the most part, the elite press can ill afford to entertain the notion of providing precious space to voices from the perceived "fringe" or to topics not perceived as part of the national conversation. By contrast, local newspapers have more tolerance for error and a certain degree of openness that allows for consideration of a variety of news topics and a range of voices, legitimate or otherwise. To be sure, many local news outlets also adhere to journalistic routines and practices, but they can tolerate a greater degree of risk-taking perhaps more so than the elite press. Local newspapers are often less tied to journalistic routines related to reporting, editing, and producing the news product.

This study's findings also raise questions about the perceived credibility and legitimacy of news sources, especially in local news. A source's frequency in news reports does not necessarily denote that the source is credible, reliable, or even legitimate. This study examines dominant news sources, or those most frequently occurring sources in news sources. The source's frequency may imply that the source was available and

accessible, not necessarily credible. On the other hand, the source's legitimacy as a news source may have been established because it was called upon frequently to provide comment. The study's findings offer no solution, but suggest that a source's legitimacy cannot necessarily be established by its frequency of use. For instance, environmental activists were dominant stakeholders in Northern California news coverage of biotechnology. Yet, were these news sources legitimate or credible? Indeed, the credibility and legitimacy of certain environmental activists as news sources has sometimes been called into question, especially in the case of Greenpeace activists. Still, in Northern California news reports, these activists, including Jeremy Rifkin, appeared to be a legitimate and credible news source, or at the very least a viable news source. The question of their credibility and legitimacy as a news source cannot easily be established and remains an open question. Of course, news is a product that must be produced on a deadline. If a source is accessible, by default then, the source might become legitimate. And certainly, at a local news outlets, where there is perhaps more flexibility and even a greater margin for error, a news source who is accessible might be seen as more credible and legitimate more quickly.

This study also exposes the problematic nature of the journalistic goal to strive for "balance" in news stories about biotechnology, particularly as it relates to the inclusion of news sources. In pursuit of "objectivity" and avoidance of "bias," journalists aim for "balance" in news stories and so aim to have different viewpoints represented. This is especially the case in stories about scientific controversies, such as genetic engineering. For example, in a story about the discovery of a new GM crop, such as pharmaceutical rice, good journalist practice would call for the story to include comments from the

scientist-researcher as well as from the opponents of biotechnology who would likely question the crop's safety. Industrial developers of biotechnology often argue that activists have no merit in news stories of biotechnology because the science is already proven to be safe, especially if the product has already won approval from the FDA. Many scientists would also question news stories that give credibility to viewpoints from so-called fringe groups. Another point is that few journalists have training in science or have real understanding of the issues, so determining how much weight to give arguments from different sides of the scientific debate proves particularly problematic, especially when reporting on a deadline. Some would further argue that the journalistic notion of balance is of no consequence in the world of science (Mooney, 2004). As Mooney observes,

> Scientific theories and interpretations survive or perish depending upon whether they're published in highly competitive journals that practice strict quality control, whether the results upon which they're based can be replicated by other scientists, and ultimately whether they win over scientific peers. When consensus builds, it is based on repeated testing and retesting of an idea.

Still, unlike other scientific concerns such as global warming or evolutionary theory, there is no real scientific consensus on the long-term effects of biotechnology, which is perhaps why the skeptics continue to be given a voice in news stories about biotechnology. How those voices are characterized or framed, however, is a different matter. This study offers some understanding of the place of dissenting voices in localized debates on genetic engineering. At least in local news, to a certain degree, oppositional viewpoints have found a place.

Limitations of Study

As this study specifically analyzes content, it is limited in several ways. A content analysis cannot determine causality. Because of its lack of inference power, it can be taken only as a first step to explore the homogeneity and differences across groups. A framing analysis serves as a grouping tool that is useful in determining frame dominance within a set of text. At best, a framing analysis can only describe frames that are present within a set of text and which frames are more dominant. While it does not answer questions of causality, the preceding analysis has provided informed speculation as to the reasons for the differences in framing the genetic engineering debate in newspaper content from Northern California and Missouri.

Furthermore, while WordStat and other statistical programs allow for precise comparison and analysis in determining frame dominance and shifts in frames over time, the quantitative foundation does offer a limitation. A quantitative content analysis, conducted with the assistance of WordStat and SPSS, is founded on the repetition of certain words or phrases in order to determine frames. Yet, many powerful concepts central to frames do not necessarily have to be repeated often to have a great impact. In addition, as addressed in the previous section on implications of the research, the frequency of stakeholders mentioned in the news articles does not necessarily determine their influence in how the story is framed. Their occurrence, coupled with an analysis by the researcher of how the stakeholders appear in the news stories as well as an analysis of data from interviews with the dominant stakeholders, offers some insight and understanding about how they might have influenced news coverage.

Another limitation of content analyses is that such analyses provide no understanding of the effects of mass media messages on audiences. A content analysis is limited to describing text and exploring the characteristics of media messages. How the messages are perceived or interpreted goes beyond the scope of a content analysis. This research focuses on the frames that are used to define issues related to genetic engineering in local newspaper reports. How local audiences cognitively process and interpret those frames or how the frames affect audience attitudes toward genetic engineering cannot be explored via content analysis.

Yet, if as Pan and Kosicki (1993) say, the language of frames can set the context for public debate as well as define the issues for that debate, then future research should consider how local readers, listeners, and viewers respond to various news media frames about GMOs. Of course, people do not wholly respond to how an issue is framed in news media. Rather, people "actively filter, sort, and reorganize information in personally meaningful ways in constructing an understanding of public issues" (Neuman, Just, & Crigler, 1992, p.76-77). The use of biotechnology to alter crops and to produce food has encountered various levels of support worldwide. Furthermore, the genetic engineering debate has political and social implications in countries that are seeking public participation in the policymaking process. Thus, research that advances understanding of how audiences process and respond to news media messages on biotechnology is an important avenue for study. In some cases, the more coverage news media have devoted to science and technology issues, the more negatively individuals have assessed the risks associated with the technology, at least in terms of nuclear power issues (Mazur, 1990).

This effect has also been suggested with news related to agricultural biotechnology (Priest, 2001b, p.60).

Finally, the reader needs to be reminded to generalize the findings of the study with caution: this study examined only newspaper coverage, leaving out many other news media that cover the biotechnology story with regularity and in varying degrees of depth. By limiting the analysis to newspapers, the study provides only one source of biotechnology news coverage in a world where other media might arguably be more influential or at least more readily consumed by the public.

Opportunities for Future Research

This study analyzed newspaper frames about genetic engineering over a 13-year period in two geographical locations in the United States. It also focused on stakeholder influences on those frames. Further research is suggested that addresses a variety of additional issues and topics related to the initial questions raised in this study as well as related to the study's findings.

Future studies should include a broader representation of news media, including television, radio, and the Internet. To gain a more complete understanding of mass media portrayals of genetic engineering, other channels for news on agricultural biotechnology must be explored and mined to capture frames used to tell the story. In what ways do different mediums tell the story? Does broadcast journalism, for example, share similar frames as those in print coverage? How is the Internet being used to tell the story and sway audiences? Which audiences? There is some evidence that industry sources, as well as the public relations companies that they hire, have been particularly effective in using

the Internet to proliferate favorable news about biotechnology via numerous websites and by posting messages on listservs. If industry representatives are posting to listservs, it would seem that their audiences are small and highly specialized. It may be that in the debate over biotechnology, the battle to sway public opinion and affect public policy on the matter may be waged most effectively in narrowly focused, elite groups who use highly specialized news media.

For comparative purposes and otherwise, more research needs to be conducted on news from other geographical regions of the United States. If archived news stories from small, local newspapers become more readily available, opportunities are created to develop a deeper and richer understanding of how the genetic engineering story is told in towns and communities across the nation. Other states with a high socio-economic interest in GMOs and/or a history of involvement with GMOs could provide interesting test cases. For example, in Vermont, a statewide coalition of public interest groups, businesses, citizens and farmers have organized to oppose genetic engineering. In 2004, about 70 townships passed local warrants to discourage the growing of GM crops in town and to support any state or federal laws calling for a moratorium on them. In April 2005, the state senate approved a bill that would make seed manufacturers liable for damages if GM crops contaminate non-GM fields. With Vermont's history of liberal politics, the state makes for an interesting case because its population is a more homogenous one than, say, Northern California, and homogenous communities have been shown to be more supportive of dominant power structures. In this case, then, is local news coverage supportive of the dominant liberal power structure?

Another avenue of research related to content would be a study of editorials and commentaries in local news. A framing analysis of editorial content could provide more precise knowledge of a newspaper's leanings toward the genetic engineering debate. Results could be compared for similarities and differences to the frames used in news content. The findings could provide greater understanding of how the GMO story is told locally and whether frames in editorial content reflect the community power structure.

As this is study not only on news content but also on the influence of stakeholders, more research needs to be conducted on other influences of news media content and/or frames about genetic engineering. Shoemaker and Reese argue that the influences on media not only come from interest groups and the journalists who write about them, but also from news organizations themselves and their policies, e.g., political endorsements, editorial positions, and corporate procedures, and from external variables, such as the current cultural, political, economic and social environment. While perhaps difficult to measure quantitatively, research using a more qualitative approach could offer insight into what and who makes the news on agricultural biotechnology. If the way that an issue or event is framed affects the way public policy is formed, then it is critical that we understand what factors influence framing.

Why do some biotechnology stories never capture the attention of national news media, and instead remain strictly the purview of local news, or even just specialized information outlets such as listservs? Examples include the rBST story or the terminator seed story, which were covered in local newspapers first. Priest and Ten Eyck have suggested that to reach the national news agenda, biotech stories must "capture the

attention in unusual ways" (2004, p. 194). Future research could examine the direction of flow of biotech news stories as well as the attributes of local news stories that do eventually receive national news coverage. What is it about certain local stories that warrant national news coverage? What stories remain local? We know that the national news often sets the agenda for more localized and regional news outlets, but in the case of GMOs, does that theory uphold? As ownership of U.S. news media organizations become more and more concentrated, opportunities for important local news stories to break through to the national news agenda may be severely curtailed. Yet, while the world of media ownership appears to be shrinking, opportunities for more individualized news accounts via weblogs or listservs appear to be expanding. In the future, where will the GMO story be told, and to whom? And where and to whom will the story matter most?

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APPENDICES

APPENDIX A

LIST OF *ST. LOUIS POST-DISPATCH* NEWS ARTICLES ON GMOS, 1992-2004

Articles listed in Appendix A were downloaded from the LexisNexis Academic Database on December 7, 2004 using keywords related to the issue of GMOs. The initial search yielded 1,134 articles, each of which was then analyzed by the researcher to determine its appropriateness for inclusion in the study. After applying the rules for deletion as specified in the section *Design of the Quantitative Study* in Chapter III, the total number was reduced to 860 articles, which are listed here.

Case # Date Topic

1. November 30, 2004, EU can't break deadlock on Monsanto's modified corn
2. November 17, 2004, Monsanto buys seed company Channel Bio
3. November 12, 2004, Soybean farmers face a winter of decision
4. October 27, 2004, EU clears way for genetically modified corn products
5. October 22, 2004, Paraguay approves Monsanto soybeans
6. October 21, 2004, Biotech crops get a rave review
7. October 20, 2004, Venture capitalists reload for next round, invest in life-sciences, GM crops
8. October 16, 2004, Brazil approves Monsanto soybeans
9. October 7, 2004, Monsanto raises bar for fiscal '05 earnings
10. September 11, 2004, Monsanto, Divergence join to fight soybean pest
11. September 9, 2004, EU sends mixed biotech signals
12. September 2, 2004, Monsanto's new soybeans slim down their trans fat
13. August 27, 2004, Stalking the biotech giant
14. August 7, 2004, Kerry pitches energy proposals to Missouri farmers, addresses GMOs
15. July 20, 2004, EU nations deadlock over Monsanto corn
16. July 16, 2004, Delta & Pine assails Monsanto on license
17. July 11, 2004, French vintners sound alarm over biotech grapes
18. July 1, 2004, Monsanto boosts its earnings by 45 percent
19. June 29, 2004, EU deadlocks on GM corn vote
20. June 26, 2004, Monsanto's corn gets European support
21. June 20, 2004, Monsanto tries to win Indian farmers over to biotech seeds
22. June 20, 2004, Banking on biotech
23. June 13, 2004, Economic reforms sought by farmers could benefit biotech companies such as Monsanto
24. June 8, 2004, Reports on biotech give Missouri a mixed review
25. June 4, 2004, Biotech artwork triggers bioterror suspicions
26. June 2, 2004, Scientists zero in on drought-resistant crops
27. May 22, 2004, Monsanto wins Canada seed patent case
28. May 20, 2004, EU lifts moratorium on biotech foods
29. May 19, 2004, Loss for GMOs as Monsanto decides not to market GM wheat
30. May 17, 2004, Monsanto boosts sales
31. May 15, 2004, EU to end moratorium on GM corn
32. May 11, 2004, Foes declare victory on delay of GM wheat
33. May 6, 2004, Biotechnology offers new grass for golf courses
34. May 6, 2004, Panel touts effectiveness of agricultural biotech
35. April 27, 2004, Monsanto biotech sales get boost
36. April 23, 2004, River locks need expansion for GM exports
37. April 19, 2004, Is the grass greener when it’s bioengineered?
38. April 18, 2004, Food industry dreads European labeling rules
39. April 3, 2004, India approves Monsanto cotton
40. March 16, 2004, Monsanto and Pioneer Hi-Bred join forces
41. March 14, 2004, GM plants to clean up industrial sites
42. March 12, 2004, Monsanto seeks okay for wheat
43. March 12, 2004, Panel says Mexican corn is at risk

44. March 11, 2004, Monsanto stock hits high after British action
45. March 10, 2004, British okays commercial cultivation of GM maize
46. March 5, 2004, Biotech crop ban passes in Mendocino, Calif.
47. March 2, 2004, California county to vote today on biotech crop ban/industry spent thousands to defeat measure
48. February 25, 2004, Monsanto predicts strong earnings on seed sales
49. February 24, 2004, China okays GM crops
50. February 20, 2004, Brits might okay GM crop
51. February 4, 2004, Monsanto wins patent dispute
52. January 30, 2004, Monsanto tries to sell benefits of GM wheat
53. January 29, 2004, Monsanto raises price of BST
54. January 20, 2004, Piracy impels Monsanto to suspend seed sales to Argentina
55. January 16, 2004, Judge won't recuse himself in Monsanto case on price-fixing GM seeds
56. January 14, 2004, Plantings of biotech crops jump 15 percent
57. January 8, 2004, Monsanto seed and Roundup Ready herbicide sales rise
58. January 2, 2004, GM salmon
59. December 29, 2003, Center hopes bioengineered crop will help feed Africans
60. December 25, 2003, Monsanto settles milk-labeling lawsuit with small Maine dairy
61. December 21, 2003, Food retailers concerns on GM
62. December 9, 2003, EU decides it won't end biotech food moratorium/Monsanto finds decision 'disappointing'
63. December 7, 2003, California blocks sales of biotech
64. December 7, 2003, Book review of pro-GM book
65. December 5, 2003, Monsanto downplays European patent ruling
66. December 1, 2003, Kids' book on healthy eating
67. November 30, 2003, Farm taskforce reports on challenges in global economy
68. November 29, 2003, Editorial, China's hurdles for soybean imports
69. November 27, 2003, GM foods at the market
70. November 15, 2003, Study: Corn farmers follow safeguards
71. November 14, 2003, Genetic manipulation isn't new, corn study says
72. November 12, 2003, Jesuits speak against creation of news species/engineered food violates church teaching, they tell Vatican panel
73. November 11, 2003, Catholic church convenes conference on GM food/Vatican considers endorsing biotech crops to reduce world hunger
74. November 9, 2003, Brazilian farmers resist paying royalties on soy
75. November 4, 2003, EPA approves Yieldguard corn product
76. November 2, 2003, U.S. companies brace for new European chemical rules
77. October 19, 2003, Book review on science and ethics
78. October 18, 2003, Monsanto broke U.S. planting rules 44 times over 12 years
79. October 16, 2003, Monsanto cuts jobs because of drop in Roundup
80. October 15, 2003, Gates Foundation gives $24 million to bring nutrients to world's poor/Monsanto is part of HarvestPlus effort to combat malnutrition
81. October 10, 2003, Monsanto aims to produce healthier soy
82. October 2, 2003, Monsanto suit is denied class-action status/judge says price of seeds is not fixed as farmers allege
83. September 25, 2003, Farmers allege losses on consumer resistance to GM foods
84. September 25, 2003, Brazil will allow growth of GM soy for second year
85. September 18, 2003, Survey finds people don't realize they've been buying, eating GM foods
86. September 12, 2003, Indian riot targets Monsanto
87. September 10, 2003, EU approves ban on GMOs
88. August 26, 2003, Illinois farmers, grain handlers deal with biotech safeguards/separation of crops is key to sales
89. August 11, 2003, Editorial, Monsanto should allow Maine dairy free speech
90. August 10, 2003, Sigma-Aldrich sprouts into plant biotech business

91. August 10, 2003, Labeling BST
92. August 8, 2003, U.S. seeks hearing on WTO dispute
93. August 8, 2003, Monsanto's new VP sees strategy through wide-angle lens
94. August 6, 2003, Altered crops face more restrictions
95. August 6, 2003, Chlorogen gets $5 million backing for biotech process
96. August 1, 2003, Biotech seeds grow Monsanto's quarterly
97. July 23, 2003, EU approves tougher labeling on GM foods
98. July 16, 2003, Biotech protesters slow Armstrong, demonstrators block a pack of top riders
99. July 15, 2003, Welcome weather for wheat
100. July 12, 2003, Letter, Concerns on GM food
101. July 12, 2003, Letter, Organic food preferred
102. July 11, 2003, Agri-business database offers one-stop shopping for discoveries; Shared research may lead to new crops, food for poor
103. July 9, 2003, New words: Frankenfoods
104. July 8, 2003, Editorial, Pro-GM
105. July 3, 2003, EU approves biotech labels; decision could end freeze on GM products
106. July 2, 2003, U.S. opposes European plan for labeling GM food
107. June 26, 2003, Bush comments on GM food
108. June 25, 2003, New study spells out benefits of GM crops; European farmers could boost their yearly income by $1 billion, report says.
109. June 24, 2003, Editorial, Biotech comes under fire from PETA
110. June 24, 2003, Bush has tall order for biotech: End hunger, cure disease, protect America
111. June 23, 2003, Protesters arrested at Calif. ag-biotech meeting.
112. June 22, 2003, Book review: "Mendel to Monsanto: The Promise and Peril of the Biotech Harvest"
113. June 22, 2003, Bush to visit five African countries, pushes Africa to accept GMOs
114. June 21, 2003, EU calls US plan to appeal biotech moratorium pointless
115. June 20, 2003, Creve Coeur startup develops human plasma from tobacco
116. June 19, 2003, New CEO puts Monsanto on a new course, puts focus on sales of seeds and genetic traits
117. June 11, 2003, Solae Co. to focus on improving taste and nutritional value of GM soy
118. June 6, 2003, Trade dispute riles soy producers
119. June 4, 2003, Monsanto and activists in discussions
120. June 1, 2003, Police investigate treatment of activists; protesters accuse officers of damaging property, acting improperly in raids
121. May 31, 2003, Monsanto's new chief expects a good year
122. May 31, 2003, Letter, Anti-GMO
123. May 31, 2003, Letter, Pro-GMO
124. May 30, 2003, Monsanto's new chief is biotech advocate, company veteran pushed GM foods
125. May 28, 2003, Editorial, How healthy is our food system?
126. May 25, 2003, Letter, Anti-GMO
127. May 25, 2003, US presses Europe over biotech
128. May 25, 2003, Dropping tariffs could help meet world food needs, some say here
129. May 22, 2003, Bush says European policies make hunger problem worse; he takes aim at limits on GM food
130. May 21, 2003, Editorial, Heavy-handed police treatment of GM protesters
131. May 21, 2003, Soybeans urged as Kenya solution to combat hunger
132. May 20, 2003, Neither panacea nor poison; delegates debate both sides of the argument over GM foods at World Agricultural Congress
133. May 20, 2003, Letter, Anti-GMO
134. May 20, 2003, Letter, Pro-GMO
135. May 20, 2003, Protesters dwindle, some say out of fear; polic actions were intended to make sure city was prepared, chief says, but the chaos never happened

136. May 19, 2003, Forum on food opens with a plea to feed world; biotechnology advocate issues appeal at meeting focused on trade barriers
137. May 19, 2003, Protesters arrive, see police and demonstrate peacefully
138. May 19, 2003, Column, City officials went into tizzy over mere anarchists
139. May 18, 2003, Editorial, GM food fight, Pro-GM
140. May 18, 2003, Protests are feared today at agriculture meeting; police give no details on arrests of activists Friday
141. May 18, 2003, Editorial, Greens – don't ignore their concerns
142. May 17, 2003, Biodevastation 7 farmers take aim at Monsanto
143. May 17, 2003, Letters, Anti-GMO meeting
144. May 16, 2003, Editorial, Anti-agbiotech industry
145. May 16, 2003, Focus on the future of agriculture: Biodevastation 7
146. May 16, 2003, Focus on the future of agriculture: World Agricultural Forum
147. May 14, 2003, US pushes to end ban in Europe on biotech crops, foods; complaint to WTO says 5-year-old moratorium is an unfair trade barrier
148. May 12, 2003, Monsanto reaps some anger with hard line on reusing seed; agricultural giant has won million sin suits against farmers
149. May 9, 2003, Monsanto backs modified seeds
150. May 8, 2003, Monsanto opponent gets prison sentence; farmer lied under oath and defied court order by burning load of seed
151. April 25, 2003, Monsanto chairman champions engineered seeds
152. April 25, 2003, New biotech crops need watchdogs, report warns
153. April 23, 2003, Editorial, Benefits of GM foods
154. April 22, 2003, Greenpeace to attend Monsanto annual meeting
155. April 20, 2003, Column, Will Saddam DNA show up in your taco shells?
156. April 5, 2003, Biotech forum affirms St. Louis' potential as life sciences hub
157. April 1, 2003, More GM crops to be planted in Illinois
158. March 15, 2003, Monsanto plays down its role in antitrust inquiry
159. March 12, 2003, Coalition asks for in-depth study of GM wheat
160. March 7, 2003, U.S. will step up inspections on biotech crops
161. March 2, 2003, British science adviser explains how US, European opinions differ
162. February 28, 2003, Letter, Anti-GMO
163. February 27, 2003, French farmer gets prison term for destroying GM Crops
164. February 26, 2003, Monsanto gets regulatory approval to sell modified seeds
165. February 23, 2003, Monsanto wants to sow a GM future
166. February 21, 2003, US will hand over $10 million for biotech programs in region; legislation is part of effort to create hub of plant research here
167. January 16, 2003, GM crop industry experiences healthy growth worldwide; 16 countries grew bioengineered crops last year
168. January 15, 2003, Group urges caution in letting biotech fish on the market; threat to species is concern
169. January 15, 2003, Missouri could lose life sciences chance
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552. May 19, 1999, British doctors seek moratorium on GM corn
553. May 17, 1999, Editorial, Biotech must be topic in international affairs
554. May 15, 1999, Editorial, Anti-Terminator technology
555. May 13, 1999, Ashcroft is among senators who want biotech on G-8 summit agenda; they say restrictions in Europe pose a threat to American farm exports
556. May 13, 1999, ADM pays more to non-biotech bean growers; Monsanto produces only GM soybean
557. May 8, 1999, Monsanto sells Gargiulo tomato operations, refuses to name buyer or price
558. April 28, 1999, Four Monsanto officials share in national medals awarded at White House
559. April 23, 1999, Monsanto will wait for studies of disputed new gene technology
560. April 18, 1999, Senator is pro-GMO
561. April 17, 1999, Swiss reject GM crops
562. April 15, 1999, Monsanto uses heavy hand to persuade Brits
563. April 12, 1999, Editorial, Biotech industry partly to blame four consumer resistance
564. March 30, 1999, Letter, Anti GM seeds
565. March 30, 1999, Letter, Anti GMO
566. March 22, 1999, Editorial, Public needs more info on GMOs
567. March 21, 1999, Brazil halts growth of Monsanto’s GM seeds
568. March 19, 1999, GM crops will get safety review
569. March 19, 1999, Webster Groves mulls changes to product labels
570. March 18, 1999, Monsanto retreats in Brazil
571. March 12, 1999, Care rejects plant to work with Monsanto
572. March 4, 1999, Gateway Green group presents petition to Webster Grove; group seeks labels listing GM foodstuffs
573. March 1, 1999, Editorial, Public must be part of dialogue
574. February 26, 1999, U.S. helps block rules on GM products
575. February 25, 1999, Talks collapse on rules for GM crops; U.S. allies block international accord
576. February 24, 1999, U.S. is soundly criticized for its tactics at session on biotech shipments
577. February 23, 1999, Talks stall on setting up global rules to regulate GM crops; optimism is fading that nations will agree on ‘biosafety protocol’
578. February 22, 1999, Compromise is proposed for pact on GM products
579. February 21, 1999, Environmentalists circulate petitions
580. February 21, 1999, Greenpeace board ships to protest bioengineering
581. February 20, 1999, Blair opposes GM food ban
582. February 18, 1999, Monsanto fined in England
583. January 30, 1999, EPA does corn farmers a big favor in bioengineering ruling
584. January 29, 1999, Monsanto sells berry arm
585. January 29, 1999, Corn group backs rules on bioengineering

586. January 25, 1999, Scientists urge that genetics rhetoric be cooled; groups warns that hyperbole over new technology could harm debate
587. January 23, 1999, U.S. reaffirms safety of Monsanto milk drug
588. January 16, 1999, Monsanto will appeal Canada's BST rejection
589. January 13, 1999, Gene critics puzzle Monsanto
590. January 11, 1999, Commentary from Monsanto CEO, Monsanto cites support for biotech as best solution for world hunger
591. January 6, 1999, Letters, Pro GMO
592. January 6, 1999, Letters, Public debate *does* occur
593. January 2, 1999, GM corn might reduce manure odor
594. December 29, 1998, Commentary, Monsanto should halt genetic engineering
595. December 29, 1998, Commentary, Regulations hinder important crop advances
596. December 27, 1998, 1998 – A watershed in biotechnology's global march
597. December 27, 1998, World recoils Monsanto's brave new crops
598. December 27, 1998, How a powerful technology works
599. December 9, 1998, Monsanto scientists win national awards
600. December 1, 1998, Regulators approve Monsanto-DeKalb deal
601. November 22, 1998, India gives Monsanto an unstable lab for genetics in farming
602. November 22, 1998, The world speaks on feeding the hungry with genetic engineering
603. November 13, 1998, Monsanto stock slides in wake of new financing plan; company suffers growing pains
604. November 12, 1998, Monsanto will cut jobs
605. November 10, 1998, Monsanto wins patent suit filed by rival
606. November 1, 1998, Critics vilify new seed technology that Monsanto may soon control; "Terminator" would prevent saving of seeds by making them sterile
607. October 31, 1998, Monsanto chief gets pie in face
608. October 31, 1998, Pioneer sues seed rivals
609. October 20, 1998, Monsanto leaves analysts wondering
610. October 19, 1998, Why do entrepreneurs leave St. Louis behind?
611. October 18, 1998, Independent Monsanto faces several hurdles; some products may be up for
612. October 18, 1998, Can we compete?
613. October 2, 1998, Monsanto licenses the key to its Roundup
614. September 23, 1998, European action on GM ban
615. September 20, 1998, Judge blocks Monsanto's biotechnology efforts in Brazil; altered soybeans worry consumers; setback puts profits at risk
616. August 10, 1998, Letter, Anti GMO
617. August 7, 1998, Corn shipments to resume
618. August 2, 1998, Scientists, activists clash over biotechnology; some laud man-made advances in agriculture; others fear corporate dependence
619. August 2, 1998, Commentary, Advances in biotech will save lives
620. August 1, 1998, Corn sales about to resume
621. July 31, 1998, GM corn ok'd
622. July 29, 1998, Rival fights Monsanto strategy; Roundup Ready line draws suit; patent runs out in 2000
623. July 24, 1998, Monsanto rival beefs up biotech
624. July 20, 1998, Biotech foes from around the world plan new tactics to tout cause; protesters who met here target Monsanto projects
625. July 19, 1998, Two sides to biotech debate see a different world ahead
626. July 19, 1998, Commentary from Jeremy Rifkin, Beware the biological century
627. July 16, 1998, Monsanto makes another purchase of seed company
628. July 15, 1998, Can St. Louis become the Silicon Valley of plant biotech? Power players place $146 million bet on world's largest plant science center
629. July 5, 1998, Editorial, Genomics makes GMOs possible
630. June 28, 1998, French are wary of Monsanto super seeds

631. June 28, 1998, Bioengineering is a fact of life in U.S. agriculture; European resistance to GM crops is seen as a form of protectionism
632. June 28, 1998, Europe's first commercial venture into modified seed is a big bust; raid by farmers group sparks debate about genetic engineering; U.S. associations are alarmed
633. June 8, 1998, Swiss reject ban on genetic altering of plants and animals
634. June 7, 1998, Monsanto adopts open strategy on altered food; campaign in Europe touts genetic engineering
635. May 28, 1998, Suit filed over labels on GM products
636. May 27, 1998, Europeans approve genetic labeling; organizations in America react angrily
637. May 24, 1998, Monsanto is making money on BST; sales of cow drug grow steadily
638. May 21, 1998, EU approves new labels for altered food
639. May 1, 1998, Agriculture department gets 150,000 negative responses to proposal on organic food; proposal to exclude GM food from 'organic' label
640. April 30, 1998, Europe may not have biotech rules until 2000
641. April 23, 1998, Europe accepts biotech seeds
642. April 19, 1998, 'Terminator' gene renders seeds sterile; farmers no longer could save them for next year; U.S. government helped develop it
643. April 15, 1998, Monsanto competitor pulls its soybean seeds
644. April 12, 1998, Many farmers finding GM cotton lacking
645. March 29, 1998, Farmers are warming to altered seed
646. March 26, 1998, Swiss are divided on gene-science ban
647. March 26, 1998, Growers want to stem use of 'organic' label; they oppose U.S. plan to allow it on GM foods
648. March 19, 1998, Rejection of GM corn hurts U.S. farmers
649. March 15, 1998, Monsanto softens its stance on labeling in Europe; it says disclosures on GM food are ok there but not in the U.S
650. March 11, 1998, Letters, Anti GMO
651. March 8, 1998, Monsanto's GM sugar beet is not sweet to Irish; GM plants are under scrutiny; company tries to sway skeptics
652. March 7, 1998, EU will consider GM corn, rapeseed
653. February 15, 1998, Monsanto launches field trials to jazz up genes in potatoes
654. February 12, 1998, Monsanto may bid for seed company
655. January 23, 1998, EU tries to ban corn
656. January 20, 1998, Monsanto copyright case opens
657. January 17, 1998, EU still undecided on labeling of GM corn
658. January 15, 1998, What food is organic? Federal rules decide
659. November 25, 1997, Monsanto buys stakes in two companies
660. October 26, 1997, Farmers see big difference in GM corn; wary eye kept on European view of
661. October 21, 1997, Firms join in seed production
662. October 10, 1997, Dictionary has '90s words, phrases in new publication, include 'pharm'
663. September 26, 1997, GM soy to be labeled in Europe
664. September 25, 1997, Monsanto sues over patented BST milk drug
665. September 21, 1997, Seeds sow court case in northeast Missouri
666. September 6, 1997, GM soybean imports to Brazil
667. August 18, 1997, Monsanto shareholders decide firm's future
668. August 16, 1997, Ben & Jerry's scoops Monsanto; hormone-free labeling allowed
669. August 8, 1997, DuPont joins genetic seed race, buys stake in Monsanto
670. May 31, 1997, Europeans warn U.S. on biotech imports
671. April 22, 1997, (Green) peaceful protest at Monsanto; genetic engineering foes briefly occupy, distrupt company's London office
672. March 16, 1997, Ben & Jerry's caught in middle of BST label confusion
673. March 16, 1997, BST milk drug turns three with little fanfare; protests fade, but product lags expectations
674. February 24, 1997, Who buys organic and where do they live?

675. February 13, 1997, France bans GM corn produced by Monsanto
676. January 24, 1997, Biotech rival sues Monsanto, two seed companies
677. December 24, 1996, Monsanto biotech corn gets approval of EPA
678. December 20, 1996, Dutch label GM soy products
679. December 19, 1996, EU will accept GM corn
680. December 9, 1996, Monsanto looks to feed the world; firm's strategy to rely on use of biotechnology
681. December 7, 1996, EU considers ban on GM corn
682. December 7, 1996, Monsanto mum on chemical unit
683. November 17, 1996, Pest insurance firm guarantees its biotech corn
684. November 17, 1996, Europe goes slow on new crops
685. November 10, 1996, Germans greet new soybeans with suspicion
686. November 1, 1996, European markets brace for GM soybeans
687. October 31, 1996, Japan give go-ahead to GM corn
688. October 27, 1996, Europe debates over new crops; nations leery of biotech
689. October 24, 1996, Mycogen sues Monsanto over patents
690. October 13, 1996, Pulling away from the past; analysts like Monsanto's split
691. October 8, 1996, Biotech boycott; targets include fries, Coke, corn and soybeans
692. October 7, 1996, Farmers go to seed to halt pests; GM corn will battle European borer
693. October 7, 1996, Scientists, critics worry about insect resistance
694. September 28, 1996, Soybean labeling sought; Europeans question GM crops
695. September 22, 1996, Roundup-proof beans popular with farmers
696. September 22, 1996, Japan eases acceptance fears; decision provides market for soybeans
697. September 16, 1996, Monsanto's new friction-reducing fluid gets rave review
698. August 23, 1996, Letters, BST uncertainties
699. August 11, 1996, Backers and critics both wrong on BST; small number of farmers are using the product
700. August 11, 1996, Dairy squeeze? Experts say small farms not hurt
701. August 9, 1996, Friday, Court rejects milk hormone label law
702. August 1, 1996, Monsanto to control biotech firm; $50 million deal will help Calgene develop crops
703. July 24, 1996, Monsanto sets record; more cost-cutting seen
704. June 18, 1996, Monsanto adds BST plant; milk hormone to be made in Augusta, Ga.
705. May 30, 1996, Studies show BST is safe, FDA veterinary panel says
706. May 24, 1996, Monsanto, Calgene in deal; trade technology for genetic engineering
707. May 15, 1996, Groups want GM food labeled
708. May 10, 1996, Monsanto Co., Eli Lilly settle BST suit
709. May 9, 1996, Mycogen sues Monsanto over biotech license
710. April 9, 1996, Monsanto buys gene splicing business
711. April 4, 1996, Monsanto beans get go-ahead in Europe
712. April 3, 1996, Letters, Anti BST
713. March 26, 1996, Calgene gives ok to sale of stock; Monsanto gets research too
714. March 21, 1996, Monsanto sues to safeguard new patent on Bt corn
715. March 11, 1996, Monsanto, DeKalb a done deal, expands agbio empire
716. March 11, 1996, Scientists say good genes could create superweeds
717. March 10, 1996, Letters, Labels on BST wanted
718. February 11, 1996, BST continues to lose money for Monsanto; sales fall short of expectations
719. February 3, 1996, Letters, Anti BST
720. February 2, 1996, Monsanto buys stake in seed firm
721. January 26, 1996, Survey: People are still unsure about Monsanto's milk drug
722. January 23, 1996, Groups defend BST, assail study
723. December 27, 1995, Biotech a step ahead of film sequel
724. December 3, 1995, Monsanto throwing financial lifelines to biotech firms
725. November 26, 1995, Book Review, Criticism of BST

726. November 23, 1995, Monsanto seed firm sign deal; Pioneer licenses research on fighting corn borer
727. November 4, 1995, Monsanto invests in bio firm; Ecogen specializes in pesticide technology
728. November 2, 1995, Scientists say they fear increased bug resistance to natural insecticides due to Bt corn
729. November 1, 1995, Monsanto cotton gets green light; new pest-resistance plants to be ready by spring planting
730. October 22, 1995, Monsanto offers discounts to diary farmers
731. October 22, 1995, FDA says cow drug is safe; Monsanto passes latest review
732. September 18, 1995, Bio-tomatoes will cost more money
733. September 6, 1995, Court ok's Vermont law requiring BST milk label
734. August 28, 1995, New store sells foods with BST-free labeling
735. August 8, 1995, Monsanto wins case challenging BST
736. July 11, 1995, Letter, Anti BST
737. July 3, 1995, Monsanto, Texas dairy settle suit
738. June 29, 1995, Monsanto to buy large stake in rival; Calgene a competitor in plant engineering
739. June 29, 1995, Americans drink only slightly less milk, despite BST
740. June 19, 1995, Monsanto develops GM potato
741. June 12, 1995, BST opponents pay for first stage of research on a test
742. May 26, 1995, Monsanto gets green light on GM soybeans; EPA approves seeds resistant to herbicide
743. May 24, 1995, Monsanto rejects biotech firm's claim
744. May 17, 1995, Officials seek FDA ruling on milk drug; states want standards for labeling BST
745. May 6, 1995, EPA approves new potato
746. April 26, 1995, Nutrition-minded Shalala eats healthy at Zanti's, defends BST
747. April 23, 1995, New Monsanto chief changing company's structure, but doesn't want to erase old links
748. April 23, 1995, High wages, high growth, high-tech; but is St. Louis losing the race to create the jobs of the future?
749. April 3, 1995, A few humans get a dose of BST, too; accidental sticks
750. March 16, 1995, Monsanto offers discounts again on BST
751. March 15, 1995, FDA finds no unusual problems with BST
752. February 21, 1995, Letter, Anti BST
753. February 20, 1995, Letter, Dairy Coalition neutral on BST
754. February 20, 1995, KC legislator seeking Missouri license for BST
755. February 19, 1995, Public fear of biotechnology fading, Monsanto executive says
756. February 5, 1995, Milk labeling rules sow confusion, anger
757. February 1, 1995, BST means more milk for 99% of users
758. January 2, 1995, Magazine jabs Monsanto
759. December 15, 1994, Schnucks changes its milk supplier, effects of BST on diary market
760. November 21, 1994, Milk drug foes take stand in Wisconsin
761. November 21, 1994, Confusion: Wisconsin consumers face array of choices
762. November 3, 1994, GM seeds approved by FDA
763. November 2, 1994, Monsanto suit against dairy co-op settled; false claims about BST
764. October 18, 1994, Review of BST marketing favorable, Monsanto says, but Vermont legislator says report shows problems
765. October 4, 1994, BST data yield no surprises
766. September 21, 1994, Letters, Anti BST
767. September 20, 1994, Discount ending; Monsanto to adjust pricing on its BST
768. September 15, 1994, Monsanto's BST figures rebut critics of drug
769. September 14, 1994, Monsanto history in ag-biotech
770. September 2, 1994, Letter, Anti BST
771. August 27, 1994, Letter, Anti BST
772. August 21, 1994, BST not an issue in stores; few consumers ask questions

773. August 18, 1994, BST to be delayed in Canada
774. July 29, 1994, BST under fire in California
775. July 22, 1994, Monsanto earnings strong; BST boosted performance
776. July 10, 1994, Commentary, Risk of genetic engineering
777. July 8, 1994, Texas chain moves away from BST milk
778. July 4, 1994, Where were genetic protesters when cheese enzyme appeared?
779. July 1, 1994, Letter, Pro BST from Monsanto employee
780. June 22, 1994, House bill calls fro BST labeling; would add some costs to milk producers
781. June 20, 1994, Vermont Congressman to introduce BST label bill
782. June 20, 1994, Letters, Pro BST labeling
783. June 13, 1994, BST divides dairy industry
784. June 13, 1994, BST user sees drug as part of progress
785. June 3, 1994, Monsanto soybean nearer to market
786. May 21, 1994, Editorial, Science and the tomato: No reason to label all GM foods
787. May 19, 1994, Genetic changes in tomato approved; FDA, for first time, oks marketing of such food
788. May 12, 1994, Minnesota fourth state to adopt label law on Monsanto's BST
789. May 9, 1994, Supplier tries to avoid BST milk
790. May 5, 1994, Diary co-ops drop ban on farmers' use of BST
791. May 5, 1994, Reaction to lifting of BST ban is muted
792. April 30, 1994, Wisconsin to allow labeling of diary products without BST
793. April 25, 1994, Trade groups fight label law
794. April 25, 1994, BST is Monsanto's splice of life; a behind-the-scenes look at drug that raises production of cow's milk
795. April 22, 1994, Monsanto's profit is up
796. April 19, 1994, House members urge BST in inquiry; conflict alleged in three FDA officials' past work for Monsanto
797. April 18, 1994, Fewer cows, but more milk
798. April 17, 1994, Farmer here leads dairymen; effect of BST on industry
799. April 15, 1994, Maine allows no BST label
800. April 14, 1994, Vermont gets law on BST labeling
801. April 9, 1994, Letter, Pro BST
802. April 9, 1994, Monsanto's milk drug sales exceed expectations
803. March 30, 1994, Letter, Pro BST labeling
804. March 28, 1994, Vermont will likely pass a milk labeling law
805. March 26, 1994, No need for BST labels, Missouri health chief says
806. March 25, 1994, Consumers unfazed by BST debate, poll says
807. March 23, 1994, Bradley wants labels on milk containing BST
808. March 20, 1994, Letter, Anti GMO
809. March 17, 1994, BST will increase production of milk, U.S. says
810. March 16, 1994, Monsanto steps up defense of BST
811. March 14, 1994, Farm bounty feeds booming population; problems of overproduction
812. March 10, 1994, Letter, Pro BST labeling
813. March 3, 1994, ABC's of BST; answering the key questions on Monsanto's new milk drug
814. February 28, 1994, Monsanto markets milk drug; company sales rep, vet talk to dairy farmers about BST
815. February 27, 1994, Bill would license BST use; legislator also would require labels on milk
816. February 26, 1994, Letter, Pro BST labeling
817. February 24, 1994, BST has the mail moving on ads; Monsanto writes warning letters
818. February 22, 1994, Iowa defends use of labels
819. February 19, 1994, Monsanto wants 'truth' told about milk drug
820. February 18, 1994, Letter, Anti BST
821. February 18, 1994, Letter, Anti BST
822. February 18, 1994, Letter, Anti BST

823. February 18, 1994, Dairies in area avoiding BST milk
824. February 13, 1994, Label rule on BST unpopular; FDA makes it tough to prove a negative
825. February 10, 1994, Monsanto hopes ads counteract critics
826. February 9, 1994, Monsanto backs FDA plan for BST labels
827. February 9, 1994, Letters, Anti BST
828. February 6, 1994, Grocers wary of BST issue
829. February 5, 1994, Lawsuit seeks a ban on BST; Monsanto says it has no merit
830. February 4, 1994, New age for milk industry; cow drug on market after years of study
831. February 2, 1994, How Monsanto will sell BST to U.S. farmers; "I've never heard of another product marketed like this"
832. December 27, 1993, FDA approves Monsanto drug – one of the top business stories of the year
833. December 6, 1993, Will Monsanto's BST send flood of milk into supermarkets?
834. November 7, 1993, Monsanto's dairy drug gets cautious greeting
835. August 9, 1993, Monsanto uses genetics to make a better tomato
836. August 7, 1993, Editorial, Test BST in the marketplace
837. August 4, 1993, Deal on milk hormone incenses Republicans
838. July 19, 1993, European proposes seven-year ban on BST
839. June 27, 1993, Senate action on BST; Danforth rescues milk hormone
840. May 21, 1993, Editorial, Victory for chemical companies; FDA says label not needed
841. May 9, 1993, Dairy Women's League opposes BST
842. April 5, 1993, Letters, Pro BST labeling
843. April 2, 1993, Monsanto stock rises on report – no harm from BST
844. March 31, 1993, FDA study clears hormone from Monsanto
845. March 28, 1993, BST facing key safety test with FDA
846. February 7, 1993, A rebuilding year; uncertain times for Monsanto
847. January 29, 1993, Monsanto lobbying efforts in Congress
848. November 15, 1992, Will BST be approved? Environmental rules under attack
849. August 15, 1992, Editorial, Why hurry on growth hormone?
850. August 11, 1992, More tests sought on cow hormone
851. June 2, 1992, Editorial, A genetic feast – be and label GM foods
852. May 29, 1992, Scientists alter gene in wheat change could herald pest-fighting plant
853. May 27, 1992, President Bush approves GM food without government testing
854. May 27, 1992, Gene cuisine scientists are working hard on GM food
855. May 26, 1992, GM foods ok'd by Bush administration
856. May 5, 1992, Boost: Monsanto donating milk drug to former Soviet Union
857. April 25, 1992, Monsanto looking to future plans for life after patents end
858. April 21, 1992, Consumer's Union wants labels
859. February 25, 1992, Federal report clears Monsanto in dispute over hiding data on BST
860. February 11, 1992, EU moratorium on BST extended

APPENDIX B

LIST OF NORTHERN CALIFORNIA NEWS ARTICLES ON GMOS, 1992-2004

Articles listed in Appendix B were downloaded from the LexisNexis Academic Database on December 1, 2004 using keywords related to the issue of GMOs. The initial search yielded 504 articles, which of each was then analyzed by the researcher to determine its appropriateness for inclusion in the study. After applying the rules for deletion as specified in the section *Design of the Quantitative Study* in Chapter III, the total number was reduced to 296 articles, which are listed here.

Case # Newspaper Date Topic

1. The San Francisco Chronicle, NOVEMBER 7, 2004, Fighting for the future of food; Deborah Koons Garcia's film documents how genetically engineered foods slipped into our supply
2. The San Francisco Chronicle, NOVEMBER 3, 2004, Two counties reject GMO ban
3. The San Francisco Chronicle, NOVEMBER 2, 2004, Voters' outlook for GMO vote
4. The San Francisco Chronicle, OCTOBER 30, 2004, LETTER, anti-GMO
5. The San Francisco Chronicle, OCTOBER 30, 2004, LETTER, pro-label
6. The San Francisco Chronicle, OCTOBER 30, 2004, LETTER, anti-GMO
7. The San Francisco Chronicle, OCTOBER 29, 2004, Earth Mother; a spiritual leader for Bay Area witches
8. The San Francisco Chronicle, OCTOBER 24, 2004, Bioengineered crops on ballot in 3 counties
9. The San Francisco Chronicle, SEPTEMBER 17, 2004, Labeling issue
10. The San Francisco Chronicle, AUGUST 15, 2004, LETTER, anti-GMO
11. The San Francisco Chronicle, AUGUST 4, 2004,Growing genetically altered foods banned
12. The San Francisco Chronicle, JULY 29, 2004, Bay Area charged higher prices for milk
13. San Jose Mercury News, July 13, 2004, Parts of California to vote on bans against genetically modified crops
14. The San Francisco Chronicle, JUNE 25, 2004, COMMENTARY, pro-GMO
15. The San Francisco Chronicle, JUNE 23, 2004, LETTER, anti-GMO
16. The San Francisco Chronicle, JUNE 17, 2004, Businesses praise how cops handled protests
17. The San Francisco Chronicle, JUNE 16, 2004, Butte County to vote on genetic crop ban
18. The San Francisco Chronicle, JUNE 14, 2004, EDITORIAL, S.F. politics need genetic modification
19. The Oakland Tribune (Oakland, CA), June 10, 2004, Biotech conference concludes quietly; Previous day's arrests totaled 130 protesters in San Francisco
20. The Oakland Tribune (Oakland, CA), June 9, 2004, Activists swarm science forum; 33 arrested in demonstration at BIO 2004 convention in S.F.
21. The San Francisco Chronicle, JUNE 9, 2004, Brunch brings bio-tech to the belly of the beast
22. The San Francisco Chronicle, JUNE 9, 2004, Biotech protesters held; Marchers disrupt rush-hour traffic near convention
23. San Jose Mercury News, June 9, 2004, Protesters Make Statement Outside San Francisco Biotech Conference
24. The San Francisco Chronicle, JUNE 7, 2004, EDITORIAL, The biotech bonanza
25. The San Francisco Chronicle, JUNE 7, 2004, Biotech summit in San Francisco; Industry makes major strides but still generates controversy
26. The San Francisco Chronicle, JUNE 5, 2004, Protesters pitching a big tent; Biotech conference viewed as raising issues from genes to jails
27. The San Francisco Chronicle, JUNE 3, 2004, Altered-food ban may make county's ballot
28. The Oakland Tribune (Oakland, CA), June 2, 2004, Networking at biotech conference
29. The San Francisco Chronicle, MAY 31, 2004, Biotech meeting to attract thousands; Protests expected to accompany gathering in S.F.
30. The Oakland Tribune (Oakland, CA), May 21, 2004, Activists planning protest at June biotech convention;
31. San Jose Mercury News, May 11, 2004, Monsanto Delays Genetically-Modified Wheat
32. The San Francisco Chronicle, MAY 5, 2004, COMMENTARY, Don't read this over a burger

33. The San Francisco Chronicle, MAY 2, 2004, The High Price of Cheap Food
34. The San Francisco Chronicle, APRIL 26, 2004, LETTER, Anti-GMO
35. The Oakland Tribune (Oakland, CA), April 22, 2004, LETTER, Anti-biotech
36. The Oakland Tribune (Oakland, CA), April 20, 2004, Alameda teens fast for a good cause
37. San Jose Mercury News, April 16, 2004, Bioengineered Rice Takes Center of Debate over Using Food Crops to Grow Drugs
38. The San Francisco Chronicle, APRIL 10, 2004, Modified rice won't be planted for now; State halts planting of rice for pharmaceutical use.
39. The San Francisco Chronicle, APRIL 8, 2004, State's rice farmers fear biotech incursion; Proposal for genetically engineered crop could threaten lucrative foreign markets
40. San Jose Mercury News, April 6, 2004, California Biotechnology Firm Likely to Miss Chance to Plant 'Pharm' Rice Crop
41. The San Francisco Chronicle, MARCH 30, 2004, Efforts to ban genetically altered crops spreading
42. San Jose Mercury News, March 30, 2004, Bioscience Firm Wants Approval to Grow Modified Rice
43. The San Francisco Chronicle, MARCH 24, 2004, GM Soyabean with little or no trans-fat
44. The Oakland Tribune (Oakland, CA), March 11, 2004, EDITORIAL, California counties unequipped to enforce biotech law
45. The San Francisco Chronicle, MARCH 8, 2004, EDITORIAL, Mendocino sows seeds of dissent
46. The San Francisco Chronicle, MARCH 6, 2004, LETTER, Anti-GMO
47. San Jose Mercury News, March 4, 2004, Biotech Industry to Fight Mendocino County, Calif., Vote against Altered Crops
48. The San Francisco Chronicle, MARCH 3, 2004, Recall, altered crops lose
49. The San Francisco Chronicle, FEBRUARY 28, 2004, LETTER, Pro-biotech
50. San Jose Mercury News, February 24, 2004, Study Finds Genetically Altered Seeds with Regular Variety in Major Crops
51. The San Francisco Chronicle, FEBRUARY 21, 2004, Biotech initiative's foes dig in deep; $150,000 donated to bury Mendocino crop-ban measure
52. The San Francisco Chronicle, FEBRUARY 16, 2004, Planting seeds of rebellion
53. The San Francisco Chronicle, JANUARY 17, 2004, LETTER, Anti-GMO
54. San Mateo County Times (San Mateo, CA), January 10, 2004, Farmed salmon joins ground beef
55. The San Francisco Chronicle, JANUARY 4, 2004, Lessons of mad cow scare; Consumers looking more at safety of food supply
56. San Mateo County Times (San Mateo, CA), January 1, 2004, LETTER, Anti-GMO
57. The San Francisco Chronicle, DECEMBER 31, 2003, Organic brewpub-restaurant grows up in Ukiah
58. The San Francisco Chronicle, DECEMBER 30, 2003, Breakthrough might lead to lifting ban in Japan
59. The San Francisco Chronicle, DECEMBER 23, 2003, Organic farmers' initiative plants seeds of dissent; Mendocino County debates ban on genetically altered organisms
60. The San Francisco Chronicle, DECEMBER 14, 2003, Book Review
61. San Jose Mercury News, December 1, 2003, Traces of Genetically-Modified Corn Still Showing in Product Supply
62. The San Francisco Chronicle, NOVEMBER 14, 2003, EU threatens to slap tariffs on U.S. agricultural exports
63. San Mateo County Times (San Mateo, CA), October 16, 2003, U.S. residents not aware of what they're eating
64. San Mateo County Times (San Mateo, CA), October 9, 2003, Mendel pumps up rubber plant
65. San Jose Mercury News, September 16, 2003, Molecule-Scale Nanotechnology Holds Both Promise and Peril, Backlash Like GMOs Feared
66. The San Francisco Chronicle, SEPTEMBER 5, 2003, Global battle fermenting; Farming key at WTO meeting

67. The San Francisco Chronicle, AUGUST 28, 2003, Bill banning ocean fish farms heads to governor; Concern over introducing non-native salmon prompts law
68. The San Francisco Chronicle, JULY 27, 2003, The antithesis of the Big Mac; Book Review
69. The San Francisco Chronicle, JULY 23, 2003, Local corn with a Southern soul, Carol Ness
70. The San Francisco Chronicle, JULY 20, 2003, LETTER, Anti-GMO
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APPENDIX C

INTERVIEW GUIDE

These questions were asked in semi-structured interviews with dominant stakeholders identified in the qualitative study in Chapter 5.

1. Tell me about your experience with the news media in discussing issues related to agricultural biotechnology (GMO's, food, crops, seed, etc.).

2. How did your involvement (or your organization's involvement) with the news media begin?

3. What resources, if any, are at your disposal for working with the media?

4. What is your perception of your organization's access to news media? (Do you think you have equal access? Equal time?)

5. What do you know about journalistic practices and routines?

6. In what ways do you think you and your organization have influenced, or have failed to influence, news media coverage?

7. How do you respond to arguments advanced by challengers in the media?

8. From your point of view, do you think that media coverage of your organization's position/activities/issues has been fair? balanced? successful?

VITA

Catherine Crawley received her bachelor of arts degree in mass communications from the University of Tennessee in 1991, graduating *cum laude*, with an emphasis in print journalism and a minor in political science. She was awarded the Scripp's Howard Ernie Pyle Memorial Award for graduating editorial student of the year; a Chancellor's Citation for Extraordinary Professional Promise; and a Horace V. Wells Jr. Journalism Scholarship.

As an undergraduate at the University of Tennessee, she was received two competitive internships – the Washington Center for Politics and Journalism internship (Fall 1990) and the Tennessee Legislative Internship Program (Spring 1989).

After graduating, she worked as a reporter and copy editor for the *Pasadena* (Calif.) *Star-News* and covered the city beat for Arcadia and Sierra Madre, California, from 1991-93. In 1993, she received an investigative reporting award from the Press Club of Southern California for a series on residential real estate fraud in the San Gabriel Valley. Moving to Washington, D.C., she became an assistant editor for trade publications at Stevens Publishing from 1993-94 and wrote and edited labor and environmental news from Capitol Hill and the White House.

In 1995, Crawley received her master's degree in secondary education with an emphasis in English education from Vanderbilt University, graduating *summa cum laude*. From 1996-2000, she taught English and journalism at Harbor Day School in Corona del Mar, California.

In 2000, she joined the Gallup Organization as an organizational management consultant and worked with Fortune 500 companies in the United States and in Southeast Asia. While at Gallup, she received the company's Leadership Award.

As a doctoral student at the University of Tennessee, Crawley was a graduate teaching associate and taught introductory journalism and editing courses. Her primary research interests are framing of science in the news media, history of science coverage, and international news media. She was a 2004 Fellow with the American Council on Germany and conducted research in Germany and at the European Commission on the biotechnology debate. She was co-winner for best graduate paper in history division at the Association for Education in Journalism and Mass Communications Southeast Colloquium in 2004, and received the top doctoral paper award at the 25th annual College of Communication and Information Annual Symposium at the University of Tennessee in 2003.

She received the Outstanding Ph.D. Student of the Year award in 2004, and the Outstanding Graduate Teaching Associate award in 2005. She is also the recipient of a 2004 Karl A. and Madira Bickel Scholarship.

As a part of her professional service, Crawley was elected by her peers to serve as the doctoral student representative on the Graduate Studies Committee in the College of Communication and Information from 2002-03.

Crawley has presented papers at several academic conferences, including the Midwest Association of Public Opinion Research, International Communication Association, and the Association for Education in Journalism and Mass Communications Southeast Colloquium.

She has been published as a journalist and freelance writer in several local and national publications including *HealthLeaders* magazine, *Orange Coast* magazine, *CityView* magazine, *Government Executive* magazine, *National Journal*, the *San Gabriel Valley Tribune*, and the *Pasadena Star-News.*

Her professional memberships also include Phi Kappa Phi Honor Society, American Journalism Historians' Association, National Association of Science Writers, Society of Environmental Journalists, Society of Professional Journalists, and Investigative Reporters & Editors.