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BIOTECHNOLOGY IN THE PUBLIC EYE, 1973-1994: A CONTENT ANALYSIS OF TIME, NEWSWEEK AND U.S. NEWS & WORLD REPORT

By

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ABSTRACT

BIOTECHNOLOGY IN THE PUBLIC EYE, 1973-1994:
A CONTENT ANALYSIS OF
TIME, NEWSWEEK AND U.S. NEWS & WORLD REPORT

By

Susan Lee Peterson

A content analysis of three news magazines was conducted to assess coverage of biotechnology from 1973 through 1994, a period of controversy and growth for this form of science. Coverage was figured by analyzing all biotechnology articles during the 21-year period in the magazines as listed in the Index to Periodical Literature. Content was coded according to 22 coding questions that inquired as to length, topics, sources and beneficial, detrimental or balanced-neutral assertions.

These data reveal the continued presence of biotechnology in the top news magazines. Of the three magazines, U.S. News & World Report increased coverage through time, while Newsweek and Time slightly decreased coverage. Scientific and medical topics dominated all other biotechnology topics. Industrial sources spoke most often, and agricultural sources were clearly absent.

Although a notable amount of coverage was non-judgmental, coverage was found to be more positive than negative through time.

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INTRODUCTION

"...In the media, biotechnology underwent a metamorphosis from 'a runaway science of genetic engineering' to a new 'technological frontier.'"[1]

For centuries, scientific inquiry has proceeded without much fanfare. Years might pass before a project came to fruition or the announcement of a new discovery was made, and until then there was the impression of science as a cloistered activity with scientists researching quietly behind closed doors. Such may still sometimes be the case; research does take time. But when a discovery is made known to the public, the scientific community has also known about and been discussing the phenomenon long before the media even broke the news.

In their report on "The Place of the Public in the Conduct of Science," Lappe and Martin explained this characteristic propriety:

> Scientific research proceeds according to general methods that have been formulated and accepted by the scientific community; its results are measured against the theories, principles, or relationships that this same community has either observed, elucidated or developed. Accordingly, scientific research has been largely a self-defined enterprise, rarely, if ever, subject to external scrutiny.[2]

During the 1970s, a form of research developed to challenge this approach to scientific discovery. The study and applications of biotechnology -- also known as

recombinant DNA research -- bring a cadre of questions and practical possibilities. The potential impact of biotechnology on every day life pulled the research from behind closed doors.

Biotechnology focuses on the genetic code for life, DNA, and involves the technique of moving pieces of genetic material from one organism to another across species lines[3] and changing these life forms for various research and commercial applications. Biotechnology has expanded from basic research in plant sciences to medical research and human genetic applications of the technology. One researcher looks at biotechnology as transferring genes, either from one variety of a horticultural crop to another one, or transferring genes or genetic information across lines that natural breeding prevents.[4]

Biotechnology is not new to humanity; forms of this research and its application have been evolving in nature and laboratories for centuries. Early methods of hybridization, or cross-breeding plants for specific traits -- which is what Austrian Gregor Mendel did to identify the laws of heredity in 1865 -- have long been the foundation for successful agricultural practices. Cross-breeding livestock for certain traits, or agricultural products such as corn or other varieties for higher yields have been occurring for years.[5]

In October 1977, the National Institutes of Health issued a statement describing this new form of research:

> The new recombinant DNA technique has resulted in a profound and qualitative change in the field of genetics. Developments in genetic research, particularly in the last four years, open avenues to science that

> were previously inaccessible. Hypotheses and ideas that were not testable can now be rigorously investigated. Understanding of basic biological phenomena has already been enhanced.[6]

Biotechnology has enabled researchers to create new and improved products, such as agricultural crops able to withstand disease and drought, livestock with leaner meat and dairy cows with increased milk production. Medical applications of biotechnology include ways to identify and treat genetic disorders or remedy hereditary defects, as well as pursue research that may find answers to various diseases. Some genetic techniques may involve only a few genes (such as with the Flavr-Savr tomato, a trademarked tomato that has a longer shelf-life, or new varieties of plants that may be able to survive harsh climates), while other methods are more complicated and involve using thousands of genes, such as finding out how to solve a medical or hereditary problem.

Biotechnology research is moving to the forefront as a possible key to controlling, if not ending sickness and hunger. Because there is greater medical and industrial interest in this research, it may be asked how much information on biotechnology has been available to the public through the media.

The impact of biotechnology's budding developments are described by a reporter for The Christian Science Monitor:

> Few other developments etch so sharply the ethical, moral and social issues involved in the modern pursuit of scientific knowledge and its exploitation as does the fledging of the new industry of biotechnology...[7]

Pfund and Hofstadter acknowledge the media's role in informing the public, reinforcing the importance of science coverage as an educational tool.

> Despite the uncertain tenor of press coverage, the importance of science news cannot be underestimated. The media are the most effective vehicle for widespread dissemination of science-related events, playing a pivotal role in shaping the public's views of scientific or biomedical innovations and their implications. Furthermore, media coverage helps dispell the insular and esoteric image so long associated with the professions of science and medicine.[8]

The foregoing statements may be continued to include the fields of agriculture and industry, also closely aligned to medicine with their foundations in basic scientific research. It is for these reasons, and the widespread effect of biotechnology, that this study is integral to a further understanding of coverage of this issue in the three newsmagazines.

The focus of this study is biotechnology as it is covered in Time, Newsweek and U.S. News & World Report over a 21-year time period. The field itself is controversial, providing ground for debate as to whether or not biotechnology research is beneficial or detrimental to society, and how this information is reported and presented to the public can largely influence how the public perceives scientific research and inquiry. Further, what voices speak for biotechnology can influence public acceptance or rejection of biotechnology and its resulting federal guidelines of approval or restraint.

The field of biotechnology, as with most scientific inquiry, is continually changing. However, biotechnological change has not been documented over a lengthy time period. Research on recombinant DNA -- the early term for biotechnology research -- first came under the media and public's scrutiny in the early 1970s. Various studies have focused on certain years and aspects of biotechnology coverage, but none have focused on coverage from its inception into the media forum and public debate to a recent year, and in news magazines.

Assessing this 21-year time period, from 1973 through 1994, can be of assistance to various people or institutions interested in biotechnology and science, as well as science reporting. Given the time period and depth of the topic covered here, media researchers and scholars may wish to answer both specific and general questions about biotechnology coverage or science coverage within their own studies. Industries or parties who have a vested interest in the media's coverage of biotechnology, as well as the lay reader's understanding of biotechnology and perceptions of coverage, can benefit from knowing the voices behind the articles and how changes have occurred through time. In their study of newspaper coverage of biotechnology, Susanna Hornig Priest and Jeffery Talbert point out, "The directions scientific research takes are inseparable from the directions of governmental science policy, industrial interest in the development of technology, and, to a much lesser extent, pressure from activist citizen groups."[9]

Finally, given the evolving, complex nature of biotechnology, this study may also provide insight to the direction of future biotechnology research and general science reporting of its discoveries and events.

CHAPTER ONE -- NOTES

1. Christopher Plein, "Popularizing Biotechnology: The Influence of Issue Definition," Science, Technology & Human Values 16, no.4 (Autumn 1991): 476.

2. Marc Lappe and Patricia Archbold Martin, "The Place of the Public in the Conduct of Science," Southern California Law Review 51, no.6 (September 1978) 1536.

3. "Ferrying Genes in Bacteria," Futures, Michigan Agricultural Experiment Station, 12, no.1 (Spring, 1994): 10. As cited from Lawrence Busch, Socioeconomic Implications of Biotechnology for Developing Countries.

4. Susan Peterson, "Building from the Past," Futures, Michigan Agricultural Experiment Station, 12, no.1 (Spring 1994): 5.

5. William Beal established the first seed testing laboratory in the United States at Michigan Agricultural College, now known as Michigan State University. "Beal was the first person to cross-fertilize corn to increase yield through hybrid vigor." As cited in Futures, Michigan Agricultural Experiment Station, 12, no.1 (Spring 1994): 6.

6. National Institutes of Health, Final Environmental Impact Statement on NIH Guidelines for Research Involving Recombinant DNA Molecules, June 23, 1976 (October, 1976) 1 at V. As cited in Lappe and Martin, Southern California Law Review 51, no.6 (September 1978) 1535.

7. Christian Science Monitor, Feb. 12, 1980, as cited in: Nancy Pfund and Laura Hofstadter, "Biomedical Innovation and the Press," Journal of Communication 31, (Spring): 152.

8. Nancy Pfund and Laura Hofstadter, "Biomedical Innovation and the Press," Journal of Communication 31, (Spring): 145.

9. Susanna Hornig Priest and Jeffery Talbert, "Mass media and the ultimate technological fix: Newspaper coverage of biotechnology," Southwestern Mass Communication Journal 10, no.1 (1994): 76.

CHAPTER TWO

LITERATURE REVIEW

Studies of science reporting and related issues provide the framework for this study of biotechnology in the media. These studies provide the background for the journalistic and societal perspectives, as well as a brief scientific understanding of biotechnology, necessary to draw comparisons and conclusions from the content of the magazines.

It has long been recognized that science and its inquiry is important to the welfare of modern society. It may also be argued that just as significant is the public's familiarity with scientific endeavor and progress, and the means to this are often through the media.

In the 1960s, science was the subject of a new book discussing the importance and difficulties of relating this type of news to the public.[1] Though science had been a news topic for decades, Kreighbaum was one of the first to argue that a diligent press was needed to educate and spark public interest in science. He contended that science was usually ignored by the media, and when it wasn't, scientific discoveries were exploited and popularized. Such exploitation would be damaging to democracy because, after all, "A scientifically illiterate polity could not possibly come to sound or rational decisions."[2]

In his review of literature discussing science and the media, Dornan discusses the suggestion that a general public enthusiastic about science is preferable to one that is skeptical, unconcerned or ignorant. Dornan's research of various literature reveals a concern on behalf of journalism where "science communication might be improved"[3] to not only inspire interest, but to combat misperceptions and educate the public.

Perhaps one of the most daunting tasks of a journalist working on a scientific story is how to best relate the sometimes technical, evolving discovery in a clear and interesting way in limited space and with a limited timeframe in which to research. At times, this responsibility has seemed to be an oxymoron. Friedman explains:

> Hard news is still the most prevalent format in journalism, and its practice has some detrimental effects on science communication. For example, its emphasis on currentness creates problems for science writers because scientific discoveries do not happen overnight and so do not have a natural news peg.[4]

By "not happening overnight," science does not appear to have the timeliness of a regular news event unless one is created. Friedman continues that in the case of the science organization or scientist seeking media coverage, news events are created by conducting press conferences and giving speeches, as well as sending out news releases.[5] By contriving news events, and thus providing a framework for an agenda of the specific interest or organization, the initial discovery is given its own occasion and timeliness is created.

But how science news is related is a challenge for writers working for a specific publication and audience, and who are trying to explain these often difficult topics with

limited time and resources. One of the most common forms of writing for journalists covering science stories are explanatory features[6] that explain a specific topic in more detail. Given the nature of the subject matter it is often necessary to spend more time and space covering the topic.

In a 1964 symposium on communications and medical research, Dr. James Shannon, director of the National Institutes of Health, commented,

> ...[Science] stories of the general sort are necessarily interpretive in nature, since science is outside the day-to-day experience of the reader. The writing must be interpretive and highly editorialized. It is necessary to discuss the mechanics by which the event took place, the investigator as a person, and the relationship to the advance of science...

He added further,

> In my experience, most bad reporting comes from a frivolous disregard for the serious matter, or from the fact that the man who writes the story can't get it published unless he finds some peg to hang it on. It's usually the newspeg that causes the distorted headline and the rewrite job that does damage to science.[7]

In a 1973 survey, Friedman found that writing explanatory features and interpretive or investigative articles were preferred by journalists because they could explain more science to their readers and have more influence on readers' opinions. Writing "hard news" stories for science topics was misleading and a disservice, according to the journalists polled for the survey. They further analogized, "Trying to

fit a science story into a hard news mode was like trying to put a size nine foot into a size five shoe."[8]

Friedman's survey also found that the journalists had, indeed, overcome the traditional hard news approach, with 51 percent of 144 science writers writing mostly interpretive rather than hard news articles.[9]

PUBLIC INVOLVEMENT

Within the premise of democracy is that the first amendment protects the public's right to make informed decisions and function as a self-governing body. The establishment of a free press ensures this process. When biotechnology became a subject of news and concern to the general public in the early 1970s, public information and involvement also became an issue that would persist throughout the next two decades.

Social safety concern is not new territory for the scientific community, which gave up its right to be left alone when it developed nuclear energy with its potential negative impact on the environment. This case has been made stronger by the succession of global warming and ozone problems. In part, the question of who is responsible for ensuring the safety of the citizenry revolves back to the citizens themselves as a part of the governmental process, and is not fully the burden of

scientists. In turn, industrial interests have concern for their own stakes in the budding biotechnology industry.

Miller identifies two purposes for communicating the scientific information to the public: "...the creation or enhancement of scientific literacy, and the dissemination of information relevant to the formulation of science policy."[10] He explains that a considerable part of mass media science writing is devoted to increasing the public's understanding of science, such as articles in National Geographic or other similar specialty magazines. But other articles on the issues, problems or risks of new science news are helpful in educating and informing the public on possible present or upcoming science policy issues.

Lappe and Martin argue that the public's right to participate in scientific decision making is grounded within the first amendment protection of "producing an informed public capable of conducting its own affairs."[11]

> The intellectual implications and potential social repercussions of genetic research -- whether imminent or merely perceived -- make this scientific activity particularly important in the process of self-government.[12]

In *Virginia Pharmacy* the Supreme Court addressed the free-enterprise economy and observed that resources are primarily appropriated through private economic decisions. Therefore, the Court held that it was both a matter of "public interest, in that society had a specific interest in the free flow of commercial information and a general interest in the free flow of all types of information to enlighten public decision making."[13]

Finally, with federal funding channeled through universities and government research programs, the public has a stake in knowing the outcome of those experiments.

Trachtman, on the other hand, contends that a public's understanding of scientific research is not necessary nor particularly relevant to the ethical, moral or political problems posed by a democracy.[14] Trachtman believes it wouldn't be worth the trouble to make a concerted effort to teach the public; that if the public had to make "crucial decisions about science," the plethora of scientific information in the marketplace already is either disputed among scientists themselves, tentative, unsupported, or qualified and it would confuse the public and further delay any decision making.

But with the growing realization that there should be more public understanding and therefore involvement through the government in this new research, there was precedence for the concern on behalf of scientists. Freedom of inquiry has meaning for the lay citizen as well as the scientist desiring to delve further into his own field.

In 1979, in the Cornell Law Review, James Ferguson noted:

> It is now apparent that American Science will be faced in the coming years with a persistent challenge to what is perhaps its most fundamental value -- freedom of inquiry. This emerging theme has been clearly signalled by recent proposals for federal control of recombinant DNA technology.[15]

One early example of the precedence of government intrusion on science progress is that of the former U.S.S.R. and Stalin's repression of modern genetics in

the 1930s. Denisovich Lysenko, a plant biologist, professed to the scientific community that "the inheritance of physical characteristics could be manipulated in plants by their environment."[16] Stalin upheld Lysenko's mistaken claim and supported the banning of all experiments in traditional genetics -- keeping Russian researchers out of "the mainstream of biological research in agriculture, genetics and heredity for 30 years."[17]

Although it is not the purpose here to discuss, nor debate federal control of recombinant DNA, it may be seen that at the time -- and earlier in the mid-1970s -- there was federal and national interest in how the issue of biotechnology research should be conducted.

THE BIOTECH EVOLUTION

A turning point for the study and application of biotechnology was a letter to the editor of Science magazine on September 21, 1973, in which two scientists related their concern about recombinant DNA research and its unknown risks to the ecosystem. "Previous discussions had taken place among the scientists conducting the experiments, but this letter put the matter before the whole scientific community and the general public, even though the latter took little notice at the time."[18]

> Up to this point, little news of these developments had passed outside the tightly-knit community of molecular biologists. Any reports that did appear were in scientific journals, in a language virtually incomprehensible to laymen.[19]

The alleged risks of biotechnology research were soon being discussed within the public forum of the media, and not strictly within the confines of scientific discourse. The letter stands alone in the history of science as leading the National Academy of Science (NAS) to name a committee to study the risks, and this assembly in turn called for the suspension of certain types of recombinant DNA research until the risks could be assessed at a world meeting.[20] The significance of this monumental step was unprecedented.

> Not since 1939 -- when a handful of physicists asked their colleagues to stop publishing atomic data to prevent the information from falling into German hands, had scientists tried such self-policing.[21]

Researchers obeyed the edict, and "...by all reports, the resulting moratorium on research was conscientiously observed in laboratories around the world."[22] Research (subject to certain cautions and restraints) resumed after the international conference at the Asilomar Center in California in 1975. At the time, conference organizers were warned that they were opening "Pandora's Box," a metaphor often applied to biotechnology research,[23] because they were holding the meeting and that sixteen reporters had been invited to attend. Ironically, though organizers had hesitated to invite the press, they would subsequently point out the press' presence as "public participation."[24]

That unknown possible dangers of recombinant DNA research were being discussed in a forum, prompted the perception that "outsiders were being left out of

decisions about science..."[25] Questions and ultimately, concern about biotechnology research surrounded the idea that scientists have a moral responsibility to consider the potential impact their research might have on society.[26]

Ironically, given the interest and concern about the subject, after the moratorium was lifted the first and only article found among the study sources in 1974, was in Time.

> The U.S. investigators, having taken a step with few or no precedents in the history of science, also urged their colleagues round the world to follow their lead until potential hazards can be better evaluated and controlled.[27]

Concern was most apparent in the article and discussion of DNA and its possible applications framed the story.

But the groundwork for future discussion, the disagreements surrounding the pursuit of further research in general, had already been placed with the frequent haunting question that scientists were somehow playing God with their research. In the March 10, 1975 issue of Newsweek, the lead question framed the story:

> Do scientists involved in the quest for fundamental knowledge have the right to create new organisms that are potential health hazards?[28]

Questions of concern provide the cornerstone for controversy in the biotechnology issue, and studies and papers have been done that trace media coverage

of biotechnology at various points in time. In particular, a few have found similar patterns in their research and results.

In Scientists and Journalists, Rae Goodell discusses the early years of biotechnology research, or recombinant DNA as it was known at the time. Goodell asserts that there are three phases of recombinant DNA influence that can be found in both the scientific community and the press: first, the development of the recombinant DNA safety controversy from about 1974 to 1977; second, the diminishing of the controversy from about 1977 to 1979; and third, the shift of attention to the genetic engineering industry, from about 1979 to the present.[29]

Goodell's discussion is an overview of observations of biotechnology in industry and the media in general, and does not discuss or assess a specific type of press or its coverage. Her analysis for Scientists and Journalists was drawn from documents, transcripts and press clippings files in the Recombinant DNA Controversy Oral History Collection, Institute Archives and Special Collections, MIT Library, Cambridge, Massachusetts.[30]

Christopher Plein's review of biotechnology as a policy issue during the past two decades argues that the biotech industry was influenced by the efforts of a well-organized coalition of research interests to define biotech in positive terms through an agenda-setting process.

> Until the beginning of the 1980s, biotechnology conjured up images of environmental risk and social uncertainty. Today biotech is largely characterized by economic themes such as patent rights, international trade, research funding and regulatory policy...The major factor in the

> transformation was the efforts of a coalition of interests committed to the development and application of biotech in the fields of agriculture, industry and medicine.[31]

Plein contends that those interests dedicated to the commercial development of biotechnology "that converged at the dawn of the 1980s,"[32] have been successful in gaining acceptance of this science as a tool of economic development for new, related industries. Plein offers well-documented analyses and reviews of various literature, "interview data, public documents and other sources,"[33] but also acknowledges that the process of issue definition is never complete. Therefore, given the multi-faceted field of biotechnology, it is an area that is still evolving and related policies -- and industries -- may continue to change.

Pfund and Hofstadter's study covers the biotech industry in selected newspapers, magazines, and the science and medical press from 1976 to early 1980. It is a study geared toward policy-oriented coverage of four biomedical areas, including recombinant DNA research. The study does not say specifically how the magazines and newspapers were selected for analysis, except for consideration of geographic variation and differing audiences. The seven newspapers selected were the *New York Times, Washington Post, Chicago Tribune, Los Angeles Times, Boston Globe, San Francisco Chronicle*, and *Wall Street Journal*. The ten news magazines (which did not include *U.S. News*) were *Time, Newsweek, National Review, New Republic, Progressive, Chemical Week, Chemical and Engineering News, Business Week, Nation* and *Economist*. Six science and medical periodicals were also examined, including:

Journal of the American Medical Association, Nature, New Scientist, Science, Science Digest and *Science News.*

Pfund and Hofstadter state that rather than attempting an all-inclusive survey of coverage, they focused on critical time periods in the four biomedical arenas; with recombinant DNA research being examined from 1976 through 1980. Like Plein, they find that economic and political interests had a strong impact on content, and that the change from a science issue to an economic "interest" was beginning during early coverage of the issue.

> Biotechnology symbolizes the aggressive pursuit of new products, new means of production...predictably then, the denouement of the DNA story ends up not in the science section, but in the business and finance.[34]

Pfund and Hofstadter acknowledge that not all sources were examined for all years of their four-and-a-half year study, and of those sources that were, general news magazines and specialty magazines such as Chemical Week, Chemical and Engineering News, Business Week and Economist (including the others listed) were combined together in the "magazines" category.

Pfund and Hofstadter recognize the evolution of biotechnology from a risk-oriented issue to one of "emerging (if still hypothetical) benefits,"[35] as correlating directly with the fact that as research progressed, risks became less newsworthy and industrial interests would be able to capitalize on that progress. Whereas risk interests

and the right of the public to have a role in determining science policy once centered around the university, industrial interests changed the venue.

According to her research, Susanna Hornig Priest would agree. In her study of newspaper coverage of biotechnology, industrial rather than academic interests set terms of the media discussion of recombinant DNA and other biomedical research during the 1970s, "downplaying" controversy and criticism. The only other study found addressing specific aspects of biotechnology in the media, Hornig Priest's and Talbert's study examined newspaper coverage of biotechnology in agriculture and medicine in 1991 and 1992. Their data was drawn from the Newsbank newspaper index, which selected all stories indexed under the keyword "biotechnology" from January 1, 1991, through June 30, 1992. A total of 132 stories were selected, but it is noted that the Newsbank index does not include wire stories.

Their research also shows the role of issue-definition in creating a positive environment of public opinion for biotechnological development and portrays biotechnology to be an economic opportunity rather than an environmental risk.[36]

Mazur's research suggests that the biotechnology dispute may be different from typical technological controversies. Though his research does not discuss nor do an in-depth assessment of biotechnology, he finds a correlation between media coverage and public bias against technological controversies. His research suggests that the public can have a bias against the controversy in question when media coverage increases, and thus, "the appearance of a dispute works to the benefit of the opponents of the technology."[37] The study explains:

> ...The quantity of coverage of a technical controversy can have as much effect on public attitudes as the semantic content of the stories that are presented. The public takes seriously any suggestion that a technology may be risky.[38]

Thus if as Goodell asserts, the biotech safety controversy evolved from about 1974 through 1977, and with that the public awareness of potential risk through the media, the public would be skeptical and apprehensive. Unless, of course, new discoveries benefitting the welfare of the public came to light and new information diminished concern. There is a large literature base exploring risk issues that is not addressed within the body of this work.[39]

How the public deals with risk issues, in particular understanding biotechnology issues as portrayed through the media, is the topic Susanna Hornig Priest's study of media frames and schema processing in "Structuring Public Debate on Biotechnology." The focus of the study was that differences in evaluating risk perceptions between experts and the lay public may be due in part to the lay public trying to bring together or reason from previous science information or knowledge, than from misunderstanding scientific data. The study suggests that in general terms framing and schema processing can be a part of gauging public opinion of biotechnology and that people do draw from related topics in order to understand an issue.

Hornig Priest differentiates between framing, as the writing process through which complex issues are distilled for a news story resulting in the selectivity of certain

subthemes over others,[40] and schema processing, a reader perceiving an issue or story as related to something previously read.[41]

Hornig Priest suggests that through framing, which "suggests or invites certain interpretations of a particular issue, the mass media may have their most powerful effects and that framing effects may be particularly significant for newly emerging issues."[42] Schema processing by a reader would tend to be subjective and involve varying degrees of perception.

For Hornig Priest's study, small groups of adults and students discussed their perceptions of agricultural and medical biotechnology issues. The focus group results suggest that lay discussion revolves around impacts and benefits, rather than other related issues; from previous research results that showed newspaper coverage of biotechnology to be dominated by industrial and economic interests, Hornig Priest reasons that the lay discussion results may be due to "framed" media coverage.

> ...To suggest generally, that biotechnology is being framed as a scientific development issue, asks if these developments could be understood in the context of some other schema? The difficulty of imagining an alternative may say something about the strength of this framing influence and the primacy of scientific explanation in American culture -- its embeddedness in everyday thought.[43]

The study acknowledges that although it provides only weak and indirect evidence to show framing effects on public discussion, it could be a method that would be useful for further understanding and discussion of biotechnology as portrayed through the media -- the only major avenue of new public education.

Perhaps no other testing ground could be a more reliable measure of public opinion than what people will eat. On May 18, 1994, the biotechnology industry reached a milestone when the FDA approved the first product of a genetically engineered plant, the Flavr-Savr tomato, which was modified by gene manipulation to delay spoilage and improve flavor. With the new Flavr-Savr tomato on grocery store shelves, other products will also be entering the market. In a 1994 public opinion survey measuring attitudes toward genetically-engineered foods, 30 percent of the 1,036 adults polled acknowledged that they "somewhat favor" genetically engineered products, compared to 14 percent who strongly favor these products. Twenty-five percent somewhat oppose genetically-engineered products and 22 percent strongly oppose them. Nine percent did not have an opinion in response to the issue.[44]

SOURCES

Sources influence the credibility of an article's arguments, and the prevalence of certain sources can be of further interest to identify imbalance and a potential bias of the journalist, or perceived bias in the minds of the reading public. According to Pfund and Hofstadter, "Manipulation of press coverage often occurs when reporters rely uncritically and exclusively on certain 'authoritative ' sources for news."[45]

In their study of four areas of biomedical innovation coverage in the press, including biotechnology during the years 1976 to the first part of 1980, Pfund and Hofstadter discovered that coverage relied heavily on industry points of view.[46] "The most quotable sources were those engaged in the biotechnology pursuit -- the scientist entrepreneurs, venture capitalists, and corporate chairmen of the boards."[47]

It was also found that scientists and other sources who did not share the generally positive perspectives of those with industrial interests were not cited as often. "During the height of the controversy, from late 1976 to mid-1977, industry coverage in newspapers, magazines and journals regularly carried opinions from dissenting experts and laypersons."[48]

But the study discovered that in late 1977 there was a significant change in coverage. According to Goodell, the reasons for this sudden decline of negative opinion in the media are varied, but are in large part due to increased lobbying efforts on behalf of scientists concerned about legislation that would curb future basic research efforts. Some of the proposed legislation would have panels staffed primarily by nonscientists, as well as the right of local communities to enact research conditions more severe than the federal ones.[49]

In the April 11, 1977, issue of U.S. News & World Report, the controversy is featured under the title, "Creating New Forms of Life -- Blessing or Curse?" The Cambridge, Mass., city council "...is allowing research to continue there, but only under tougher guidelines than those published by NIH."[50] Reseachers could see that some communities (such as Harvard) would also be at a disadvantage with local

regulations, and they were further concerned about competition from abroad and their own plans for proceeding with the new information at hand. Thus, a new lobbying effort began, with some scientists changing their minds about the presumed "unsafe" research and the new industry possibilities ahead.

"By the end of 1977, when the mainstream scientific community suggested that there was no cause for debate, reporting dissident views decreased sharply. Direct quotes from critical scientists or environmentalists occurred as the exception rather than the rule."[51]

Pfund and Hofstadter see this discrepancy in source use to be a bias in source selection, and that this may come from within the professions themselves. They offer that at the individual and professional levels, the science community has its own circle of communicative and respected voices. A reporter may come to rely on these sources, and perhaps, hesitate to stray from them or in some way infringe on the accepted norm by reporting (extensively) the views of the "dissident" scientists for fear of alienating any established rapport.[52]

Pfund and Hofstadter's reasoning is not new to source use discussions. Reporters in general -- not exclusively science reporters -- can fall prey to the assimilation of source values, and it perhaps should not be surprising in an arena such as science, where sources are often seen as intelligent and powerful, if not intimidating. Similarly, in a study of source-reporter relationships conducted 20 years earlier, Gieber and Johnson found that reporters covering a city hall beat had become "unwitting adjuncts to city hall."[53]

Cooperation and collaboration among sources and reporters can be keys to assimilating values, they explain. In their study of the roles of city hall reporters and the roles of sources used in the studied "city hall," Gieber and Johnson discovered that a mutual dependence can evolve between the two roles: one that has a need to send a message and the other to retrieve that message and deliver it to the public. In doing so, a common interest in the purposes of communication can develop between the two groups, forming in some cases, an avoidance of conflict on both parts. Initially, the sources may believe that the reporters should pass unmediated information to the public, and the reporters reserve the right to determine how to present that information.[54] But by establishing rapport with the other, and the reporters' dependence upon those sources through time and the security of knowing a dependable source, the communication goals of both parties begin to overlap.

Gieber and Johnson explore how this assimilation can evolve between reporters and sources, and briefly why, but they do not assess how it can be avoided, or if avoiding assimilation is completely possible; a tenuous line often exists between establishing a professional source rapport of mutual respect, and one of inadvertent collaboration.

Based on the Pfund and Hofstadter research, Goodell's, as well as Gieber's and Johnson's, one might assume that the mainstream scientists began to initiate positive opinions of research in the mid-1970s, leading eventually to the burgeoning of the industrial and economic aspects of biotechnology. Further, Pfund and Hofstadter continue, "The current abundance of benefits-oriented stories indicates that much of

science reporting is being influenced by the mainstream science community (as well as by the private sector), which is intent on avoiding debate and creating a positive image for the research."[55]

In a speech to the American Association for the Advancement of Science in 1978, U.S. Representative Richard Ottinger expressed his support for critics of DNA research, and implored the minimum federal standards to all DNA research and any commercial applications. Most interesting, however, was his comment on a January 13, 1978, editorial in Science magazine in which a "warning" was sent to researchers involved in recombinant DNA research, that "A scientist who furnished the pretext for restrictive legislation could count on the ill will of many of those he or she most wants to impress."[56] Ottinger's reply to the editorial correlates with the theory of a science community closely linked with its own commmunicative voices, that "any scientist who lends support to more proscriptive regulation will be unpopular with his colleagues and ...scientists who themselves urge constraints may similarly be alienated from the scientific mainstream."[57]

In a study of biotechnology coverage in newspapers, Hornig Priest and Talbert found coverage to be primarily "producer-driven," with little attention paid to outside interests. "Industry and university sources combined accounted for 72.9 percent of all the arguments presented; not only activists but agricultural and even governmental sources were relatively invisible in the news."[58]

Conversely, in a survey of scientists from both the physical/biological and the social/behavioral sciences, Dunwoody found that scientists working in government or

in public institutions such as universities, talk to journalists more often than those in private industry.[59] A reason for the lack of industrial contact may be due in part to industry policies of protecting information, whereas government and university scientists often have an obligation to be accessible to the media due to federally funded research projects. Further, not all sources interviewed are quoted in stories, and university professors often provide background material that may or may not be used.

A study by Dunwoody and Ryan addresses the question of credible source use by evaluating the criteria of how science sources are selected. Following the definition that "the credible scientist is one who communicates within his or her area of research expertise,"[60] Dunwoody and Ryan sought to determine if journalists select sources based on the source's area of expertise, or if sources are selected regardless that they are outside of their expertise, in that they are asked questions unrelated to their own specialties. If the latter is the case, then perhaps journalists use their own criteria for deciding why a particular source is selected.

That criteria might involve three factors Dunwoody lists in a separate article: mainstream status, administrative credentials and previous contact with the media.[61] Arguing that sources are selected with those criteria, Dunwoody reasons, "Journalists are very dependent on their scientific sources and don't want to alienate them by going to dissident scientists."[62]

Ultimately, Dunwoody and Ryan found that scientists surveyed for this study were also involved in other roles (such as administrative) outside of their respective disciplines, opening up the possibility that their credibility might have been evaluated

on other areas. Even so, the study showed most often that scientists as sources were confined to their research disciplines, but one-third of the time scientists were also asked about areas completely unrelated to their expertise. This raises the suggestion that journalists use other criteria in determining who is called as a source. Reasons given for possible journalistic criteria include the importance of "localizing" a story even when there is not an expert in the area, a conscious decision to use other sources or mere negligence by the reporter.

In Shepherd's study of media coverage of marijuana research, the primary sources (seven out of ten) were administrative officials of government institutions. Shepherd found that these authorities quoted were administrators "with credentials such as M.Ds or Ph.Ds involved administratively or tangentially [to the topic] but not directly conducting related research."[63]

Over time, source use can affect the quality of coverage of certain topics. Plein explains,

> The science writer's conceptualization of what constitutes a relevant and legitimate source can determine not only how long a scientific controversy endures, but may also affect who joins in the fray, and in what capacity.[64]

Branscomb suggests that it is the journalist's responsibility to identify sources clearly, and that the reader will determine the source's credibility (on the subject.) In her article, "Knowing how to Know," Branscomb is concerned about a knowledge "gap" between scientific and technological experts and a reading public not always able

to understand "the level of erudition and unfathomable language used by the scientific 'literati,'"[65] Branscomb recommends a list of methods for improving scientific "education." Among them, the importance of:

> ...Assuring that the sources of scientific assertions, assumptions, and opinions are clearly identified, enabling their validity and utility to be evaluated according to the user's trust in the sources.[66]

Further, Ziman believes that the public is not an idle recipient of science information. Sources outside of their expertise would be disregarded for other sources more pertinent to the subject matter. "People do not accept passively the knowledge presented to them by scientific experts. The credibility of a source depends strongly on its perceived interests in a particular context. This applies to individual scientists, scientific institutions, public bodies and private enterprises."

A review of the literature shows that no study has focused exclusively on media coverage of biotechnology as portrayed through time in general news magazines, specifically the top three in circulation, Time, Newsweek and U.S. News & World Report. Further, though a few studies have analyzed shorter segments of time, no study at all has done a comprehensive analysis of articles in a particular media for the two decades since biotechnology became a research focus and came to the public's attention through the media.

The Pfund and Hofstadter study analyzed a three-and-a-half year time frame from 1976 through the first part of 1980, revealing a window of change that was taking place in the biomedical policy arena with recombinant DNA technology. However,

though their study showed that industrial and economic interests were becoming more prevalent, the newspapers and magazines analyzed also included special interest business magazines, perhaps contributing additional emphasis on business news.

Susanna Hornig Priest and Talbert conducted the only other study that closely addresses the biotechnology issue in the media through an analysis of newspaper articles over a two-year timeframe, and their conclusions also revealed an economic focus. They also coded the sources of arguments, including agricultural, science, government, anti-biotechnology activists and unattributed sources, among others, and the tone of those arguments as positive or negative.

Several studies address source use and the voices that speak for the various facets of the biotechnology industry. An effort to gauge the sources of statements would reveal the voices behind topics, and finally, as Plein noted, if various aspects of the biotechnology industry were "defined by positive terms."

Further inquiry may also investigate if and how Goodell's three phases of recombinant DNA coverage in the press from the early 1970s may be revealed in news magazines.

HYPOTHESES

With the preceding literature and ideas in mind, the following hypotheses were developed to determine the extent to which three weekly news magazines, Time, Newsweek, and U.S. News & World Report published articles about biotechnology from 1973 through 1994:

1) The number of stories involving biotechnology coverage in the three major news magazines, Time, Newsweek and U.S. News & World Report, will increase over time between 1973 and 1994.

2) Of the coded topics encompassing biotechnology research in the news magazine articles, the economic and medical topics will be emphasized the most.

3) Industrial and educational sources will be the most prevalent in biotechnology stories in the three magazines between 1973 and 1994.

4) Between 1973 and 1994, stories concerning biotechnology discussed more often the consequences of biotechnology and its research as beneficial, rather than detrimental to society.

CHAPTER TWO -- NOTES

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3. Ibid.

4. Sharon M. Friedman, "The Journalist's World," chap. in Scientists and Journalists: Reporting Science as News (New York: The Free Press, a Division of Macmillan, Inc. 1986): 25.

5. Ibid.

6. Ibid., 23.

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9. Ibid.

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11. Marc Lappe and Patricia Archbold Martin, "The Place of the Public in the Conduct of Science," Southern California Law Review 51, 1535. Statement attributed to *Red Lion Broadcasting Co. v. FCC*, 395 U.S. 367, 392, 1969. See also *Virginia State Board of Pharmacy v. Virgina Citizens Consumer Council, Inc.* 425 U.S. 748, 765, 1969.

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14. L.E. Trachtman, "The Public Understanding of Science Effort: A Critique," Science, Technology and Human Values 36 (Summer): 10.

15. James R. Ferguson, "Scientific Inquiry and the First Amendment," Cornell Law Review 64, 639.

16. "Lysenko's Legacy," Time, Dec. 6, 1976, 48. See also: Burkett, 37.

17. Burkett, 37.

18. Alexander Morgan Capron, Southern California Law Review 51, no.6 (September 1978) 973.

19. "Tinkering with Life," Time, April 18, 1977. 39.

20. Capron, Ibid. 974.

21. "Tinkering with Life," Time, April 18, 1977. 40.

22. Capron, Ibid.

23. Ibid.

24. Rae Goodell, "How to Kill a Controversy: The Case of Recombinant DNA," chap. in: Scientists and Journalists: Reporting Science as News (New York: The Free Press, a Division of Macmillan, Inc. 1986): 173.

25. Capron, Ibid. 974.

26. Ibid. 976.

27. Time, July 29, 1974. 59.

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29. Goodell, Ibid. 175.

30. Ibid.

31. L. Christopher Plein, "Popularizing Biotechnology: The Influence of Issue Definition," Science, Technology & Human Values 16 (Autumn 1991): 475.

32. Ibid. 486.

33. Ibid. 474.

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36. Susanna Hornig Priest and Jeffery Talbert, "Mass Media and the Ultimate Technological Fix: Newspaper Coverage of Biotechnology," Southwestern Mass Communication Journal 10, no.1 (1994).

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38. Ibid.

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43. Ibid.

44. Telephone survey conducted by the Wirthlin Group, March 14-16, 1994, as cited in The Congressional Quarterly Researcher, "Genetically Engineered Foods," 4, no.29 (August 5, 1994): 676.

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59. Sharon Dunwoody, "The Scientist as Source," chap. in Scientists and Journalists: Reporting Science as News, (New York: The Free Press, a Division of Macmillan, Inc., 1986): 5.

60. Sharon Dunwoody and Michael Ryan, "The Credible Scientific Source," Journalism Quarterly, (Spring, 1987): 22.

61. Sharon Dunwoody, "The Scientist as Source," chap. in Scientists and Journalists: Reporting Science as News, (New York: The Free Press, a Division of Macmillan, Inc., 1986): 7.

62. Ibid.

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64. Plein, 148.

65. Anne W. Branscomb, "Knowing How to Know," Science, Technology & Human Values 6, no.36 (Summer, 1981): 5.

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CHAPTER THREE

RESEARCH METHOD

With the preceding hypotheses in mind, a coding instrument including 22 variables and accompanying operational definitions was developed with which to code each article about biotechnology over the 21-year time period. The coding instrument is in Appendix A.

The major newsmagazines, Time, Newsweek and U.S. News & World Report were selected as the group from which the articles relating to biotechnology would be coded. The magazines were chosen for their similar content as news magazines, high circulation rates (listed in appendix A), and presence in the news media during the timeframe which would be studied. The medium of magazines often enables more opportunity for in-depth coverage of a topic on a continuing basis than newspapers, radio, or television. Further, a number of studies have shown newsmagazines as a primary source of science news among U.S. readers.[1]

The years 1973 through 1994 were chosen in order to most accurately capture the emergence and evolving discussion of the biotechnology industry. Coverage was figured by assessing all biotechnology articles during the 20-year time period in the three magazines as listed in the Index to Periodical Literature. A total of 117 articles were identified in the Index to Periodical Literature under the "keywords" of genes,

genetic research, plant research (and later) plant genetics, genetic engineering, human engineering and other subcategories such as genetic counseling, that may appear under the keyword, "genetics."

To investigate the hypothesis, "The number of articles involving biotechnology coverage in the three major news magazines, Time, Newsweek and U.S. News & World Report will increase over time between 1973 and 1994," items were coded based on the following: (1) the magazine in which the article was published; (2) the length of each article in square inches; and (3) the month and year of the article's publication.

The second hypothesis explored which particular topic areas, economic, political, agricultural, medical and/or scientific are mentioned the most in the articles throughout the 21-year time period, with the assumption that economic and medical topics will be emphasized the most. A topic was defined as a significant portion of the story measuring approximately 20 percent devoted to a particular topic, and each topic is defined accordingly in Appendix A. As many as five topics or as few as one could be listed. A measurement for the amount of space devoted to the topic was recorded on the coding sheet.

Hypothesis three was investigated in an effort to gauge the extent of positive and negative coverage in the magazines of biotechnology and its research. Given the writing styles used to report science topics, other types of assertions (not only beneficial and detrimental) might be made when discussing biotechnology, and so explanatory neutral and balanced neutral assertions were also coded. For research purposes here, an assertion is defined as a statement of intent, main point or premise of

a source, an argument, quotation or attributed to a statement. An assertion may be found in one sentence or a series of related sentences that might constitute an entire paragraph. Thus, with those thoughts in mind, the number of respective assertions in each of the four categories was counted.

Due to the specialized nature of science fields, and the literature discussing sources, hypothesis four was investigated to determine the voices behind various assertions. A source is defined here as the person to whom an assertion is attributed. A source does not need to "speak" to be a source, but can be referred to or stated with agreement to an assertion. Each assertion has a source which, for this study's purposes may be one of the following: industrial, political, agricultural, medical, educational, a private citizen or unknown. All sources were coded on the coding sheet.

Inferential statistics will not be used because this is a census of a content population.

An intercoder reliability check of the coding categories was conducted to test the reliability of the coding instrument and operational definitions. The intercoder reliability check involved the coding of 35 articles from the three magazines. All variables were used in the intercoder reliability check, in which the agreement level was determined by the number of times the coders' variables agreed divided by the number of articles. A goal of 85 percent agreement was established in the proposal.

More than 85 percent agreement was reached by the two coders on all but three of the questions; one of which was 80 percent agreement and the other two were 83 percent agreement. Variables 1 through 4, 21 and 22 were not measured for reliability

because they involve identifying the magazine, date and measurement of the article as well as measuring photos and graphs. Variables 5 and 7 both had 91 percent agreement, variable 6 had 89 percent, and variables 8, 10 and 11 had 86 percent. Variables 12, 14 and 15 all had 89 percent.

Variable 9 had 83 percent, which inquired as to the identification and amount of space devoted to science topics. Coder discussion determined that differences were due in part to definition and then measurement of a topic that, if a coder wasn't careful, could be misunderstood or categorized under a medical topic. More careful measurement would be followed, as well as adhering strictly to the respective definitions of medical and scientific topics. Variable 13 also had 83 percent agreement, which involved identifying explanatory neutral statements. Again, simple adjustments were made to the definition. It was somewhat surprising that this variable did not reach a higher agreement level because the definition seems very clear, but with more careful thought, various circumstances within coding the articles necessitated more examples for the definition and classifying explanatory neutral statements, rather than just beneficial or detrimental.

Variable 16 achieved 100 percent by default, in the sense that what can only be summed up as a "fluke" in the reliability check is the unavailability of data to determine its reliability. The variable asked the number of times agricultural sources are quoted, and it was later discovered that only three sources were found in the entire study and none, by chance, were selected for the random sample. Variables 17 and 18 had 89 percent and 86 percent respectively, with variable 19 achieving 89 percent

agreement. Variable 20 had 80 percent agreement, and upon more careful consideration, adjustments were made in the operational definition to define an unidentified source or "no source" more clearly. When an assertion of fact is made without a source or attribution (when it should be attributed to someone) it is considered to have been made with an unidentified or "no source." An anonymous source may be an "unidentified" source, but sometimes it is not that easy to identify a statement without a source. Journalists sometimes use information gleaned from many sources and some of those statements need attribution, but due to oversight or improper style, attribution isn't given. Disagreement was due in part to understanding and applying the definition, the extremely tedious nature of coding this data and also coder carelessness. Data for variables 21 and 22 were ultimately not included in the final analysis.

CHAPTER THREE -- NOTES

1. See Donald L. Shaw and Paul Van Nevel, "Informative Value of Medical Science News," Journalism Quarterly 44 (Autumn, 1967) 548. See Jonathon T. Rich, "A Measure of Comprehensiveness in Newsmagazine Science Coverage," Journalism Quarterly 58, 1981.

CHAPTER FOUR

RESULTS

Of the three magazines analyzed for this study, based on percentage and the number of articles related to biotechnology, U.S. News published the most articles with 39.9 percent or 46 articles, Newsweek published 31.6 percent or 37 articles, and Time captured 29.1 percent with 34 articles of the total number published.

Length was also considered in this study and U.S. News also had longer articles with an average length of 56 inches. However, Time edged past Newsweek with 43.1 average inches compared to Newsweek's average of 41.7 inches per article. Overall, articles averaged 47 inches for all articles.

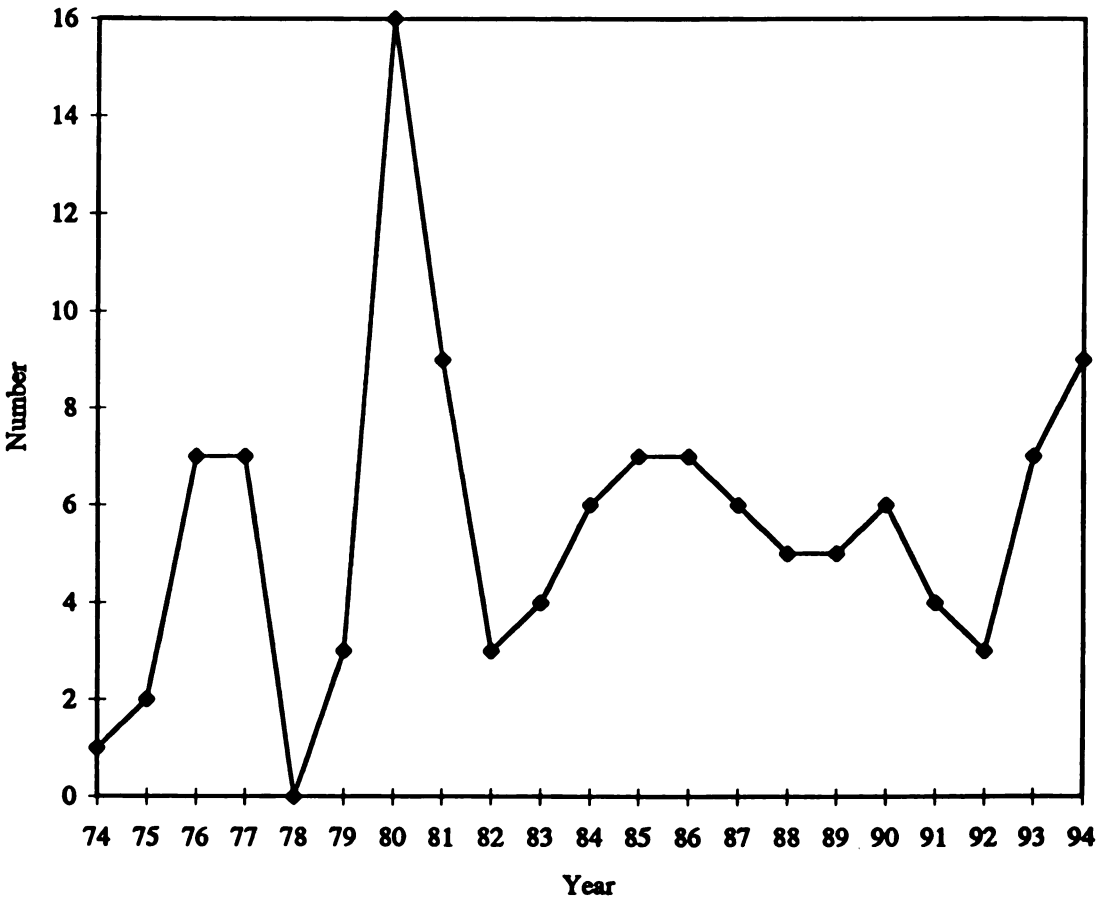
In response to the first hypothesis, which sought to evaluate the extent of biotechnology coverage in Time, Newsweek and U.S. News & World Report from 1973 through 1994, data showed an increase in the number of articles published each year, as shown in Figure 1.

The second year studied, 1974, featured one article published in Time. As new discoveries and controversies within this research field developed, more articles were published with peak coverage occurring in 1980 with 15 articles among the three magazines. With the exception of 1978, for which no articles were found, the average number of articles published each year in the three magazines was 5.6.

Using the Pearson's correlation coefficients to correlate the number of articles with the years, it was discovered that while U.S. News & World Report (hereafter signified by U.S. News) did increase and published the most articles overall, Newsweek slightly decreased coverage and Time's correlation revealed an even slighter decrease through time. By correlating the articles, similarity of news values can be examined. A correlation between the number of related articles per magazine and year showed that U.S. News had a correlation of .66. Newsweek had a correlation of -.19, and Time's correlation between the article count and year was -.06.

Time and Newsweek had a .64 correlation across the 21 years, showing a similarity in the numbers of stories. U.S. News and Time had a -.03 correlation, which reveals that they were not correlated at all. U.S. News and Newsweek had a -.22 correlation, which means that while U.S. News increased its stories, Newsweek did not. Overall, Time and Newsweek had similar news values, but U.S. News stands alone.

Figure 1: Cumulative number of stories per year in TIME, NEWSWEEK, and U. S. News 1974-1994



To the best of this author's ability no articles were found for the year 1978, in Time, Newsweek, and U.S. News. In the Pfund and Hofstadter study six articles were found for 1978, but it is most likely that they are from the other eight magazines they used as sources.[1] One reason for the lack of coverage during 1978 could be that the initial safety controversy about biotechnology research appeared to have subsided; the lobbying efforts begun in 1977 against restrictive legislation of recombinant DNA

research had seemed to pay off as Senator Ted Kennedy withdrew his support from his bill that would have imposed strong regulations for the research. "Nothing reached the Senate floor by the end of 1977, and in 1978 the same process was repeated on a smaller scale with weaker bills."[2]

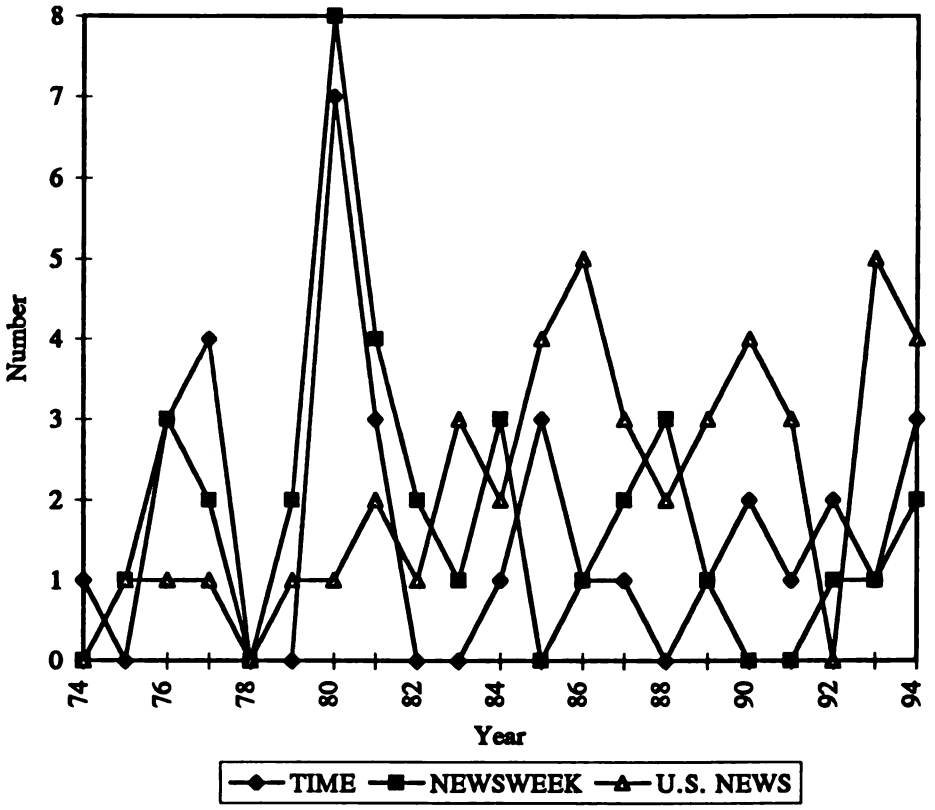
Signaled by a few key events, a meteoric rise in coverage occurred in 1980. In June the Supreme Court ruled that new life forms developed in the laboratory could be patented:

> The decision, climaxing an eight-year legal battle, should give a boost to an emerging industry, genetic engineering, which seeks to create new life forms. This promising field offers the prospect of advances in everything from medicine and food production to alternate energy forms. The court's ruling also revived fears -- vastly exaggerated in the opinion of most responsible scientists -- about the dangers of tampering with life.[3]

In October of the same year, three immunologists working independently won the Nobel in Medicine for gene research, and a U.C.L.A. Hematologist used genetic engineering techniques for the first time on humans.

Time and Newsweek consistently follow the other with only a few lapses in coverage, as illustrated in Figure 2. No articles related to this study appeared in Time in 1975, 1978, 1979, 1982, and 1983 when U.S. News began its climb toward its peak coverage in 1986. Time also did not have any related articles in 1988. Newsweek did not have any related articles in 1985, 1990 and 1991.

Figure 2: Number of articles in TIME, NEWSWEEK, and U.S. NEWS 1974-1994



To the reading public, perhaps 1985 may be thought of as the year that genetic engineering became noticeable in two diverse spectrums: medical and agricultural applications. With the exception of Newsweek, which did not have any related articles that year, the other magazines appeared to be in the thick of their coverage. In September, a government advisory panel approved national guidelines for gene therapy -- the treatment of inherited diseases by replacing or altering abnormal genes.[4] In November, the EPA approved an outdoor experiment by Advanced Genetic Sciences, a

California biotechnology company, to use a bacteria that had been genetically altered to fight frost. It was the first time a man-made organism was approved to be released into the open air and to occur in February, 1986.[5] However, 1986 found all three magazines reporting about the issue when the EPA suspended Advanced Genetic Sciences' permit to conduct the research.

Coverage in Time and U.S. News rose again in '90, perhaps buoyed by the news that the Human Genome Project, an estimated $3 billion effort to map the entire gene by 2001, had begun. 1990 also heralded the first recipient of gene therapy, a four-year-old girl with a rare genetic immune disorder. Newsweek coverage breaks again between 1990 and 1991, and U.S. News drops coverage in 1992.

The second hypothesis inquired as to which topics involving biotechnology were emphasized the most in the articles. Up to five topics -- economic, political, agricultural, medical and scientific -- could be listed per article. The most prevalent topic was scientific, with 55 articles. Forty articles featured biotechnology as a medically-related topic, and 32 articles involved biotechnology as a political topic. Twenty-one articles were economically related, with only 14 articles involving agriculture as a topic.

The third hypothesis suggests that industrial and educational sources would be the most prevalent through time. Of the 117 articles coded in the study, 80 stories featured educational sources. The next highest were political sources in 64 articles. Industrial sources were given attribution in 49 articles, and 48 articles had medical sources. Forty-two articles had one or more statements without attribution. Private

citizen sources were attributed in 36 articles, and there were only three articles with agricultural sources in the entire study. However, there were 14 stories with agricultural topics, revealing that sources other than agricultural sources were used to discuss agricultural topics.

Table 1: Average number of sources per story with a given topic

	Sources						
Topic N*	Ind.	Pol.	Agric.	Med.	Educ.	Priv.	None
Economic(21)	5.6	1.1	0	0.9	2.4	0.5	1.1
Political (32)	1.8	2.7	0.03	0.7	2.3	0.9	0.7
Agricultural(14)	4.4	2.1	0.2	0.2	2.6	0.5	0.6
Medical (40)	1.4	0.8	0	3.6	1.7	0.6	0.8
Scientific (55)	1.4	1.5	0.02	0.8	3.4	0.6	0.8

* ( ) indicates the number of articles per topic

Table 1 shows the disparity between source use for the topics analyzed for this study. Within topics, by far the greatest average overall is 5.6 industrial sources per each of the 21 articles with economic topics. The next highest is an average of 4.4 industrial sources for each of the 14 articles that have agricultural topics. Educational sources had the highest percentage within stories with agricultural topics, having spoken an average of 2.6 times per each article. The lowest averages are with agricultural sources which rank zero in the medical and economic categories. "Private citizen" and "no source" categories are the next lowest.

The fourth hypothesis explored whether the overall emphasis of the articles, collectively, is beneficial or detrimental. Fifty-one percent of the articles were coded as having a beneficial emphasis, with forty-two percent having a detrimental emphasis.

In an effort to gauge the voices behind various assertions and the topics for which they spoke, the sources were coded for beneficial, detrimental, balanced-neutral or explanatory statements, as shown in Tables 2 and 3.

Table 2: Average number and percentages of assertions made per topic

	Topics					
Topic N*	Econ. 21	Pol. 32	Agric. 14	Med. 40	Scien. 55	Total
Beneficial	5.0 53%	2.2 32%	5.6 54%	3.8 39%	3.1 34%	19.7 43%
Detrimental	0.6 6%	2.0 28%	0.9 9%	0.9 9%	1.6 17%	6.0 14%
Balanced	0.3 3%	0.9 13%	1.4 14%	0.8 8%	0.8 9%	4.2 9%
Explanatory	3.6 38%	1.9 27%	2.4 23%	4.2 44%	3.7 40%	15.8 34%
Overall	9.5	7.0	10.3	9.7	9.2	

* number of articles per topic

Articles with agricultural topics had the highest percentage and number of beneficial assertions with an average of 5.6 per article or 54 percent, as shown in Table 2. Articles with economic topics ranked a close second with an average of 5 beneficial

assertions or 53 percent. The highest number of detrimental assertions was found in articles with political topics, and they had an average of two per article or 28 percent being detrimental. Articles with scientific topics had the next highest number of detrimental assertions with an average of 1.6 or 17 percent. Agricultural topics also had the most balanced-neutral assertions with an average of 1.4 per article, and with the exception of economic which had the lowest number of balanced assertions, political, medical and scientific were very close with an average of just less than one per article. Articles with medical topics had the most explanatory assertions with an average of 4.2 per article or 44 percent, and scientific and economic each follow with an average of 3.7 and 3.6 respectively.

Table 3: Average number and percentages of assertions made by sources

	Sources							
Topic N*	Ind. 49	Pol. 64	Agric. 3	Med. 48	Educ. 80	Priv. 36	None 42	Total
Beneficial	4.5 42%	3.0 34%	6.7 48%	3.5 35%	3.1 35%	3.9 37%	4.2 39%	28.9 39%
Detrimental	1.4 13%	1.7 19%	3.3 24%	1.4 14%	1.3 15%	1.8 17%	1.3 12%	12.2 16%
Balanced	1.0 9%	0.9 10%	3.0 21%	0.8 8%	0.8 9%	0.8 7%	0.7 6%	8.0 11%
Explanatory	3.9 36%	3.2 37%	1.0 7%	4.3 43%	3.6 41%	4.2 39%	4.7 43%	24.9 34%
Overall	10.8	8.8	14.0	10.0	8.8	10.7	10.9	

* The number of sources

Table 3 shows the average number and percentages of assertions made by sources. The highest number of beneficial assertions were made by agricultural sources with an average of 6.7 per article, with 48 percent of agricultural assertions as beneficial. The lowest number was made by political sources with an average of three per article. Agricultural sources also had the highest number of detrimental sources with 3.3 and thus, 24 percent detrimental, and the highest balanced neutral statements with an average of 3. "No source" attribution made the highest number of explanatory statements, with an average of 4.7 per article or 43 percent. Agricultural sources had the lowest number of explanatory statements with an average of one per article. Overall, no source attribution had the highest number of assertions with 10.9, closely followed by private citizen and industrial with 10.7 and 10.8.

Given the varying numbers of sources, their statements were also figured by percentages. Agricultural sources had the highest percentage of beneficial assertions in the study with 48 percent. Political sources had the lowest of beneficial assertions with only 34 percent, closely followed by medical and educational sources. Agricultural and political sources were closely aligned with the highest percentage of detrimental assertions, with 24 percent and 19 percent respectively. Agricultural sources had the most balanced neutral assertions with 21 percent. Medical and no source assertions both had the most explanatory statements with 43 percent each

Table 4 illustrates the beneficial and detrimental assertions made cumulatively (in percentages) between the three magazines from the first available article for the study in 1974 through 1994. Concurring with Goodell's research that the scientific

community began lobbying for minimal legislative research restrictions in the mid-'70s and the general growth of biotechnology industries, beneficial assertions made in the three magazines seem to correlate with the changing tide in the public sector. Table 4 shows that the shift occurred from 1976 to 1977 and with the exception of 1978, is most clearly revealed by 1979. Balanced neutral and explanatory assertions (combined here to be "non-judgmental") reveal a surprisingly steady presence throughout the entire two decades.

Table 4: Percentages of beneficial, detrimental and non-judgmental assertions made in TIME, NEWSWEEK, and U.S. NEWS, 1974-1994

Year	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	Ave
Beneficial	0	17	24	31	0	53	44	50	60	39	48	61	35	13	40	40	26	19	19	46	23	35
Detrimental	83	29	29	28	0	10	12	4	0	13	18	3	18	21	11	25	12	13	9	6	10	17
Non-judgmental	17	54	47	41	0	37	44	46	40	48	34	36	47	66	49	35	62	68	72	48	67	48
Number Articles/yr	1	2	7	7	0	3	15	9	3	4	6	7	7	6	5	5	6	4	3	7	9	5.6
Number Assert./yr	6	17	62	79	0	19	111	86	17	61	46	54	33	38	23	51	51	37	19	51	81	45

CHAPTER FOUR -- NOTES

1. Nancy Pfund and Laura Hofstadter, "Biomedical Innovation and the Press," Journal of Communication 31 (Spring, 1981): 143.

2. Rae Goodell, "How to Kill a Controversy: The Case of Recombinant DNA," chap. in: Scientists and Journalists: Reporting Science as News (New York: The Free Press, a Division of Macmillan, Inc. 1986): 174.

3. "Test Tube Life: Reg. U.S. Pat. Off.," Time, June 30, 1980, 52. See also: "The Right to Patent Life," Newsweek, June 30, 1980, 74.

4. "Genes," U.S. News & World Report, Nov. 11, 1985. 56.

5. "Fresh from the Labs, a Farming Revolution," U.S. News & World Report, Nov. 25, 1985, 74.

CHAPTER FIVE

CONCLUSIONS AND DISCUSSION

As a relatively new field of scientific research, biotechnology is a relevant point of departure for analyzing the evolution of a scientific topic in the media. A content analysis provides the opportunity to analyze data through time, and given the emergence of biotechnology research in the early 1970s and its potential impact on society, this study sought to discover the accuracy of four hypotheses drawn from reading previous research data and literature.

As was stated at the beginning of this study, the objective here has been to assess the coverage of biotechnology in Time, Newsweek and U.S. News & World Report throughout the 21-year time period from 1973 through 1994. No previous study has measured the coverage of biotechnology in the top three news magazines specifically, and given the opportunity for more in-depth reporting than other media, news magazines provide another forum for gauging how much information on biotechnology has been available to the public as well as assessing the prevalence of related biotechnology topics and sources.

It was expected that as a newly developing issue in the scientific and public arenas, coverage in the three news magazines would increase steadily through time. However, it was discovered that while U.S. News did increase and published the most articles overall,

Newsweek slightly decreased coverage and Time's correlation revealed an even slighter decrease through time. It may be concluded that the number of stories was irregular and the trend was only for an increase in U.S. News.

The finding that scientific and medical topics were more prevalent than economic topics did not fully support the second hypothesis. Given the previous literature data, it was assumed that economic topics would be featured more often. Fifty-five scientific topic articles were coded, compared to 21 economic topic articles. Medical topics were coded in forty articles.

However, as might be assumed, industrial sources spoke more often in articles with economic topics than any other topic. But that is not the case with agriculture. Perhaps one of the most intriguing findings of this study was that only three articles were coded to have agriculture sources but there are 14 articles with agriculture topics, revealing that sources other than agricultural were used to discuss agricultural topics. This is consistent with Dunwoody's study about sources.

The percentage of various assertions made by sources revealed that industrial sources made almost ten times more beneficial assertions than political sources. Industrial sources are also almost ten times more likely to make beneficial assertions than detrimental assertions.

This gap between beneficial and detrimental assertions (with just one balanced-neutral assertion) made by industrial sources, supports Plein's argument that the biotech industry was influenced by interests dedicated to defining biotech in "positive terms" for

commercial development.[1] Hornig Priest and Talbert also found that "industrial sources might be responsible for creating an economic agenda."[2]

It was also found that "no sources" made 39 percent beneficial assertions, and in turn, 12 percent detrimental assertions. It may be considered that "no source" statements are the reporter's thoughts and efforts to explain during the writing process, when the statement could or should have been supported with attribution by another source. Thus, if in certain cases the reporter was speaking through a "no source" assertion, this finding would, in part, support the Gieber and Johnson study which discovered that a dependency can evolve between reporters and sources, and ultimately, an assimilation of source values. This may also be evident with the consistent voices of other sources, but that is not as clearly identified at this time.

To link "no source" attribution to the high prevalence of economic topics is reasonable, but not a strong possibility here. Table 1 reveals that "no sources" (signified by "none") spoke an average of 1.1 times (as did political) as a source for economic topics, behind industrial and educational sources.

Educational sources also had a high percentage of beneficial assertions with 35 percent, just behind private, no source and industrial sources. Though still not the highest, this finding may also show a relation to Hornig Priest's and Talbert's study of biotechnology articles in newspapers that found university sources to account for "28.8 percent of the positive arguments and 11.7 percent of the negative arguments."[3] Hornig Priest and Talbert say that one reason for university (or, as defined in this study, "educational,") sources to speak in positive terms is that the universities and research

institutions would have interest in promoting biotechnology because its research is expensive, as compared to "industrial developers who bear the costs."[4]

This study also shows itself to be consistent with past research discussing the overall treatment of science in the media and lends further validity to studies examining the more positive language used by the press in covering science issues. In his unpublished thesis, "The Comparison of the New York Times', The Times of London's, Science's and Nature's Coverage of the Birth of Modern Atomic Theory: 1896-1922," Erik Larson found that overall coverage was primarily neutral and positive for all of the publications, but that skepticism was still present from the beginning.[5] Larson combined the methods of previous researchers who studied media and science effects: Weart, who assessed headlines and images, and Claudill, who analyzed the pattern of coverage over time,[6] to conduct a content analysis. Larson found that articles were not quite as positive as conclusions drawn by Weart, perhaps in part because Weart examined only headlines and Larson coded entire articles. Weart followed early perceptions of press coverage of the nuclear issue from the turn of the century. Weart found "very little negative language from 1900 to the middle 1920s, and almost three quarters of the titles from 1900-1940 were neutral with the majority of the rest being hopeful."[7]

This study echoes Larson's findings by revealing that as time progressed, assertions maintained relatively steady non-judgmental (balanced neutral and explanatory) assertions. In the early 1970s, coverage showed more detrimental assertions, possibly due to skepticism, but by 1979 had leaned to more positive and non-judgmental coverage, revealing some semblance of journalistic objectivity that carried through into the 1980s and

1990s. Goodell's claim that an early shift occurred with the initial controversy to other avenues such as the benefits of industry around 1977 and 1979 to the present is also supported, in part by this study.

These data clearly reveal the continued presence of biotechnology in the top news magazines and its widespread facets of industry, medical and other applications that are of importance in today's society. Further study may inquire as to the continued prevalence of documented industrial and economic interests, as well as other topics and sources used throughout the entire twenty-year time period.

If there is one particular area that should be emphasized in this analysis, it is the use and apparent absence of various sources. That biotechnology's early beginnings are rooted in agricultural practices that continue to this day, but seem to be overshadowed by industrial and medical interests to the point that sources outside of agriculture are used to discuss agricultural topics, is an area that should be explored further. Perhaps those stories coded in this study that involve agriculture are written by journalists who do not have the large source base from which to draw agricultural sources. But, those sources can be found.

Reliability of sources may also be a factor in their use. As in other areas of science, reliable sources are sometimes difficult to find. When they are, as Gieber and Johnson discovered, source values may be assimilated between the source and the reporter. Perhaps that is also to be considered in this study with the high prevalence of "no source" and other sources' assertions. The author of this study, as well as the outside coder, both commented during the coding process that the same sources were used again and again through the years. Further, journalists appointed to the science or medical beat on a national magazine

may hold the position for a few years or more -- long enough to establish a "reliable" source base from which to draw for an article.

It has been shown through this study and previous other studies of media, that biotechnology has evolved in multi-faceted capacities since the early 1970s, leaving its mark in various industries and changing as new developments arise. Consistent with other research, coverage of biotechnology has been more positive than negative. Although a notable amount of coverage has aimed at explaining, the pages of news magazines have not provided as balanced an image of negative as positive. The average number of detrimental assertions in the last 15 years was 10.4. Over time, too, there seems to have been a move back to the "center" of biases; perhaps some of the differences may reflect the traditional hard news coverage by newspapers, compared to the more in-depth coverage featured by magazines.

Erik Larson found that negative coverage of radium increased as time went by, due to increasing evidence of disease and cancer from the misuse of radium. Conversely, this research suggests a decrease in negative coverage over time. Perhaps this is due, in part, as Priest and Talbert suggest in their study's title, to society's search for the "ultimate technological fix." Biotechnology may be seen as the arena in which food shortages might be solved and diseases might be cured. The advantage of a content analysis is to see these changes or shifts through time, at different stages in time. In the early 1970s, biotechnological research developments were progressing perhaps more quickly than anyone, including scientists, realized. Suddenly too, the implications of both good and evil were to be considered, as evidenced by both the researchers' and government's concern for

application of biotechnology. For various reasons, biotechnology was met initially with skepticism; some previous science discoveries had not necessarily provided the "fix" to problems. It was an arena virtually unknown to the public.

But, as has been shown, the early skepticism diminished; a shift to more positive coverage occurred around the same time that the patenting of various biotechnology applications was approved. As a natural next step for scientific research, the application of discovery, industrial interest in biotechnology grew. As previous studies also show, there was a strong growth in commercial application, and industries involved with biotechnology would have interest in maintaining and supporting a more positive image of biotechnology. This study also supports findings that industrial sources were more prevalent than other sources, and more likely to make beneficial statements regarding biotechnology.

As a channel of communication, magazines by nature provide an in-depth perspective of issues that are more complex or often misunderstood by society. How this information is related is vital to its understanding and acceptance or dismissal of its presence in the marketplace. Biotechnology's broad reach affects the public in various roles, as a potential key to medical issues and improved food products and productivity, among others. The availability of this information and its application is of invaluable importance to public knowledge and confidence, as well as to those voices speaking and those sending the messages. The question of the media's role in the biotechnology debate has now been more completely answered by its broad presence in various media, significantly the news magazines Time, Newsweek and U.S. News & World Report.

CHAPTER FIVE -- NOTES

1. L. Christopher Plein, "Popularizing Biotechnology: The Influence of Issue Definition," Science, Technology & Human Values 16, (Autumn, 1991): 486.

2. Susanna Hornig Priest and Jeffery Talbert, "Mass Media and the Ultimate Technological Fix: Newspaper Coverage of Biotechnology," Southwestern Mass Communication Journal 10, no.1 (1994): 81.

3. Ibid.

4. Ibid., 83.

5. Erik Sean Larson, "Comparison of the New York Times', The Times of London's, Science's and Nature's Coverage of the Birth of Modern Atomic Theory: 1896-1922," (Unpublished Masters thesis, Michigan State University, 1992): 35.

6. Ibid., as cited in Ed Claudill, "A Content Analysis of Press Views of Darwin's Evolution Theory, 1860-1925," Journalism Quarterly 64 (Winter, 1987): 784.

7. Ibid., as cited in Spencer R. Weart, Nuclear Fear, (Massachusetts: Harvard University Press, 1988): 3-13.

APPENDICES

APPENDIX A

CONTENT ANALYSIS CODING PROTOCOL

Magazines selected for this study were Time, Newsweek, and U.S. News & World Report. A content analysis of these sources will be conducted to determine the extent of biotechnological coverage including its various topics, discoveries and voices throughout a 21-year time period.

Because the field of biotechnology is one that spans several disciplines, it is necessary to know that "biotechnology" encompasses the keywords: genes, genetic research, plant research, plant genetics, genetic engineering, human engineering and other subcategories such as genetic counseling that may appear under the keyword, "genetics."

Articles will be studied and measured in their entirety, including any photographs, charts, diagrams or graphs. Excluded would be any paid advertisement (topically related or not) that may appear on the same page as the article.

CODING PROCEDURE

1. Record the number of the article (in the upper left corner) on the coding sheet.

2. Which magazine is the article from?
    1. = Time
    2. = Newsweek
    3. = U.S. News & World Report

3. Record the month and year of the magazine using numbers 01 - 12, such as January = 01, February = 02, etc. The years would be recorded accordingly, such as 1973 = 73, 1979 = 79, etc.

4. Measure the length of the article in square inches, from the beginning of the type at the left margin to the widest point at the right margin. Measure lead paragraphs. Then measure from the top of the first capital letter at the story beginning (including lead paragraphs) to the lowest descender below the bottom line. (Exclude the title.) Multiply each width section by each length section and add the products together for the final figure. Carry measurements to the 1/2 inch when measuring articles. Translate into decimals and use decimals on the coding sheet, for example: 1/2 = .50.

Unit of analysis: the topic(s) of an article

There may be more than one identified topic of discussion for each article. A topic (for purposes here) may be defined as *a significant portion of the story measuring at least 20 percent devoted to a particular topic*. For each topic listed, a correlating measurement will be recorded on the coding sheet. The topics are economic, political, agricultural, medical and scientific. Thus, an article may have as many as five topics discussed or as few as one; in either case, the numbers would be recorded on the coding sheet. If a topic is discussed, measure the (area) amount of space in inches devoted to the topic. If a topic is not discussed, mark 0 on the coding sheet.

economic: any aspect of a discussion that involves finances, monetary potential, investment, capital, costs.

political: mentions government involvement with the biotechnology industry and any related persons, policy, laws, patents, regulations or agencies, such as the FDA, USDA, etc.

agricultural: affiliated with agriculture; any mention of farming; may refer to a scientist or researcher specializing in the application of biotechnology to agriculture or developing a better commodity through biotechnology -- such as a higher protein soybean, etc.

medical: affiliated with medicine; may refer to a medical doctor or researcher specializing in the application of biotechnology to medicine; mention of hospitals or medicine; mention of health-related societies such as the American Cancer Society.

scientific: mentions the word "science" with reference to biotechnology's importance and/or foundation in the broad spectrum of scientific research.

5. This article is primarily but not exclusively about biotechnology and 20 percent is devoted to the economic topic:
   a) If yes, record number of inches of space for topic
   b) 0 = no

6. This article's topic is political:
   a) If yes, record number of inches of space for topic
   b) 0 = no

7. This article's topic is agricultural:
   a) If yes, record number of inches of space for topic
   b) 0 = no

8. This article's topic is medical:
   a) If yes, record number of inches of space for topic
   b) 0 = no

9. This article's topic is scientific:
   a) If yes, record number of inches of space for topic
   b) 0 = no

Unit of analysis: the assertion(s) of an article

Those statements referring to biotechnology as beneficial, or detrimental are assertions. Some statements may assert beneficial and detrimental aspects within the same

sentence or related sentences or paragraph, and include a "but" or an "or," implying neutrality. Some statements may be explanatory, defining or discussing biotechnology, and also be considered neutral.

There may be several assertions of either classification, beneficial or detrimental, or there may be none and statements would be neither beneficial nor detrimental but "neutral." When the coder is in doubt, it may be marked "neutral." In any case, the assertions would be tallied and noted on the coding sheet.

assertion: a statement of intent, main point or premise of a source, an argument, quotation or attributed to a statement. An assertion may be found in one sentence or a series of related sentences that might constitute an entire paragraph.

For example, "I believe that DNA research is vital to the future health of society," the doctor said.

beneficial: good, can bring positive results, such as cures for disease, birth defects or further knowledge; listing positive aspects of research applications.

For example, "Biotechnology research can increase the world's food supply."

detrimental: bad, disadvantage, can cause harm; such as risks to people's health or nature, raising people's fears, development of a potentially dangerous virus or listing negative aspects of research.

For example, "Genetically engineered food could cause allergic reactions in some people."

neutral: assertions presented objectively; a statement that is neither positive nor negative. For purposes here, there are two types of neutral assertions, balanced and explanatory. A balanced neutral assertion mentions benefits and detriments of any research equally within the same sentence or group of related sentences by the attributed source. An explanatory assertion explains or defines biotechnology.

> For example, a balanced neutral assertion may be: "New technology enables us to improve on nature. How far should we go?" The assertion is neither positive nor negative, because it does not state whether "improving on nature" is good or bad, but alludes that there is a possibility of taking the new technology *too* far. An explanatory neutral assertion may be: "Biotechnology involves the process of creating new life forms from other life forms."

Count (or tally) the number of assertions (argument statements) that are beneficial, detrimental and neutral as related to biotechnology. (Regardless if the article discusses another topic also, only count those assertions regarding biotechnology.) There are two neutral types of statements to be counted: a balanced type includes both beneficial and detrimental aspects of biotechnology, and may (or may not -- see example above) include a "but" or an "or" within the same sentence or group of sentences stated or attributed to a source. The other, an explanatory neutral statement is simply explanatory or defines biotechnology.

10. Record the number of beneficial assertions in the appropriate column.

11. Record the number of detrimental assertions.

12. Record the balanced neutral statements that include beneficial and detrimental aspects attributed to (or stated by) a source.

13. Record the explanatory neutral statements.

Unit of analysis: the assertions of a source

Each assertion has a source which may be one of the following: industrial, political, agricultural, medical, educational, private citizen or unknown. The respective definitions may be referred to as often as necessary. An article may have up to seven types of sources or as few as one, and they would be noted on the coding sheet. Sources may be quoted directly, signified by quotation marks, or indirectly through paraphrasing. Thus, a source does not need to "speak," to be a source. For example: "A General Electric researcher has already..." with the GE researcher being the (industrial) source attribution.

agricultural: affiliated with agriculture: any mention of farming; may refer to a scientist or researcher specializing in the application of biotechnology to agriculture or developing a better commodity through biotechnology -- such as a higher protein soybean, etc.

industrial: affiliated with corporations, companies or businesses that have a vested interest in biotechnology and its production, such as Monsanto and Archer-Daniels Midland. Not to be confused with the term "biotechnology industry," which is the term referring to biotechnology and its many applications. For clarification, a source who may be affiliated with a university tangentially, but who has started his/her own company and is speaking as a representative of that company is an industrial source.

educational: affiliated with a university, college or directly related to a mentioned educational institution or field; a student studying the field may be considered an "educated source," therefore, "educational source" would be listed.

political: affiliated with the government, or mentions involvement with the biotechnology industry and any related policy, laws, patents, regulations or agencies such as the FDA, USDA, etc. The Pope would be considered a political source because he is a head of state.

private citizen: a person not affiliated with the above sources, and may be identified directly by name or other profession. "Susan Peterson, a student," could be listed as a private citizen source if her opinion was asked and she was not identified as being a student of related research. However, a "Susan Peterson, a microbiology student studying DNA structure," would be an educational source.

A private citizen may also be plural, such as "Unruly opponents chanted..." (*Opponents* are private.)

medical: affiliated with medicine; may refer to a medical doctor or researcher specializing in the application of biotechnology to medicine; mention of hospitals or medicine; mention of health-related societies such as the American Cancer Society. A geneticist is a medical source.

No source given: an assertion of fact or personal statement with no source given or identified at all. A statement by an anonymous source is considered to be made by an "unidentified" or "no source." Sometimes statements are made by the reporter or gleaned from sources that should be identified. These statements would be considered "no source" statements.

14. Record the number of times types of sources for this article speak who are primarily involved in biotechnology through industrial affiliation. (May have more than one "industrial" source for each article.)

15. Record the number of times political sources are quoted:

16. Record the number of times agricultural sources are quoted:

17. Record the number of times medical sources are quoted:

18. Record the number of times educational sources are quoted:

19. Record the number of times private citizens serve as sources:

20. Record the number of unidentified sources used:

21. Count and measure the photos in the article. Denote the number of photos on the coding sheet and measure the photos to the nearest half inch, such as 1.5.

22. Count and measure the number of graphs used in the article. Denote the number and measurement to the nearest half inch, such as 1.5.

APPENDIX B

Table 5: Circulation Figures for various years from 1973 - 1994*

	Newsweek	Time	U.S. News
1973	2,642,820	4,339,516	1,941,229
1980	2,934,0083	4,314,279	2,067,321
1990	3,288,453	4,393,237	2,351,313
1994	3,240,131	4,203,991	not avail.

*1973-1990 (with the exception of U.S. News) figures are from the *Gale Directory of Publications and Broadcast Media.*

U.S. News & World Report's 1990 figure as well as the figures for 1994 are from *Ulrich's International Periodical Directory.*

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