The Future of Food Irradiation

Toby A. Ten Eyck*

Louisiana State University, USA

The prevelance of starvation and malnourishment in the world today raises questions about the ability of the human race to feed itself in the future. Some have argued that technological innovations are the answer, while others point to the less-than-perfect track record of food technologies, such as DDT and carcinogenic food dyes. These opposing sides have become engaged in heated public debates, and one of the newest debates centers around irradiation. This paper is aimed at understanding the resources behind the actors involved in this debate so as to gain an insight into how future debates on food technologies will be shaped. Data was collected through interviews with the reporters and sources involved in newspaper coverage of this issue.

Keywords: mass media, irradiation, technological innovations, food supply

*Direct all correspondence to Toby A. Ten Eyck, Department of Sociology, 126 Stubbs Hall, Louisiana State University, Baton Rouge, LA 70803, USA. (e-mail: eten@lsuvm.sncc.lsu.edu). This Study was partially supported by the Rural Sociological Society.

Introduction

Concerns centering around the availability and safety of the world's food supply are centuries old (Anderson 1995; McIntosh 1995; McKeown 1976). For example, in the United States--a country which some experts argue has the safest food supply--10 to 30 million cases of illnesses and nearly 9,000 deaths occurring each year (Aldrich 1994; Roberts and Unnevehr 1994). Other parts of the world are even more susceptible to foodborne illnesses, and food stuffs, such as wheat and flour, are spoiling in warehouses in countries where thousands of people are suffering from malnutrition or food deprivation (Chinsman 1987). Large amounts of economic resources have been aimed at solving these problems, with annual financial expenditures in the U.S. alone, including research and development and lost productivity from workers who have become ill from eating tainted food, has been estimated to be between $5 billion and $6 billion (Lee 1994).

One post harvest technique which has been promoted as a means to stop food spoilage and make the food supply safer is irradiation. This technique, which will be described shortly, has become the focus a heated public debate. My goal in this paper is describe how the issue of food irradiation has been framed by different individuals and groups who have been used as sources at two different newspapers. By describing this process, I hope to shed light on the struggles for control over newsmaking so as to set a framework for future studies, both concerning the framing of food safety and reporter-source interactions. Data was collected through semi-structured interviews, conducted by the author, with 40 sources and 12 newspaper reporters. Sources came from sectors such as government regulatory agencies, university research centers, activist groups, and industry (such a grocery store chains and food processors). The reporters interviewed had covered the issue of food irradiation at either a newspaper in Louisiana or Florida, the latter being chosen for its proximity to the only commercial food irradiation

facility in the United States. Both telephone and face-to-face interviews were used.

The Technology and Politics of Food Irradiation

The irradiation of food involves exposing food stuffs, such as fruits and vegetables, poultry, and pork, to ionizing energy. The energy source can be radioactive materials, such as cobalt-60 or cesium-137, X-rays, or high energy electron beams (Gunther 1994). The ionizing radiation breaks down the molecular structure of the cells which are present in or on the food at the time of exposure, killing bacterial organisms, such as E. coli and Salmonella, and insects, such as fruit flies, in the process. In addition, the molecular reconfiguration of many fruits and vegetables keeps them from spoiling or sprouting quickly, giving them a longer shelf life (Urbain 1989).

Food irradiation is not a new technology. It was first recognized as a potential process in 1898 (Ford and Rennie 1987), and the first patent was issued in 1905 in the United Kingdom, while x-rays were used to kill cigar beetles in the United States in 1929. The process did not gain much attention and was not used beyond some initial efforts and small scale experiments, due to a lack of readily available radioactive materials and nascent technology that could not stand up to commercial demands (Diehl 1993, 1995).

With the onset of the atomic/nuclear age at the end of World War II, radioactive materials became readily available, and the accompanying technology advanced rapidly, fueled in large part by the Cold War. These changes led to a renewed interest in the practical applications of radioactive material, including potential application to consumer products, and by 1947 food irradiation experiments were being conducted, though high energy electron beams were being used in some of the experiments at this time (Brasch and Huber 1947). By the 1950s, institutions such as MIT and the University of Washington were conducting their own irradiation experiments, with irradiators, or the money to build them, provided by the United States Atomic

Energy Commission (USAEC)(Diehl 1995; Imperato and Mitchell 1985). The foods being experimented with included such diverse items as milk, steak, seafood, and fruits, and results were usually positive, though some foods, such as milk, were altered to the point of being inedible (Brasch and Huber 1947). Unfortunately for those conducting irradiation research, food technology as a field was growing, providing many alternatives to irradiation. As one university-based food scientist, who was involved with early experiments on shrimp, recalled

> *…I obtained a grant from the Atomic Energy Commission to do food irradiation work, primarily on shellfish, Louisiana shellfish, since this was economically important to the state of Louisiana. And, we received a grant that totaled $50,000 a year. The grant went through 1967, when all these projects were then terminated because of lack of funds. During that interim, we were able to show that the low dose irradiation was feasible in extending the storage life--this is the ice storage life, not frozen but ice storage life--of Louisiana shrimp and of oysters. And it would extend the storability for quite some time. (Interview, April 30, 1997)*

One of the drawbacks of irradiation is that food can be cooked while being irradiated, much like the process of microwaving food, if the dosage is too high, or, if the dosage is too low, the food will not be effected, and the process is of little use. By reopening the black box which has enclosed early experiments, we find that these unknowns had to be dealt with, which were detrimental to students who were used as taste testers.

> *…You see, I didn't start working with irradiation in '61, I started in '55. My major professor at [a northern university] was working meats irradiation. [The university] did not have an irradiator at that time, so we would prepare the samples. We would put them in cans, and we would take them to [another university] . Irradiate them, and then bring them back, and then store them and do storage studies. We'd open up a can, say at zero time, and we would run analyses, chemical ana-*

lyses, microbiological analyses, and then have taste panels. And a very amusing thing about that is, at that particular time we did not know what dose to use. And so they were using some real high doses. And when you use real high doses, sometimes you get protein breakdown, and sulfidrals go floating through the air. And so, they had us graduate students notified when there was going to be a taste panel. You know, the first few times they were able to get us. When we walked into that building, you could smell the sulfidrals. Just like hydrogen sulfide. It got to the point when the notice went out graduate students would take off. They would go to the Union, they would go to the library. You couldn't find them. Finally, the faculty had to bride students with a steak dinner. If they participated in this, then they would get a steak dinner. (University Food Scientist, Interview, University Scientist, April 30, 1997)

Proponents argue that they now are able to calculate proper dosages, though experiments continue. In 1980, a joint committee made up of members from the World Health Organization (WHO), the Food and Agriculture Organization (FAO) and the Organization of Economic Cooperation and Development (OECD) approved of the process, and agreed that a dose of 10 kiloGrays (the unit of measurement for irradiation is rads) would not pose any toxicological threat. This guideline has been accepted as the high end for irradiation in most countries that use irradiation, though in some countries, such as the Netherlands and South Africa, higher doses (up to 75 kiloGrays) are used to completely sterilize meat or food for hospital patients with compromised immune systems. In the United States, where food irradiation is considered a food additive by the Food and Drug Administration (FDA), the approved level for most foods is one kiloGray or lower, though up to 30 kiloGrays have been approved for herbs and spices for the purpose of controlling foodborne pathogens, and some foods are completely sterilized by irradiation for use with people needing such food (Diehl 1995).

If the irradiation of food was found to be safe and effective by such organizations as WHO, FAO, OECD, and FDA, and scientists have been arguing since 1947 that this was a safe process, why did it

take nearly 45 years to build the first commercial food irradiation plant in the U.S.? First of all, not all scientists agreed that is was safe and effective. As early as 1951, scientists argued that the process might not kill all the harmful pathogens, and the possibility of human error and risks stemming from mishaps could not be overlooked (Proctor and Goldblith 1951). More recently, the debate has focused on possible detrimental effects from eating irradiated foods, such as an increase in cancer rates (Bhaskaram and Sadasivan 1975), and a loss in nutritional value when the molecular structure of the food is altered (Louria 1990). Scientists on both sides of the issue have entered the debate, though they are quick to point out that they do not necessarily agree that these debates are focused on the right issues. The following is from a scientist who viewed himself as a mild opponent against food irradiation

> *…when we got into the debate [over food irradiation] it was so venomous, and, actually the food irradiation people tried to prevent me from debating. They sent the Dean of my school a letter saying that I would ruin the school's reputation if I were allowed to discuss this. And, so what I did was read the letter out at the debate, and that took care of the audience…There's a lot of money involved… [T]he proponents claim to be interested in the public health aspects -- some of them are -- but most of them are interested in money. Until they speak to the concerns of qualified opponents, such as I, I think we will stay opposed… (University Scientist, Telephone Interview, May 12, 1997)*

In addition to scientists being opposed to the process, accidents involving radioactive material started to become highly visible in the 1970s. Industry could not agree on how to approach food irradiation, and finally, government bodies were not in agreement with each other on whether to ban or promote the process, or if they did approve the process, it was often after a lengthy debate, as noted by a government spokesperson

…we were not very, we were not in an advocates position at all. Again, because of the politics of the issue… [w]e were never in a positive mode, because, quite frankly the industry, the poultry industry, for example, was very suspicious of irradiation for a lot of reasons, and we regulated the poultry industry, but by the same token, by the same token, we regulated it, but at the same time we were, I wouldn't say we were in bed with them, but we were trying to make the inspection system safer, and to do that you don't beat the regulated industry over the head with a club and try to coerce them, and then try finesse them to agree to the kind of regulations that we want to put on the books. (U.S. Government Spokesperson, Telephone interview, June 9, 1997)

Not all government agencies, though, have had the same experience. The government agency overseeing the space program successfully petitioned the regulatory agencies to approve irradiated food for space travel.

… We send, been sending up on the Russian Space Station Muir, it's been up there for two or three years now, irradiated turkey and irradiated beef. It has a lot of advantages for us, but, because there's no juice and a lot of, with irradiated steak, for example, it's one of the best ways to provide a steak. (NASA Scientist, Telephone interview, May 27, 1997)

Politics, of course, do not always involve only politicians. One government spokesperson, who had been in a position of influence, found both industry interests and political interests could interfere with progress on irradiation.

The poultry industry has neglected to use irradiation for a number of reasons, most of them unfounded, even though they have approval. The beef industry wants to use irradiation, but they can't get approval from [an agency] to use it yet. And, so that's most what we talk about. We say that we think that public wants it, we have, based on preliminary market information that shows that they will buy it. Now we just got to get the industry or the government to give it to them to see if they

would or they won't. (Telephone Interview, U.S. Government Spokesperson, June 12, 1997)

A number of activist groups have taken up an anti-irradiation position, and one group in particular has had their message widely disseminated by the press. Even these groups, though, find that coming to an agreement on an issue is not always easy.

…we haven't had the greatest relationship with [another activist group] because at one point about six years, five, six years ago they were going to come out kind of on a whimpy policy on food irradiation… [K] ind of strattling the middle-of-the-road, and we had to do quite a bit of lobbying with [their lead person] and other folks there to get them to strengthen that up or at least drop some of the whimpy parts out of it. (Activist, Telephone Interview, May 23, 1997)

Given these divergent opinions concerning food irradiation, it comes as no surprise that the process has not gained wide appeal in the United States, in addition to the concerns consumers in the U.S. have with any issue related to nuclear power or radiation. Though scientists argue that the process of irradiation is not the same as used in nuclear reactors, they understand the concerns of the public.

Most…people still associate irradiation with the nuclear bomb. And they're thinking, and that's the quote, "oh, you're nuking the food, uh? " And we say, "no, we're not nuking the food, we're irradiating with low dose pasteurization, which is going to eliminate a majority of the bacteria, spoilage bacteria, which might be there."…I don't think the public understands…I think they're still of the old school that where, that Chernobyl, that ruined us again. When Chernobyl happened that ruined irradiating the food all over again. Three Mile Island, technically, ruined it again. I mean, we have these markers along the line that we think we're getting over things, and these things happen. It's big setbacks. (University Food Scientist, Interview, May 1, 1997)

One possible tool for public education on such issues is the mass media, and all sources which I spoke with agreed that this is an issue that should be covered by the press. Coverage, though, depends on the newsworthiness of those interested in gaining media attention. Given the limited carry capacity of newspapers (Hilgartner and Bosk 1988), it becomes apparent that newsworthiness is a matter of controlling resources which can be utilized to attract reporters. I turn my attention now to these struggles for control.

Struggles for Control between Sources and Reporters

The mass media have long been considered important in the construction of social reality (Couch 1995; Hilgartner and Bosk 1988; McLuhan 1964), though the actual strength and direction of media effects is a contested area of research (Fiske 1992; Gamson et al. 1992; Gitlin 1980). It has also been the assumption in many of these studies that newspapers are public arenas. Public arenas, though, would be characterized by, among other things, high degrees of audience participation and information flow from contestants to audience members, but newspapers typically do not espouse these characteristics. For example, Tuchman (1978) and Gans (1979) have argued that sources are coveted objects for reporters, and once a link between a source and reporter is formed, it is protected, and other potential sources must negotiate -- overtly or covertly -- for the reporter's attention. This is true even with coverage of scientific issues, where it has been found that sources used in previous interviews will often be used by reporters for subsequent stories, even when they are not experts on the issue at hand (Dunwoody and Ryan 1987; Shepherd 1979). In addition to the propensity to use the same sources, Ericson, Baranek, and Chan (1989) found that, because sources and reporters had to struggle to gain access to each other when constructing ties, many organizations which were covered extensively by news reporters maintained offices for those reporters. Interactions based on privileged access are not typically considered

to be public but elitist.

In addition to privileged access to the newsmaking processes, exchanges of information between audience members and newspaper reporters and editors are not evenly distributed, leaving the news consumer to feel alienated from the production of news (Montgomery 1989). Letters to the Editor and invited pieces may satiate an audience's need to feel like they could be part of the newsmaking process, but in actuality very little audience feedback is given to most stories. In fact, as one reporter noted

> *Well, it's often been disheartening to me the extent to which we don't get feedback on our stories. I can assure you that when I wrote this story [on food irradiation], I remember, I do remember it, I remember working very hard on it. I remember thinking it was a very important story, one that was very, and a very interesting story··· [I]t tseems like we get very little feedback from the public. I don't know if I got any calls on this story···I haven't even done any follow-up. I'm embarrassed, I haven't done a follow-up. It was June of'92, it was five years ago. I have no idea what's been going on with food irradiation, I'm embarrassed to say. (Telephone Interview, June 12, 1997)*

The fact that reporters at both newspapers noted the seemingly lack of interest by consumers over food irradiation should not take away from the finding that a majority of both reporters and sources agreed that newspapers were (or could be) important in the education process of the consumer. Given the lack of experiential knowledge most people have concerning food safety and irradiation, they must rely on public wisdom and media discourse (Gamson 1992) to shape their attitudes concerning food processing techniques. The importance of the media in shaping public opinion is clear in the following statement made by an industry spokesperson who is in the business of processing seafood

> *···In life, I've learned perception is reality. If you think I'm a bad person, and I am. I could be a great person, but you think I'm a bad*

person, so your perception becomes your reality. And, most of the time, that perception comes from something you've read or heard, generally on the radio, television, or in the newspaper. So, if I can communicate well, and get you to believing my issue, using whatever public relations, advertising message, that's available to me, then I'll be successful in getting you to understand me, and, in terms of business, eat my product, because I have a great product. I have a wonderful industry I'm involved in. So, if you believe that I'm good at all the things that I do, then you're going to believe that you want to eat my product. (Seafood Industry Spokesperson, Interview, June 17, 1997)

If people believe that mass media are powerful socializing tools, and that access to these organizations is not completely open to the public, then we need to understand how sources and reporters get action from each other, while blocking the action of opponents. Action, from a pragmatic perspective, is engagement in purposive behavior when goals are obstructed (Mead 1934; Strauss 1993; Turner 1988). Action, though, does not take place in a vacuum, but within social space, which is characterized as much by contingencies as by discernible patterns (White 1992). In such a space, getting and blocking action is embedded in a something more than wishful thinking. Individuals interested in engaging in action must control resources deemed valuable by those others with whom they hope to engage with or disengage from.

Boorstin (1961) and Sigal (1973) have argued that many interest groups have become media savvy, in that they understand how to manipulate news coverage by engaging in made-for-media activities, such as demonstrations, press releases, and press conferences. Much the same has been true in the coverage of food irradiation, from both scientists and activists. Compare the following stories

Well, how did we come to get quoted so much on this issue? I think it's just the result of a lot of hard work and a lot of very credible information that we've put out over the years, you know, starting with the fact sheets and newsletters, and now we put out [our own] Journal

and, and doing a lot of cultivation with the media. You know, each and every day making sure that, you know, we prepare press releases, we prepare press briefings, we do enormous numbers of phone calls, in meetings with people from the press to make sure that they see the information we prepare, and so that they are given our point of view on this issue. And, it also comes as a result of a lot of organizing the general public. Organizing rallies, and information gatherings, and protests that become very visible and newsworthy that the press then covers…

We, we organized a rally out front of the hotel where they had the seafood irradiation conference, and did a lot of pre-media work in terms of making sure they got, you know, first find out who's beat it was and making sure they got our material, and our fax sheets and a lot of phone calls before we got down there. And then, also, you know, a lot of work when we were down there at the events and before and after them as well. So, we actually had a press conference too, so. It was a really well attended press conference in the same, it was actually quite a fun little thing we did. We, we, which isn't uncommon for us a way to get the media is when we find out about these conferences, when we try to figure out what's the best way we can get our angle, you know, we know, and the media stories that are going to be around it, we know that it's going to be a story down there, that we see that they've got press conferences planned, and press briefings, and what not, for the pro side, so, you know, we, we're going into it thinking, "OK, we desperately need to get our side out." What we did there was they're having, I forget the hotel they're having it at, it was a fancy hotel right downtown there, we called them up and asked if they had any rooms, press rooms, conference rooms that were available for that same time period, and luckily they did, and we rented it, telling them up front, in the sense that we told them who we were and that we were having a press conference, and secured the room. And, then, after looking at their agenda, figuring out when was the best time for us to have our press conference, and we decided at this particular event that we had our press conference about 45 minutes before they were

going to have theirs, or maybe it was like a half hour. Strategically, the idea was, we get the press first. Well, they're doing a lot of the press work, first of all, for us. We know they're having a press conference, as I was saying, it was like at 1 o'clock or something, so we have ours at 12:15, so it's not that big of a deal for the press; it's like, OK, it becomes more of a story for them. Here we have competing news conferences, we get to piggyback on their press work, in terms of trying to make seafood irradiation a story, and then the clincher for this particular one, which worked beautifully is that we get the press to come up, to come over to our room first. (Activist, Telephone Interview, May 23, 1997)

> *…when there are major conferences, you'll get some wire press, like Associated Press, UPI, what have you, CNN. They'll be covering at major conferences and so forth. Oh, look, when we had the national convention here in New Orleans, we had, good night, we must of had over 60 different agencies covering. We had CNN, we were on CNN, we were on Associated Press. We had 20/20 came and covered part of it. 20/20 part of it. A lot of the various associates… We were co-chairing the public relations part… [T]he Institute of Food Technologists… informed these of important papers that were being presented, and they would set up press conferences and things like that. (University Food Scientist, Interview, April 30, 1997)*

The manipulation of reporters does not end with demonstrations and press releases. Government regulatory agencies, such as the FDA, have media relations offices which are staffed by people trained to deal with inquiries from reporters. The importance of controlling the information flow from such sources and the press was clearly stated by a former government agency spokesperson.

> *…every major media call, whether it was print or broadcast, had to come to my office. And then I would either answer it directly or if I thought it too technical for me and did not have political overtones, I would, I would…forward that person to a technical person. Say a trade*

publication wanted to know about irradiation, a trade publication, and after twenty minutes of talking with this reporter I realized that I had expended all I knew, he wanted too much technical, then I'd turn him over to one of the technical people. So, [for four years] the purpose of that was to control, as much as possible, the way we gave out information on all issues, and irradiation was a very interesting issue. Again, it was almost a secondary issue because I could see that the politics would not allow irradiation to really find it's way into the, into the system. So, I acted as gatekeeper for those four years, and I got fairly, I was fairly well rehearsed on irradiation, the technical application and everything else, and I could speak fairly authoritatively about it. But that's how we did it, and it worked pretty well most of the time. (Telephone Interview, June 9, 1997)

One industry which is caught in the middle between regulatory agencies and consumers are the grocery store chains. The fine line which must be walked between offering safe food and safe technologies is very thin, and, again, the control of information is extremely important, forcing these industries to keep tight control over media relations. As an spokersperson noted,

I think that private companies have to make a business decision based on whether they think it's going to help them or hurt them. To be proactive on this kind of new technology, whether it's genetic engineering or food irradiation, or some of these other kinds of things. With, with the press media attention that is leveled on anybody that comes out with something new it can potentially be a real damaging thing to be singled out as somebody that's doing something new or revolutionary, whether or not its going to benefit health or not, because then you become the target for any group opposed to it. And, you can take a lot of heat in the press and customers, being they're actually conservative, are going to say "well, gee, you know, until it's well-proven, maybe I'll buy my food elsewhere." (Telephone Interview, Supermarket Spokesperson, June 9, 1997)

Unlike economic capital invested in advertising, which offers the

source preliminary approval of the message to be disseminated, made-for-media events are open to interpretation by reporters. At least one source, who is pro-irradiation, felt that he had been duped into promoting an anti-irradiation message.

> *…this one reported called, and she said she would like to do a story on food irradiation, since I had been working on it for years, and I said fine and we set up an appointment. She came in, I think they took a half and hour setting up the lights and the cameras and all that… We spent 45 minutes talking about food irradiation. And I gave her facts and figures, sort of like I've given you. And then she told me when this would air. I watched it. I probably had ten seconds on there. She cut out completely all the pro arguments for the use of irradiation, and just loaded it with the con arguments, with the con interviews. She had oyster people, processors. NOOO, they weren't going to use irradiation. They were using depuration…It was just geared to a non-irradiation program to start off with. And, so I contacted the Institute of Food Technologists on this, and they said what you need to do is write the program director. Tell them they did not present a fair, balanced program on this, and let the public make up their minds. And I did, so. I haven't been interviewed by them since. (University Food Scientist, Interview, April 30, 1997)*

Other sources who were the targets of demonstrations were quick to point out the tendencies of reporters to focus on such emotional appeals, instead of the real issue at hand.

> *Some good things did come out of the coverage, but I felt that too much of the coverage was about things like how did I feel about having picketters in front of the store. (Industry Spokesperson, Reconstructed Telephone Interview, May 19, 1997)*
> *There was a major national, slash, international convention of the top scientists in irradiation in the country and around the world in [a nearby city] . Irradiation, because it's connected to radiation, conjures up all sorts of fears. But, as you know, it's been used in U.S. military*

for 20-30 years. It's recommended by the World Health Organization, all that sort of thing. It's got nothing to do with nuclear power. You know, the concepts are not, not the same. The concept's the same, but the end results' not the same. But, because of the connotations of irradiation, it is a handy thing to jump on, and make all sort of media hey out of it for those who are so inclined. This individual put together four, five people to protest. They made wonderful signs and she was, stood up there, and the cameras were there. Five people in protest from, you know. It was a classic absurdity in molding and using the media to pursue an end on something that had no physical support other than this tiny, tiny group of people. And, what she did was she got right in front of the camera, and started hollering, "Hell No, We Won't Glow. G-L-O-W. Hell No, We won't Glow." (State Government Spokesperson, Interview, May 14, 1997)

By relying on emotional appeals and made-for-media events, sources force themselves into a dependent relationship with reporters in a number of ways, as demonstrated above. First of all, there is no guarantee that a message will be noticed by reporters, and desperate or determined individuals and groups may find that they need stronger, more radical approaches to gain attention, leading to a spiral of sensationalism. Secondly, the message itself is filtered by the reporter and his/her editorial supervisors, which can give rise to issue framings far removed from the original message. For example, one reporter felt sure that her news coverage had cast an activist group in a negative light, a framing the activist group no doubt was trying to avoid.

I was pretty much trying to lay out what's going on, and then lay out, to a certain extent, you know, who these [activists] people are, and I think I did a pretty good job in portraying them as fanatics, you know, without taking a definitive stand on are they right or are they wrong. (Reporter, Telephone Interview, May 7, 1997)

Conclusions

Wolcott (1994) has argued that qualitative methods can be used for descriptive, analytical, and interpretive purposes. I have deliberately presented my data in a descriptive manner in hopes of giving the reader enough information to understand the process of linkage construction between reporters and sources. As both Boorstin (1961) and Sigal (1973) noted over twenty years ago, source organizations have become adept at gaining media attention, though as Ericson, Baranek, and Chan (1989), both sources and reporters are involved in a struggle for control over these linkages. I argue that the latter is a more useful perspective, though, in the end, reporters have a greater amount of control over the newsmaking process, and it has been my goal to provide enough description for readers to come to their own conclusions concerning the importance of this debate for the future of food technology in general.

Food is essential to human survival -- that is a given. The continued trends of increasing populations and decreasing land under cultivation has put a higher demand on our food supply systems. Humans have used their capacities for knowledge to build technological systems which help in the capacity to store foods for long periods, and to ship them across greater distances. The results, though, have not always been positive. Problems stemming from pesticides such as DDT, soil erosion from plowing, and new strains of food crops that have become susceptible to insect infestation are well known. The paradox of technological innovation will continue well into the twenty-first century, including technological innovations concerning food processing. This is true in the case of food irradiation, where activists and other opponents of the process have been able to delay the widespread use of this technique through threats of consumer boycotts and public debates. These tactics are not new, as the history of milk pasteurization show (e.g., Larsen and White 1913). In fact, concerns over irradiation echo many of those used against pasteurization, such as it masks filthy processing plants, and is an expensive, unnecessarily added cost.

To understand future debates over food technologies, and, therefore, the future of these technologies, we must also consider the ability of the different players to gain access to the mass media, which must now include mediums such as the Internet and e-mail networks. Economic resources play a part in these contests, as do cultural and social resources. Groups lacking in the economic resources to buy media (advertising) time, may be able to compensate by engaging in activities that attract media attention, such as boycotts, letter writing campaigns, and demonstrations, but by relying on these types of actions, they leave themselves open to various interpretations, which could be harmful for their cause. So, while there is little doubt that scientific research on food and food technology will continue, we can expect groups that are both opposed to and in favor of these technological innovations to continue their crusades in much the same way as has been presented here.

References

Aldrich, Lorna. 1994. "Food-Safety Policy: Balancing risk and costs." *Food Review* 17:9-13.

Anderson, Clifton. 1995. "The Food Information War: Consumer rights and industry perogatives." Pp.167-187 in *Eating Agendas,* edited by Donna Maurer and Jeffery Sobal. New York: Aldine de Gruyter.

Bhaskaram, C., and G. Sadasivan. 1975. "Effects of Feeding Irradiated Wheat to Malnourished Children." *The American Journal of Clinical Nutrition* 28:130-135.

Boorstin, Daniel. 1961. *The Image.* New York: Harpers.

Brasch, Arno and Wolfgang Huber. 1947. "Ultrashort Application Time of Penetrating Electrons: A tool for sterilization and preservation of food in the raw state." *Science* 105:112-117.

Chinsman, B. 1987. "Food Irradiation." *World Health* (March, 1987):10-11.

Couch, Carl J. 1995. "Oh, What Webs Those Phantoms Spin." *Symbolic Interaction* 18:229-245.

Diehl, Johannes F. 1993. "Will Irradiation Enhance or Reduce Food Safety?" *Food Policy* 18:143-151.

___. 1995. *Safety of Irradiated Foods.* New York: Marcel Dekker.

Dunwoody, Sharon and Michael Ryan. 1985. "Scientific Barriers to the Popularization of Science in the Mass Media." *Journal of Communication* 35:26-42.

Ericson, Richard V., Patricia M. Baranek, and Janet B.L. Chan. 1989. *Negotiating Control.* Toronto: University of Toronto Press.

Ford, Norma J. and Denise M. Rennie. 1987. "Consumer Understanding of Food Irradiation." *Journal of Consumer Studies and Home Economics* 11:305-320.

Fiske, John. 1992. "Audiencing: A cultural studies approach to watching television." *Poetics* 21:345-359.

Gamson, William A. 1992. *Talking Politics.* New York: Cambridge University Press.

Gamson, William A., David Croteau, William Hoynes, and Theodore Sasson. 1992. "Media Images and the Social Construction of Reality." *Annual Review of Sociology* 18: 373-393.

Gans, Herbert J. 1979. *Deciding What's News.* New York: Vintage.

Gitlin, Todd. 1980. *The Whole World is Watching.* Berkeley, CA: University of California Press.

Gunther, Judith A. 1994. "The Food Zappers." *Popular Science* 244:72-78.

Hilgartner, Stephen, and Charles L. Bosk. 1988. "The Rise and Fall of Social Problems: A public arenas model." *American Journal of Sociology* 94:53-78.

Imperato, Pascal and Greg Mitchell. 1985. "Bombarding Bananas, Zapping Zucchini." *The Sciences* 25:14-19.

Larsen, Christian and William White. 1913. *Dairy Technology.* New York: Wiley.

Lee, Philip R. 1994. "Irradiation to Prevent Foodborne Illness." *The Journal of the American Medical Association* 277:261.

Louria, Donald B. 1990. "Zapping the Food Supply." *The Bulletin of the Atomic Scientists* 46:34-36.

McIntosh, Wm. Alex. 1995. "World Hunger as a Social Problem." Pp.35-64 in *Eating Agendas,* edited by Donna Maurer and Jeffery Sobal. New York: Aldine de Gruyter.

McKeown, Thomas. 1976. *The Modern Rise of Population.* New York:

Academic Press.
McLuhan, Marshall. 1964. *Understanding Media.* New York: McGraw-Hill.
Mead, George H. 1934. *Mind, Self, and Society.* Chicago: University of Chicago Press.
Montgomery, Kathryn C. 1989. *Target: Prime Time.* New York: Oxford University Press.
Proctor, Bernard E. and Samuel A. Goldblith. 1951. "Food Processing with Ionizing Radiations." *Food Technology* 5:376-380.
Roberts, Tanya and Laurian Unnevehr. 1994. "New Approaches to Regulating Food Safety." *Food Review* 17:2-8.
Shepherd, R. Gordon. 1979. "Science News of Controvery: The case of marijuana." *Journalism Monographs* 62.
Sigal, Leon V. 1973. *Reporters and Officials.* Lexington, MA: D.C. Heath.
Strauss, Anselm. 1993. *Continual Permutations of Action.* New York: Aldine de Gruyter.
Tuchman, Gaye. 1978. *Making News.* New York: The Free Press.
Turner, Jonathan. 1988. *A Theory of Social Interaction.* Stanford: Stanford University Press.
Urbain, Walter M. 1989. "Food Irradiation: The past fifty years as prologue to tomorrow." *Food Technology* 43:76, 92.
White, Harrison, C. 1992. *Identity and Control.* Princeton, NJ: Princeton University Press.
Wolcott, Harry F. 1994. *Transforming Qualitative Data.* Thousand Oaks, CA: Sage.