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A COMPARISON OF THE ATTITUDES TOWARDS GENETICALLY MODIFIED FOOD IN THE UNITED STATES AND DENMARK

An Interactive Qualifying Project Report

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by

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Abstract

A Genetically Modified (GM) organism is one that has been altered at its most fundamental level, at the root of what makes the organism unique, its genetic code. Today, one of the main focuses of biotechnology is the genetic modification of food, which has caused a global debate. This project explores and compares the knowledge, attitudes and practices of the key actors involved in the GM food debate in the United States and Denmark in order to better understand and characterize the debate in both countries.

Executive Summary

This project has been completed to fulfill the requirement of the Interactive Qualifying Project (IQP) as part of the Bachelor of Science degree at Worcester Polytechnic Institute, Worcester, MA. The overall goal of this degree requirement is to explore how technology affects society as a whole. This project was sponsored by and completed in conjunction with NOAH (Friends of Earth, Denmark), Copenhagen and the Science Shop in the Department of Technology and Social Science at the Danish Technical University (DTU), Lyngby, Denmark.

Genetic modification is the alteration of any organism at its most fundamental level, its genetic code. This can now be done in the laboratory and is currently being used in food production. The use of genetic manipulation in food production has created a global controversy concerning the possible risks it could impose on society.

The goal of the project is to compare the knowledge, attitudes and practices of the actors in the Genetically Modified (GM) Food debate in the United States and Denmark. In order to explore this debate it was important to identify the key actors that interact in the controversy arena. This was done by identifying those groups that play key roles in the debate from those that research and develop the technology, to the end users of GM products. Using these areas, six main categories were determined as representatives of those that are affected by and that have an influence in the debate. These categories are manufacturers, farmers, supermarkets, general consumers, consumer and environmental organizations, and the regulation and legislation applying to the GM food controversy.

The attitudes and practices of these groups were determined by assessing the policies and opinions of specific groups and individuals within these categories. The research was conducted using various methods. Published materials such as magazines, newspapers, journals, books and

the World Wide Web were utilized, but many personal, phone and electronic interviews were also conducted throughout the research. This information was combined to form a general attitude for each category. The attitudes of each category were then compared between the two countries in order to determine any differences or similarities between them. This analysis helped us in creating general networks that characterize the debate in each country.

Using the attitudes of the actors involved in the debate and the comparisons of the categories in the two countries the arena was characterized by creating a general network. First, separate networks were created for each country (Figs. 14, 15). The two networks were then compared to each other. The network provides insight into how the actors interact in the debate as well as the relative amounts of influence the actors have on one another. The structure of the networks are essentially the same in the two countries, most of the interactions are the same. It is within these interactions that the majority of the differences between the two countries appear.

The following is a brief description of this general network. The consumers are the center of the network, as all other actors are influencing and being influenced by them. The media surrounds the consumers and acts as a filter. They filter the information being provided them by the two sides of the debate. The two sides of the debate in the network are the driving forces in favor of the technology and the slowing forces in favor of precautionary principles. The government, oversees the entire debate, and has a two-way relationship with all three of the above groups. Farmers and supermarket chains have different places in the two networks. This fact also illustrates differences between the two countries.

For the manufacturers section, the multinational companies AgrEvo, DuPont, Delta and Pine Land, Monsanto, and Novartis and the Danish Sugar Beet company Danisco as well as the Danish industry umbrella organization, Dansk Industri were all researched in order to assess the

opinion of the manufacturers. All of these companies research and develop these products and believe that the technology is a useful tool that is capable of helping to solve many of the world's problems. Currently, these companies market products that are designed to aid the farmer such as crops that are resistant to pesticides or contain built-in insecticides so that the farmer has an easier time dealing with weeds and insect pests. These companies stand by their decision to market these products, despite the controversy they have caused, and think that the technology is going to prove to be useful and valuable in agriculture and many other areas such as health care. The manufacturers in both countries have virtually identical points of view.

In order to assess the view of the farmer in the United States and Denmark various forms of published communication were used and in addition to this, organizations such as the Organic Farming Association, the Danish Slaughtery and the Agricultural Council were interviewed in Denmark to attain insight into the feelings of the farmer. Farmers in both countries have mixed opinions; some are for the technology while others are against the technology. Overall, it was found that U.S. farmers initially embraced the technology but are now becoming more hesitant to grow these products due to decreasing world wide acceptance. The Danish farmer is unable to grow these products because of legislation.

Several supermarkets in the U.S. were contacted but none of them responded to the request for information, but it was determined through other materials that the debate is only prevalent at supermarkets in the U.S. that specialize in organic and health foods. The majority of supermarket chains do not have any policy concerning GM food. The Danish supermarkets however, are much more involved. According to FDB, a supermarket umbrella organization in Denmark that owns the largest market share, the supermarkets have banded together to better serve the consumer. They say that the consumer is their primary concern and in response to

consumer disapproval of the technology they have decided to ban the use of GM ingredients in their own products. They are not against the use of gene technology in food; they are only concerned with offering the consumer a choice.

In order to assess consumer attitude, a general survey was done in the U.S. and Denmark. The same questions were asked in both countries. The survey was done on the web and was publicized via e-mail. The e-mail survey had approximately a 20% response rate. People were also surveyed personally on trains in Denmark in order to validate the e-mail results and the results came out similarly, this portion of the survey had a 60% response rate. The analysis of the results compared the student results with the adult responses. The results from each country are compared separately on the basis of age and gender and then these results are compared between the two countries. The major difference between the two countries was found in the amount of media coverage the consumers have been exposed to concerning GM food. American Consumers had been exposed to significantly less media coverage on the topic than Danish consumers. When this result is kept in mind while analyzing other survey data, it allowed an understanding of the consumer information debate. This is based upon the argument that more consumer information equals more support. The various survey questions provided excellent insight into this argument. The conclusions the survey leads to cannot be presented here, they are in section 6.4. This is an extremely important result because of the fact that consumers the center of the network.

In order to assess the attitudes and actions of the environmental and consumer organizations, many groups were investigated. In the U.S., Friends of the Earth-USA, Greenpeace-USA, the International Food Information Council, the Sierra Club and the Union of Concerned scientists were examined. In Denmark, the Danish Consumer Council, Greenpeace-

Denmark, Nature Conservation, NOAH-Friends of the Earth Denmark, the Danish Food and Allied Workers Union and the World Wildlife Federation were researched. Overall, these groups have similar concerns and attitudes in both countries. They are all in favor of the Precautionary Principle, which states that it is better to be cautious and explore all possible risks before integrating the technology into society. They are concerned with issues such as genetic transfer, biodiversity, consumer choice, labeling of all GM products, possible harm to human health and ultimately the unknown effects that this technology might have on the environment and society as a whole. These groups say that they are the voice of the consumer and the environment in government and they lobby for what they feel is the best way to treat this technology without harming either society or the environment.

The government in both countries regulates the technology, based on their perception of what is in the best interest of society. For this discussion, the regulatory procedures of each country were investigated as well as the legislative process itself. In the two countries, the procedures are quite different but the applications are in some ways similar. In both countries, the government is the ultimate decision maker, however the U.S. works alone while Denmark is subject to European Union legislation. Many interested bodies outside of government take part in the legislative process in Denmark, they can take part in public hearings before a measure is passed. Similar bodies in the U.S. do not have this voice.

Another way of characterizing the debate is through the major issues that stem from it. Characterizing it this way is useful because it is the issues that drive the discourse between the advocates and skeptics of the technology. The major issues of the GM debate as it exists right now in both countries were determined to be labeling, antibiotic resistance, feeding the world, affects on the environment, risk assessment, benefits, public dialogue, public disapproval,

developing countries, ethics and morality, possible harm to human health, consumer choice and unknown risks. Each of the two forces in the network have a general position on these issues and these are presented in the text (section 6.7).

Ultimately, the debate about a new technology is about the risks and benefits of that technology and whether or not one outweighs the other. The most critical thing about technology debates, is that they exist. They are vital because technology gets steered towards the betterment of all society, instead of the betterment of a handful of individuals. The nature of the human race is to increase knowledge and along with that comes questions about the appropriateness, necessity and usefulness of any advancement. This project will be used by NOAH, DTU and others for general information on the topic of GM food as well as insight on the attitudes and practices of the actors involved and how they interact in the current debate.

Acknowledgements

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1.0 Introduction

The Genetic Modification (GM) of food has sparked a worldwide debate concerning its safety, consequences, ethics and ultimately the best way to use such a technology without causing irreversible damage to the population and the environment. This project explores the knowledge, attitudes and practices of all the players from the United States and Denmark in the genetically modified food/fodder debate. The ultimate goal of the project is to compare the different views of the key actors in the United States and Denmark concerning genetic modification of food. It identifies all of those in the string from production to consumption, including consumer, environmental, agricultural and governmental organizations.

The project is sponsored by NOAH (Friends of the Earth, Denmark) in cooperation with the Science Shop at the Technology and Sciences Department at the Technical University of Denmark (DTU). The final report will be used to help NOAH, specifically the gene group, to gather general information that will help them with their work and lobbying effort in the GM food area. The project will also be used as general information in the Technology and Sciences Department at DTU.

The research of the project was conducted by breaking the population into six categories, each of which play a critical role in the GM food issue: Manufacturers, Farmers, Supermarkets, Consumers, Environmental & Consumer Organizations and Regulation & Legislation. The project contains information from press releases and articles from the World Wide Web, as well as personal and phone interviews that helped us extract the different points of view of the interested groups. In addition to the research on the attitudes of organizations and institutions, a survey was conducted via the World Wide Web to perceive the attitude of the general population in Denmark and U.S.A.

The final report includes a scientific background in the areas of genetics and social science. This section provides critical background that aids in the understanding of the attitudes of the six focus categories discussed above. The section for knowledge, attitudes and practices discusses separately the opinions towards GM Food found in Denmark and in the U.S. Each category has its own section, which is broken down into the attitudes of the specific groups found in the U.S. followed by the Danish perspective. Each U.S. and Danish category is broken down further into major individual groups or organizations that were interviewed and/or researched. These are the groups identified as main actors in either country that shape and represent the attitudes and practices of the category as a whole.

Finally, a comparison section paints a general picture of the U.S. and Danish networks, presents a controversy overview and it discusses any similarities and/or differences between the knowledge, attitudes and practices of each of the main players identified by the project in Denmark and the U.S.A. This comparison will lead to a better understanding of the major issues of the debate itself and what shapes the views of major actors involved. Ultimately, the project explores how differences between knowledge, attitudes and practices of a culture can influence the way a controversy is viewed and addressed.

There are a number of acronyms utilized in this report. For this reason, a glossary of acronyms is provided in Appendix F.

2.0 Scientific Background

2.1 Genetics

For centuries, humankind has made improvements to crop plants and animal breeding through selective breeding and hybridization- the controlled pollination of plants [1]. Humans have exploited the fact that biological variations occur by natural mutation and recombination [2]. Biotechnology is an extension of traditional breeding techniques with one very important difference, it allows for the transfer of a greater variety of genetic information in a more precise and controlled manner [1]. Farmers have selected particular qualities in food by crossing certain varieties, artificially selecting for desired traits and even distributing genes geographically (e.g. the soybean is native to Asia yet it is now a flourishing crop worldwide) [2]. Essentially, DNA has never been "static" and as long as people have been farming, genetic material has been manipulated to acquire desired features in crop or animal production [2].

In conventional breeding, new assortments of genes are created, more or less, at random and with an uncertain result [2]. Genetic modification allows specific genes to be identified, isolated and copied in a direct and controlled way and it is possible to transfer genes between species [1,2]. This more precise science allows plant breeders to develop crops with specific beneficial traits and without undesirable ones [1]. Biotechnology is and can be used in a variety of ways. Genetic manipulation could create a range of crops resistant to pests, disease and herbicides. Some modifications could be made to improve shelf-life and processing qualities as well as natural toxins and allergens within food could be reduced or even eliminated. With better understanding of how crops react to environmental stress, some crops could be made to grow in areas that are currently inhospitable for them. Genetically engineered vegetables and

animal products (e.g. milk) could be used as a way to produce and distribute necessary drugs in large volume [2]. The uses, benefits and ethics of Genetically Modified (GM) food are currently being debated and discussed by everyone from manufacturers, farmers, governmental organizations to the general consumer. This debate is ongoing and the remainder of this project focuses on these varying attitudes and opinions. However, people may be able to better form an opinion on the topic if they know how GM foods are made and how the genetic manipulation works.

Genetic modification works because the genetic information of all organisms is made up of the same basic chemical, DNA (deoxyribonucleic acid). DNA is simply a genetic code made up of 4 bases, A (Adenine), G (Guanine), C (Cytosine) and T (Thymine). The order or sequence of these bases dictates the structure and functions of larger molecules called proteins, which carry out all of the jobs within the cell. DNA is ultimately the basis for all life [1,2,3]. Because the genetic code, the sequence of the bases, of most organisms is the same, scientists have the ability to transfer specific pieces of DNA from one organism to another. This is done by cutting desired pieces of DNA out of one genome (the term used for all of the genetic material of an organism) and pasting the DNA into the genome of the organism that the researcher would like to acquire the trait that the DNA piece codes for [1,2]. Then the organism makes multiple copies of this new DNA and gains the trait that the new DNA codes for.

This entire process can be done in the laboratory using various molecular biological techniques. The cutting and pasting processes are done with the help of enzymes, a class of proteins that through particular catalytic activity are able to perform a specific job within the cell [3]. DNA cutting can be done using restriction enzymes. Restriction enzymes are enzymes that recognize a particular base sequence within a DNA strand and cut the strand at this site. Because

DNA is double stranded, the restriction enzyme creates what are called "sticky ends" when it cuts the DNA (Figure 1). The four nitrogenous bases of DNA are complementary and base pair to one another using hydrogen bonding; A binds with T and G binds with C. The "sticky ends" that are created when a restriction enzyme cuts a DNA sequence cause some of the bases to not be bound to a complementary base [2]. A general rule in molecular biology is that if a base can pair, it will, and scientists use this fact to their advantage when creating GM organisms. This is used when pasting the desired sequence into the DNA of the recipient organism. Researchers merely cut the recipient DNA so that a complementary sequence will be created and then a certain percentage of the desired DNA will bind to the recipient DNA with the help of the enzyme DNA Ligase, which is used to piece DNA sequences back together [2].

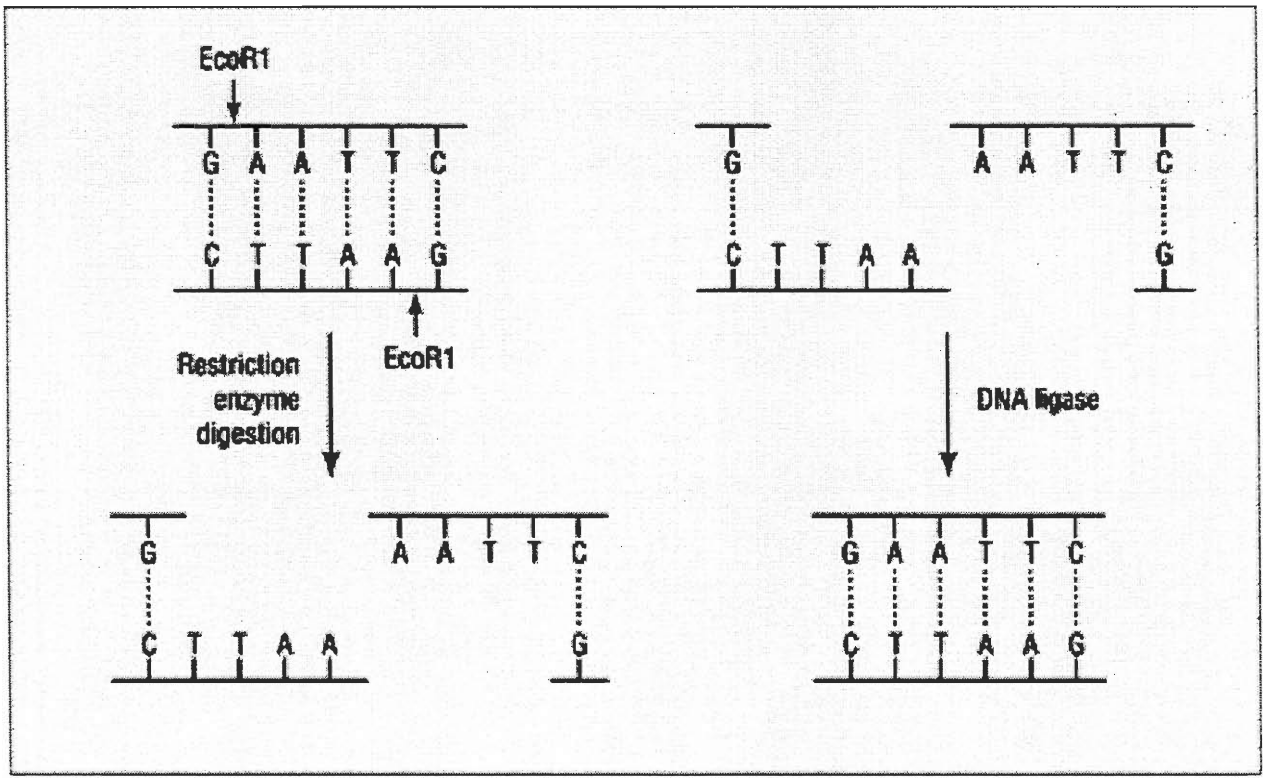

Fig. 1: An example of DNA cutting and pasting [2]. The first part of the figure shows the restriction enzyme EcoRI cutting a piece of DNA at its recognized cutting sequence AATTC. The restriction enzyme digestion (cutting) results in "sticky ends". The second part of the figure shows that these two complementary sequences can be put back together using DNA Ligase to obtain the original double stranded DNA sequence.

Next, a bacterial plasmid is used to put the new DNA into the organism of choice. Plasmids are small loops of bacterial DNA that are able to independently replicate, meaning they can make more copies of themselves separately from the central bacterial genome [3]. The desired DNA can be transported using a plasmid because the plasmid can be cut open using a restriction enzyme and the desired DNA can be ligated, or attached, into the break in the molecule as long as the cuts create complementary "sticky ends". Complementary ends can be guaranteed by using the same restriction enzyme to cut the desired DNA and the plasmid. After the desired DNA is ligated into the plasmid, it is complete again and is able to undergo replication [1,2,3]. Under certain conditions a bacterial cell can be forced to take up a plasmid. This procedure is called transformation, which involves a series of cell wall (plants) or cell membrane (animals) disrupting reagents and a series of heating and cooling steps, and thereby a plasmid can enter the cell via breaks in the cell wall or membrane. Once in the cell the plasmid is able to replicate and many copies of the plasmid are made, all of which contain the desired gene [2].

Once many copies of the desired gene have been made using the transformation procedure described above, it is possible to take these copies of the desired DNA and place them into the animal or plant cell that is going to be genetically modified. This cell will then express the trait coded for by the desired gene [2].

Genetically modified animal cells are created by excising the desired gene out of the bacterial plasmids (using a restriction enzyme) and introducing the gene into fertilized eggs, using various methods depending on the animal of choice. It is the hope that the desired gene will integrate into the animal zygote's own genome and that it will be replicated, thus causing the

trait to be expressed in the animal. During cell division, the gene will be passed on to each cell causing every cell in the animal to have a copy of the new gene. Usually, the desired gene integrates into the host genome in only about 1% of attempted cases [2].

In order to put the amplified, desired DNA into a plant cell, the gene is generally linked to a plasmid of *Agrobacterium,* a naturally occurring plant pathogen. Individual plant cells that have been grown in culture in the laboratory are exposed to a non-virulent strain of the bacterium [2]. A non-virulent strain of bacterium contains all of the information that the bacterium needs to replicate but the DNA that causes infection is taken out, therefore the plant does not get infected but acquires the desired DNA that has been spliced into the bacterium DNA. This plasmid that carries the desired DNA is called a vector. Once the plant cell has been exposed to the bacterium, it is are cultured into a callus (an undifferentiated cell mass) and in the correct media (food), roots and shoots are produced and the cells eventually grow into an adult plant (Figure 2). Because each plant is generated from the same parent cell, each daughter plant contains the plasmid that includes the desired DNA.

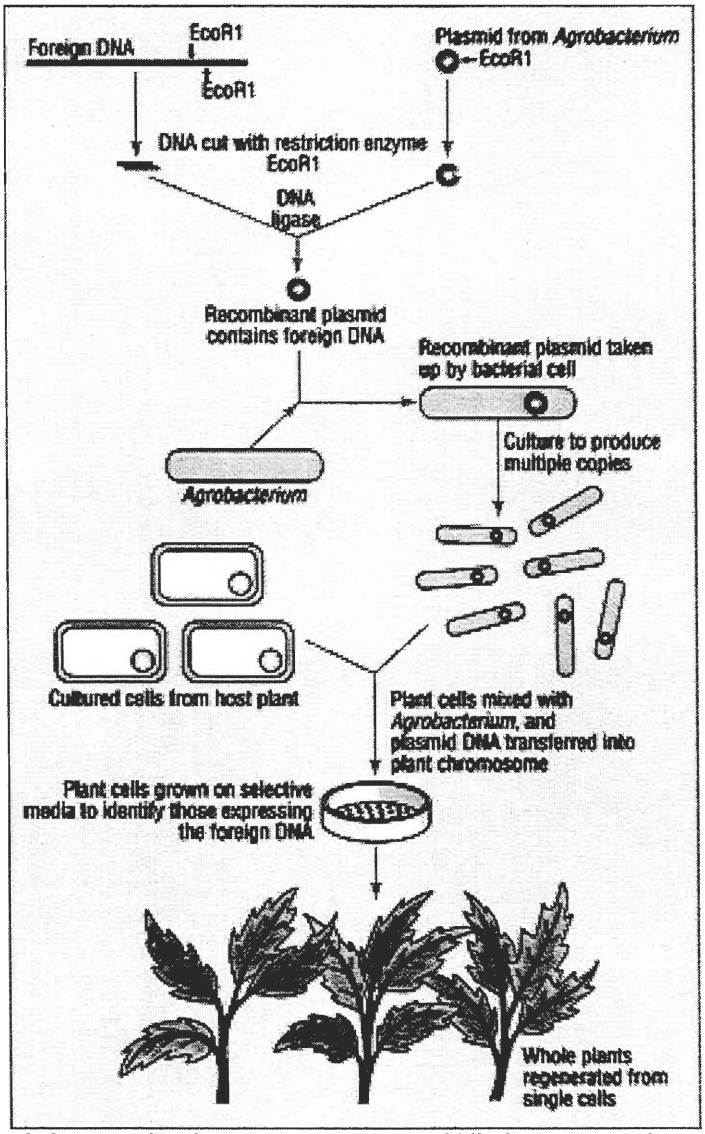

Fig 2: Method for producing genetically modified plants using a bacterial vector [2]. This is a schematic of how a recombinant plasmid would be made and inserted into plant cells in order to create an adult plant that contains a desired piece of DNA.

Another method of genetically modifying food is to use what is called the Antisense

Approach, which turns off or lessens the effects of a gene. For example, this approach could be used to lessen the effects of the enzyme that causes fruit to rot, polyphenol oxidase. By lessening the affects of this gene it may be possible to slow the spoilage of fruits [2]. As mentioned above both animal and plant cells can be genetically modified. It is possible for

consumers to eat GM foods by directly eating a GM food such as GM tomatoes or soybeans, but consumers can indirectly consume GM food as well, by eating meat products from animals that have been raised on GM feed (e.g. GM corn meal).

It is unclear as to whether or not eating GM foods will pose any health risks in the future, but some reassurance can be found in the fact that before GM products appear on the market they are supposed to be extensively tested by their producer. The debate as to whether or not GM food production is appropriate is an ongoing discussion that has not reached an agreement, but the ability to bioengineer food products has and will continue to revolutionize biotechnology and all of science.

2.2 Social Science

The social science section of this investigation will introduce key concepts utilized in this project combined with the characterization of the debate in the risk versus benefit controversy arena. The section contains the definition of technology and the relationship existing between this and the knowledge, attitudes and practices concepts. This conceptualization of the key terms used in the project will lead to a better understanding of the positioning of the identified players and how the attitudes of these players will be used to characterize the said risk versus benefit controversy arena. This is where the whole debate develops

Technology is defined in the *Concise Oxford Dictionary* as the "(science of) practical or industrial arts; (the) ethnological study of the development of such arts; (the) application of science" [4]. Willoughley expresses that the definition does not convey much complexity of meaning because the more elaborated meaning of technology is constantly changing along with

the needs of the society. Technology is thought to be the "sum of knowledge and received information, which allows things to be done [4]".

Technology and society are perceived not as a discrete interaction but as an overlapping and mutually determining one. Society becomes more "technologized" and technology reflects the structures and interests of the society [4]. Technology has come to be viewed more as a system or a form of rationality rather than just a collection of facts [4].

Rationality drives the discussion into an emotional floor, where emotions can be seen as rational ways of perceiving and interacting with the world, rather than random, self-enclosed psychic or physical sensations [5]. This characterizes the attitude of the person towards the knowledge that has been proportionate. In a broad sense, any mental state with prepositional content shapes an attitude, and in this sense they include beliefs, desires, hopes and wishes [5]. In the specific case of the genetic modification debate, there is an arena of controversy that is characterized all of the actors, which is shaped by the emotionally driven interests of the actors shown through their position in the arena. Their position is defined by their attitude, their feelings and actions toward the issue, their practice, and the amount of knowledge that they have about the issue, which may or may not influence their attitude and practice.

The relationship between knowledge and attitudes toward science and technology is controversial and contradictory. There are strong, common sense expectations among scientists and policy makers that more knowledge of science leads to more support of it. This expectation is consistent with a traditional view of science that it is a "rational pursuit of objective 'truth' about the world [6]." For knowledge justification, a true belief is a necessary condition [5] and this bears an appropriate causal connection to the fact in question [5].

"The notion of truth as a relation of correspondence between belief and reality and is not rejected but clarified by reference to actions, future experiences, etc [5]." This statement provides a framework of what is expected, but rather than perceptions, social practices are the site where common sense operates: the focus is on what people are doing rather than on what they are thinking [7].

Controversy over technological change has occurred on a number of fronts. Concern has been expressed about the basic prospects for human society and the natural environment. These concerns are increasingly linked together by analysts on the understanding that they form a complex system of mutually reinforcing factors, which creates such phrases as "the global problematic" [4]. Controversy is the questioning of a technology when there seems to not be any apparent answer as to whether or not to integrate the technology into a society. A controversy leads to a debate among the key actors that hold direct interest in the technology. These actors directly affect the attitude of those that do not have particular interest in the technology but will be affected by it in some way. The debate may result in an ultimate societal rejection or acceptance of the technology or as a result of gridlock; the decision may simply be left up to each individual whether or not to accept the technology.

And at this point the rationality combines attitude and knowledge. Individually, each entity develops a position based in the reliable process or method through which its knowledge has been adopted. Skeptics analyze every logically possible alternative relevant [5] before taking the position. For some actors, conforming the controversy science will correct the errors of common sense, but a too radical correction of common sense done by science runs the danger of depriving scientific theories of the ultimately commonsensical evidential basis on which they depend [5]. We can assume after this analysis, that the driving force shaping the controversy is

what happens when science seems to undermine not particular beliefs, but whole traits of experience [5].

Acceptance of a particular technology does not occur as a result of one single event, but emerges from a bundle or ensemble of ideas, information, technology, knowledge and know-how, which may or may not be embodied within the product or process. Social interaction towards technology has moved from a "science-push"- "market-pull" model to an interactive one where innovation organizations manage relationships internally with project groups and departments, but also externally with the industrial sector and the public [8]. There is a critical link between research and development and marketing, as well as strong interaction with external actors, including customers and suppliers that must be addressed in order for a particular technology to make an impact and be integrated into a society [8].

All societal activity is embedded in complex networks of social relations. Those that model societal networks usually adopt a functional perspective, which emphasizes that the structure and functioning of social systems are evolutionary and adaptive. Social structures (networks) encompass the enduring pattern of social inter-relations, such as class, roles, rules and social institutions. The social system, as a whole (the network), is pre-eminent over the individual parts (human subjects) [8]. It concentrates on examining the complicated social interactions, which lead to the development and implementation of new technologies [8]. Networks are made up of all of the actors with a direct interest in the technology and all those that are indirectly affected by the technology.

The social network is held together by a web of viewpoints of those directly concerned with promoting or shifting the technology, but it is how the average member of society is influenced by those viewpoints and the attitude that he/she forms toward that technology that is

important. This is what determines the probability of eventual acceptance of the technology into everyday society [8]. Attempting to explain this phenomenon, six categories are being characterized and analyzed as the key actors that foster the mechanism dynamics of the genetic manipulation debate. The groups of actors categorized by manufacturers, consumers, governmental system, consumer and environmental organizations, farmers and supermarkets are the responsible agents of making the network adopt its particular form. They have been chosen because they represent all aspects of the controversy arena.

The following are characterizations of the GM food debate. The manufacturers adopt the position of technology promoters and spread the knowledge acquired by their scientific investigations. The opposite view is characterized by the consumer and environmental organizations that are skeptical of the new technology. These groups are attempting to slow down the advancement of the technology in order to weigh all risks and benefits before accepting it. For this group, the scientific knowledge of the technology promoters did not provide a reliable process or method that provokes a true belief. This belief will lead an individual to an appropriate causal connection to the topic in question [5].

The government acts in the arena as the decision maker and balance provider, theoretically. It has the responsibility of looking for the public's best interest, focusing its effort in harmonizing the situation between all the groups shaping the controversy arena; its importance in the debate resides on the power that the institution owns.

The consumers are the key players in the whole controversy, because they are influenced by the comments of the manufacturers and the environmental organizations. They are participants in the arena with the most diverse opinion. Their knowledge, attitudes and practices

towards technology will be shaped in response to the manufacturers, environmental organizations, consumer organizations and the government.

The supermarkets and farmers are the actors that rely on the consumer's opinion and have to adopt the guidelines imposed upon them by the government. Being dependent of what the market demands, they shape the role of the suppliers of the products and the embracers of the technology.

This brief description of the six forces interacting in the controversy arena shows the importance of each of the players that are interconnected and create the forces that shape the GM food debate. Each player has justified their presence in the debate, which is strongly moved by the particular knowledge, attitudes and practices of the players. This enables them to have different opinions towards technology and science adoption.

This project investigates the knowledge, attitudes and practices of these actors as a way of characterizing the GM food debate. It is the hope that by examining the thoughts and actions of the particular actors involved in these categories the attitudes and practices of the entire category can be assessed and analyzed. This can then be used to describe the way all of these actors affect the arena and each other. Examining these actors is also the best way to understand the network of the arena as a whole, how all of the categories interact, and what major issues are at the center of the debate today.

3.0 Methodology

3.1 Overview

The overall goal of the project was to make a comparison between the knowledge, attitudes and practices toward genetically modified food in the United States and Denmark. The ultimate goal of this project is to attempt to assess and describe the arenas, at the time of this project, around gene technology concerning food production in the United States and Denmark then compare these two arenas. In order to do this it was important to use the same general procedure in both countries. A general framework for the project was set up before any of the research began, specifying who, what and how the research was to be conducted in both countries. This general plan was followed in both the United States and Denmark and is outlined in this methodology. It can be assumed by the reader that the same procedure was followed in both countries unless otherwise noted.

3.2 Identification of Key Actors

Six groups/areas were identified as being the key actors in the GM food debate based upon suggestions provided by the sponsors, NOAH (Friends of the Earth, Denmark) and the Science Shop at DTU. These were the categories where the research was focused in both the U.S. and Denmark. They were chosen because they were determined to be the groups or areas that are most important in shaping the debate and ultimately how the two countries are dealing with the GM food issue. They are all directly involved in the debate in some way and their attitudes and practices are all critical to the overall workings of the controversy. They all have a particular stake in the issue that makes them unique and their attitudes are described separately in

the knowledge, attitudes and practices portion of this report. The six groups/areas that were identified and researched were:

- Manufacturers
- Farmers
- Supermarkets
- Consumers
- Environmental/ Consumer Organizations
- Regulation and Legislation, in both countries

3.3 Organization of the Report

The report contains a short introduction on the general goals of the project. It also contains a scientific background section that includes information about the genetics of GM food as well as the social science behind the interaction of knowledge, attitudes and practices in a social network. The scientific background portion of the report was included in order to provide the reader with useful information that would aid them in the understanding of the attitudes of each group and how they interact and affect the entire GM food debate.

The knowledge, attitudes and practices portion of the report is separated into the categories described above in section 3.2 and each category is broken down into two large subsections, one for information found in the United States and one for the research done while in Denmark. Each of the country's subsections are broken down further into the particular players or areas that were found to be critical to the understanding of the attitudes and practices of the category as a whole within that country.

Next, a section was devoted to the overall networks in the two countries and the interactions within these networks.

Finally, the comparison section was included. It includes a specific comparison of each of the six main categories. The comparison section also includes an overview of the GM debate,

based on the major issues. This section was organized in this way for ease of understanding and to focus the thoughts and ideas on each broad group/ area.

3.4 Research for the Scientific Background Section

Research for the scientific background portion of this report was performed by collecting and compiling previously published materials. The genetics behind GM food was investigated, as well as the social science that applies to the issue. This included social networks, attitudes towards technology and how knowledge of technology affects these attitudes. This can be used in the analysis of the actions that each actor takes concerning GM technology. The information section came from a combination of scientific journals and general textbook material. The material was found by doing literature and journal searches and some sources were identified and provided by the group's sponsors.

3.5 Research for the Knowledge, Attitudes and Practices Section

This section of the report presents the knowledge, attitudes and practices of the various actors identified as being influential in the debate. This section is designed to merely present information provided by the actors as to their thoughts and actions towards the GM food issue. Information found in the knowledge, attitudes and practices section comes from information on each category compiled from a variety of sources. In all categories the World Wide Web was used to look up background and general information on the attitudes and practices of the various actors. Additional information was also provided through personal contact via personal and phone interviews as well as e-mail correspondence. A description of the interviewing methodology appears in section 2.6. Other pertinent information was provided by the various

groups themselves through the mail. The most important information obtained via web research, mailed information and personal contact was combined and appears in the knowledge, attitudes and practices section. It is the best possible representation of each group's thoughts, policies and goals concerning the genetically modified food issue. This general method was used for all of the categories presented here.

For the section on the opinions and attitudes of manufacturers of GM food, five major multi-national companies were chosen as representatives. All of those selected have GM products currently on the market and were alluded to in several articles and other references as being some of the central producers of transgenic foods. The companies chosen were AgrEvo, Delta and Pine Land, DuPont Corp., Monsanto Corp. and Novartis. In addition to these multi-national producers, information is included on one small Danish company that is interested in marketing GM products, Danisco. Dansk Industri was also interviewed, as they are a representative of industry in Denmark.

The primary sources used were the homepages on the World Wide Web for each of the companies. Each company was also e-mailed and asked whether or not they could provide any information about their attitude toward the issue. Responses were received from Monsanto, Novartis and Delta and Pine Land via e-mail and a representative from DuPont was interviewed over the phone. AgrEvo did not respond to the request for information. Danisco was also contacted for an interview and was not willing to speak with the group directly. However, they did provide some information on their company and its interest in GM food production.

The information on farming in the United States was found by accessing newspaper and magazine articles as well as Internet postings. The information included studies conducted by major U.S. Universities and a variety of national farming statistics. In Denmark, information

was also found on the World Wide Web, but interviews were done with interested farming organizations involved in both crop farming and animal breeding for meat production such as IFOAM (A Danish Organic Farming Organization), Dansk Slagteri, and the Agricultural Council.

In addition to the usual background research, personal contact was attempted with supermarkets. In the United States, three major chains were contacted and none of them responded. In Denmark, FDB, an organization that acts as an umbrella organization for several individual chains, was contacted and information from that interview is found in the Danish supermarket chain portion.

For the general consumers portion of the project, a survey was undertaken in addition to background research in order to obtain a better idea of the public's attitude in the two countries. A description of the survey methodology appears in section 2.7. Surveys done by separate parties in the United States and Europe were also used. The goal of the research was to discover the general public's opinion as well as how and why it was formed.

To understand the point of view of the environmental and consumer advocate organizations, groups that have expressed concerns about GM foods were chosen and their opinions were assessed. The five organizations investigated in the United States were Friends of the Earth-U.S.A., Greenpeace-U.S.A., The International Food Information Council, The Sierra Club and The Union of Concerned Scientists. Each of these groups has particular concern in protecting the rights of the environment and the consumer. The research for this section was mainly conducted using the homepages on the World Wide Web from each of the organizations. Each organization had ample information and clearly stated their feelings about food biotechnology on their web pages. However, each organization was also contacted directly via

e-mail. The organizations were asked to provide any information they could that supported or discussed their view in the GM debate. Unfortunately, none of the groups responded. In Denmark, similar groups were investigated such as NOAH (Friends of the Earth, Denmark), Greenpeace-Denmark, The World Wildlife Federation, Nature Conservation, The Danish Food and Allied Workers Union (NNF) and the Danish Consumer Council. Interviews were conducted with these groups and published materials were also obtained from them.

The research for the regulation and legislation part was mainly based on official documents. In the United States, the U.S. Code and the Federal Registers issued by the three governmental agencies (FDA, USDA, and EPA) that are in charge of monitoring and regulating biotechnology were analyzed. In addition to governmental sources, articles publicized by the governmental entities were useful research tools. To complement the investigative process, phone interviews with members of the three bodies and a personal interview with a business law and ethics expert were conducted. For the Danish regulative and legislative research, information was obtained from official documents released by the European Union (EU) as well as the Danish Parliament. Political Parties were also talked to and contact was made with the EU. Some researchers in the area of regulatory policies concerning genetically modified food were also interviewed in order to obtain a better understanding of the regulatory process in Europe and Denmark and to discuss current and pending regulation.

It is important to mention that other interested groups were interviewed in Denmark. This includes organizations and researchers that have interest and take part in the GM food debate but do not have a particular stake in it. The information provided by these people was used as additional background to allow the group to better understand the debate and to

supplement the results. This information can be found throughout the knowledge, attitudes and practices section and is cited accordingly. All of these interviews appear in Appendix B.

3.6 Interviewing Methodology

The first step of the interviewing process was identifying the major players in the GM food debate. Once this was accomplished, contact information was obtained. In Denmark, the group's sponsors provided an extensive list of contacts. Contact information was acquired by the group itself in the U.S. The group then proceeded to contact every organization to request interviews and/or information.

A number of interviews were conducted as part of the research. These interviews facilitated a more complete assessment of the knowledge, attitudes, and practices of the major players in the GM food/fodder debate. It must be emphasized that every interviewee was informed that the group was completely objective on the issue. This was done to ensure that the interviewee would openly share his/her views.

The following general questions were asked to every organization or individual that was interviewed:

- What is the position of the person being interviewed in the organization?
- What is his/her personal background?

  -education

  -term of employment with organization

  -other pertinent information
- What is the overall purpose of the organization?

- How is the organization funded?
- What groups do you focus on as an organization and how do you approach them?
- Does your organization have an official position in the Genetically Modified (GM) food debate?
- Has your group taken any action in respect to Genetically Modified Organisms (GMO's)?
- Do you have any published documents or other information pertaining to GMO's?
- Are you currently taking any kind of action? If so, how are you implementing this action?
- What are the group's long-term goals for GMO's and how do you plan to achieve these goals?
- Are you affiliated with or supported by any other organizations interested in GMO's?
- What actions, if any, do you take to publicize the organization's views (media)?

There were also a number of organization-specific questions asked. Governmental/ regulatory, consumer, food and farming organizations were interviewed and since each organization is concerned with separate parts of the debate, the questions addressed the role of each. All of the interviews are summarized in Appendix B and a list of the interviewees and contact information is provided in Appendix C.

3.7 Surveying Methodology

The survey was conducted in both the United States and Denmark. It was a major part of the consumer research and created a good basis for comparison between the two countries.

The survey was created with the hope that it would provide a sufficient representation of the general consumer, and their views, in each country. However, this was not the case as most of the respondents were college students, but a general idea of the consumer attitude was obtained, which is the overall goal. The American version of the survey included nine questions as well as age and gender for demographic breakdown. The Danish version of the survey was translated to include the same nine questions in addition to three Denmark-specific questions. The extra questions were placed at the end of the survey so that they would not influence answers to the original nine questions. These questions were added at the request of NOAH. NOAH wanted the results for their gene group that is also working with the issue of Genetically Modified food. The group's sponsors provided all of the translations for the survey: the survey questions themselves, the e-mail sent to Danish students, and the introduction to the survey on the web.

It was publicized in much the same way in both countries. For the U.S. survey the entire WPI campus was e-mailed (students and faculty). Personal friends and family were also asked to take and distribute the survey. In Denmark, students at DTU were e-mailed. This is a similar student population to that of WPI. The Danish students were also asked specifically to pass on the survey to members of other age groups, whereas the faculty and family were relied on to get respondents from the older demographics in the U.S.

In Denmark, the survey was also distributed personally on the trains. This was done because publicizing the survey in this way provides a better representation of the public than students and their families (an affluent and educated demographic) and it allows a much higher response rate to reduce the chance of response bias. If similar results were obtained from the e-mailing and from the personal distribution it would allow a stronger argument to be made with

the results. The comparisons made between the two countries used only the results from the e-mail surveys because of the similar population. Error calculations were not made because of the nature of a web-based survey publicized via e-mail.

The survey was created using HTML code and was placed online. It resided on the WPI server for the U.S. survey and on a Microsoft Network server for the Danish survey. It was moved to the Microsoft Network server for overseas speed considerations. A point-and-click format was used for the survey as no question had more than five possible answers. The selected answers were then e-mailed automatically to the group. Once the answers were received they were input into an Excel spreadsheet, separately for different age groups and genders. The spreadsheet did the rest of the work after being programmed. This included percentages for each answer, as well as group totals, both of which were used to create charts that displayed the information graphically. The results from the compilation of the survey in both countries were compared on the basis of the demographics to assess differences not only between country but age and gender as well.

3.8 Analysis of the Knowledge, Attitudes and Practices of the Key Actors

3.8.1 Networks of the United States and Danish Debates

Two separate networks have been designed that paint a picture of the U.S. and Danish arenas. They were created with the social science background portion of the report in mind, as well as the actors themselves and how they interact with one another. This network gave us a basis to organize the interaction between the various groups and to present, in a general way, how the actors shaped the debate in both countries. The level of influence that they have over one another was also addressed and how it impacts the network as a whole.

3.8.2 Comparison of the Categories

Once the knowledge, attitudes and practices of the key actors in the GM food debate were assessed and analyzed, they were compared between the two countries. This was done on an individual basis first. Also included, is a section that presents an overview of the controversy, which attempts to characterize the debate as a whole. This was done by determining what the main topics are that shape the debate and analyzing what mechanisms they use to do so. These topics are then related to the actors themselves. This is done by analyzing the solutions they propose to solve the problems surrounding the debate.

It is important to recognize that all information contained in this report has been obtained from a citable source and that none of it is the personal opinion of the writers. The comparison section is a representation of similarities and differences that were recognized or observed by the writers conducting the investigation. The comparison is based upon the facts and opinions obtained while performing the research, not speculation or personal views.

The final report will ultimately be used by NOAH and the Science Shop at DTU as background information on the particular actors that have been researched and their roles in the GM debate as it currently exists. It will also be used to better understand the differences between the U.S. and Denmark on the issue. NOAH is particularly going to use it within their "gene group" as a reference and a lobbying tool. Copies were provided to NOAH, the DTU Science Shop, WPI and others that requested the report to increase their personal knowledge on the subject.

4.0 Knowledge, Attitudes and Practices

Presented here are the detailed results of the research concerning the knowledge, attitudes and practices of the key actors in the debate. The goal of this section is to report the policies, views and actions of the particular players researched within each category in order to obtain an overall idea of the attitudes and practices of each category as a whole in each country.

4.1- Manufacturers

4.1.1 Introduction

This section will report the positions of various companies that research and develop genetically modified plants and seed for distribution in the world market. GM products originate in the laboratories. These companies sell GM seed to farmers as well as products that they have produced using genetic modification directly to the consumer. These companies are involved in the research of new products and ways to utilize the technology as well as the production and implementation of their use.

4.1.2 International Manufacturers

4.1.2.1 Attitudes and Practices of the International Manufacturers

AgrEvo

AgrEvo is a German company that became interested in the production of Genetically Modified Food after United States scientists involved in GM research in the U.S., particularly at Massachusetts General Hospital in Boston, established laboratories in Germany. In September 1996 acquisition of a Dutch/Belgian company, Genetic Systems, made AgrEvo one of the key players in GM research and food production, but it has been interested in plant biotechnology for more than 15 years. AgrEvo is a world leader in the production of pesticides, herbicides and

insecticides. AgrEvo's interest is to equip plants with their own defense mechanisms against diseases, insects and other pests through genetic engineering. They are convinced that the future of weed control also lies in Genetically Modified Plants [9].

AgrEvo has been producing the herbicide glufosinate for more than 10 years now and their first biotechnology program was designed to widen the area of use of this product. To do this AgrEvo designed glufosinate tolerant plants and they tested these for adverse effects on man, animal and environment. These plants have been approved in North America and the risk profile for these plants is no different than that of other newly-bred plants made from traditional plant breeding techniques [10]. They have also done research into antifungal agents, anti-viral components and other modified plant constituents [9].

There are no current ways in which crop plants can protect themselves from competition from weeds. AgrEvo feels strongly about only designing products that are as environmentally benign as possible. They feel genetic modification is a reasonable alternative to chemical control. AgrEvo also feels that safety investigations are an absolute must and that law should require them. They realize that chemical weed control will probably need to be used for the next 10-20 years, but chemical agents are also going to need to be replaced with a new, more ecologically conscious system. Genetics may play a role in this [9].

AgrEvo is ultimately committed to the farmer and hopes to provide the farmer with means and materials that enable them to economically produce their crops in a manner that is friendly to the environment. According to AgrEvo, the world population will be ~7.6 billion by the year 2015 and farmland is continually being lost to urbanization. The solution to maintaining the world's food supply is to either turn acres of wildlife habitat into cropland or to increase

production of the current available farmland. AgrEvo feels that biotechnology can make the second option possible.

AgrEvo feels that there are numerous benefits of the use of biotechnology. They feel that agriculture will benefit from guaranteed and increased yields, increased productivity, improved harvest quality and innovative products with added value potential. Consumers will find improved product freshness, appropriate calorie content and reduced allergens. The environment will benefit from improved processing qualities of harvest, less waste, less energy use an conservation of fossil fuels through things such as bioprocessing. Finally, industry will benefit because raw plant materials can be made to have particular desired qualities and there will be adequate amounts of these raw materials [9].

AgrEvo produces the oilseed rape variety, the Innovator, which is tolerant to glufosinate, the herbicide that they produce. This variety has been available in Canada since 1995. They also produce corn, rice, rapeseed, soybeans and beets that are tolerant to another herbicide, phosphinothricin. AgrEvo tests for years before bringing their products to market and compare their products to those that are already traditionally found in nature [9].

AgrEvo responds to public opinion by saying that all new technologies meet resistance. They are aware of their responsibility to listen to criticism from experts and the public. At stake is the current and future use of resources, new ways of handling technological progress and of dealing with the changes that progress brings in people's lives. They are convinced that a reasonable agreement can be found through discussion of scientific and economic considerations.

AgrEvo emphasizes that biotechnology is not new; selective crossbreeding has been occurring for centuries. They feel that gene technology is an effective tool in crop breeding, enabling them to develop new crops rapidly and specifically. It will make breeding more

efficient, optimizing contents and making valuable substances to suit wishes of the consumer and the processing industry. AgrEvo supports the principle of living nature through agriculture, which is suitable for its surroundings [9].

Delta and Pine Land

Delta and Pine Land operates the oldest, continuous private cotton program in the U.S., and its main headquarters is located in Scott, Mississippi. It is a leader in research and breeding of conventional new transgenic cotton as well as soybean varieties for the southern United States market. Delta and Pine Land is made up of three companies: Deltapine (Cotton and soybeans), Paymaster (Cotton seed) and SureGrow (Cotton and Soybean). Delta and Pine Land has recently been acquired by Monsanto and distributes some Monsanto products such as Bollgard and Round Up ready cotton as well as Round Up transgenic soybeans. Delta and Pine Land is also interested in commercializing other technologies from other providers without having to pay royalties. Their recent agreement with Monsanto will allow them to do this [11]. Being a part of Monsanto, Delta and Pine Land complies with the standards and regulations Monsanto has set for the use, production and testing of GM food (Please refer to the section on Monsanto below).

Delta and Pine Land is involved in the Technology Protection System (TPS) that was developed with the U.S. Department of Agriculture's Agricultural Research Service (U.S.DA-ARS). The purpose of TPS is to ensure that North American farmers have a level playing field when competing in commodity production with farmers world wide. Farmers have been paying for advanced seed technologies for several years based upon the value of proven enhancements [12].

Essentially, the TPS system prevents the possibility of biotechnologically derived genes from being able to cross to wild relatives. The system seems to work so well that even the pollen of transgenic plants, if it should pollenate a wild plant, will render the seed produced non-viable. TPS is a transgenic system comprised of a complex array of genes and gene promotors that, in a normal state, are inactive. The plant is normal and produces normal seeds [13]. Seeds carrying the TPS system that are produced for sale to the farmer will simply have a treatment applied prior to the sale of the seed which, at the time of germination, will trigger an irreversible series of events rendering the seeds produced on the plants non-viable. This ensures that whatever genetic modification was made for sale purposes (e.g. herbicide resistance) will not be carried to any subsequent generations and there is no danger of genetic mixing. TPS will have no effect on the seed produced (the vegetable) whether it be for feed, oil, fiber etc. Farmers will be able to choose transgenic varieties of plants that are TPS or non-TPS. This is an additional transgenic trait to the plant beyond that of the desired modification. Delta and Pine Land also claims that genetic diversity will not be affected by TPS seeds. TPS is not yet available for commercial use but should be in a few years. No TPS varieties are currently being grown [13].

DuPont Corporation

DuPont is an international company with many interests, but biotechnology has recently become one of their main focuses, as they see it as a wave of the future. DuPont's view is that even though genetically modified foods are the focus of the media, biotechnology is much broader and that it has a critical role to play in all of our futures [13, 14]. DuPont feels that biotechnology has enormous potential in making our future world more sustainable for business as well as science. DuPont's main interest is sustainability and this is related to their core values

of safety, environmental stewardship, ethics and fair treatment of people. DuPont is on a journey to become a sustainable growth company. Their main focus is in increasing shareholder and societal value while reducing DuPont's "environmental footprint" or environmental impact. They feel that biotechnology is going to be critical to achieve this goal. DuPont makes "Better Things for Better Living." They are essentially a science company and they feel that part of the future for better things and science lies in biotechnology [13, 14].

DuPont is interested in genetic enhancements that can improve the nutritional and health qualities of food. But they are interested in other uses for genetics as well such as making polyesters from plants and microbes as well as bioprocessing [13, 14].

DuPont is aware of the growing public concern with food genetics and is aggravated by the perception that industry has often acted as though public fears are not legitimate and are the result of ignorance [14]. DuPont and industry must do a much better job of engaging, listening to and addressing the concerns of all stakeholders in the global debate. They want to listen to the people who are raising alarms. They say that listening requires initiative and patience and the willingness to build relationships that will provide a point of view that may be counter to theirs. DuPont will advocate consumer choice through meaningful information and product assurances. They feel consumers will be able to make better choices if provided with more science-based information. They are currently trying to inform consumers in credible ways and as much as possible [13, 14]. Many feel that the opinion of the manufacturer may be suspect, but DuPont realizes that they have an obligation to provide information to the consumer and the information must be useful [13].

In order to aid them in providing useful and accurate information, DuPont has created a biotechnology advisory panel that will guide their actions, help them to create positions on

important issues and guide and challenge them in the development, testing and commercialization of new products based on biotechnology [13, 14]. The panel consists of people that are experts in the fields of religion, ecology, ethics and science [13]. The panel will also audit their progress and provide reports that will be available to the public. The panel consists of people from within the company as well as others from outside of the company. The panel is also responsible for listening to all stakeholder groups, including biotechnology critics [13,14].

DuPont feels that there is a need to boost agricultural productivity because there will not be enough food to feed ~8 billion people by the year 2025 and beyond. They feel that providing crop protection through modern genetics is a very good way to ensure plentiful food for the future. In addition to genetics they plan to modify current chemicals as well as investigate the uses of organic farming for the same purpose [14].

Currently, DuPont only has a couple commercialized products. It has a type of GM cotton that is tolerant to an herbicide called sulfonylurea. They also produce a type of soybean that interrupts the process that leads to saturated fat production therefore reducing the amount of saturated fat and oil content of the soybeans [13, 14, 15].

DuPont feels very strongly about the importance of testing all GM products. They do so by comparing all GM products to the substantial equivalent, meaning they compare the GM product to a non-GM equivalent. They look for whether or not the GM version produces different testing results than the non-GM version. Mainly, they test for the potential of the product to become a weed, the potential to enter into animal feed and the product's potential to affect any aspect of the environment. DuPont also performs soil trials on soil that GM plants have been grown in to see whether there is any alteration in the soil components. They do water

testing to monitor effects on ground water; they also test the effects of GM products on beneficial insects such as the ladybug. DuPont also does feed testing to see whether the food affects different types of animals, in particular birds and mammals (e.g. mice). Analysis is also done to determine whether any new proteins that might be expressed will interact with any natural proteins in an adverse way. All of DuPont's products are also tested by the FDA and if need be, the EPA and the USDA [13].

Labeling, according to DuPont, is a very complex issue, but where it is mandatory or if it is determined to be the most appropriate way to provide meaningful information, they will join in developing workable labeling systems that are science-based, clear and understandable to users [14]. In some ways, DuPont feels that labeling may not be the best way to educate consumers due to the technical challenge. This issue is not black or white because everyone needs to be involved in the labeling process from the producer of the GM seed, to the farmer, to the supermarket that sells the products. Essentially, the entire way of labeling food in the United States would need to be altered in order to label GM products. Historically, food has been labeled based on product, or what is in the food, but labeling GM food involves labeling the process of how the food was made. There would be shift from product to process labeling. DuPont is afraid that process labeling would lead to unnecessary consumer fear and result in the same situation as Europe, where they have decided to ban the food all together [13].

DuPont is an advocate for the carefully deliberate advancement of this crucial area of 21st century science. Safe practice in biotechnology is just an extension of DuPont's commitment to safety throughout history. Currently, they are collaborating with the U.S. Center for Disease Control to improve food-borne disease surveillance. They are also allied with the *Instiute Pasteur de Lille* in France to improve food safety worldwide [14].

Overall, DuPont feels that they are in the business of discovery into value, using the best scientific tools available and biotechnology is a tool that offers tremendous potential [13, 14]. They feel that biotechnology should be done safely, ethically and responsibly [14]. DuPont feels there is no need to rush into anything and that all proper precautions should be taken and information should be found out. DuPont would rather have an open discussion where all aspects of the debate are talked about and a reasoned decision is made rather than prematurely and blindly losing a potentially useful and beneficial technology [13].

Monsanto Corporation

Monsanto is considered by many as the largest supporter, researcher and producer of genetically modified foods in the United States and the world. Monsanto is interested in agricultural biotechnology products to help farmers with insect pests, weeds and plant disease. Monsanto argues that humankind has made improvements to crop plants through selective breeding and hybridization for centuries. They feel that plant biotechnology is an extension of this with the very important difference that plant biotechnology allows for the transfer of a greater variety of genetic information in a more precise, controlled manner. Biotechnology allows for the transfer of only one or a few desirable genes. They feel that this precise science allows plant breeders to develop crops with specific beneficial traits and without undesirable traits [1].

Monsanto speaks extensively of the benefits of biotechnology for the farmer. According to Monsanto, biotechnology will improve crop yields, feed quality, and reduce labor and pesticide costs. Farmers often must plant more acreage than they expect to harvest. With the promise of more viable crops these "extra acres" will be eliminated. Biotechnology will reduce

insecticide sprays and thereby benefit the environment. Reduced pesticide use improves water and top soil quality as well as other natural resources. Monsanto says that the consumer will benefit from lower costs since farmers are able to produce food more efficiently [16].

Currently, Monsanto has only introduced single or a few genes into its products and they say that their foods are substantially equivalent to their traditional counterparts. Monsanto has the most GM products on the market of any company that produces them. A majority of their products contain a genetic modification that they call Bt. Bt modifications are genetic modifications that control pests by disturbing the digestive systems of the targeted insects. Their New Leaf Potato protects against the potato bug, the Cotton with the Bollgard gene protects against bollworms and Yield Guard Corn protects against the corn borer. Farmers need to battle weeds. Herbicide tolerant crops allow farmers only to apply herbicides when needed. Herbicide tolerant products from Monsanto include canola, corn, cotton and soybeans. These plants are Round Up resistant. Round Up is a herbicide, made by Monsanto, which inhibits growth by establishing a roadblock in the plant's metabolic pathways. They originally created Round Up resistant products to increase sale of Round Up. The gene inserted into Round Up ready plants increases the enzyme that Round Up attacks in plants providing a detour from the roadblock [1,16]. Other possible Monsanto products include modifications that control the ripening of tomatoes, peppers and tropical fruits. This allows time to ship crops long distances and results in tastier food. Another possibility is potatoes and tomatoes with higher solids content. This decreases processing costs because less energy is needed to extract water while producing potato and tomato products [16]. Monsanto is researching the possibility of creating corn and soybeans with increased amino acid content. Amino acids are the building blocks of proteins, which perform all of the "duties" of the cell [16].

Monsanto seeks the Food and Drug Administration's review of all GM products that they produce and are committed to addressing and resolving any issues raised by the FDA before the product is sold commercially. Monsanto also tests all of their products along with research institutes and universities before even sending their products to the FDA. Monsanto has found that all current products are compositionally and nutritionally equivalent to existing varieties. They also make sure that proteins expressed by the inserted DNA are safe for humans, animals and the environment. Monsanto tests its products by comparing altered food and feed products to those currently on the market that are not biotechnologically altered. They also do tests that ensure that allergenic potential has not been significantly increased [16]. Monsanto feels that new biotechnology plant varieties are more extensively tested than varieties obtained from traditional breeding methods. Over 100 million acres of Monsanto's transgenic products have demonstrated excellent human and safety records in the past few years. Monsanto and other scientific experts are continually pursuing and evaluating new methods to improve testing [16].

Monsanto supports the FDA's initiative in sharing information about the regulatory processes and encouraging public dialogue. Monsanto believes that having a more "transparent" regulatory method will assure the American public that the FDA procedures for regulating foods, including those derived from biotechnology, are both rigorous and appropriate [1,16]. Although there is information available, Monsanto feels much more should be done to educate the public. Government, companies and food and feed growers associations should all play active roles. Biotechnology companies should provide general information on the science of biotechnology. Monsanto says it takes its role as a company that should provide information about products and support for education seriously. Currently, Monsanto is collaborating with groups like the National Science Teachers Association, the National 4-H club and the Future Farmers of

America. Monsanto says that information should be available in a variety of ways such as mail, toll-free consumer phone numbers, food companies, trade associations, web sites and e-mail, and they try to provide information through many of these venues [16].

Monsanto supports the current FDA policy on labeling, which requires special labeling if there are meaningful changes in composition, nutrition or allergenic potential for the food regardless of method used to produce the food. Monsanto feels that labels should be concise and easy to read. They also believe that the FDA should change the name of the food if the non-GM counterpart is no longer available [16].

In the future Monsanto hopes to enhance the nutritional characteristics and improve the agronomic performance of food and feed ingredients with processing traits that increase efficiency and reduce waste. Currently, foods are being developed to reduce childhood micronutrient deficiencies and improve productivity crops in the developing countries [1, 16]. Monsanto supports the furthering of the use of biotechnology in food production and feels that the technology has and will continue to change the world of agriculture for years to come.

Novartis

Novartis Crop Protection is a Swiss company that strives for profitable growth by providing products and services, which support the principles of sustainable agriculture. They discover, develop, manufacture and market fungicides, herbicides, insecticides and seed treatment products. The only GM food product that Novartis currently has on the market are beets that are tolerant to the herbicide glyphosate [17, 18].

Novartis is committed to the future of plant biotechnology. Consumers can be confident of the safety of genetically enhanced products that have been approved for marketing. These

products have undergone an unprecedented scientific and governmental analysis and review. They have been judged to be safe for humans, animals and the environmental. Novartis takes its responsibility for environment stewardship seriously. All products are tested by the FDA, EPA and the USDA [18].

Novartis is involved in an industry initiative to provide information on biotechnology and genetically enhanced products in order to enable their customers and consumers to make decisions based on full information [18]. Novartis feels it is unfortunate that misinformation spread by a few activist groups may delay acceptance of a technology that has the potential to enhance nutrition, reduce starvation and help sustain the environment around the globe [18].

Novartis is convinced that plant biotechnology will be fully accepted in the long term as consumers begin to see its benefits, which are not currently obvious. Consumers will eventually see benefits such as genetically enhanced foods that have greater nutritional value, that taste better or that are healthier and lower in cost [18].

4.1.2.2- Overall Attitude of the International Manufacturers

It is apparent from the information gathered from the five companies above that they are strong advocates of the benefits of genetically modified foods. They all are proud of their products and are willing to stand by them no matter how much controversy or criticism because they feel that they have made the right choice by choosing to research, produce and market these products.

They all recognize their responsibility as a producer to inform the public and provide current, up-to-date scientific-based knowledge that the public has access to. They also seem to realize that others have valid views that need to be heard. All five companies seem willing to engage in an open, civilized discussion that will help to have everyone's opinions recognized.

All of these companies also take testing of their products very seriously and respect the government's right to test products on behalf of the general consumer. It seems that the general consensus is that labeling needs to be clear and concise yet informative, but there is still debate as to how this should be done and how technical GM labeling should be and who should be responsible for it.

Most of these companies seem to aim at GM crops that are herbicide resistant so that the farmer can freely treat plants without harming their crops. The other major trend seems to be making the plants themselves insect resistant so that insecticides do not need to be used at all. Currently, the benefits seem to target the farmer, but these companies claim there will be benefits for the environment and consumers as well. The general skepticism about these claims may arise from the fact that consumers and environmental lobbyists have not yet seen these benefits because these are a little ways down the road.

It is clear that these companies are very confident in the power of biotechnology to be the scientific innovation of the future. They feel that it is not only going to affect the food industry but health care and other aspects of industry as well. There is no doubt that these and many other companies that are interested in biotechnology are confident that they have made the right decisions. However, there are still questions to be answered that are related to religious, moral and health issues, and the answers to these may never be found because these are not simple yes or no questions. It is reassuring to know that industry is not ignoring the opinion of the general consumer and for the most part is taking their concerns seriously. These companies make it clear that although they are obviously concerned with business, they are also aware of the effects their business has on the world around them. They demonstrate this by testing their products,

considering the issue of labeling and being willing to enter into dialogue with others of opposite opinion.

4.1.3 Danish Manufacturers

4.1.3.1 Attitudes and Practices of the Danish Manufacturers

Danisco

Danisco Sugar, previously under the name *De Danske Sukkerfabrikken* (Danish Sugar) has been manufacturing sugar in Denmark for 125 years. Danisco produces, develops and markets sugar and animal feed products, all of which are based upon the sugar beet as the only raw material. Danisco has factories in Nakskov, Nykobing, Gorlev and Assens. Their development division is in Nakskov and their head office is in Copenhagen. In 1989 *De Danske Spritfabrikket* (Danish Distillers), Danisco Limited and Danish Sugar merged into the group Danisco A/S. Later in that same year, Nykobing Sugar Refinery was acquired making Danish sugar the sole producer of sugar in Denmark. In 1991, Danish Sugar acquired a factory in Germany and in 1992 they acquired *Sockerbolaget* (The Sugar Company) in Sweden. The combination of the Danish and Swedish sugar industries made Danisco Sugar one of the largest sugar producers in Europe [19]. In addition to Danisco Sugar and Distillers, Danisco A/S has other branches such as Danisco Seed, Danisco Biotechnology, Danisco Food and Beverages and Danisco Ingredients.

Danisco's overall goal is to develop new products and processes, which can create added value for their customers while decreasing their impact on the environment. Danisco has been working on gene technology as a way to do this since the beginning of the 1980's in order to develop functional ingredients for the food industry. Danisco feels that it is necessary to use

gene technology to ensure their competitiveness in the global market. Their central reason for becoming involved in the technology was because they wanted to remain among the leading companies in plant breeding [20].

The research and development unit of Danisco Biotechnology, part of Danisco Ingredients, works on the development of genetically modified organisms (GMO's). Danisco is particularly interested in using the technology to make genetically modified sugar beets. They say that traditional breeding methods usually require 20 to 30 years of development work, but the need to reduce the use of pesticides on fields is so great that Danisco has chosen to use gene technology in its work to develop plant species that require fewer sprays of milder weed killers to control the weed problem. Danisco developed a Round-Up resistant sugar beet and field trials have been underway since 1990. These beets have been part of Danish and International field trials along with DLF-Trifolium, a major plant breeder and seed producer [20]. DLF-Trifolium is working with Danisco on a GM fodder beet as well; they are planning to market the seed in cooperation with Danisco. They not only work with DLF-Trifolium but they also work along with Monsanto and Novaris on the Sugar beet project. In addition to the Round Up resistant sugar beets, Danisco is researching rape seed and potatoes with higher starch content as well as ways to produce various enzymes using gene technology [21].

Danisco says that it is important to distinguish between refined products (sugar and enzymes) and crops (potatoes and tomatoes). Refined products cannot contain genetic material; this means that the beets grown from GM seed will produce sugar with the exact same chemical properties as traditional sugar [20]. Danisco says that it will not use products or processes if any reasonable doubts have been raised about their effect on the environment or human health. At no

time during the nine years that Danisco has carried out field trials with sugar beets has any doubt about their safety been raised [20].

Danisco wants to use products manufactured by means of genetic engineering, provided the authorities have approved them and that they are produced according to relevant legislation. Genetic Engineering may eventually involve Dansico Ingredients, Danisco Sugar and Danisco Foods and Beverages [21]. Parts of society, including Danisco, are very enthusiastic about this opportunity because genetic engineering is a tool that, if used consciously, can improve product quality, production, nutrition and may prevent environmental problems. Danisco says that when confronted with something new, there's always fear that something may go wrong. Because of this, they see it as an important task to help clarify all aspects of the technology. Danisco respects that consumers may be skeptical and hesitant about biotechnology, both consciously and unconsciously. Consumers are entitled to proper information about the debate on the advantages and disadvantages [21]. In its work with gene technology Danisco feels that it has always exhibited full openness and cooperated closely with the authorities. Danisco has always met any request for documentation or information [20]. They feel that by being open about their activities they will have a competitive advantage with consumers [21].

Danisco says that they thoroughly assess the attainable advantages and potential risks before starting each individual project. Danisco's attitude is that if there's any doubt whether something is safe, it is better not to do it [21]. Since laboratory tests began in the late 1980s they have had closed greenhouses and closed field trials. The first fully controlled, open field trial began in 1995 [20]. Danisco says that it will only use the technology responsibly, and they won't use processes or produce goods that may raise reasonable doubts about the effect on

people's health or that are meant to increase the use of pesticides. Danisco will not use genes isolated from people for any use [21].

Danisco's attitude toward genetic engineering is positive because both the company and society are given access to a number of advantages. They do not see any fundamental ethical problems in using genetic engineering to breed plants and microorganisms, but that does not mean that all uses are ethically acceptable. Genetic engineering must be used with care, consumers must feel safe about it and that is why Danisco will not push GM products on the market [21].

Danisco says that they will comply with all labeling rules, but they do not see a purpose in labeling products that are identical after the use of genetic engineering, and they do not advocate warning labels. They feel that the consumer needs more relevant and meaningful material than there is room for on a label. They feel that it is more important to inform the consumer of the quality of the product rather than the production methods. Danisco says that labeling only gives consumers a real choice if they understand its meaning and the background of the product. The question is how consumers can get the best information, which least nourishes unfounded myths. Danisco says that there may not seem to be any immediate advantages for consumers and they understand that this makes many people insecure, both as to the use of genetic engineering and the companies' motives. Danisco feels they can ease hesitation by informing the public about the background perspectives and safety of the technology. Danisco says that it has been informing the public of their activities for over 12 years through newspapers, electronic media, lectures, company visits and press conferences [21]. They do not publish all of their work due to research and business competition, but everything

they do has been approved by Danish authorities such as the Danish EPA and the Danish Environmental and Regional Planning committee of the Danish Parliament [21].

Danisco recognizes that there are environmental and health concerns surrounding the technology. They have a group environmental policy based on the International Chamber of Commerce (ICC) Business Charter for Sustainable Development. This requires that in cooperation with customers, efforts must be made to develop and improve the results of individual divisions in the environmental area. Danisco's environmental policy says that:

1) Danisco respects the fact that development, production and trade influence the environment.
2) They invest in developing environment-friendly products and processes by using cleaner technology.
3) They will by making regular technical improvements and providing training and motivation, create a safer environment for employees.
4) Danisco communicates its environmental objectives, initiatives and results internally and externally.

In order to limit impact on employees and the environment, Danisco continually tests new plants and processes and performs research on new products in dialogue with customers. They take this relationship very seriously when it comes to topics such as gene technology [20].

Danisco says that their genetic modification process is highly controlled in order not to affect the environment. They recognize the concern about genetic transfer among plants and that this could have an effect on biodiversity. They say that the sugar beet is bred in such a way that

there is little risk of it hybridizing with other crops because very few beets in the field bloom and spread pollen. Only a fraction of one percent of sugar beets develop seed before their second year, but beets are lifted in their first year so this is not an issue. Danisco is also a part of the GM rape project, the plant that is used to make vegetable oil. They know that compared to the sugar beet, rape plants are more capable of hybridizing with wild relatives, Danisco says that the solution to this is in varying the crops that a farmer grows through a calculated crop rotation [21].

Danisco recognized that antibiotic resistance was a real concern among many when it came to GM food products. In response to this Danisco researched and patented a way of doing genetic research that makes the use of antibiotics as a genetic marker unnecessary in 1991. Danisco not only did this because of the antibiotic resistance issue but because the use of antibiotic markers was inconvenient in the laboratory. The alternative used now is mannose and since the patenting of this procedure, laboratories all over the world have started to use it in their genetic research [21].

Not all of Danisco's branches are currently using biotechnology, for instance Danisco Foods finds that consumers do not feel safe where genetic engineering is concerned and they are not large enough, commercially or politically, to defend a choice to use the technology on their own. Also, Danisco Distillers would like to eventually use it but they do not have a direct use for it at the moment. They say that it would be useful if a GM yeast could be developed but until that time there is no reason for them to look into using GMO's in everyday production.

Overall, Danisco feels that gene technology is essential to ensure that they are competitive in the world market for years to come. They recognize that there is hesitation among the general public concerning the technology, but they feel that the best way to combat

this is through honest, accurate information. Aksel Buchter-Larsen, regulatory affairs manager at Danisco Biotechnology says:

> "Fundamentally, genetic technology is a continuation of the breeding, crossing and selection work carried out since humankind began farming the land. But the technology has been refined by genetic engineering so that by moving genes we can work more precisely and create a new solution to well-known problems much faster than before. This goes for quality, nutrition, the environment and finances [21]."

Dansk Industri (Danish Industry)

Dansk Industri (DI) is the main umbrella business organization in Denmark with over 6,000 members. They act as a voice for the industrial population, but they also have an obligation to inform industry of technologies and policies that affect them [22]. Dansk Industri has 57 industrial and employer's associations totalling 5,800 members representing the Danish manufacturing industry. They protect the interests of management and owners in a wide array of matters affecting competitiveness and profitability. On behalf of manufacturers DI seeks to have influence on regulations and laws drawn up by government, parliament, counties, municipalities and other Danish authorities. DI also negotiates with labor organizations and unions on behalf of its members. DI holds a lot of political influence and it is their job to voice objections and support to pending legislation that affects the Danish industrial population [23].

Dansk Industri has set up a special committee that works specifically with the food and drink industry called the Food and Drink Federation. As part of its work the Food and Drink Federation voices the point of view of industry on genetically modified food. Overall, Dansk

Industri that the food and drink industry would like to have a discussion that does not put so many demands on the technology. They also feel that the Ethical Guidelines that have been set up by the Ministry of Business are too strict and do not leave any room for growth of the technology. They say that they are willing to discuss with those groups that adhere to the Precautionary Principle, but they must define its uses more in terms of how industry can use it during everyday production [22].

Dansk Industri does not think that the technology can be stopped. They realize that right now the products are beneficial for the farmer but they feel that by being beneficial for the farmer they are beneficial for the consumer as well. Dansk Industri also does not understand why genetic modification cannot be considered an extent of traditional breeding [22].

Dansk Industri is supportive of Danisco and genetic modification of food and would be supportive of any of their other members that decided to use gene technology. They agree that GM products should be segregated and although they are in favor of labeling, they are against negative labeling such as a label that says that a product does not contain genetic modification. They feel that labeling should inform the consumer. They suggest having a label say something to the affect that a product is "Bred with genetic modification." They also agree that products such as meat and milk that come from animals that have been fed with GM feed should be labeled. It is most important that a label does not assume any public knowledge and that it cannot be too extensive and overwhelm the consumer [22].

Dansk Industi feels that there is going to have to be a shift in the products from products that mainly benefit the farmer to products that will benefit the consumer in order for general acceptance to take place. Most of all, they do not want to lose the technology, but they agree with many other groups that reasonable restrictions must be placed on the use of genetic

manipulation. Dansk Industri knows that it is important to calculate the benefits and the risks of the technology, but the benefits and risks of doing something with the technology and NOT doing anything with the technology must be calculated as well [22].

4.1.3.2- Overall Attitude of the Danish Manufacturers

From the information supplied by Danisco and Dansk Industri it is obvious that the Danish Industrial population is in favor of the use of gene technology in food production. Danisco feels that it is imperative that they research and develop this technology in order for them to remain competitive in the world market. Danisco also sees that it will provide a way for them to create foods with added value for their customers while decreasing their impact on the environment. Danisco recognizes that there are environmental and possibly health implications to the technology and they feel that the best way to deal with these implications is to be as safe as possible when developing every process or product and stop further development if any concrete risks are found. They agree that labeling and approval of all products by the proper authorities are essential. They feel that it is most important that they are open and honest about all of their activities and think that this practice will award them the trust and confidence of the consumer in the long run.

Dansk Industri, being a political advocate and supporter of the Danish food industry is a good indication of the attitude of the industry in general. They are supporters of the technology and support Danisco in their efforts to promote the technology, as Danisco is one of its members. Overall, they think that it would be a shame to lose the technology completely but agree there must be restrictions on its use. They do not think that the technology can be stopped, but they think that consumers will eventually see products that will directly benefit

them leading to a general acceptance of the technology. Their job is to represent the general attitude of industry and though industry sees that there are risks to the use of gene technology, they feel that the risks of not using the technology should also be thought through. They think that it would be a shame to lose a technology that could benefit the environment, agriculture and society in general.

The food industry in Denmark is very concerned with the attitudes of the consumer. They seem to be very in touch with the fact that the general consumer population is skeptical about their motives in using the technology and that the consumer is the limiting factor as to whether or not these products get put on the market. They understand that they cannot force this technology on the general population, but they are trying the best they can to promote it because they see uses that could be beneficial to society in many ways. In their eyes, as long as they are aware of the risks involved, they can try to control the technology in the laboratory and in the fields in order to prevent speculation from ever becoming reality making this a truly worthwhile technology for society to embrace.

4.2 Farmers

4.2.1 U.S. Farmers

The United States is the leading producer of genetically modified food products in the world, therefore the U.S. farmers are a very important part of this debate. Genetically modified crops were introduced in the early 1990's with little resistance. This section will explore why this happened and provide miscellaneous other facts about farming in the United States.

"U.S. farmers embrace technology very quickly, we want the newest thing on the market, the latest thing . . .I think that we're just finding out that maybe this technology wasn't researched as well as it could have been." This is a quote from Doug Doughty [24], who is a genetically modified seed dealer and farmer. This summarizes the situation in the early 1990's. The farmers in the United States did indeed embrace the technology and believed what the companies told them. The technology had mixed results, though. They were promised higher yields and lower expenses on pesticides. The promise, however, was based on theory and not on fact. Traditionally, companies in the United States introduce a new variety, and crop specialists, based out of each state in the union, field test the new product for three to five years [25]. The crop specialists then are able to produce unbiased information to the farmers in their state. This process was largely bypassed with genetically modified seed. The agriculture companies would go directly to the farmers with contracts for the genetically modified crops. The farmers bought into the promises of higher yields and lower costs and consequently began purchasing the seed at high rates. In many cases farmers did get higher yields, and this boosted sales for the companies however, not all farmers had success with the new seeds. Bill Christison, President of the U.S. National Family Farm Coalition said, "The promise was that you could use less chemicals and produce a greater yield. But let me tell you none of this is true [25]." Nonetheless, in the two

years from mid-1997 to mid-1999 the amount of genetically modified crops in the U.S. increased by a factor of six to over 20 million hectares (50 million acres) [24].

Now, some farmers are taking a second look at GM crops because Europe isn't buying them anymore and they have not performed as well as predicted in many cases. Two separate studies have shown that Monsanto's biggest seller, Roundup Ready soybeans, actually have a lower yield than that of conventional soybeans [26, 27]. It is also fact that farmers *have* benefited from planting GM crops, it is just not a 100% success rate. Increased yields and reduced labor and chemical costs will improve profits for farmers as long as there is a market for the product. Some farmers have reaped these rewards and are advocates for the technology. It is the statement 'as long as there is a market' that is most pertinent to farmers currently. As an example, the National Corn Growers Association reported the sale of 70 million bushels of corn in 1997. This plummeted to just 3 million bushels in 1998 because the U.S. crops contained genetically modified corn [28]. Because of this drastic drop in sales, two of the world's leading corn processors, Archer Daniels Midland Co. and A.E. Staley Manufacturing Co., announced in April of 1999 that they would not buy American corn unless it was accepted in European markets. This has an obvious impact. American corn growers who plant GM corn, and used to sell it to one of these two companies, no longer can. They must either find someone else who's buying, which is difficult, or switch back to conventional corn. "Farmers cannot afford this uncertainty in the market," said Gary Goldberg, "The customer is speaking, loud and clear [29]." Mr. Goldberg is the head of the American Corn Growers Association. An Illinois farmer and seed dealer named Steve Mattis put it this way, "I've been a seed dealer for Monsanto for 18 years and this is the year we are going to have to part ways. They've forgotten that they have to

serve farmers. I don't think they care who we've got to grow for. They're just concerned with making a fast buck [28]."

A Reuters straw poll was conducted in January 2000 [30]. It asked 400 farmers of their genetically modified planting intentions for the coming season and compared that with what they had planted in 1999. According to responses, 16% fewer hectares of GM crops would be planted in 2000. If projections are correct for 2000, worldwide plantings of genetically engineered crops will drop from over 40 million hectares (98.8 million acres) in 1999 to just 30 million hectares (74.1 million acres) [29]. The media has frequently pointed this out, and reasoned that farmers are afraid of or against the technology. The real reason for the decline in production is the decline in worldwide acceptance of GM food, primarily in Europe. Farmers are afraid they will not be able to make a living (market acceptance), not necessarily of risks associated with GM crops.

In 1999, 39.9 million hectares (98.6 million acres) of genetically engineered crops were harvested in the United States. This made up a third of the soybean crop, a quarter of the corn crop, and a third of the national cotton crop as well [31]. This is a large percentage of the total crop for products that are losing market acceptance around the globe. Other countries are taking advantage of this. Brazil, the second largest soybean producer in the world at the time, announced in early 1999 that they would not grow any genetically modified soybeans [32]. This is expected to boost their sales. Australia's food exports are at an all-time high as well.

Organic farming is a growing industry in the U.S., this is largely due to the GM food debate. Organic farming only accounts for one fifth of one percent of U.S. farmland and only one percent of retail sales [33]. However, the fastest growing segment of the U.S. food industry today is the sale of organic produce. "It's not a niche market anymore in terms of consumer interest," said

Harvey Hartman, a market researcher and retail industry consultant in Seattle. Surveys by his company, the Hartman Group, found last fall that 90 percent of American consumers were either buying organic products or considering doing so, up from 60 percent two years earlier [33]. This year, for the first time, the Agriculture Department has budgeted $5.5 million specifically for organics research. Barnaby J. Feder wrote, "Organic farmers are getting a boost from having what appears to be the perfect public enemy: genetic engineering," in a 9 April 2000 New York Times article [33]. It is not accurate to state that all organic farmers are against gene technology, though. Some are for it if it can potentially provide gains for sustainable farming (there is nothing like this yet). Many organic farmers are most concerned with the issue of sustainability. "Among organic farmers the views about transgenics range from 'no, never' to 'not yet,' " said Brian Baker, policy director of the Organic Material Review Institute, a nonprofit group in Eugene, Ore., that rates the acceptability of materials for organic farming. Organic farming, as stated above, is a very small segment of the U.S. farming industry though.

4.2.2 Danish Farmers

Danish Farmers do not plant any GM crops that enter the market. The few GM crops planted in Denmark have been for testing purposes only. However, farmers are preparing for the day when they are allowed to plant these crops, and in some cases pushing for permission to do so. Bruno Nielsen, an advisor in the Department of Research and Food Legislation in the Danish Agricultural Council stated that Danish farmers are just like society in general-some are advocates for the technology, while others oppose it and the rest are somewhere in the middle [34]. Farmers make up 3% of Denmark's population.

The Danish Agricultural Council, an umbrella organization, includes all of the farmers in Denmark. This means that all pig, dairy, poultry and crop farmers are members of the organization. The Agricultural Council is financed 100% by their members. That said, the Agricultural Council has an official position paper on the GM issue. It was formed in February of 2000. The following is a brief summary of the contents of this policy paper:

- They believe gene technology is a valuable technology that can create benefits for farmers and consumers.
- They do not want to use the technology if there is a chance that it is dangerous to the environment or to people.
- They are in favor of the 1% threshold for labeling and for labeling non-GM foods.
- They believe that pre-market approval is very important. This is approval for environmental and health risks only, not for agricultural problems.
- They believe GM crops should be treated on an individual basis, not just as using the technology or not (discussion of a new seed should begin with what it does, its benefits, and not with "Is it GM or not?")
- They do not want any GM in organic farming, but are willing to consider technology that solves the problems organic farming creates.
- They believe there should be some form of liability for GM products if they create environmental or health problems.
- It also contained a code of practice for farmers wishing to plant GM crops. The following are some of the ideas the code consists of:
    - Farmer must make sure there is a market for the crop
    - Farmers must keep detailed records of plantings

- A variable barrier (depending on type of crop) must be between GM and non-GM crops
- Farmers must inform buyers of their crops that they are GM
- Cross pollination must be prevented at all costs
- Farm machinery must be thoroughly cleaned if used on different crops

This is the Danish Agricultural Council's official policy. It is important to add that their goal is to participate in the public debate, not to promote gene technology [34].

Pigs make up Denmark's largest agricultural section. Denmark is the world's largest exporter of pork and their pigs have the highest veterinary standards in the world. In total, a third of the country's agricultural revenue is derived from pigs [36]. This makes the Danske Slagterier, a member of the Agricultural Council that deals exclusively with pigs, very important. The GM fodder debate is the only one that enters discussion at Danske Slagterier. Currently, it is a cost issue for them. There are two main types of fodder for pigs: maize and soya. Soya (imported from the U.S., Brazil, or Argentina [36] is a cheaper option, but it is unavoidable that some of it will be GM. Many Danish farmers opt for the soya to increase profits. The organic issue does not come into play with pigs either. Organic pig farming is 75-100% more expensive [34], and consequently only 1% of Danish pork is produced organically [37]. Thus, many of Denmark's pigs are fed with GM fodder. However, this has not been a significant issue as yet. The Slagterier is still selling their exports and profits are higher all around because the cheaper imported soya is used for fodder. Until this changes, Danish pigs will continue to be fed GM fodder [36].

Organic farming is growing rapidly in Denmark. Table 1 illustrates this. The trend is also, more and more, spreading to larger farming operations. These large operations are converting because of the expanding market and potential for higher profits. This can be seen by taking a closer look at the information presented in Table 1. In 1993 there were 32 fewer organic farms in Denmark than in 1991, but there was a total of 2,130 ha more area covered by these farms. It is shown graphically in Figure 3 that over the past ten years the average size of organic farms has been steadily increasing.

	1988	1989	1991	1993	1995	1997	1999
# of Farms	219	401	672	640	1,050	1,617	3,000
Total ha	5,881	9,553	17,963	20,093	40,884	64,366	150,000
Total acres	14,532	23,606	44,388	49,651	101,027	159,052	370,658

Table 1: Number of and Area Covered by Organic Farms in Denmark [37]

The 150,000 hectares covered by organic farms in 1999 made up about 5.5% of the total farming area in Denmark [37].

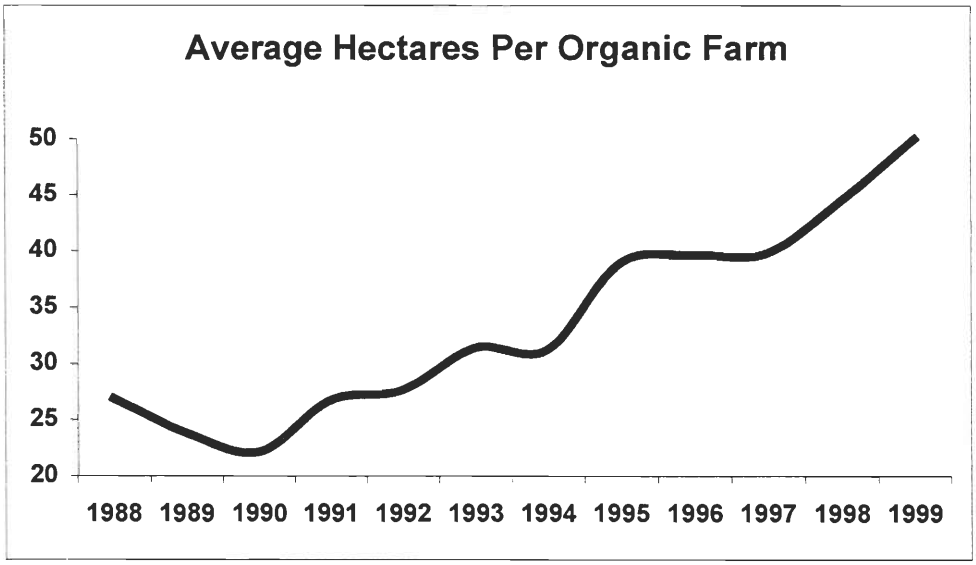

Fig. 3: Average Hectares Per Organic Farm

This growth is largely due to increased consumer demand. Organic milk has a 20% market share in Denmark, potatoes 7%, whole meal flour 22%, eggs 13%, and carrots 11% [37]. These numbers are very high in comparison to the rest of the world. This illustrates the power of the consumer in Denmark. Numbers were not provided for the percentage of total retail sales organic foods obtain. Three quarters of Danish consumers have purchased organic food in the past six months and 1-2% purchase organics exclusively (this study was conducted in September 1999) [37].

Section 6.2 will bring to light the differences that exist between farmers in the two countries.

4.3 Supermarkets

4.3.1 U.S. Supermarkets

The food store chains that were contacted would not or did not supply any information. Therefore, information that could be found using other sources will be reported here. Thus far, in the U.S., the debate is only having an effect on specialty supermarkets, ones that specialize in organic or healthy foods for instance. Two examples are given below of chains that have banned them from their own products.

In late 1999, Whole Foods Market Inc. banned the use of genetically modified foods in its store brand products [38]. Whole Foods is based out of Austin, Texas and they have 103 stores nationwide. At the same time their chief national competitor, Wild Oats Markets, decided to do the same thing. Wild Oats is based in Denver, Colorado and includes 111 stores. It must be pointed out that both of these chains are specialty food stores that sell a lot of health foods and a wide variety of organic foods. They are not general supermarkets. If this were to spread to general supermarket chains, it could have a serious impact on American agriculture. This is not probable in the near future, however. The growing consumer concern is beginning to have small effects on the general supermarkets, though. Some of the larger supermarket chains are providing customers with more organic foods (mostly produce) [33]. The European market has already shrunk considerably and America's farmers cannot afford to grow GM foods if no one will accept them. As of right now, there are no large American supermarket chains with a specific policy regarding GM food.

"We have people coming in every day, asking about GM food, looking for information," said Harry Day, vice-president of Wild Oats Markets. "It's a very complex issue that a lot of consumers don't understand [39]." The situation has been unsatisfactory, with most

supermarkets relying on their telephone help-lines to answer customers' questions, but with the employees on the help lines ill-equipped to give accurate information [40].

4.3.2 Danish Supermarkets

There are a number of supermarkets in Denmark. The majority of them, however, are organized under a select few organizations. One of these organizations is FDB. They have the largest market share at 35% in Denmark and they are a consumer co-operative. Its members, who elect representatives from every part of Denmark, govern the company. There are 1.3 million members in FDB, which is about a quarter of the entire population of Denmark. The next largest organization is Dansk Supermarked; they are a privately owned and operated organization. There are also a number of smaller regional organizations.

Shortly after suppliers of soya claimed they could not separate GM and non-GM soya before exporting it, all of the food store organizations in Denmark, save one (Aldi-a German based company), decided to work together on the problems the issue would create [41]. This is the opposite of what happened in the UK. Supermarkets in Great Britain are using the debate as ammunition for ad campaigns [41]. They decided that working together would be the best way to serve the consumer, and that the consumer will become better informed than if companies are utilizing the issue to increase profits. FDB stated that informing the consumer is their primary goal, and after informing them, offering them a choice of what to buy [41]. This is the policy of all supermarkets in Denmark (save Aldi); consensus has been reached as a result of working together. The supermarkets would provide this choice by making all of their own products GM-free, but also stocking their shelves with outside private products that may contain GMO's. The companies also believe that the legislation that is now in place is unsatisfactory. Stronger

legislation would provide their consumers with better and more complete information. For example, right now it is impossible to make a guarantee to the consumer that meat products are GM-free. There is no legislation in place to provide a tracing method all the way back to the animals feed, which could have been GM.

It must be made clear that Danish supermarkets are not against gene technology. Their priority is their customers, the consumers. This is very similar to the view of the Danish Consumer Council, of which they are members.

4.4 Consumers

4.4.1 U.S. Consumers

The survey was a large part of the consumer research conducted for the project.

The following nine questions made up the survey.

1) Were you aware of the existence of Genetically Modified Food?

2) Do you feel that food labels should distinguish between Genetically Modified and Non-Genetically Modified Food?

3) If food labels were to distinguish between Genetically Modified and Non-Genetically Modified Food would you specifically look for products that did **NOT** contain Genetically Modified Food when you shop?

4) Would you pay more money for food that is **NOT** genetically modified?

5) There are health risks involved with eating Genetically Modified Food.

Strongly Disagree Disagree Neutral Agree Strongly Agree

6) There are health risks involved in eating meat that was fed with genetically modified fodder.

Strongly Disagree Disagree Neutral Agree Strongly Agree

7) Are you concerned with possible changes in the ecosystem/environment due to Genetically Modified Food? (For instance, are you concerned with how this might affect the food chain?)

8) How many news stories have you seen, heard or read in the last 6 months that dealt with the issue of Genetically Modified Food?

0 1-5 6-10 10+

9) Are you interested in finding out more about Genetically Modified Food?

Note: question six was determined to be worded poorly and the results for this question will not be used in this section. If interested, the reader can still find the results of question six in Appendix A.

The survey was distributed via e-mail to the entire WPI campus (students and faculty) as well as to friends and family. They were asked to pass the word on as well. A copy of the survey is provided in Appendix A. Nearly 700 submittals have been received and tabulated. The following paragraphs and figures will summarize the results of the survey. The complete results are presented demographically in Appendix A. The majority of the comparisons made in this section are made between students and adults. The respondents in the 18 to 23 year old age group are considered students and all of the older groups were combined to create the "adult" group. This is, however, not the case for the Denmark survey because of differences in the higher education system in the two countries, as will be shown later.

The survey yielded significant differences on certain topics between males and females and between students and adults. The largest of these differences was seen on question eight. This asked how many news stories on genetically modified foods the person had seen, heard, or read in the past six months. There was a large difference between students and adults. This is presented below (Figs. 4, 5).

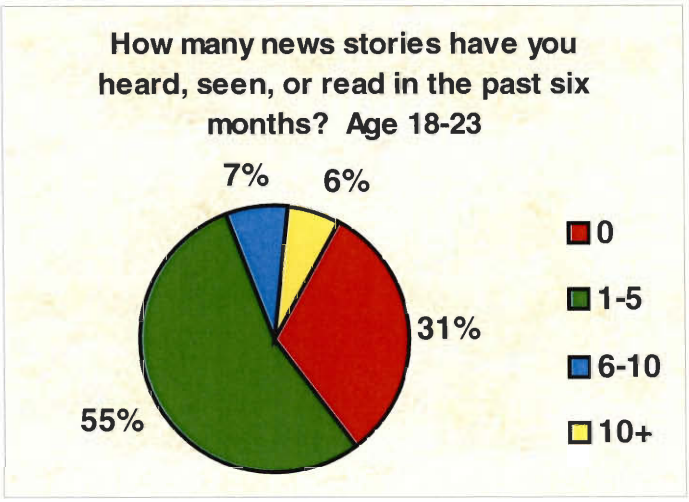

Fig. 4: Question 8 (U.S. Students)
Notice the large percentage of respondents who have not seen a single news story.

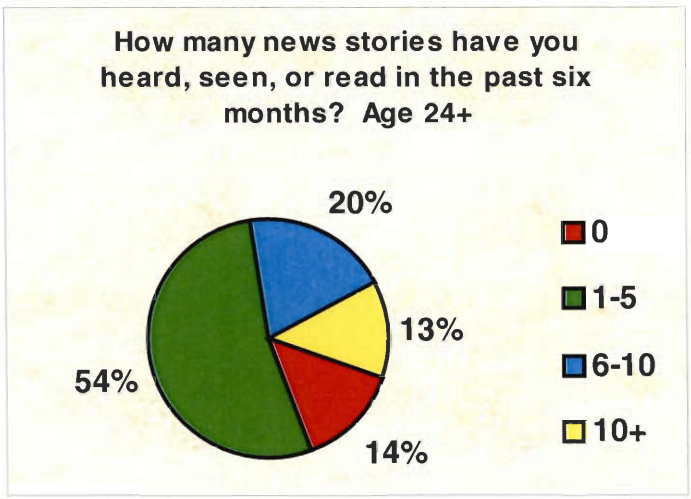

Fig. 5: Question 8 (U.S. Adults)
The older age group appears to be more informed

Only 14% of adults have not seen any news stories on the topic while a much larger 31% of students have not seen a single one. To make up for this difference the older demographic also had a higher percentage of consumers that had seen 6-10 news stories and more than 10

stories. The larger discrepancy coming with persons seeing six to ten stories, 20% of adults answered this way while only 7% of those between 18 and 23 did. This shows that adults are more informed on the topic than college students are, as news stories are the primary way in which the public would learn about a topic of this type, unless they are in the biotechnology field themselves. This is important to note because the rest of the results must be viewed with this in mind. Based on the results to question eight, the adult population is more informed than their younger counterparts. If one is more informed, one is more likely to have submitted an educated opinion on the topic.

There were six yes/no/no opinion questions on the survey. There were differences between the two age groups on all of these questions. The totals for the two age groups can be seen below (Figs. 5, 6).

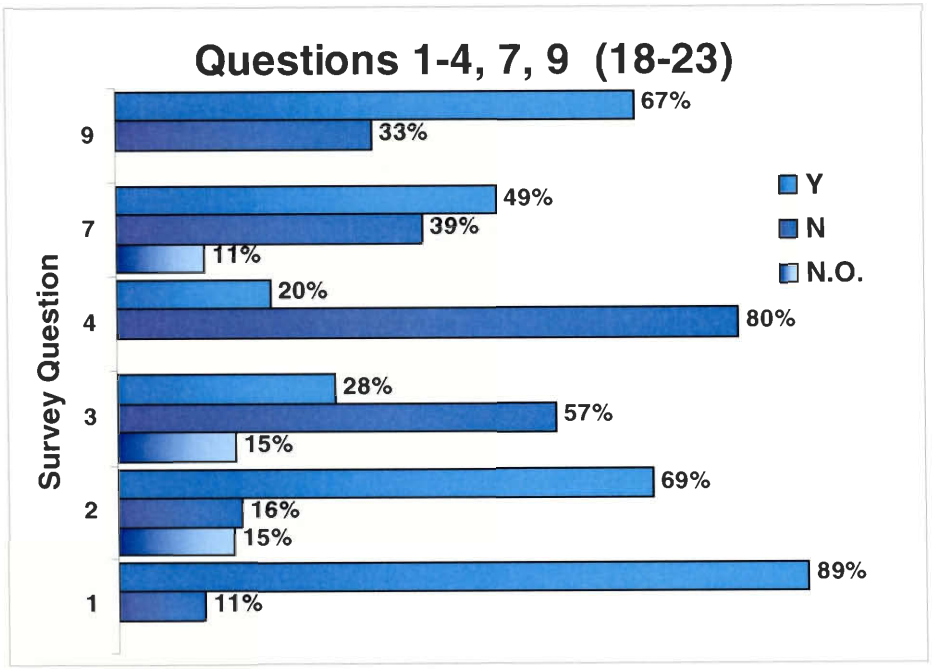

Fig. 6: Y/N/N.O. (Students)
The respondent was asked a yes or no question and was given the option of answering "no opinion" as well.

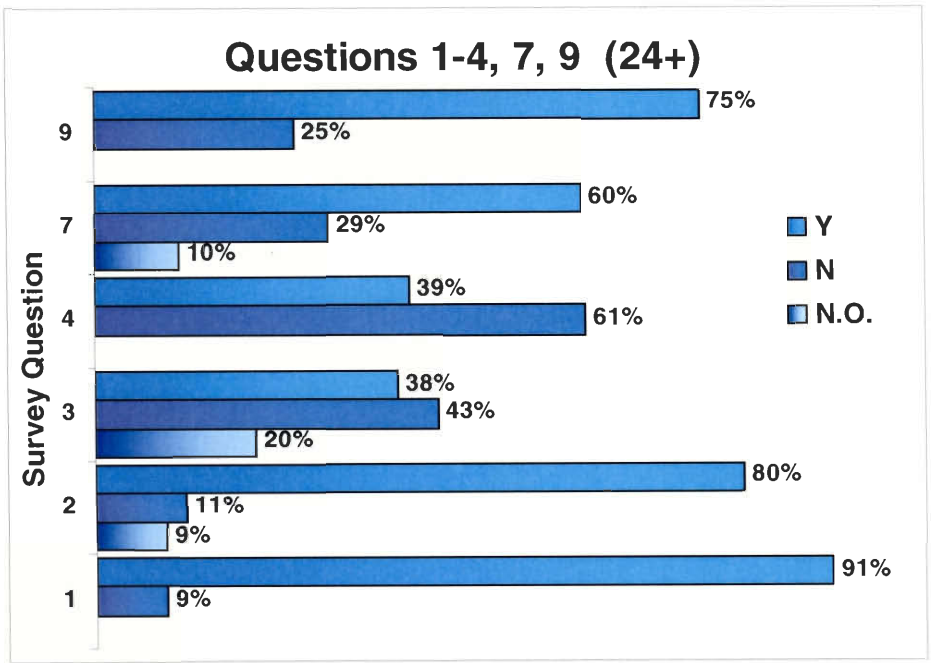

Fig. 7: Y/N/N.O. (Adults)
The respondent was asked a yes or no question and was given the option of answering "no opinion" as well.

The largest discrepancy appeared on question four, which asks the consumer if he/she would pay more for food that is not genetically modified. Only 20% of college students would pay more, but nearly twice as many older adults (39%) would be willing to pay more for natural foods. Question two asks the consumer if he/she would like to see labeling on genetically modified products. Eighty percent adults answered yes (86% of women), while only 69% of college students did the same. The same question was asked in a Time magazine poll in January 1999 and in an MSNBC poll in January 2000. Both of these polls yielded that 81% of respondents (Americans) wanted to see labeling on GM foods [31]. This is nearly the same result that was received for respondents over 23 on question two. Question three asks the respondent if he/she would specifically look for non-GM foods while shopping. College students answered no 57% of the time and only 42% of the older demographic answered no. These three questions, two through four, all address shoppers. The difference of the answers between the two age groups can be attributed to the fact that many college students still have not become serious food consumers (i.e. many students do not shop for themselves yet, food is still provided for them). Therefore, the results for the 24 and above age group should be taken more seriously.

Question seven asks the respondent if he/she believes that genetically modified food will have an affect on the ecosystem/environment. One in nine of all respondents had no opinion on the subject. The remaining results demonstrate a difference between the two age groups. For adults over 23, 60% answered yes and 29% no. Only 49% of college students answered yes and 39% answered no.

The following is a poll conducted by Time magazine [42]; it shows that 64% of consumers are at least a little concerned about eating GM foods.

More and more food is being produced from plants and animals that have been genetically modified. Are you concerned about consuming meals made from such ingredients?

Fig. 8: Time magazine poll [42]
This was an online poll conducted by Time Magazine.

Question five poses a similar question to that of the above poll. It made a statement to the reader and asked the respondent if he/she agreed, disagreed, or was neutral on the subject. Question five stated "There are health risks involved with eating genetically modified foods." The survey results for this question are presented graphically below (Figs. 8, 9). There is a significant difference between males and females of all ages. Of those who are not neutral, more males disagree or strongly disagree than agree with the statement and females have the opposite opinion.

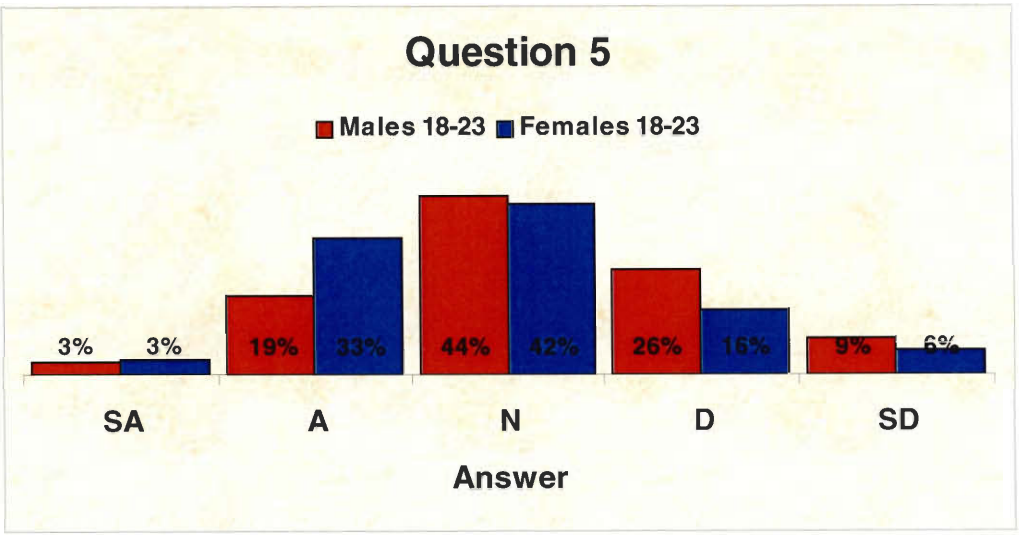

Fig. 9: Question 5 (Age 18-23)
Notice the difference of opinion between the sexes.

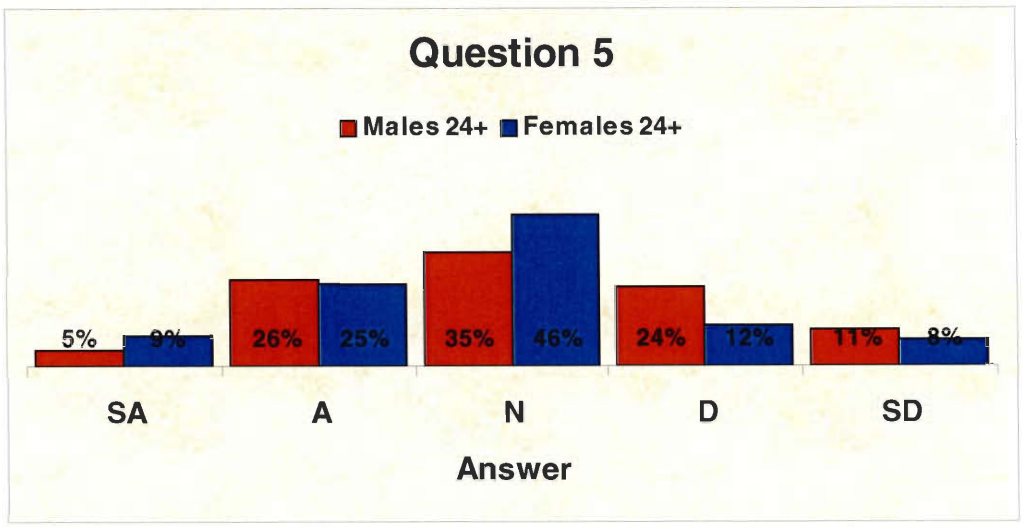

Fig. 10: Question 5 (Age 24+)
There is a difference of opinion between the sexes here as well,
But it is not as pronounced as above.

In recent months, the overall consumer awareness of this issue has increased in the United States. This is due to increased media coverage. In turn, the increased media coverage is largely due to the effect that Europeans are having on American farmers; Europe isn't buying American crops that have been genetically engineered. The media has the responsibility to educate and inform the American public on the topic. The public must be aware of the benefits

and the risks involved with GM foods. Informed choice by consumers will protect the integrity of the biotechnology and food industries and maintain confidence in the American food supply [43].

4.4.2 Danish Consumers

The Danish survey was distributed via e-mail to approximately 2500 students at DTU (Danish Technical University). These students were also asked to pass it on to friends and family. There were about 350 submittals in the three weeks that it was online (4/4/00-25/4/00). On top of this, a personal survey was conducted in which the exact same survey was given to passengers riding on trains. Seventy submittals were received using this method. Results for each survey are provided in Appendix A, in which they are broken down demographically. One purpose of conducting the personal survey was to attempt to validate the responses received in the e-mail survey, as the population sample from the train is considered more accurate than the e-mail sample. In the following paragraphs, there will be comparisons made between the two surveys as well as between different demographics in each. The comparisons made between the U.S. and Danish survey are saved for the comparison section (6.4).

There were three questions added to the Denmark survey at the request of NOAH. The results for these questions and the questions themselves can be found in Appendix A. They will not be discussed in this or any other section because they are not a part of the comparison that is the overall goal of this project. Also note that question six was determined to be worded poorly and the results for this question will not be used in this section. If interested, the reader can still find the results of question six in Appendix A.

The survey did yield differences between the age groups, but also many more similarities than were seen in the U.S. results.

Question one asked the respondent if he/she was aware of the existence of genetically modified food. The response to this question was nearly unanimous. There were three submittals in the e-mail survey that answered 'no', however, these submittals had no credibility

as all three respondents answered question 8 (How many news stories have you heard, seen, or read in the past six months?) with '10+.' It is hard to believe that a respondent can see more than ten news stories on a topic and not be aware of its existence. Therefore, these three submittals were thrown out. One respondent out of the 70 from the train survey answered 'no.' The end result of this is that one individual out of the 420 who took the survey answered 'no.'

Question two asked the respondent if they feel that labels should distinguish GM from non-GM food. As can be seen in Table 2 below, the results of the separate surveys were nearly identical.

Question 2			
	Y	N	N.O.
Students (E)	88%	9%	3%
Students (T)	92%	3%	5%
Adults (E)	90%	6%	3%
Adults (T)	88%	6%	6%

Table 2: Results of Question 2 in the Denmark Survey
The E and T represent the E-mail and Train surveys
N.O.=No Opinion

All age groups agree on this issue and in a vast majority.

Question seven omitted similar results. It asked the respondent if he/she was concerned with possible changes in the environment/ecosystem due to GM foods. The results for this question are presented below in Table 3.

Question 7			
	Y	N	N.O.
Students (E)	90%	8%	2%
Students (T)	89%	8%	3%
Adults (E)	90%	3%	6%
Adults (T)	91%	3%	6%

Table 3: Results of Question 7 in the Denmark Survey
The E and T represent the E-mail and Train surveys
N.O.=No Opinion

The difference between the train and e-mail surveys for both age groups is a single percentage point. The results for both of these questions, two and seven, are so similar that a stronger argument can be made that it is representative of the population.

Question eight, as mentioned above, asks the respondent how many news stories he/she has heard, seen, or read in the past six months. There was a significant difference between students and adults on this question. Figures 11 and 12 illustrate this below using the results of the e-mail survey. 63% of adults surveyed answered that they had seen more than ten news stories in the past six months. This is compared to only 45% of students. The discrepancy was even larger for those answering '1-5.' Students answered this way 36% of the time as compared to 11% of adults. This implies that adults, as a whole, are more informed on the issue. The results of the train survey for adults was very similar (Train-64%,24%,12%; Email-63%,26%,11%; for '10+','6-10', and '1-5' respectively). This was not the case for students however.

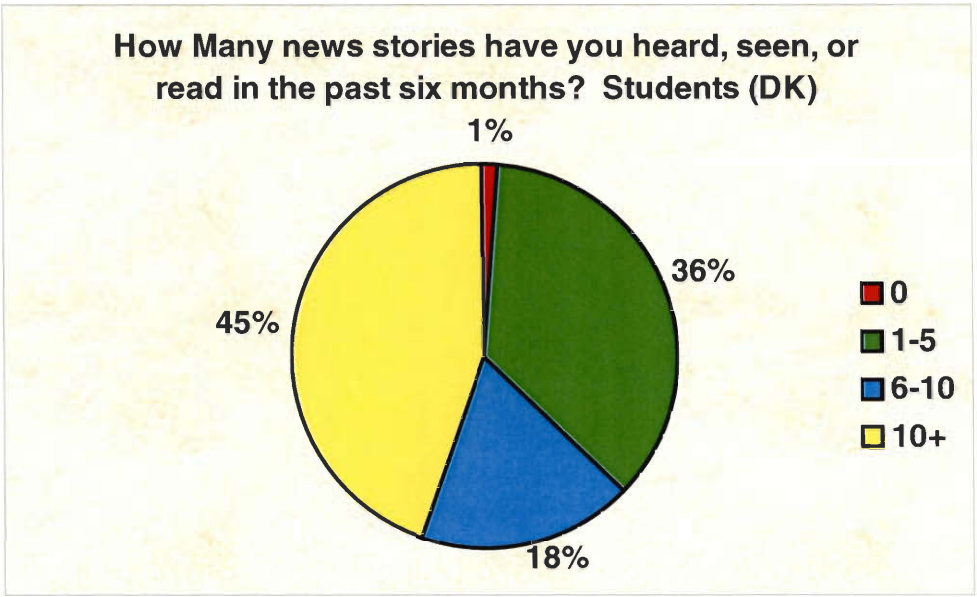

Fig. 11: Question 8 (Danish Students) – E-mail only
A larger portion of the student population has seen only a few news stories

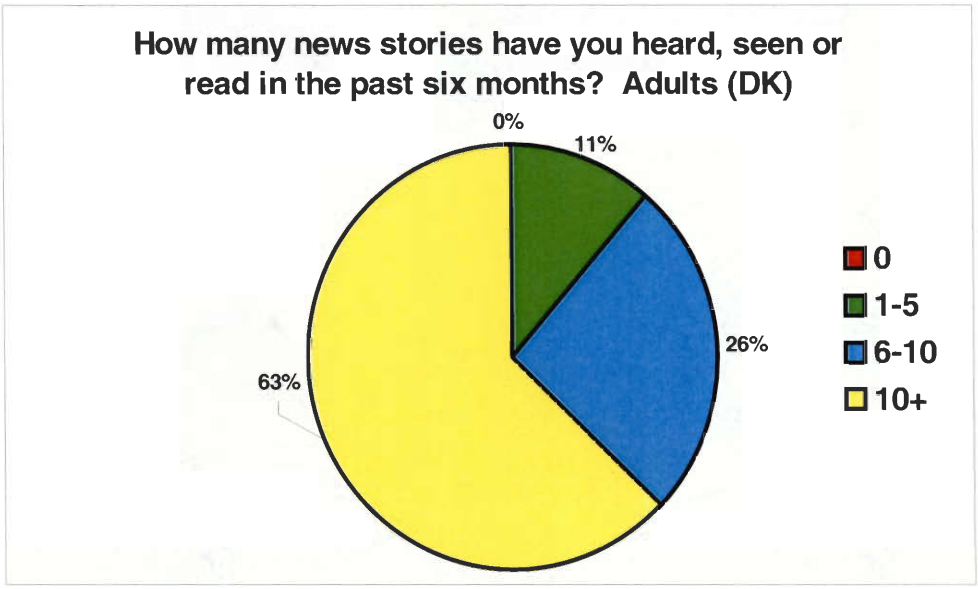

Fig. 12: Question 8 (Danish Adults) – E-mail only
Notice the fact that the majority of the adult population has seen more than ten news stories

Questions three and four concern shopping. Three asks the respondent if they would specifically look for non-GM food if foods were labeled. Four asks if the consumer would pay more for food that is non-GM. These two questions produced large differences between the sexes and slightly smaller ones between the two age groups. This is shown in Tables 4 and 5. The adult portion of this was tabulated by combining the e-mail and train surveys to acquire a larger sample size. The student portion uses just the e-mail results because it is already a significant sample size.

Question 3			
Total Adults	**Y**	**N**	**N.O.**
M (56)	59%	23%	18%
F (39)	77%	3%	21%
Students			
M (177)	45%	38%	18%
F (103)	59%	25%	16%

Table 4: Question 3 – Denmark

Question 4		
Total Adults	**Y**	**N**
M (56)	64%	36%
F (36)	81%	19%
Students		
M (177)	51%	49%
F (103)	66%	34%

Table 5: Question 4 – Denmark

The differences vary from 13 to 20% for all comparisons:
Males to females and students to adults
Sample size is noted in parentheses

These results imply that females are either more conscious or more concerned shoppers than males are. The same can be said of adults as compared to students. The minimum discrepancy, excluding those who answered 'no opinion' on question 3, was 13% for all of the above comparisons. These results are admittedly not as strong as the above ones are. However, the results do lead to an interesting conclusion. Females do more grocery shopping than males, and adults do more than college students. It is these two groups that are more willing to pay extra, and more likely to specifically look for non-GM food. Also, an answer of 'no' to either

question implies neutrality towards (an "I don't care" attitude) or support of the technology. Therefore, it is likely that a larger percentage of shoppers are against the technology than the rest of the general population.

Question five made the statement – there are health risks involved with eating genetically modified food. The respondent was given was given the choice of answering agree, disagree, neutral, or strongly disagree and agree. There ended up being a large difference between the two age groups on the question (see Figure 13).

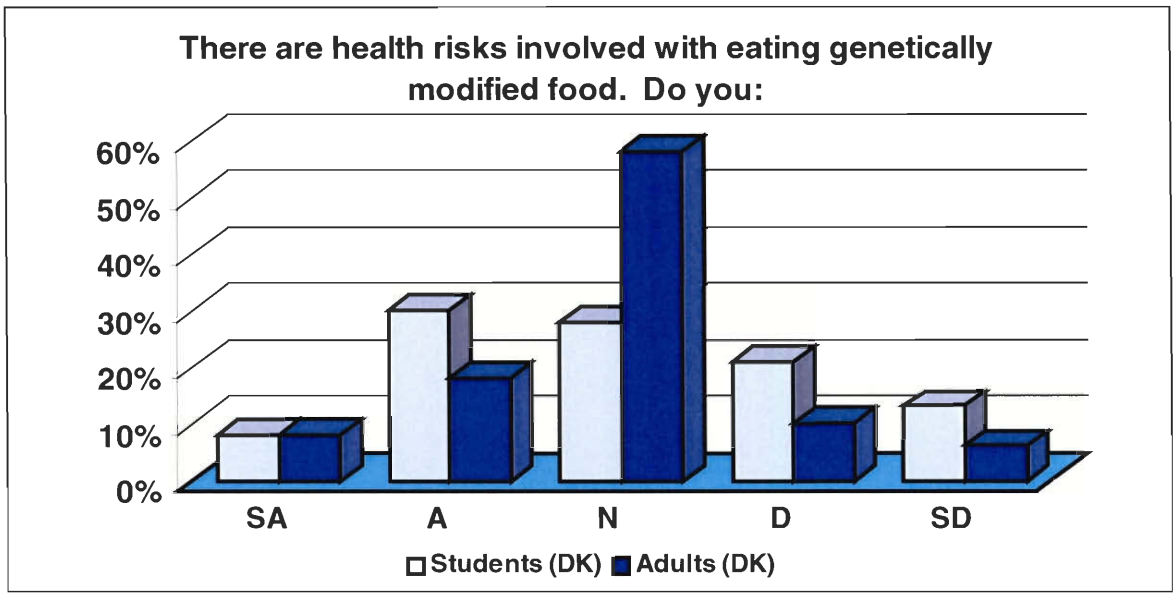

Fig. 13: Question 5 – Denmark
Notice the overwhelming neutrality displayed by the adult respondents

The most significant difference is in the amount of respondents who answered 'neutral' on the question. 58% of adults answered this way while only 30% of students did the same. This is interesting because the more informed of the two groups is less opinionated on the subject of health risks. Both groups are similar in that slightly more respondents agree or strongly agree than disagree or strongly disagree.

The consumers in Denmark are well informed as a whole on the issue. Media coverage is quite significant. Nonetheless, all of the players in the Danish debate believe the consumer needs to be more informed. This includes the Danish Consumer Council, FDB, Dansk Industri, and the environmental organizations like NOAH and Greenpeace to name a few (see Appendix B). The U.S. consumer section ended with the point that informed choice by consumers will protect the integrity of the biotechnology and food industries. That is the goal of these organizations, to produce an informed consumer choice.

4.5 Environmental and Consumer Organizations

4.5.1 Introduction

This section presents the attitudes and practices of various Environmental and Consumer Organizations in both the United States and Denmark. The information presented here conveys the positions and actions each group takes concerning genetically modified food. The information for the positions of these groups was found from position papers, lobbying materials published by the groups themselves, their websites and personal interviews.

4.5.2- Environmental and Consumer Organizations in the United States.

4.5.2.1 Attitudes and Practices of the United States Environmental and Consumer Organizations

Friends of the Earth- U.S.A.

Friends of the Earth (FoE)-U.S.A. feels that United States consumers are becoming concerned about genetically modified food but are being kept in the dark when it comes to these products. They feel that the Food and Drug Administration (FDA) should be labeling gene-altered food, just as other additives must be listed, but they feel that serious action has not been taken to reach this goal [44].

Friends of the Earth are concerned about the research and commercialization of genetically modified foods for several reasons. They are concerned that there may be health risks involved. They feel that consumption of GM food may increase resistance to antibiotics and cause allergic reactions to individuals unknowingly consuming foods with genetic material from other crops [44]. They are also worried about the effects GM products might have on the environment. They feel that genetic transfer from GM crops to wild relatives will occur creating "superweeds." This may destroy delicate ecosystems throughout the world. New insect resistant

crops are also likely to accelerate the natural evolution of the "superbug", which would be resistant to all of our insecticides. This "gene jumping" is a real possibility, and this is one of the biggest fears that Friends of the Earth and many others share. FOE also feels that GM products will increase the use of chemicals. Approximately 2/3 of genetically engineered crops being grown for commercial use have been engineered to be tolerant to a specific herbicide (e.g. Round Up) a trait that encourages the use of chemicals [44].

The Friends of the Earth are currently concerned with the International Biosafety Protocol. The Biosafety Protocol is forcing delegates that go to various meetings concerning regulation and policy about GM food (e.g. Montreal, Jan. 24-28, 2000) and making them consider what should be important when it comes to genetically modified organisms, people, and the environment or free trade. The Biosafety Protocol would establish basic rules ensuring the protection of biodiversity and human health, preventing further corporate consolidation of agriculture at the expense of small farmers. It would give countries the right to choose whether not to import GM products. Friends of the Earth feels that there is a significant need for this protocol and others like it because GM food poses a significant risk to the environment, which was revealed last may when Cornell University described how Bt corn could be killing the Monarch butterfly [45]. The problem arose when pollen from Bt corn dusted milkweed plants, the only source of food for Monarch butterfly larvae, caused some larvae to die after eating it. This means that GM pollen and plants could be harmful to non-pests [45]. Swiss researchers have also found that Bt crops are harming beneficial insects such as ladybugs. Finally, New York State University showed that the toxins exuded by Bt crops can leach out of plant roots and persist in the soil, damaging soil health [44]. Friends of the Earth has recognized all of these studies as well as others as cause for great alarm [44].

Friends of the Earth-U.S.A.'s position concerning these issues and the Biosafety Protocol is Biosafety first- Trade second. The Biosafety Protocol, as a legislative document should not take priority to the World Trade Organization, a governing body that can make decisions that are best for each situation. They also want to make it clear that *all* genetically modified organisms must be covered under any treaty constructed. They think that countries should have the right to reject the importation of GMOs and that they should be labeled extensively including a packaging requirement [44].

Friends of the Earth encourages consumers to take action and commends companies like Frito Lay, Gerber and Heinz that have banned the use of GM crops. They also feel that the only way consumers will be released from the "dark" is by making their voices heard by standing up for what they believe. Otherwise, it will be too late. There will not be a choice between GM and non-GM food because these products will become so integrated into food products that it will be impossible to distinguish between them [44].

Ultimately, Friends of the Earth believes in the Precautionary Principle, which states, "Where any activity raises threats or harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established [44]." This is completely applicable in the case of GM food because their affects (if any) may not be discovered for many years to come.

Greenpeace-U.S.A.

It has been suggested that because farmers have been modifying the genes of plants for thousands of years, genetic engineering is simply an extension of traditional breeding and practices. While it is true that the food crops that consumers eat bear little resemblance to the

wild plants from which they originated, Greenpeace feels that through this new technology organisms are being manipulated in a fundamentally different way [46]. They feel that the random insertion of a foreign gene may disrupt the tightly controlled network of an organism. The gene could alter chemical reactions or disturb cell functions [46].

One of the main differences with genetic engineering that Greenpeace is concerned with is that this process involves antibiotic gene markers, which allow plants to be grown in a medium with the antibiotic and those plants that contain the desired DNA survive. Greenpeace, like many others, is concerned with possible antibiotic resistance. They agree that the marker genes used in GM products resemble antibiotics used in human and veterinary medicine and bacteria may develop a resistance by the transfer of these resistant genes [46].

Greenpeace has done surveys world wide on public attitude, and they all seem to show a discrepancy between government policy and public concern. Greenpeace says that consumers are worried that there is a lack of segregation and labeling of GM products. Their surveys indicate that the public is also becoming aware of possible health risks, such as antibiotic resistance, that might be associated with GM foods. People also feel that there are ethical issues involved with the technology and that some feel that it is unnatural and unnecessary. Greenpeace says that people are also concerned that unelected bodies such as GM manufacturers are influencing government and ultimately trade. The public feels that GM food crops are dominated by a handful of multinational corporations such as Monsanto, Novartis and DuPont and it is widely believed that these are the only beneficiaries of GM food. Finally, according to Greenpeace, the public is concerned with the environment and that genetically modified organisms pose new risks to ecosystems, with the potential to threaten biodiversity, wildlife and truly sustainable forms of agriculture [46]. Greenpeace is partly a consumer advocate

organization so it can be extrapolated that they have defined their views on this topic based on these survey results.

Greenpeace is also concerned that genes that have been engineered into plants and animals can be transferred to other species. They say that once released the new living organisms made by genetic engineering are able to interact with other forms of life, reproduce, transfer their characteristics and mutate in response to the environment. This creates concern about impacts GM plants and animals may have on biodiversity. The concern here is sudden genetic uniformity, which leads to vulnerability because pressure from animal pests, diseases and weeds is higher in areas where the same crop is grown all year round. Biodiversity is traditionally understood to be the very basis of food security. The more genetic diversity there is within an agricultural system, the more it is able to accommodate challenges from pests, disease or climactic conditions, which tend only to affect certain varieties [46].

Greenpeace is also concerned with the continued industrialization of agriculture and is adamant that GM food is not the way to feed the next millennium. Rather the focus should be turned on organic farming [46]. They are also trying to create awareness that GM crops appear in animal feed and that animals used to produce meat may eat GM containing feed and this could affect the beef, pork or poultry that people buy [46]. Most importantly, Greenpeace is concerned with the unpredictable effects that may arise from introducing GM food into the ecosystem. They feel that there is very little understanding of the way genes are regulated within the cell and that a change to the DNA of an organism at any point may affect things that are impossible to predict or control [46].

Greenpeace feels that regulatory efforts are inadequate and that the current technique used to test genetically modified foods called "substantial equivalence" (used by Monsanto and

DuPont for example) is flawed from a scientific standpoint. Substantial equivalence tests a GM product against its non-GM equivalent in various ways and assesses whether or not there is any difference in how they affect the thing being tested (e.g. soil). They say that this method of testing can not be counted on as a criterion for food safety. For example, if a GM food contains an unexpected allergen it could be deemed substantially equivalent because it is very likely this allergen will go through the testing process undetected. Greenpeace also notes that none of the foods currently on the market have undergone long-term safety studies or the kind of rigorous toxicological assessments that are applied to pharmaceuticals [46].

Greenpeace makes it clear that they feel there should be mandatory labeling of all GM food and, as a consumer organization, they feel that it is their responsibility to fight for this. Mandatory labeling would mean that consumers could boycott GM food and segregation could occur, potentially making GM food uneconomical for the food industry. The scientific argument is that the DNA is destroyed when the food is processed; nevertheless, people want the right to know whether the food they are eating comes from something that has been genetically engineered [46].

Greenpeace claims that a few multinational companies are in control of the GM debate and are beginning to hold monopolies in the global market of genetically engineered food. Facilitation of this occurs through the World Trade Organization, patenting rights and systematic acquisitions and mergers. They are concerned that lobbying of industry has paid off and that their share of the global food market is disproportional. Greenpeace says that if current trends continue, the majority of the food we eat could be genetically engineered within a decade [46].

Greenpeace has become an worldwide activist group against the use of GM food by placing stickers on products and protesting in front of supermarkets. With these and other non-

violent acts they hope to influence consumers not to buy GM products so that companies will no longer find it profitable to make them [46].

> Greenpeace-U.S.A. says, "Genetically modified organisms must not be released into the environment as consequences for the environment and evolution are unpredictable and irreversible [46]."

International Food Information Council (IFIC).

Founded in 1985 the IFIC is a non-profit organization whose mission is to communicate science-based information on food safety to health and nutrition professionals, educators, government officials, journalists and others providing information to consumers. These groups find the IFIC reservoir of science and health data valuable and an easily accessed resource [47]. Based out of Washington D.C. the IFIC focuses mainly on the U.S. but is a part of an informal network of food information organizations world wide. The purpose of the International Food Information Council (IFIC) is to bridge the gap between science and media by collecting and disseminating scientific information on food safety, nutrition and health by working with an extensive roster of scientific experts [47].

The IFIC informs the public that the agricultural industry has moved and changed genes to enhance beneficial qualities of food for decades. The IFIC says that biotechnology allows food producers to do the same thing today but with greater understanding and selectivity. Traditional methods to modify food crops have serious limitations. Crossing can only occur in the same species and this limits the genetic resources breeders can draw upon. Also, when two plants are crossed all of the ~100,000 genes are mixed together. Standard breeding also takes a

long time (~10-12 months). Thanks to biotechnology crop breeders no longer need to let the "birds and the bees roll the dice for them to bring out one specific trait [47]."

The IFIC claims that biotechnology is selective and precise. Biotechnology may help improve products vital to food production such as enzymes, proteins and vitamins. It has brought us products such as: better-tasting tomatoes year round, environmentally friendlier crops, potatoes and cotton that resist insects, herbicide tolerant plants, fruits and vegetables containing higher levels of nutrients, and lower fat potatoes that absorb less oil when fried. Biotechnology has provided the ability to eliminate allergy-causing proteins from food, better ways to identify and locate toxins, pathogens and contaminants and increased environmental protection. In the future the IFIC says that biotechnology will provide better crops that will feed the population and it will improve the quality of seeds. Plants will have drought as well as heat and cold tolerance, and biotechnology will provide the means to grow new crops in new lands [47].

The IFIC feels that labeling should be mandated for foods that show potential food allergy or other health or safety risks. Labeling should also be present on any foods where breeding substantially changed the composition of a fruit or vegetable. Names should be changed if a different variety has been made to distinguish between the traditional variety. The IFIC feels that a label should not and cannot provide all the answers for consumers. However, other forms of information need to be available for consumers to access like grocery store managers and toll-free (800) numbers [47]. After decades of research the IFIC has found that consumers want to learn more about biotechnology and suggests that providing information from sources like the government, academic institutions and health professionals is more credible than

labels. The IFIC is committed to providing more complete and accessible information to consumers [47].

The IFIC provides a lot of excellent information about biotechnology background, current regulatory policy and what GM products are currently on the market. Their information is clear and easy to read for the use of the general consumer. The IFIC attempts to present their information without bias; however, it is obvious that they are very supportive of biotechnology and genetically modified food. It is apparent from their web site that they are attempting to abolish myths and misconceptions about GM food. The IFIC has spoken to many experts (Appendix C) and conducted representative surveys and investigated the topic. For general information of all types their web site is recommended (http://ificinfo.health.org/). The IFIC also provides a biotechnology resource kit that contains a compilation of backgrounds on biotechnology topics, product benefits, consumer attitudes, federal safeguards and labeling and the environment.

The IFIC agrees with a statement made by Consumer Reports that said, "There is no evidence that genetically engineered [biotech] foods on the market are not safe to eat." It is clear that the IFIC provides information based on this statement [47].

Sierra Club.

The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; to educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful means to carry out these objectives [48].

The Sierra Club Board of Directors on May 1st and 2nd, 1976 adopted the Sierra Club's agricultural policy. They see agriculture as the raising of plants and animals for food and fiber and as an essential human activity. They believe that its use of land, water, energy and other resources merits high priority, but its impacts on these resources are many and distribution of its benefits far from equitable. They feel that humans must strive for an equitable and sustainable balance between human population and agricultural supply [48].

They adopted a policy on the release and commercialization of genetically engineered organisms on September 18th and 19th, 1993. The Sierra Club recognizes that a major scientific revolution is underway, generating new technologies whose products may present hazards as well as benefits. They are opposed to any release or misuse of biological agents that have the potential to cause environmental damage. Their policy focuses on environmental and public health concerns surrounding genetically engineering research and the safety and labeling of foods derived from genetic engineering [48]. The Sierra Club uses the term "genetic engineered" organisms to mean organisms that have been altered by recombinant DNA or other genetic techniques, which allow further transfer of genetic material from one species to another [48].

The Sierra Club urges full public discussion and evaluation of the potential hazards, the potential benefits, and policy options for genetic engineering research and the development and the use of products from that research. They urge full public disclosure of the present and potential extent of such research and development and adequate regulatory, legislative and other controls [48].

The Sierra Club feels that there are health and environmental risks inherent in the release of new organisms. Testing needs to be done and enforced by the government. Policies should

require stepwise testing with strict controls to prevent accidental release. Stepwise testing must include laboratory tests, contained facility (e.g. greenhouse) tests, small-scale field tests and large-scale field tests. The results of these tests should be made available to the public. Before release into the environment the following must be considered:

1) Assessment of the genetically modified organism's role in the ecosystem.
2) Their impact upon release into the ecosystem and potential affects on genetic diversity.
3) Effects of its potential use on sustainable agriculture, resource use and cultural systems.
4) Health impacts of the organism and its products
5) Impacts of marker genes as well as genes of interest.

The Sierra Club feels that all GM crops should be monitored long-term and that this data should be made available to the public. They also feel that all GM food should be labeled with the changes made including the presence of new, genetically encoded substances that affect the characteristics of the foods, or changes in food composition that may cause reactions in sensitive individuals [48].

The Sierra Club also supports the right of states, localities and nations to adopt their own more stringent regulations concerning the experimental release and commercialization of genetically modified organisms [48].

The Sierra Club realizes that GM food is a very important environmental and trade issue and they recognize the recent arguments that have arisen about biodiversity effects, genetic pollution, increase of resistance of insects and disease causing microorganisms, allergic reactions

and other health affects. They support Gerber and Heinz in their refusal to use GM food in their products. Further, the Sierra Club commends Gerber for making this decision in spite of being owned by Novartis, one of the top four agricultural biotechnology developers [48].

The Sierra Club has also helped author the Technical Statement by U.S. Environmental organizations along with the following organizations: National Wildlife Federation, World Wild Fund, Friends of the Earth, Natural Resources Defense Council, Greenpeace U.S.A., Defenders of Wildlife and Community Nutrition Institute, American Lands Alliance, Consumer's Choice Council, Earth Justice Legal Defense Fund, Institute of Agriculture and Trade Policy, and Pacific Environment and Resource Center. This statement makes recommendations, identifies specific reforms needed to the World Trade Organization, and deals with the issue of environmental impacts on trade. Although GM food is not specifically mentioned, it is obvious that trade of GM products is of central concern in the world trade. The Sierra Club also took part in the World Trade Organization's meeting in Seattle, participated in peaceful marches and met with President Clinton about environmental trade.

It is important to note that since their biotechnology policy of 1993 "The Sierra Club has not taken a position on the 'ag-biotech' developments. [They] just want to be included in the WTO discussions while further study is done on possible environmental and health problems [of GM food]. [48]"

Union of Concerned Scientists (UCS).

The USC recognizes that one of the newest developments in U.S. agriculture is the widespread use of forms of biotechnology. They see many traditional applications, such as using microorganisms to ferment beer, as uncontroversial. But genetic engineering, a powerful new

technology that can change the genetic makeup of cells and transfer genes from one species to another, has provoked intense public interest and scrutiny. They know that genetic engineering is bringing agriculture novel varieties of crops, animals and microorganisms. The biotechnology industry touts these products as a major contribution toward sustainable agriculture, but the UCS is not clear whether or not agriculture will truly benefit from this technology. The UCS examines agriculture products that genetic engineering has brought us. They claim to ask hard questions about their risks, benefits and whether other alternatives would accomplish the same purpose. In particular, they ask whether each product will move agriculture toward sustainability or whether it might block progress in that direction [49].

In an article that appeared in *Nucleus*, the magazine of the Union of Concerned Scientists they state that they do not understand the difference between the U.S. and European views of GM food. The Europeans have said "No" to GM products and that if the U.S. government and Monsanto go to the World Trade Organization, they are prepared for a trade war. The Union of Concerned Scientists does not say whether or not the U.S. should follow the European boycott of GM food, but they mention that Europe's choice does not seem to have a logical basis [50].

UCS says that current biotechnology is not fruitful for the quest for sustainable agriculture, which solves problems by understanding and adjusting the elements of the system to achieve its goals rather than by developing new products to be purchased. Agricultural biotechnology, by contrast, is basically an input industry, developing expensive products priced to cover the costs of research and development. In sustainable agriculture, new products are less important than new knowledge and new ways of manipulating the agricultural system [50].

The UCS feels that there are many alternatives to the use of biotechnology. If one of the goals of GM food is to reduce the dependence on herbicides and pesticides, they feel that crop

rotation would be a better way of doing this. Crop rotation keeps pests under control by depriving them of the continuous food they need to build up large populations. The advantage of this is that it controls a broad variety of pests, not just one or two. It also does not select for resistance genes like GM crops and does not result in the ongoing pollution of the air and water, and it is far preferable to insecticides and herbicides. The UCS says there is no industry support for this method because it involves altering the process of growing food rather than the product itself. They feel that conversion from industrial agriculture to a sustainable system such as crop rotation, which depends less on chemicals, creates no industrial need for biotechnology. Although there may still be a need for GM crops, agricultural systems still need to be more developed than they are [49].

The UCS feels that biotechnology poses many challenges on society. They feel that current U.S. institutions provide meager opportunities to openly evaluate new technologies in advance of their implementation. As a result, decisions are left to the private sector, which is given full latitude except only in regulation to prevent harm to human health and the environment. While this is important it is no substitute for societal evaluation of the impacts and recommendations of alternatives to the new technologies. They feel that the framework of regulations applied to GM organisms is weak because it leaves important, categories of genetic engineered organisms uncovered. It often lacks strong authority to require premature review of genetically engineered products [49].

Most statutes grant companies broad privileges to withhold data and information from the public. The UCS feels that agencies that regulate GM products in the U.S. (FDA, EPA and USDA) should hear from the public because all too often governmental position coincides with that of industry. They agree that over 700 million people are undernourished and that in future

years the lack of food will become an increasing problem. However, the UCS states that GM food is not necessary to solve the world's food problem. They feel that genetic engineering could play a role, but other kinds of technology such as breeding technology will be more important than transgenic technology [49]. They say that biotechnology should not be relied upon to feed the world. They say that more productive crops will not alleviate the hunger problem because of deficiencies in other areas such as a lack of income to buy food and current trade polices. Where more productive crops are needed, there is little reason to believe that genetic engineering will be better than other technologies, particularly institutional breeding, at producing higher yielding crops. They claim that genetic engineering is being applied to crops that are important to the industrialized world, not crops that the world's hungry depend on.

What can be done to help the world's food supply? UCS says that the answer is better targeting of agricultural research. Industry cannot simply increase production but must find ways to minimize soil erosion, degradation of lakes and rivers and groundwater pollution. They are also promoting an increase in agroforestry, intercropping, mixed crop-livestock and minimizing chemical fertilizers and pesticides [49].

The UCS is also warning about the severe ecological effects of GM food production. Bt toxins are able to seep into the soil creating an unknown impact on valuable soil-inhabiting insects. Transgenic crops could introduce new allergens into the food supply (e.g. milk proteins into carrots and then a person intolerant of the protein eats the carrot and has a reaction). Antibiotic resistance is also a concern of the UCS. Selectable markers in food could reduce the effectiveness of antibiotics to fight disease. Resistance genes could produce enzymes that can degrade antibiotics or these genes could be passed on to pathogens making them impervious to antibiotics. Most importantly, there are unknown harms [49].

The Union of Concerned Scientists is concerned with effects GM food may have on the environment. GM plants have the potential of becoming weeds; they could transfer genes to wild or weed relatives via pollen or through the soil. These crops could lead to new chemical herbicides resulting in greater levels of environmental harm. Overtime "superbugs" could be created rendering all modification useless, and virus-tolerant crops might result in worse, more devastating viruses [50].

The UCS view is essentially summarized in the following quote.

> "Biotechnology is being developed with the same vision that promoted chemicals to meet the single, short-term goals of enhanced yields and profit margins. This vision embraces a view of the world characterised by beliefs that nature should be dominated, exploited and forced to yield more; by preferences for simple, quick, immediately profitable 'solutions' to complex ecological problems; by 'reductionist' thinking that analyses complex systems like farming in terms of component parts, rather than as an integrated system; and by a conviction that agricultural success means short-term productivity gains, rather than long-term sustainability."
>
> -Jane Rissler (Union of Concerned Scientists) [50]

4.5.2.2- Overall Attitude of the U.S. Environmental and Consumer Organizations

Based on the information found from these five environmental and consumer organizations it is clear that GM food has many risks. First and foremost, these groups are concerned about protecting the rights of the consumer and ensuring that the public's point of view is heard and respected. They all feel that the opinion of the consumer should be first and foremost above that of manufacturers, government and lobbyists.

They are also concerned with issues such as antibiotic resistance, gene transfer, impacts on biodiversity, herbicide and pesticide resistance, hidden allergens and other possible human health issues. Most do not feel as if GM food will help alleviate food supply problems and there is indication from many of these groups that they feel that this is simply an excuse to produce GM products.

Regulation and trade are also key issues on the minds of these organizations. Some feel that there is not enough regulation, and others feel that unelected bodies such as the manufacturers themselves are controlling the regulatory process. All of the organizations feel that the public should be more involved in the regulatory process. They all feel that regulatory bodies do not do an adequate job of informing the public of new technologies. It was mentioned by many of these organizations that trade should be left up to the WTO, but they feel nations and even individual states should have the right to reject GM food if they want to.

These organizations feel strongly that labeling should be mandatory especially when a food is significantly altered. But many say that this isn't enough. Other resources need to be in place so that people can get the information that they want. They suggest free (800) phone numbers, educating health professionals so that patients can go to their doctors, placing more information online and brochures. They agree that providing free information and education to the public is key to answering many questions in the GM debate.

These organizations are aware that there are benefits to the production and commercialization of GM food, but most of these groups feel that the risks outweigh the benefits. The exception to this seems to be the IFIC. The other organizations would prefer to be more cautious when playing with genes. They are concerned with the unknown effects that may appear years down the road once GM food is integrated into the world's food supply. These organizations have taken on the obligation of informing the public of the benefits and especially the risks of GM food. When analyzing the opinion of these groups it is important to remember that slowing technology is as critical to a balanced society as advancing it.

4.5.3 Environmental and Consumer Organizations in Denmark

4.5.3.1 Attitudes and Practices of the Danish Environmental and Consumer Organizations

Danish Consumer Council

The Danish Consumer Council represents the interests of consumers and is an independent organization from public authorities and commercial interests. They were founded in 1947 and are the spokesman for consumers' interests. They lobby on behalf of the consumer in government, Parliament, public authorities and the business community [51]. They work for a consumer's right to health and safety, education, to choose, to be heard, to redress, to be informed, and a healthy and sustainable environment. The Danish Consumer Council operates to articulate the consumer views and promote consumer rights. They represent more than 200 committees, boards and councils dealing with matters important to consumers, and they have an extensive dialogue with the business community. Internationally, the Danish Consumer Council is represented in BEUC, the European Consumer Organization to work with the EU, and they are also involved with Consumer International (CI) in order to voice opinions in the United Nations, WHO and the World Trade Organization. In Denmark, 26 national organizations are members of the Danish Consumer Council from household/ women's, youth and elderly, environmental and educational organizations to trade unions and local consumer groups. These groups form an assembly a few times a year, and their job is to define the goals of the organization for the coming year and make new polices while the everyday functions of organization are carried out by a 40 member secretariat. The Danish Consumer Council is funded by their consumer magazine called *Think* and from the government under the Finance Act [51].

The Danish Consumer Council does not choose a side in the debate. Their main concern is for consumer welfare. They focus on the environment and benefits of the technology. Their

top priorities are enforcing the Precautionary Principle and labeling of GM products [52]. Their official policy is the same as the consensus of the Trans Atlantic Consumer Dialogue (TACD) [52]. The Danish Consumer Council is a member of the TACD, which is an organization that was set up to assess and lobby for consumers across the Atlantic involving Europe and the United States. This is a dialogue forum that deals specifically with the GM issue. The Danish Consumer Council's point of view is identical to that of the TACD because as a member they must agree with and support all of the points decided upon by the TACD [52]. The TACD calls upon the government to establish effective and mandatory government approval systems of human health, safety and environmental protection [52].

The policy paper for the TACD appears as Appendix E of this report, please refer to it for detailed information because only the highlights will be discussed here. Essentially, the TACE and the Danish Consumer Council insist that Genetically Modified Organisms (GMOs) should offer real benefits to consumers and not harm health or the environment. They say that consumers have a fundamental right to know what they are eating, which means that all GM foods and foods made using genetically engineered ingredients should be labeled [53]. They say that the main concern of the consumer is safety and that the long-term impact of GMOs on human and animal health as well as the environment should be carefully assessed before their commercial introduction and release into the environment. They also say that consumers are concerned about potential allergies from transferring traditional foods into genetically modified variants (e.g. a gene from a Brazil nut being placed into Soybeans) and antibiotic resistance from the use of antibiotic markers used in the modification process. They also say that consumers are concerned about unwanted side effects of genetic modification, which might be the creation of new toxins or increased levels of some toxins in food. They are also worried

about the increase of decrease of the nutritional content of a food and what that might mean for their nutritional health [53].

The TACD has outlined a specific agenda of things they believe are important to fight for in relation to the consumer [53]:

- *Consumers' right to know:* TACD believes that consumers have a fundamental right to know what is in their food and because of this all GM food, including food produced from GM ingredients, which do not remain detectable in the final product should be labeled.
- They have a right to information, which includes full disclosure of all aspects of the safety evaluations of GM foods and clear and truthful labeling of any approved product.
- Government should consider developing an internationally recognized symbol indicating that they product has been produced using genetic modification.
- Consumers should have the choice whether or not to eat GM foods.
- Labeling of the final product should depend on the presence of GMOs in the raw materials from which the product was made. This requires complete traceability of GMOs throughout the entire production process; therefore segregation of GM products is essential.
- Sensitive and reliable test methods should be developed and validated to confirm whether or not a product has been genetically modified.
- The U.S. and the EU must agree upon the threshold of the amount of unintentional genetic contamination allowed in a product and this threshold must be at an absolute minimum.
- Consumers should not be asked to pay more for non-GM food products.

- Strict long-term assessment of the impact of GMOs on the environment [53].

The TACD has come up with a list of recommendations as well, that might help in deciding the best way to deal with the above issues [53]:

1) Establishment of mandatory human health evaluation that will screen foods produced by genetic modification.
2) Strong methods for assessing GM foods, unlike the use of "substantial equivalence," that can give a clear idea of potential unintended consequences.
3) Conduct consumer research to gain a clearer understanding of consumer attitudes.
4) Development of a strong system of safety evaluations that will screen GMOs and prevent release of any products that will have negative environmental effects.
5) Ban the use of antibiotic markers.
6) Label all GM food sold in Europe and the United States, including those processed foods with GM ingredients as well as animal feed with GM soy, corn etc. in it.
7) Government notification that is shipment specific in order to distinguish between GM and non-GM shipments.
8) Corporate liability and mandatory insurance for companies that want to release GMOs.
9) Development of common standards for ensuring that non-GM ingredients are preserved so that consumers will be confident that they are truly getting non-GM products if they choose [53].

The Danish Consumer Council is also a member of BEUC the European Consumer Organization. BEUC collectively would like to see a revision of the novel food legislation so

that it is based on traceability through identity preservation. They would also like to see a threshold for unintentional contamination. They would like labeling but they do not support "GMO free" labeling. They would especially like more independent research into alternatives to food biotechnology [54].

The risks posed by eating these products and the potential long-term effects on the environment and biodiversity have become an important issue. Consumer organizations actively support the *de facto* moratorium on new EU approvals for commercial releases. The Danish Consumer Council is not afraid of new technology or gene technology, but it is important to remember that gene technology is just a tool. Whether consumers accept the products that come from using the tool is dependent on a number of factors- among others the benefits from using the technology [54]. The Danish Consumer Council feels that consumers have not at any point been involved in the decisions relating to whether the world actually needs gene technology and if so what it should be used for. The Danish Consumer Council says that the argument that a pesticide with lower environmental impact can be used more efficiently with genetically modified crops is not valid. They say that with sugar beets the use of pesticides will be reduced by 30% over 20 years, while GM rape requires the same amount over time [54]. They are also concerned that if a few companies "own" the whole resource base for corn or soy, a large impact on the economics of agriculture will result and free competition of the use of these products will never be established [54].

The Consumer Council is aware that some consumers have ethical and moral concerns, particularly those people with strong religious beliefs and they feel that it is important that those views be taken into account [54]. Because of this the Consumer Council helped to draft some Ethical Guidelines for the use of genetic modification at the request of the Ministry of Business.

In these guidelines they say that the possibility of a technology becoming extremely useful does not preclude the possibility that the very same technology can be misused [55]. They say that the world presently faces the task of facilitating positive uses of the technology while preventing misuse and negative uses. They make it clear that an important precondition for societal life, including research, is exactly that one refrains from doing specific things to each other despite the fact that they are possible. A society devoid of social norms and prohibitions would in reality, be an inhumane society [55].

Some of the key ethical guidelines that pertain to gene technology for use in food production are [55]:

- The technology must be developed and used to benefit man; society and living things provided that one promotes and prioritizes the quality of life.
- Gene technology is developed and used with respect for the integrity of life, for the vulnerability of living things and for the individual societies right to self-determination and freedom of choice, in that decisions should reflect the worries and wishes of those among the population.
- Genetic engineering may not harm the environment or diminish the sustainability of nature by affecting the ecological balance, cause harm to non-target organisms, cause deterioration of biodiversity in nature and agriculture, cause nutrient turnover in the soil, or contribute to enhanced or undesirable use of chemicals in agriculture.
- Democratic debate and decisions on the use of genetic engineering shall be based on openness to all viewpoints prior to every decision. Human beings' rights to self-determination should be respected by giving citizens a possibility

> to choose freely and assess and prioritize technologies and their uses such that decisions and their implementation is clearly defined, alternatives will be taken into account, harm is minimized, flexibility and reversibility are maximized and dependence is limited [55].

The Danish Consumer Council fights for the rights of Danish and European consumers in a number of arenas, and they are most concerned that the consumer has the right to choose for him or herself whether or not they want to eat GM food. They also think it is important that authorities recognize that genetic modification has important implications in the spheres of health, the environment, ethics, religious beliefs and the economy and that they realize that the general consumer cares and is concerned about the impacts that gene technology might have on all of these areas.

Greenpeace-Nordic (Denmark)

Greenpeace Nordic agrees and supports all of the views and policies of Greenpeace International. They are not opposed the use of genetic modification in all areas but are strongly opposed to use of genetic manipulation in terms of the environment. Greenpeace Nordic does not feel educated to discuss all applications of the technology such has health care, but they do believe that they have the knowledge and expertise to debate about the topic when it comes to environmental impact [56].

Greenpeace Nordic believes that genetic modification creates a threat to biodiversity and the environment in general. They also believe in and practice the Precautionary Principle. Their overall goal is that there will be no commercial release of any GM products into the

environment. They want to stop any new test fields from being planted in Denmark and Europe and hope that the ones that currently exist will phase out of use. They also want to protect consumer interest and they feel that pesticide resistant crops promote pesticide use and they think that agriculture should move to abolish pesticide use [56].

Currently, Greenpeace Nordic is focusing on the animal feed issue because there are not any GM products on supermarket shelves. They desire legislation that requires labeling and testing of GM animal feed, particularly soya meal that contains an unknown percentage of GM soya in virtually every shipment. There is currently no regulation concerning the use of animal feed in the production of any meat product. They feel that the key is to separate GM from non-GM feed. They are also fighting on behalf of farmers so that they can have the option between GM and non-GM feed, which is not the present case because most animal feed is mixed [56].

Greenpeace Nordic also advocates labeling of all GM products including end products that include any GM from the production process and animal products that come from animals fed with GM feed [56].

Greenpeace has recently done quite a few actions concerning GM food. They performed an action against a potatoe test crop in Zealand, where the potatoes were modified to have reduced starch content. Greenpeace took this action because they felt that this use of gene technology was unnecessary. They are also lobbying in the EU for legislation on the current directive to include the banning the use of antibiotic markers in the laboratory and comprehensive testing of GM products because they think that the current testing methods are not complete. Another action they recently took was to sample eight different types of soya feed, made by different companies, in order to find out how many contained GM soya and if so how

much. They found that all eight samples contained some amount of GM soya and that two contained at least 55% [56].

Greenpeace Nordic feels that if a future lies in the use of GM food, consumers are going to have to see a direct benefit, which they do not see now. Greenpeace feels that the products currently on the market will be phased out and ultimately rejected by the public as is the trend in Europe, Japan and Thailand [56]. The major question that Greenpeace will be asking and attempting to answer as the debate develops is "how much risk should we accept? [56]"

Nature Conservation

Nature Conservation was founded in 1911 and was originally started to provide the public with access to nature and their main goal was to conserve special areas of Denmark. Now they work on all sorts of areas such as water and air quality and chemical pollution. They currently have approximately 200,000 members, who are comprised of families and individuals and almost all of their funding is supplied by their member fees [57]. Nature Conservation has a say on all legislation that is written about topics with which they are concerned, and they frequently asked to speak and reply on various pieces of legislation in Parliament; this includes legislation dealing with GM food [57].

Nature Conservation does not have a policy paper about GM food simply because the issue changes to rapidly that any policy paper they drafted would never be up-to-date. They feel that the most important issue in the debate is that those consumers and farmers that want non-GM products are able to buy it, therefore they fight for segregation of GM products because this is the key. Farmers and consumers will never have a choice about what to buy until GM is completely separate from non-GM [57]. Nature Conservation feels that it is incredibly important

that both consumers and farmers have a completely free choice in terms of GM products, and they are also very concerned about the possibility of gene transfer through pollen and other venues [57]. They also say that herbicide resistant crops create a biological desert in the fields and resistance spreads to other plant. They also think that insect resistant crops cause insects to become resistant at a faster rate than they would with conventional methods and that these crops also hurt beneficial insects in the environment [57].

They are also nervous that ultimately, all food might mix together and segregation won't be possible anymore. Their position as it stands now is that GM food is unnecessary but if it is going to be a part of society, it is critical and possible to get legislation that protects nature, the environment and the consumer. Nature Conservation does not feel that GM food is a viable scenario for a democratic society partly because monopolies in the food industry are a threat [57].

Nature Conservation is currently taking action in the EU making suggestions for the EU directive 90/220 that is up for revision, but they do not think that their suggestions are having any impact. Recently, they also fought in the EU for a three year moratorium on GM food release in order to assess risks, but the only result of this lobbying effort was the current *de facto* moratorium. All actions that Nature Conservation takes are on the political level, mostly they make suggestions, speeches at both the Danish and the EU levels of government. They are active in the public by voicing their view through newspaper articles, radio and television. They also use their large member base to spread information, and they have direct contact with them concerning their opinions on the issues through letters and e-mail [57].

Their main focus right now is to make the directive 90/220 as precautionary as possible. They have three focuses in terms of the GM issue [57]:

1) Liability clause that holds companies liable if damage were to occur do to genetic modification.
2) They would like to ensure that GM characteristics are not spread to other natural flora.
3) Banning of antibiotic markers.

Nature Conservation's long-term goal is not to have to fight about GM food anymore because they hope that the issue will disappear and no longer exist [57]. Nature Conservation says that there may be positive outcomes to genetic modification, but there are obvious problems with release and safety of these products that are not adequately being explored.

NOAH (Friends of the Earth, Denmark) and Friends of the Earth Europe

Friends of the Earth (FoE)- Europe has just recently launched a campaign entitled "You can't stop bees from flying" on the premise that everyone says that health and environment are protected and no damages will come from GM crops, but pollination happens in more ways than just by wind over distance, for instance through pollination by honey-bees, which can not be controlled. Bees can carry pollen from genetically modified rape for distances up to 4.5km, while European buffer zones are as small as 50 meters. This promotes genetic transfer and genetic pollution [58]. Research has shown that genetic contamination is "inevitable," which could lead to irreversible spread of genetically modified traits. FoE Europe says that other traits such as antibiotic resistance could threaten human health. They claim that consumers have rejected GM food and many retailers and manufacturers have pledged to stock only non-GM products. FoE says that farmers that have pledged to stay GM-free will never be able to guarantee this. They also think that labeling laws have loopholes, they mention the law, which

allows 1% contamination before a product must be labeled. They also say that food containing GM ingredients such as soya oil and corn starch are not labeled and neither are meat and dairy products that come from animals reared on GM feed [58].

FoE Europe has a Manifesto concerning GM foods that was set up to protect food, the environment and farmers. They say that GM pollution needs to be halted in Europe and the current campaign is working to ensure that Europeans have the right to choose GM-free food and to safeguard GM-free agriculture. Their Manifesto is based upon six principles [58]:

1) Precaution: Safe is better than sorry. Further authorization of commercial releases of GM crops must be halted.
2) Prevention: Release of GM crops, which can pollute or damage the environment and which present an unacceptable risk to human health, must be outlawed.
3) Polluter Pays: Specific liability that addresses who is going to pay for any damage that has been done due to gene technology. The polluter, not the victim should pay.
4) Participation: The public needs a legal right to know about GM pollution and participate in decisions.
5) Public Choice: GM food should be segregated and labeled from farm to plate and organic standards should be protected.
6) Political and Corporate Accountability: These Principles need to be given legal backing particularly the EU's deliberate release directive 90/220/EEC [58].

FoE UK voiced specific concerns through a small pamphlet about GM food. One of their main points is that there are unknown consequences to this technology and there may even be health risks. They say that the technology may cause antibiotic resistance in animals and people and until proper research is done, these dangers can't be ruled out. They are concerned that gene transfer of herbicide resistant genes to weeds forces farmers to apply more and more chemicals in attempts to fight "superweeds." FoE UK believes that when companies sell herbicide resistant crops and sell a particular type of herbicide along with it, this allows farmers to kill all other plants except the desired crop [59]. This could wipe out many wild plants and threaten birds and insects that depend on them for food. They also say that right now farmers risk being sued because liability is unclear in legislation. They think that biotechnology companies such as Monsanto and Novartis are trying to control all stages of food production from a farmer's field to the plate. Because so many products contain GM food they have taken away the freedom to choose what to eat. FoE UK says that little has been done to control the biotechnology industry [59]. In their pamphlet they encourage the public to write supermarket managers and demand GM-free products. They are promoting voting while shopping by buying fresh vegetables and fruits and organic foods. They warn consumers not to buy processed foods that contain corn or soya because they could be genetically modified [59].

NOAH- Friends of the Earth, Denmark, being a part of FoE Europe supports and is active in the campaigns mentioned above with FoE Europe and FoE UK. NOAH in particular is not in favor of the technology but is doing the best that they can to protect the environment and consumers with the realization that the technology may not be able to be stopped [60]. Their main focus is that Europeans always have a choice whether or not they want to buy these products. They are fighting for labeling on the front of packaging for all GM products that is.

They think that the label should be clear and recognizable; they think that something similar to the sticker for organic products should be used. They are also fighting for segregation of GM in all aspects. They are against the 1% rule because they think that the limit is too high and believe that all products dealing with antibiotic, herbicide or insecticide resistance should be banned. They are confident that the EU will ban the use of antibiotic markers and would like a section on liability put into the directive. NOAH, like FoE UK, provides information to the public through pamphlets and their website. Currently, NOAH is working on an Internet project called gene debate (www.gendebat.dk) that provides Danes with information on field trials and EU progress. NOAH works along with an unofficial network of organizations such as Greenpeace, Nature Conservation, Organic Farmer's Association, Active Consumers, and of course, FoE International to lobby for consumer and environmental rights. They warn that there is risk in everything, but if genetic material spreads there is no way to clean up genetic pollution [60].

Danish Food and Allied Workers Union (NNF)

NNF is not a traditional type of consumer organization such as the Danish Consumer Council; however, they do lobby for the interests of a particular type of public consumer, the individuals that work in the food industry. NNF is a worker's union for members of the food industry. Currently it has approximately 40,000 members. These members are manual workers in all aspects of food production such as workers in the dairies and slaughteries, in confectionary areas such as sugar and chocolate and in many other areas. Their members are considered unskilled workers and they join on an individual basis. Their funding is solely from their member fees. Some companies have agreements with the union in terms of employment but not many. NNF has agreements with employer's organizations such as the Danish Slaughtery, and

they work together to provide good working conditions for the members of the union. They are a member of the International Union of Food Workers (IUF). NNF also works along with consumer organizations such as the Danish Consumer Council. NNF works mostly on working conditions and wage issues such as insurance, but they also work on lobbying again public authorities on the part of the workers they represent. NNF works for the rights of their members in all areas. NNF deals on a more political level than unions in the U.S., and this may be because they originally were a part of the Social Democratic political party and still are in contact with them now that they are a completely independent organization. NNF works mostly at the political level but also works at the consumer level as well because the consumer opinion and response directly affects their members [61].

NNF published a short booklet where it defined their viewpoint on genetic engineering in connection with food production. The booklet was also used to provide information about the technology to NNF members. They lobby for sustainable production of foods worldwide that is sustainable for the environment, people, domestic animals and economics. They are not interested in clever technological solutions whose only function is to improve the earning capability of certain industries and the cost of public interests [62]. NNF says that the world needs high-quality, healthy and tasty food, and they feel that the research community, agriculture and industry should help to obtain this. They want to ensure openness when it comes to gene technology and they feel that safe limits must be established for the use of the technology. They want consumers to have a genuinely free choice. NNF tends to distrust researchers because they think that researchers are naïve. Researchers, according to NNF, are engaged in their own narrow problems and do not have an understanding of how things work in a large context and what consequences there may be [62].

NNF is fighting for total labeling of both product and process. They say that it must be possible for consumers to make their choices based on what they read and what they feel. NNF thinks that large companies such as Monsanto need to separate GM products. They use the argument that if genes can be separated in the laboratory they can also be separated in the subsequent production process. They are calling for systematic risk assessment and management where all aspects are subject a risk assessment that includes that of the health and safety of the food worker. NNF feels that the labor movement must also give priority to the GM issue and participate in the debate and they must ask the right, critical questions on behalf of their members. NNF says that it is the job of the labor movement to keep agriculture, industry and Parliament on their toes. They would like to see a broad public debate that exchanges views in order to ensure development. NNF wants to make it clear that all research and production has consequences [62].

The NNF is not against the technology, but they would like to have the time to evaluate whether or not there are benefits for society, consumers and whether there are any risks for their members. Their perception is that consumers in general do not want GM food, and their interest is that companies provide consumers with what they want in order to ensure that their members keep their jobs. Essentially, they want sustainable employment for their members, and they think that the best way to do this is to use technology that can last for decades and not merely result is a short-term increase in profit. They are in favor of using new forms of technology in food production, but they feel that there are no shortcuts for good food and proper hygiene during the production process. The point is that if the consumer is provided with the highest quality products, then higher prices can be asked, which increases profit and the wages of the workers. They want to ensure job security and do not want to lose jobs at any price including the

environment, consumer acceptance and a proper working environment for their members. GM is just another issue that the NNF is getting involved in that will hopefully make companies and people think about the health and safety of the worker. NNF does not want to prevent progress. In fact, they see that eventually there might be some advantages for their members because gene manipulation could lead to fewer chemicals in the food that their workers have to deal with; for example, they might see a reduction in the amount preservatives, additives and pesticides in food [61].

An action plan was decided upon as part of a convention that is held every four years, which is where the highest authorities in the union are elected (e.g. Chariman, secretaries etc.). It is here that they decide on what the union is going to focus on for the next four years. There are usually about 350 delegates present and the entire convention lasts about one week. At the most recent convention they decided that they were going to focus on getting a risk assessment for the safety of the workers that work with GM food in place. Right now the approval process for a food involves a risk assessment for society and the environment but there is no risk assessment for the safety of the worker that must work with very high concentrations of these GM products. NNF would like to know what impact GM food is going to have on the workers' health and safety. When the EU published its most recent paper on food safety, NNF got a chance to reply and asked that the EU think about the safety of the workers. They have also brought this issue up to the Food Ministry as they are a member of an advisory committee there. They also speak to their contacts in Parliament about the issue whenever possible. NNF tells their point of view wherever possible. They do not feel that these attempts are futile because they think that organizations have great influence in Denmark. They have also talked to researchers to see whether anyone would be willing to come up with a model that would

determine any risks to the worker. Unfortunately, they do not feel that their view is being heard because many think that it would be too complicated to involve a new assessment process for the safety of the workers. NNF thinks this is because the production process is usually taken for granted and overlooked in the matters of food, they are referred to as the "black box" that is in the background. NNF feels that the issues that the workers face are not being thought of. NNF thinks that eventually their thoughts will be listened to because competitiveness depends on the work force a company employs. If a company has an educated work force, they have the tools to run smoothly and grow. On the other hand, one bad worker can affect the entire company when it comes to food production. For instance, if one worker does not know how to wash his/her hands properly, it could ruin the whole factory because food production is so integrated therefore a company needs good workers to produce good food. In their contact with employers' organizations on the issue they felt like they do not want to complicate the risk assessment either because it only delays the process of putting the foods on the shelf. They are concerned about the workers but are only willing to discuss in small committees, and NNF is not really informed on their opinion [61].

NNF is concerned that GM food production could create a monopoly in the food industry that may result in the loss of jobs for any workers that are not a member of the company that has the monopoly on the industry. They also think that the company that employs the worker should be responsible for any damages that occur that are proven to be caused by genetic modification of a foodstuff because they were the ones to decide to produce and market these products. The company then can look for compensation from the company that supplied them with the GM product, if they so chose [61].

In the future, NNF hopes that sustainability of the worker will be a concern and that people will consider the role of the worker an important one. They are most concerned about the risk assessment for their workers. Next they would like to find a way to truly make better products for the consumer and the environment. Finally and most importantly for the worker themselves they would like to see antibiotic resistance markers banned and the safest, not the easiest, possible methods used in the laboratory. They are also concerned with the impact gene technology might have on the natural world around them. Ultimately, they do not want to lose the technology but they want to find ways to use it that are beneficial and safe for everyone involved [61].

World Wildlife Federation (WWF)

WWF's mission is to conserve nature and ecological processes and to address this in a way that benefits human needs and livelihoods. WWF recognizes the potential value to society arising from the new opportunities by the science of Genetically Modified Organisms (GMOs). However, WWF is concerned about the potential dangers involved in releasing GMO's into the general environment through agriculture [63]. Evolution ensures that each species optimizes its fit within the broader community of organisms where it occurs. Different species are adapted to different conditions. Some are sensitive to minor changes in these conditions, and adaptability depends on genetic diversity. Using GMOs results in a great reduction of genetic diversity [63]. Introduction of new species can alter the natural balance affecting ecosystem processes, which is essential to a stable environment. Recent cause of reduction in biodiversity has been addressed by WWF through work with communities and agencies to identify more sustainable production methods [63]. The application of GM technology to agricultural crops may bring short-term

opportunities but is also a threat to sustainable agriculture and biodiversity. WWF feels that herbicide tolerant crops promote free use of herbicides and insecticide resistant crops are the cause of death for beneficial insects. WWF says that gene transfer to wild species shrinks the world's genetic base, increasing vulnerability and dependence on the technology [63].

For the present, WWF wishes to see a strong precautionary approach to the use and release of GMOs into the wild. The science is still very new and it is apparent that much ecological research needs to be done before this technology moves from the laboratory into standard practice. WWF seeks [63]:

- Comprehensive environmental impact assessment of planned release into the environment.
- Avoidance of additional impacts of genetic modification, which facilitates chemical use, harm pest controlling and other beneficial insects, lack safeguards against gene flow and use artificially constructed genes.
- Control of gene technology through governmental regulation.
- Recognition of the role of traditional knowledge in crop breeding [63].

WWF plans to take action by alerting government, aid agencies, industry and the public of the good and bad practices that have to do with gene technology. They are also going to support the moratorium on the use and release of GMOs in crops until there is wide consensus that research on ecological impacts has been completed and evaluated. They also are supporting calls for eco-labeling to promote consumer awareness and informed decision making [63]. WWF Denmark supports all efforts of WWF international, which were summarized above, and they work particularly with the biodiversity issue [64].

WWF also was part of the Biosafety Protocol along with other environmental groups such as Greenpeace. The protocol will be signed on by countries and, once ratified, will become law in those countries. Its main concern is international trade regulation and biosafety, specifically dangers to biodiversity [64]. WWF Denmark says that they are not planning to take a much more active role in the debate, but they will continue to support WWF International in any action or campaign they choose to undertake [64].

4.5.3.2- Overall Attitude of the Danish Environmental and Consumer Organizations

The Danish Environmental and Consumer Organizations feel very strongly about the consumer's and the farmer's right to choose whether or not to eat or plant GM food. Many of these groups feel that the freedom of choice has been taken away from consumers and farmers because of the lack of segregation of GM products, and they are fighting for segregation from field to plate with a strict documentation system. All of these organizations feel very strongly that all GM products should be labelled, and most feel that meat or diary products that come from animals that have been fed by GM feed should be labeled as well. These groups are not so concerned with health risks other than possible antibiotic resistance or causing allergies due to modification. Most of these groups are fighting for the banning of the use of antibiotic resistance markers, and some are confident that in the EU directive 90/220 will ban the use of these markers. Most of these organizations are concerned about the impact genetic modification will have on the ecosystem, particularly biodiversity. They are nervous about the transfer of genetic material through pollen and other venues and want more research done on the possible ecological impacts of the technology. Another concern was voiced by NNF about the impact that this technology might have on the food worker; they desire risk assessment as to health or safety

risks this technology might have for them in particular. These groups are concerned that researchers, public authorities and industry are not paying enough attention to the potential ethical, moral, environmental and health consequences that genetic modification might have. Overall, they all believe in and practice the Precautionary Principle and think it is better to be safe than sorry where gene technology is concerned.

4.6 Regulation and Legislation.

The purpose of this chapter is to present the regulation and legislation of Biotechnology in the U.S.A. and Denmark as the attitude that the government has taken in each country towards GMOs. A separate section has been dedicated to each country, and it contains important information collected from official sources. This chapter will focus on explaining, in each section, how the debate is handled inside the governmental institutions, including pertinent information about the regulatory documents issued and the procedure that an entity has to follow in order to make a release of GMOs.

4.6.1 Regulatory Overview – U.S. Process.

The legislation of food derived from new plant varieties in the U.S. is currently a hot issue, and the agencies in charge of the development of regulation are continuously researching new varieties of seeds and products. The main concern of the U.S. is ensuring the public that the products sold are safe to grow, safe to eat and safe for the environment [65].

4.6.1.1 Responsible Agencies.

The Government of the United States has given power to three agencies in order to ensure the safety of the products. The agencies primarily responsible for regulating biotechnology in the United States are the U.S. Department of Agriculture (USDA), Environmental Protection Agency (EPA), and the Food and Drug Administration (FDA). Products are regulated according to their intended use, with some products being regulated under more than one agency [65].

The U.S. Department of Agriculture is in charge of regulating plant pests, plants and veterinary biologics. The Environmental Protection Agency regulates the microbial/plant pesticides, new uses of existing pesticides and novel microorganism products. The Food and Drug Administration regulates food, feed, food additives, veterinary drugs, human drugs and medical devices.

An illustrative example is shown below:

New Trait/Organism	**Regulatory Review Conducted by:**	**Reviewed for:**
Viral Resistance in food crop	USDA EPA FDA	Safe to grow Safe for the environment Safe to eat
Herbicide Tolerance in food crop	USDA EPA FDA	Safe to grow New use of companion herbicide Safe to eat
Modified Oil content in food crop	USDA FDA	Safe to grow Safe to eat
Modified flower color ornamental crop	USDA	Safe to grow
Modified soil bacteria degrades pollutants	EPA	Safe for the environment

Table 6: Illustrative Examples of the U.S. Regulatory System [65].

4.6.1.2 Main Sources of Law and Regulation.

Before commercialization, genetically engineered plants/organisms must conform to standards set by State and Federal marketing statutes such as State seed certification laws, the Federal Food, Drug, and Cosmetic Act (FFDCA), the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Toxic Substances Control Act (TSCA), and the Federal Plant Pest Act [65]. There are no national requirements for varietal registration of new crops. This articles are to be found in the U.S. Code.

Apart from the regulation stated on the U.S. Code, the agencies in charge of controlling the safe development of the processes issue Federal Registers periodically, where the Code is expanded and issues are mentioned more specifically.

4.6.1.3 History of the regulation.

For more than two decades the Food and Drug Administration (FDA) has been studying genetic modification techniques. Nevertheless, it was in March 1990, that the FDA issued the first regulation in the U.S. for the use in food of a substance produced by recombinant DNA techniques. The Federal Register, vol 57, pp 10932-10936 affirmed that chymosin was recognized as "Generally Recognized as Safe" (GRAS) [66]. Chymosin is the milk-clotting enzyme used to make cheese and other dairy products. The notation as GRAS enables the product to be exempt from the premarket approval requirements that apply to new food additives [67].

In 1992, the FDA published and invited public comment on a policy statement (the 1992 policy) clarifying its legal and regulatory framework for oversight of food and animal feed derived from new plant varieties developed by both conventional and new breeding techniques, such as recombinant DNA techniques [67]. The FDA's policy explains how whole foods, including animal feeds, derived from fruits, vegetables, grains, and by-products such as vegetable oils and food starch are regulated under the Act. The policy covers foods derived from plants developed through all methods of breeding, including genetic engineering [66].

The center of the 1992 Policy Statement is a comprehensive "guidance to industry" section that discusses issues for assuring safety and identifies scientific and regulatory questions for which firms should consult the FDA [66]. The principles are consistent with the principles

for safety assessment discussed by various prestigious organizations, including the National Research Council in the U.S., the World Health Organization and the Food and Agriculture Organization of the United Nations, and the Organization for Economic Cooperation and Development [67].

In April, 1994, the FDA, the EPA, and the USDA hosted a scientific conference on "Scientific Issues Related to Potential Allergenicity in Transgenic Food Crops". The goal of the conference was to foster a dialogue among scientists on food allergy and new varieties of food crops developed by gene transfer to assess current information regarding the attributes of substances (such as proteins) that are food allergens [67]. Scientists noted that allergic reactions to foods occur in a small percentage of the U.S. population, but affect a significant number of individuals. Life threatening reactions are a rare occurrence, and most allergic reactions to foods can be attributed to fewer than a dozen foods [67].

The first food derived from a crop modified via recombinant DNA techniques to come before the FDA was the Flavr Savr tomato developed by Calgene, Inc. of Davis, California. To develop this tomato, Calgene used recombinant DNA techniques. The result is a tomato that remains on the vine longer for enhanced flavor [67].

Calgene asked the FDA to evaluate the Flavr Savr tomato under the most stringent procedures available for foods to ensure public confidence in their product. Thus, in addition to evaluating the firm's safety and nutritional assessment of the tomato per se, Calgene requested that the FDA regulate the APH(3')II enzyme. This is the only new substance in the Flavr Savr tomato, as a food additive. The question to ask was whether Flavr Savr tomatoes were as safe as other currently consumed tomatoes [67].

Based on the safety and nutritional assessment described in the 1992 policy and the modifications of the Flavr Savr tomato, this new tomato was addressed by an analysis of the following information: the source, identity, function, and stability of genetic material introduced into Flavr Savr tomatoes; analytical studies on the composition of Flavr Savr tomatoes; and the safety of APH(3')II. Also evaluated was the environmental safety of the use of the kanamycin resistance gene as part of the review of the food additive petition for APH(3')II [67].

Calgene compared the nutritional profile of Flavr Savr tomatoes to the parental variety to ensure that the new tomato did not exhibit unexpected changes in composition. The firm also showed that the introduced DNA was stably integrated in the tomato chromosome and remained unchanged over five generations. The only new substance introduced into the Flavr Savr tomato was the APH(3')II marker gene protein. Calgene evaluated the safety of this protein and showed that APH(3')II is rapidly inactivated by stomach acid and digestive enzymes [67].

Based on the information that Calgene submitted concerning the Flavr Savr tomato, the FDA concluded that this new variety had not been significantly altered in regard to safety when compared to varieties of tomatoes with a safe history of use. the FDA did not require special labeling for the Flavr Savr tomato. The agency also stated that the correct common or usual name for the Flavr Savr tomato is "tomato", because the new tomato was not significantly different from the range of commercial varieties referred to by that name. However, Calgene decided to provide special labeling, including point of sale information, to inform consumers that the new tomato had been developed through genetic engineering [67].

Since the decision on the Flavr Savr tomato, developers of foods derived from new plant varieties developed using recombinant DNA techniques have been asked to provide only summary information of their safety and nutritional assessment to the FDA and to make a

scientific presentation of their data to the scientists. The informal notification process serves to inform the agency about developments in the technology and permits the agency to identify any unresolved safety or regulatory questions.

In November 1994, the FDA completed informal notifications with developers on seven additional foods derived from plants modified via recombinant DNA techniques, and presented the safety and nutritional summary information on the products to the agency's Food Advisory Committee. These foods included: delayed ripening tomatoes (DNA Plant Technology, Monsanto, Co., and Zeneca Plant Sciences); pest resistant crops: virus-resistant squash (Asgrow Seed Co.), and Colorado potato beetle-resistant potato (Monsanto, Co.); herbicide-tolerant crops: bromoxynil-tolerant cotton (Calgene, Inc.), and glyphosate-tolerant soybean (Monsanto Co.). the FDA agreed that there were no outstanding food safety issues associated with these products [67].

4.6.1.4 Role of the FDA.

The public relies on the FDA for assurance that foods are safe and wholesome. The FDA has authority under the Federal Food, Drug, and Cosmetic Act (the Act) to ensure the safety of most domestic and imported foods in the U.S. market, except meat and poultry, which are regulated by the U.S. Department of Agriculture (USDA) [65]. The FDA monitors foods to enforce the tolerances for pesticides set by the EPA. The FDA regulates foods and food ingredients developed by genetic engineering by the same provisions and regulations under the Act that regulates other food products [66]. The food or food ingredient developed by genetic engineering must meet the same rigorous safety standards under the Act as other food products.

the FDA has broad authority to take legal action against a substance that poses a hazard to the public and fails to meet the safety standards of the Act [66].

In conducting its safety evaluations of genetically engineered foods, the FDA considers not only the final product but also the techniques used to create it. Bioengineered foods and food ingredients must adhere to the same standards of safety under the Act that apply to their conventional counterparts. This means that these products must be as safe as the traditional foods in the market [68].

The FDA relies primarily on two sections of the Act to ensure the safety of foods and food ingredients:

1. The adulteration provisions of section 402 (a)(1). Under postmarket authority, the FDA has the power to remove a food form the market (or sanction those marketing the food) if the food poses a risk to public health. The Act places a legal duty on developers to ensure that the foods they market to consumers are safe and comply with all legal requirements [66, 69].
2. The food additive provisions (section 409). Under this section, substances that are intentionally added to food are food additives, unless the substance is generally recognized as safe (GRAS) or is otherwise exempt (e.g., a pesticide, the safety of which is overseen by the EPA) [66, 69].

The Act requires premarket approval of any food, in the specific case of foods developed utilizing the tools of biotechnology that are not generally recognized as safe (GRAS) under section 409 of the 1992 Policy. The FDA set up a consultation process to help companies meet the requirements. The Agency requests that firms submit a summary of their assessment. Consultation is voluntary, but the legal requirements that the foods have to meet are not. the

FDA believes that all bioengineered foods on the market have gone through the process before they were marketed [68].

Companies send the documents to the FDA summarizing the information and data they have generated to demonstrate that a bioengineered food is as safe as the conventional food. The documents describe the genes they use: if they are commonly allergenic plants, the characteristics of the proteins made by the genes, their biological function, and the concentration of the substance in the food. Firms are required to inform if the new food contains the expected levels of nutrients or toxins, and any other information about safety and use of the product [68].

The FDA recommends initializing the consultation process several months in advance, because the information provided is subject to revision of the FDA scientists and the firms are required to answer the questions they could raise [69]. If the information provided satisfied the FDA and they have no further questions at that time, then the company will receive a letter stating the completion of the consultation process. the FDA's consultation process aids companies in determining whether the protein they want to add to a food is generally recognized as safe. If the FDA has concerns about the safety of the food, the product would have to go through full food additive premarket approval process [69].

The food additive provision of the law ensures that a substance with an unknown safety profile is not added to food without the manufacturer proving to the government that the additive is safe. This intense review is not required under the law when a substance is generally recognized as safe (GRAS) by qualified experts. A substance's safety can be established by long history of use in food or when the nature of the substance and the information generally available to scientists about it is such that does not raise significant safety issues [66]. In case of bioengineered foods, DNA is added to the plant to direct production of a specific protein. DNA

already is present in all foods and is presumed to be GRAS; this leads to the point that is does not raise any food safety issues [68].

Traditional and bioengineered foods are all subject to the same labeling requirements. All labeling for a food product must be truthful and not misleading. If a bioengineered food is significantly different from its conventional counterpart (if the nutritional value changes or it causes allergies) it must be labeled to indicate that difference [66]. The Act requires that a food be given a common or usual name, and that the label disclose information about representations made or suggested about the product and consequences that may arise from the use of the product [66]. If a new food contains a protein derived from a food that commonly causes allergic reactions (and the developer cannot demonstrate that the protein is not an allergen) labeling would be necessary to alert sensitive consumers because they would not expect to be allergic to that food [67]. About 90 percent of all food allergies in the United States are caused by cow's milk, eggs, fish and shellfish, tree nuts, wheat, and legumes, especially peanuts and soybeans. So far, none of the proteins in foods evaluated through the FDA consultation process have caused allergies, as stated by Commissioner Jane E. Henney, M.D., from the FDA [68].

If a protein commonly produces very serious allergic reactions (e.g. peanut protein) and is transferred to another food, the FDA would need to evaluate whether it would be practical to label the food throughout its distribution. Circumstances could exist for which labeling would not provide sufficient consumer protection, and the FDA would take appropriate steps to ensure that the food would not be marketed [68].

4.6.1.5 Role of the U.S. Department of Agriculture (USDA).

The U.S. Department of Agriculture has as an agency called the Animal and Plant Health Inspection Service (APHIS); its responsibility is protecting U.S. agriculture form pests and diseases. APHIS works under the authority of the Federal Plant Pest Act. Their regulations provide procedures for obtaining a permit or for providing notification, prior to "introducing" a regulated article in the United States. Regulated articles are considered to be organisms and products altered or produced through genetic engineering that are plant pests of that there is reason to believe are plant pests. The act of introducing includes any movement into (import) or through (interstate) the United States, or release into the environment outside an area of physical confinement. The regulations also provide for a petition process for the determination of nonregulated status [65]. Any permit which has been issued may be withdrawn by an inspector or the Administrator (APHIS/USDA) if he/she determines that the holder thereof has not complied with one or more of the conditions listed on the permit. Of course, an appeal is accepted for reconsideration of the action taken [70].

This inspector is any employee of the Animal and Plant Health Inspection Service, U.S. Department of Agriculture, or any other person, authorized by the Director, in accordance with the law enforcement provisions [71].

APHIS can issue either a permit or a courtesy permit. The administrator may issue a courtesy permit for the introduction of organisms modified through genetic engineering which are not subject to regulation under 7 CFR 340 to facilitate movement when the movement might otherwise be impeded because of the similarity of the organism to other organisms regulated under 7 CFR 340. The courtesy permit is a written permit issued by the Director, or designee of the Director, of the Biotechnology, Biologics, and Environmental Protection (BBEP) division of

the APHIS. APHIS will determine whether a courtesy permit is issued or advise the responsible that a permit is required. The permit enables the introduction of a regulated article under conditions determined by the Director not to present a risk of plant pest introduction. Once a determination of Non-regulated status has been made, the product (and its offspring) no longer requires APHIS review for movement or release in the U.S. [71].

APHIS follows the procedural requirements under the National Environment Policy Act (NEPA) and the existing USDA authorities to identify any plant pest risk posed by transgenic plant under the FPPA. Based on these facts, and on its experience in having completed one determination of non-regulated status, APHIS does not believe that its review under the petition process provides inadequate oversight; nor that the data requirements are inadequate [72].

In addition, under the U.S. code in Title 7, Section 450 the USDA has the power to assign competitive, special and facilities research grants. The code establishes a category of High Priority Research. Most of the priorities are biotechnology related [73].

4.6.1.6 The Role of the Environment Protection Agency.

The Environmental Protection Agency (EPA) ensures the safety of pesticides, both chemical and those that are produced biologically. The BioPesticides and Pollution Prevention Division of the Office of Pesticide Programs (OPP) uses the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to regulate the distribution, sale, use and testing of plants and microbes producing pesticidal substances [66].

The reason for the EPA to intervene in the process of regulation is that substances in genetically modified organisms are handled as pesticides under section 2 of FIFRA (7 U.S.C. 136 (u)). Substances are intended to prevent, destroy, repel, or mitigate any pest or are intended

for use as a plant regulator, defoliant, or desiccant [73]. The EPA would define these substances as plant-pesticides, that is, a pesticidal substance that is produced in a living plant and the genetic material necessary for the production of the substance where the substance is intended for use in the living plant [74].

Under the Federal Food, Drug and Cosmetic Act (FFDCA), the EPA sets tolerance limits for substances used as pesticides on and in food and feed, or establishes an exemption from the requirement of a tolerance [65]. The EPA also establishes tolerances for residues of herbicides used on novel herbicide-tolerant crops. Under the authority of the Toxic Substances Control Act (TSCA), the EPA's TSCA Biotechnology Program regulates microorganisms intended for commercial use that contain or express new combinations of traits [65].

Most of the regulations were developed generally for traditional, chemical, pesticides. Because of the unique characteristics of plant-pesticides, the EPA recognizes that the existing regulations may not always be appropriate for these products. The characteristics of plant-pesticides such as both their production and use in plants; their biological properties; and their potential ability to spread and increase in quantity in the environment distinguishes them from traditional, chemical pesticides.

An important consideration not seen with traditional pesticides is the potential for spread of the plant's genetic material. Plants can reproduce sexually and/or asexually, and the ability to produce the plant-pesticide could spread through the agro- or natural ecosystems, particularly if wild relatives acquire the ability to produce the plant-pesticide through successful hybridization [75].

The EPA has identified categories of plant-pesticides that are likely to pose little risk and others that are not likely to cause unreasonable adverse effects on the environment even in the

absence of regulatory oversight [75]. EPA proposes under 40CFR 174.5 to exempt those from FIFRA regulation. Reasons for doing this are that the low probability of risk does not justify the cost of regulation. In addition, EPA found that the risks posed by biological control agents other than microorganisms were adequately addressed by other Federal agencies such as the U.S. Department of Agriculture's (USDA's) Animal and Plant Health Inspection Service (APHIS) and the U.S. Department of the Interior [74].

Nevertheless, information on potential unreasonable adverse effects would be required to be reported, if such information is obtained from any source or by any person who sells or distributes a plant-pesticide. Failure to comply with Sec. 174.7 would be an unlawful act under FIFRA section 12 (a)(2)(S) and could result in an enforcement action (for penalties) under FIFRA section 14. In addition, FIFRA section 6(a)(2) applies to plant-pesticides that would not be exempt under this proposed rule [74].

4.6.17 Overall Process.

.For research into the regulation and legislation of biotechnology in the United States the group determined that the Government is concerned about the safety of the consumers and about the environmental repercussions that the use of GMOs could cause, but it tends not to publicize the issues or alarm the population.

Regulation exists in order to ensure that the products comply with a minimum of requirements in order to permit the exposure of them to the public; however, this regulation is oriented to food in general and is not specifically addressing GMO containing products. Huge quantities of tests are required and tools are available to the producers to ensure that their

products are safe enough to be commercialized under the existing laws. The company wishing to make the release assumes full legal duty of the product and its effects in the environment.

The Government has delegated the authority to three agencies, the Federal Drug Administration, the U.S. Department of Agriculture and the Environment Protection Agency, that are in charge of monitoring the safe development of the processes. Every Agency has its own role in the system and is continuously doing research to improve its activity.

Analyzing the research done into the existing legislation, it can be perceived that the United States believes genetically modified foods are as good as traditionally grown food. U.S. regulation puts genetically modified food in the same legal frame as traditionally grown food, and sees no substantial risk for the public or for the environment in this practice.

4.6.2 Regulatory Overview – Danish Process

It is important to mention before starting to explore the regulation and legislation field in Denmark that the area has two connotations. Being part of the European Union (EU) means creating, adopting and agreeing on common regulation between all the member states. This implies that Denmark, in addition to having national regulatory agencies and bodies, is part of an organism that harmonizes the process with the other countries member of the EU. The 15 countries comprise the EU follow the same directives.

The countries, members of the European Union are required to regulate deliberate releases into the environment of genetically modified organisms in order to minimize their potential negative effects on human health and the environment, since living organisms released in the environment for experimental purposes or as commercial products may cross national

frontiers and affect other Member States by virtue of their irreversible effects on the environment [76].

The regulation of biotechnology in Denmark will follow the European Union guidelines agreed between the Member States and accepted by the European Union.

Internally, Denmark has its own agencies that control, monitor and deal with the concerns of the population. Particularly for the biotechnology issue, the players involved in the governmental decisions are the Parliament, The Ministry of Environment and Energy, the Forrest and Nature Agency and the Food Directorate. However, these agencies are supported with other bodies like the Environmental Committee, agencies in the food directorate (for example the toxicology agency), the Nature Environment Research Institute (NERI), Danish Environmental Protection Agency and different particular organizations invited to submit comments (advice) in public hearings.

4.6.2.1 Institutions in the EU: The role of the European Commission and the European Parliament [77].

The European Union (EU) contains several institutions that have different responsibilities, duties and power. They were established as organisms that give expression to an ever-closer Union of European nations. In the first 20 years, the Commissions would propose, the Parliament would advise, the Council of Ministers would decide and the Court of Justice would interpret.

"In the last 20 years, the Parliament has become directly-elected and acquired new powers, the European Court of Auditors has arrived on the scene, the European Investment Bank has

emerged as a major source of finance for economic development, the Economic and Social Committee has demonstrated to the value of debate and cooperation between the economic and social partners and, most recently, the Committee of the Regions has been set up to advance regional interests and diversity."

The European Commission – the driving force for the European union

The European Commission (EC) is composed of 20 members and 1600 people staff. Two members from France, Germany, Italy, Spain and the United Kingdom; and one from each of the other member states form the Commission that meets in Brussels once a week. The members are changed every 5 years; the next change will be 2004. Most of their members have previous experience before entering the position having been members of their national parliaments or members of the European Parliament. The president of the Commission is elected by common accord of the government of the Member States and subject to the approval of the European Parliament.

It is defined as the centre of the policy making process of the European Union (EU). A proposal from the EC is needed for The Council of Ministers and the European Parliament to pass legislation. "EU laws are mainly upheld by Commission action, the integrity of the single market is preserved by Commission policing, and European policies, such as agriculture, regional development, research, educational exchanges and many others, are sustanined, managed and developed by the Commission." But the Commission is not and all-powerfull institution, its proposals, actions and decisions are subject of discussion by other EU institutions. The Commission's role identifies three functions: initiate proposals for legislation, be guardian of he Treaties and execute EU policies and actions.

As a legislative initiator they have to identify the European interest, as a whole, without favoring any nation in particularly. They have the responsibility of consult as widely as they consider necessary. It is essential to listen to governments, industry, trade unions, special interest groups and technical experts before passing a proposal. Finally, they have to observe the principle of subsidiarity. This means that the Union should take action only when it will be more effective to adopt a position than if decisions were left to individual Member States.

The Scientific Committees are specific bodies that provide the Commission with scientific advice. Scientific advice by these committees is made available following a request by the Commission for a scientific advice or opinion. The Committess that provide support in the area of GMOs are the Scientific Committee for Food (that works on "Scientific and technical questions concerning consumer health and food safety associated with the consumption of food products and in particular questions relating to toxicology and hygiene in the entire food production chain, nutrition, and applications of agrifood technologies, as well as those relating to materials coming into contact with foodstuffs, such as packaging.") and the Scientific Committee for Plants (that deals with "Scientific and technical questions relating to plants intended for human or animal consumption, production or processing of non-food products as regards characteristics liable to affect human or animal health or the environment, including the use of pesticides").

The EC's mission as guardian of the Treaties is to ensure that legislation is applied correctly by the Member States. The commission will proceed and the infringents will face Commission action, including legal proceedings at the Court of Justice of the European Communities.

The EC also has executive responsibilities; it manages the EU budget, has delegated powers to make rules which fill in the details of certain EU legislation and enforces the Treaty's competition rules. The commission has also the role of negotiator of trade and cooperations agreements with other countries or group of countries.

The European Parliament – Guardian of the European interests and citizen's rights

The European Parliament is composed by 625 members that are elected every 5 years. A list of the number of representatives of each Member State at the European Parliament are shown bellow:

Germany	99
France	87
Italy	87
United Kingdom	87
Spain	64
Netherlands	31
Belgium	25
Greece	25
Portugal	25
Sweden	22
Austria	21
Denmark	16
Finland	16
Ireland	15
Luxembourg	6

"This body is the directly-elected expression of the political will of the peoples of the European Union." It is the largest multinational Parliament in the world, where European citizens, individually or as a group, have the right to petition the Parliament on matters that correspond to their sphere of responsibility. They conduct, what they call parliamentary assizes, where discussions of Union policies are enlivened. They try to maintain constant link to national

parliaments. The most important powers of the European Parliament fall into three areas: legislative power, power over budget and supervision of the executive.

Originally, the Treaty of Rome (1957) conceived the body as a consultative institution, giving the Council of Ministers the power to decide legislation. Subsequent treaties have extended Parliament's jurisdiction, so that the Parliament and the Council now share the power of decision in a large number of areas.

The consultation procedure requires an opinion from the Parliament before the Council can adopt the proposal developed by the EC. The cooperation procedure enables the Parliament to issue amendments. It involves to readings in the Parliament, giving members ample opportunity to review and amend the Commission's proposal and the Council's preliminary position on it. This procedure applies to several areas, including European Development Fund, research, the environment and overseas cooperation and development.

The co-decision procedure shares decision-making power equally between the Parliament and the Council. A conciliation committee (gathering equal numbers of members of Parliament and Council, with the Commission present) seeks a compromise on a text that the Council and Parliament can both subsequently endorse. When no agreement can be reached, the Parliament can reject the proposal. This procedure applies to a wide range of issues including free movement of workers, consumer protection, education, culture, health and trans-European networks.

Parliament's assent is necessary for important international agreements such as entrance of new Member States in the EU, association agreements with non-member countries, the organization and objectives of the Structural and Cohesion Funds and the tasks and powers of the European Central Bank.

Parliament and Commission

The Parliament has an important role in appointing every 5 years the President and Members of the European Commission. It exercises a detailed scrutiny through a close examination of the many monthly and annual reports that the Commission has to submit to the Parliament. Members submit written and oral questions to the Commission (about 5570 in 1998), interrogate Commissioners at Question Time during plenary sessions and at meetings of parliamentary committees.

"If the worst comes to the worst (which has never yet occurred), Parliament can pass a motion of censure on the Commission and force it to resign."

4.6.2.2 The two main sources of law pertaining to Genetically Modified Organisms

The placing on the EU market of genetically modified organisms is dictated mainly by a key legislative element, the Directive 90/220/EEC of 23 April 1990. This directive regulates all GMOs (plants, animals, micro-organisms) to be released in the environment. Market authorizations are given only after an environmental risk assessment has been carried in compliance with the annex II of the Directive and if the risks for human health and the environment are below the acceptance level [78].

In this approval process it is also considered the effect of pesticides in the environment, where the Danish Environmental Protection Agency emits its judgment; and the seed is tested in order to enter the Seed List [79]. This seed list is created at a national level; the tests shall demonstrate stability of the seed. After 3 years of laying on the seed list, the seed is incorporated into the EU seed list [79]. Consents determine conditions for use labeling of the products to be

placed on the market, several amendments have been done to the Directive since its issuance date on 1990, for example the directive 97/35/EC or the conformance to the novel food regulation 258/97 [78].

"In addition to the horizontal GMO legislation, specific GMO (derived products) are regulated by vertical legislation, for which specific risk assessment has to be performed [78]". GMOs or GMO-derived products that will be used as food or food ingredients are required to go through a process of food safety assessment. This process was stipulated before under the regulations of the 90/220/EC Directive, but since May 15 1997 the European Parliament and the Council put in force the regulation 97/258 [80]. This act regulated novel foods and novel food ingredients, including GMO foods. It distinguishes two kinds of procedures for food approval of novel foods: the general procedure and a simplified procedure for substantial equivalent products [78, 80].

It established a simplified food approval "notification" procedure, where proves of substantial equivalence were found. Several GMO derived products that had been evaluated and found substantially equivalent by national committees received authorization on the market through this notification procedure [79].

There are two different approval procedures pertinent to GMOs. One approval is required to deliberately release genetically modified organisms into the environment and a different approval is needed for products that will be used as food or food ingredients assuring food safety. One measures the risks that implies growing it and the other the risks of eating it.

4.6.2.3 The 90/220/EEC directive [81]

The 90/220/EEC directive is the document that sets the guidelines for the market release into the environment of genetically modified organisms. This directive expresses the necessity for Member States to regulate the deliberate releases because of the potential negative effects on human health or on the environment that this practice could cause and cross national boundaries.

The directive states the procedure that any person wishing to undertake a deliberate release of GMOs is required to follow. The document issued by the European Community has approved the release into the environment of different products. The content of the 90/220/EEC directive is under constant revision and subject to updating. Bellow, a commission list of implementing measures is provided [81]:

" Decision 91/274/EEC - Official Journal L 135, 30.05.1991
Commission Decision of 21 May 1991 on a list of Community legislation referred to in Article 10 of Directive 90/220/EEC.

Decision 92/146/EEC - Official Journal L 60, 05.03.1992
Commission Decision of 11 February 1992 concerning the summary notification information format referred to in Article 12 of Directive 90/220/EEC.

Commission Decision of 18 December 1992 concerning the placing on the market of products containing GMOs pursuant to Article 13 of Directive 90/220/EEC.

Decision 93/572/EEC - Official Journal L 276, 09.11.1993
Commission Decision of 19 October 1993 concerning the placing on the market of products containing GMOs pursuant to Article 13 of Directive 90/220/EEC.

Decision 93/584/EEC - Offical Journal L 279, 12.11.1993
Commission Decision of 22 October 1993 establishing the criteria for simplified procedures concerning the deliberate release into the environment of genetically modified plants pursuant to Article 6(5) of Council Directive 90/220/EEC.
This text applies only to genetically modified plants, which is the group of GMOs with which most of the experience has been acquired to date.

Directive 94/15/EC - Official Journal L 103, 22.04.1994
Commission Directive of 15 April 1994 adapting to technical progress for the first time Council Directive 90/220/EEC on the deliberate release into the environment of genetically modified organisms.

Decision 94/211/EC - Official Journal L 105, 26.04.1994
Commission Decision of 15 April 1994 amending Council Decision 91/596/EEC concerning the summary notification information format referred to in Article 9 of Council Directive 90/220/EEC.
This decision replaces the annex to Decision 91/596/EEC.

Decision 94/730/EC - Official Journal L 292, 12.11.1994
Commission Decision of 4 November 1994 establishing simplified procedures concerning the deliberate release into the environment of genetically modified plants pursuant to Article 6 (5) of Council Directive 90/220/EEC.

Decision 96/158/EC - Official Journal L 37, 15.02.1996
Commission Decision of 6 February 1996 concerning the placing on the market of a product consisting of a genetically modified organism, hybrid herbicide-tolerant swede-rape seeds (Brassica napus L. oleifera Metzq. MS1Bn × RF1Bn), pursuant to Council Directive 90/220/EEC.

Decision 96/281/EC - Official Journal L 107, 30.04.1996.
Commission Decision of 3 April 1996 concerning the placing on the market of genetically modified soya beans (Glycine max L.) with increased tolerance to the herbicide glyphosate, pursuant to Council Directive 90/220/EEC. This Decision authorizes the United Kingdom to place on the market a product consisting of soya beans derived from the soya bean "Glycine max L cv A 5403".

Decision 96/424/EC - Official Journal L 175, 13.07.1996
Commission Decision of 20 May 1996 concerning the placing on the market of genetically modified male sterile chicory (Cichorium intybus L.) with partial tolerance to the herbicide glufosinate ammonium pursuant to Council Directive 90/220/EEC.

Decision 97/392/EC -Official Journal L 164, 21.06.1997
Commission Decision of 6 June 1997 concerning the placing on the market of genetically modified swede- rape (Brassica napus L. oleifera Metzg. MS1, RF1), pursuant to Council Directive 90/220/EEC.

Decision 97/393/EC - Official Journal L 164, 21.06.1997
Commission Decision of 6 June 1997 concerning the placing on the market of genetically modified swede- rape (Brassica napus L. oleifera Metzg. MS1, RF2), pursuant to Council Directive 90/220/EEC.

Decision 97/549/EC - Official Journal L 225, 15.08.1997
Commission Decision of 14 July 1997 concerning the placing on the market of T102-test (Streptococcus thermophilus T102) pursuant to Council Directive 90/220/EEC.

Decision 98/291/EC - Official Journal L 131, 05.05.1998
Commission Decision of 22 April 1998 concerning the placing on the market of genetically modified spring swede rape (Brassica napus L. ssp. oleifera), pursuant to Council Directive 90/220/EEC.

Decision 98/292/EC - Official Journal L 131, 05.05.1998
Commission Decision of 22 April 1998 concerning the placing on the market of genetically modified maize (Zea mays L. line Bt-11), pursuant to Council Directive 90/220/EEC.

Decision 98/293/EC - Official Journal L 131, 05.05.1998
Commission Decision of 22 April 1998 concerning the placing on the market of genetically modified maize (Zea mays L. T25), pursuant to Council Directive 90/220/EEC.

Decision 98/294/EC - Official Journal L 131, 05.05.1998
Commission Decision of 22 April 1998 concerning the placing on the market of genetically modified maize (Zea mays L. line MON 810), pursuant to Council Directive 90/220/EEC."

4.6.2.4 Procedure for the deliberate release of GMOs into the environment

This procedure for the market release of GMO involves two processes. One is the national internal notification and approval process. The second is the international issue where all the member states take a position and a decision is taken in respect the product.

The procedure to be followed internally in Denmark

The general procedure established by the EU requires the company interested in doing the market releases to present an application to the competent authority of the member state where the release is going to take place. In Denmark the competent authority for the deliberate release of transgenic organisms (directive 90/220/EEC) and for contained use of transgenic organisms (directive 90/219/EEC) in collaboration with Arbejdstilsynet is The National Forest and Nature Agency.

This agency is an administrative national organization, whose main work is decided by law, and its job is to give advise to politicians and listen to and give information to citizens. It is responsible for the administration of specific notifications on experimental release and Danish positions on notifications in the placement on the market of genetically modified organisms (directive 90/220/EEC). They give technical and scientific advice on effects of using transgenic organisms and are part of the Minister of Energy and Environment [82].

The authorization procedure begins with the submission of the notification composed of a technical dossier and a summary. The summary is called SNIF or Summary Notification Information Format [78]. The technical dossier includes a full risk assessment, appropriate safety and emergency response measures and, in the case of products, precise instructions and conditions for use, plus a proposal for labeling and packaging [76]. The application will have an identification number defined by: C-for part C/Member State Initials/ year of introduction / national code [78].

This application is then passed by the Forest and Nature Agency to different specified particular organizations, which are invited to submit their comments about the market release. This consultation alternative is more like a national decision to involve Industry and NGOs into decision making at an early stage. It asks interested bodies for advise and provides these organizations a summary of the notifications [83]. The entity in charge of compiling all the comments coming from the different organizations is the Forest and Nature Agency [84]. Denmark practices public hearings and the organizations involved have a deadline to submit their comments. The Forest and Nature Agency also asks for advice from other agencies specifically focused on scientific advice: Institute for Food Safety and Toxicology and the Institute for Food Research and Nutrition [79]. The rapporteur, in this case Denmark, examines

compliance with the directive, with particular attention to the Environment Risk Assessment (ERA).

Ulrich Karlson, a senior scientist at NERI informed the group that the applications are not secret; he personally publicized one on the World Wide Web and received many comments about it [84]. However, Jesper Toft, a researcher at the University of Roskilde, expressed that the complete applications are not usually sent to the organizations under the list of organizations taking part of the public hearing [79].

After the public hearing ends, The Forest and Nature Agency decides the government position they are going to suggest. The authorities judge whether any undesirable effects on nature or the environment could occur [83]. This notice is passed to the Ministry of Environment it is the Minister who decides whether or not to release the GMO [84]. The governmental notice can be from 3 to 15 pages long approximately, and it also contains recommendations and conditions, which are passed to the Parliament in order to be approved or rejected. In addition of being supported by the prior work developed, the Parliament has the Environmental Committee and the Parliament Committee to revise the application. The process explained above is 30 days long at the maximum, but it can be extended, if further information is required by the notifier [78].

If the application fulfills the requirements of the directive and the state gives a favorable opinion, then the issue turns into a EU concern, where the rest of the Member States take stake in the decision and go through a revision period. The case and the complete application are passed to the European Commission for review.

The approval process outside the territory of the rapporteur country

Once an application passes to the European Commission (EC), the EC has to forward the application packages to the rest of the Competent Authorities (CAs) in each Member State. The CAs have exactly 60 days to evaluate the notification and possibly raise objections. If there are no objections, the rapporteur Member State gives consent in writing to the applicant and the product can be market [78].

In the case where objections are raised the commission shall draft a Proposal for Commission Decision to the Council in accordance with article 21 of the Directive.

"Article 21:

The Commission shall be assisted by a committee composed of the representatives of the Member States and chaired by the representative of the Commission. The representative of the Commission shall submit to the committee a draft of the measures to be taken. The Committee shall deliver its opinion on the draft within a time limit, which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148 of the Treaty in case of decisions, which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The chairman shall not vote. The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the committee.

If the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

If, on the expiry of a period of three months from the date of referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission [81]."

The qualified majority referred in Article 21 is a total of two thirds of the votes. The votes are divided by Member States individually. Luxemburg has 2 votes; Denmark, Finland and Ireland have 3; Austria and Sweden have 4; Belgium, Greece, Holland and Portugal have 5; Spain has 8 votes; France, Germany, Italy and Great Britain have 10 votes. This makes a total of 87 votes, where 62 are required to get an approval [85].

"Since 1997 the Commission waits for the advise of the Scientific Committee on Plants (SCP) of Directorate General Consumer Health Protection before drafting a Proposal for Commission Decision. If a qualified majority is reached, the Proposal shall be adopted and the Commission Decision published in the Official Journal [78]."

If after voting no qualified majority has been obtained the Commission Proposal is transmitted to the Council of Ministers (of the Environment) [78]. Current legislation states that the Council can only adopt the proposal by qualified majority or reject it by unanimity. If the Council is unable to deliver an opinion, the application shall be sent back to the Commission and the proposal shall be adopted.

The last word is said by the country that submitted the proposal for the first time. The Commission sends the proposal back to the country that issued the application and the Member State decides if the market release is approved. In addition to the 90/220 approval guidelines, transgenic plant lines have to be registered (at national level) as plant variety before any

cultivation is allowed [78]. This registration enters the variety to a Seed List; this list is developed by the Member State and enters into the EU level after three years [79].

Where a product containing GMO or a combination of GMOs is placed on the market and has been duly authorized pursuant to this Directive, a Member State may not prohibit, restrict or impede the deliberate release of this product on its territory [76] unless they have justifiable reasons for banning the product.

"Article 16

1) Where a Member State has justifiable reasons to consider that a product which has been properly notified and has received written consent under this Directive constitutes a risk to human health or the environment, it may provisionally restrict or prohibit the use and /or sale of that product on its territory. It shall immediately inform the Commission and the other Member States of such action and give reasons for its decision.

2) A decision shall be taken on the matter within three months in accordance with the procedure laid down in Article 21 [81]."

Member States are entailed to send the Commission, at the end of each year, a brief factual report on the control of the use of all products placed on the market under the 90/220 Directive [81]. And the Commission shall send to the European Parliament and the Council, every three years, a report on the control by the Member States of the products placed on the market [81].

4.6.2.5 The Food Approval process

The Food Approval Process is mainly required to follow the same approval procedure developed for the Market Release Approval process with slight modifications. An environmental risk assessment must always be undertaken to ensure environmental safety; whereas in order to establish a unified Community system for assessment of such products, provision must be made under the EC regulation 258/97 for a specific environmental risk assessment, which in accordance with the procedure provided in the article 10 of the 90/220/EEC Directive must be similar, but must include the assessment of the suitability of the product to be used as a food or food ingredient [80].

The risk evaluation has to be submitted to the Competent Authority (CA) in charge, in this case the Food Ministry [86]. The Food Ministry only examines a product in terms of food safety and whether or not it can be eaten. The Ministry of the Environment is responsible for determining whether or not the product is safe for the environment. A product cannot be approved without the approval of both ministries [86]. At the level of European Commission, the Scientific Committee to provide advice is the Scientific Committee for Food as opposed to the release approval process, where the main advisor is the Scientific Committee for Plants [79].

4.6.2.6 Overall Process

Denmark as part of the European Union shares with 14 more Member States the combination of guidelines that harmonize the system and look for a consensus. The existence of official bodies to control and monitor the normal development of the communication flow makes it possible for each country to be heard.

The system used to approve any GM market request requires the communication of different organizations and entities that enforce the democracy of the population and the ideology of a union. The public is motivated to participate in decisions, even though the governmental entity has always the last word. It can be perceived that the public wants to be informed of the steps that the government takes, they demand the government to be as transparent as possible.

The Ministry of Food and the Ministry of Environment and Energy play a very important role in the decision-making inside the country and have the responsibility of as well as consult external national sources for advice; they have to work together and provide their opinion to the European Commission to make the system flow.

5.0 Networks

In this section two networks are going to be characterized, the U.S. arena and the Danish arena as applies to the GM food debate. It is crucial to express the complex interactions existing between each of the players at a national level because these two individual networks will establish the differences and will provide the background for a comparison of the two countries.

The section presented below has been called networks because its purpose is to define the position and role of each of the key actors having direct or indirect interest in the GM food debate. This will be done by interconnecting a web of viewpoints towards the technology. The forces driving the debate form mechanisms that define the interaction and shape the network.

The controversy illustrated arose because of the unsatisfied desires of the different groups that are trying to influence each other in order to reach an agreement or a compromise concerning the GM issue. The players in these networks have different focuses on the problems and the solutions in the debate. Each party has its own viewpoint and tries to influence others to accept their position by providing information and facts that prove their arguments.

These networks function differently in each country and this reveals their particular social organization. However, a similar scheme can be maintained, which serves as support for the analysis of the Danish Network and the U.S. Network. Therefore, the same diagram was used for both countries. It is the interactions in the diagram that generate the differences.

Every category mentioned in section 4 interacts with one another in the genetic manipulation arena in a very complex form. There are links, intentions and interests pointing to each of the other groups.

As an attempt to characterize the situation, the consumers are placed at the center of the network. The debate develops around the consumers and the efforts of the other players are

directed at influencing the consumer. Two driving forces are located at the sides of the consumer: the force for the development of the technology and the force demanding a slow down in the advance of the technology.

The government is placed as the omnipresent observer and decision maker. Each of the three groups, mentioned above, tries to influence the decision of the government. They try to express their opinion to implement a change in legislation that is based upon the knowledge and the attitudes they have decided to embrace. The government has the parental role of looking for a benefit to society and what is in the best interest of the population. The Government, in theory, represents the public opinion and democratic consensus.

The two driving forces have their own points of view clearly defined and have their arguments to back them up. Their goal is to pass the information on to the consumers in order to gain their acceptance, which may aid in getting their arguments and interests validated into law.

The direct information provider is the media, they are the body that filters the information and publicizes it among the population. The amount of information available to consumers is dependent upon the demand of information from the public and, obviously, from the input the two driving forces provide, assuming the media will listen to them. The government also has the opportunity to use the media to publicize its decisions and to open the floor for opinions or discussion from the different sectors of society.

This characterization of the controversy in the arena of risk versus benefits presents the players in a similar position for both countries, but the networks analyzed at a national level provide important information about particular relationships that make the mechanism work in different forms. These differences are primarily attributed to the presence of each of the players

in the debate and the differences in their actions. In order to facilitate the analysis a graphical representation has been attempted. It follows in sections 5.1 and 5.2.

5.1 United States Network

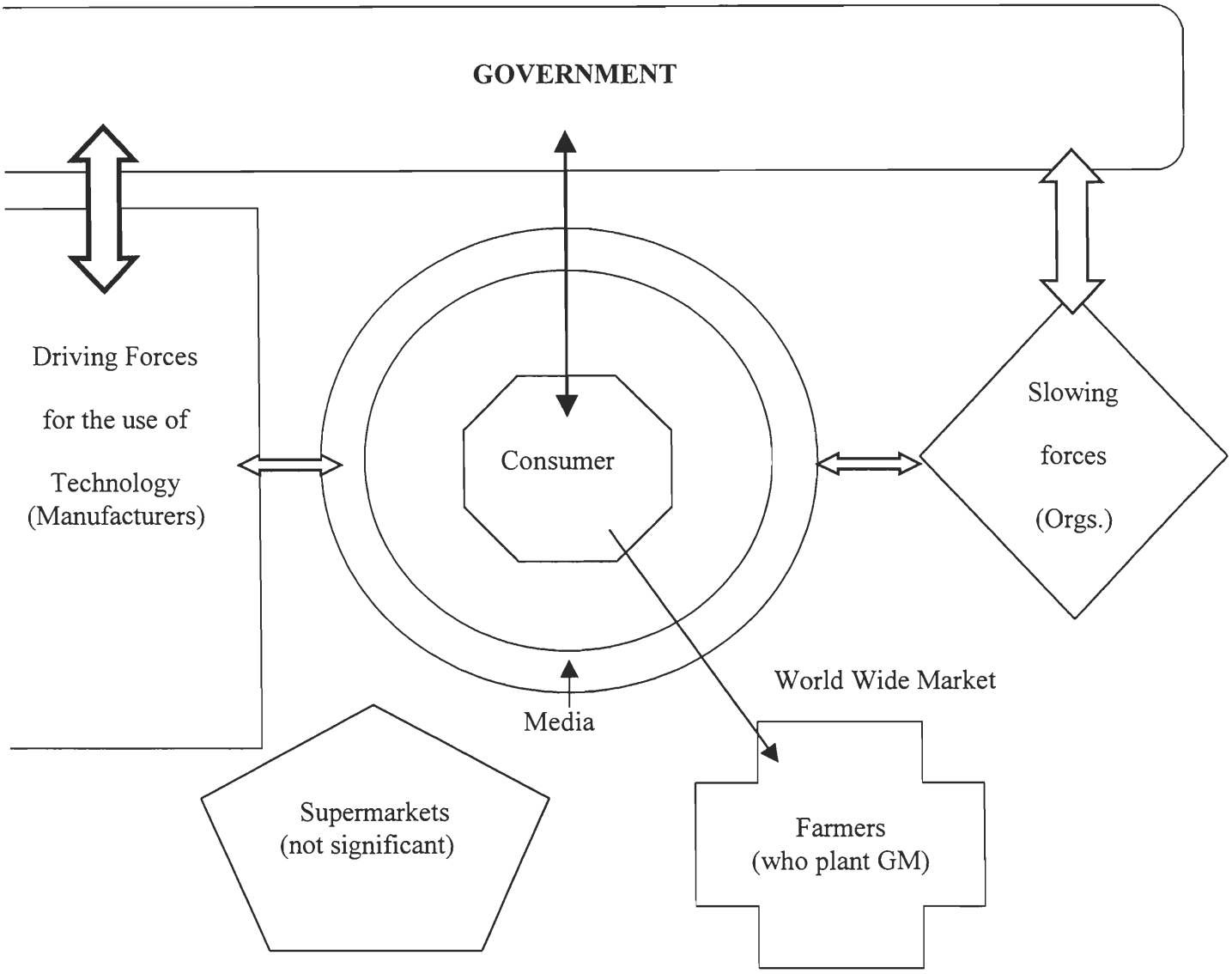

Fig. 14: The United States Network. Above is a diagram representing the network surrounding the GM food debate in the U.S. The consumers are in the middle surrounded by the media and shown to be affected by and affecting the three major forces (driving, slowing and government). The slowing forces and driving forces both have influence over the consumer but the relative amounts are uncertain (shown by equally dark arrows). These forces also affect government but the darker arrow on the side of the driving forces demonstrates the stronger influence in the U.S. The smaller size of the slowing forces in relation to the driving forces shows the relative influence as a whole being less by the slowing forces. The U.S. farmers are largely influenced by consumers of the world wide market (not the U.S. market) and the supermarkets are not significant in the U.S. debate shown by the lack of an arrow going to this category.

As shown in the graphic, the scheme of the network is conceptualized in the introduction above, positioning the consumers as the target of the two 'forces' and the center of attention. The debate in the United States has changed shape recently and the consumer is becoming more interested in the topic. This is the reason why the media is surrounding the consumers, the media is the carrier of the majority of the information, which enables the consumer to make decisions and forms their opinion. However, the information publicized by the media about GM food is very scarce and barely visible. Hence, the small circle around the consumers.

On one side, the presence of the forces creating barriers for the utilization of GM foods in the U.S. is rather small. Their voice is not really heard, the media rarely covers them, so they do not get their message to many consumers. On the other side, the driving force promoting the use of technology in the U.S. has an equally small effect on the consumer. They are not forced to defend the technology because farmers are purchasing their products and there is not a significant consumer concern.

The government has a two-way relationship with all three of the aforementioned groups. First, the affect the groups have on the government. The forces slowing technology do not have a significant voice in the U.S. government, they are not listened to as much the manufacturers are. The manufacturers have a lot of money with which to lobby for favorable legislation. The opposing forces do not have this luxury. The consumers affect the government in that they are responsible for electing officials, who are in turn responsible for the legislation. However, because GM food is not such a hot issue in the U.S., this effect is minimal.

The government affects all three groups with the legislation they pass and the policies of the significant government organizations (USDA, FDA, and EPA). If manufacturers are told by the government they cannot produce a certain product, they obviously will not. The existing

legislation determines what the opposing forces push for. When this legislation changes, the aim of this group changes with it. Finally, legislation can affect the consumer in a variety of ways. For example, the labeling of GM products may make a consumer who bought a product before, wary of buying it again because they now see a label on it. Legislation also has the power to alter the consumer's attitudes about GM products.

Farmers and supermarkets are also included in the diagram. U.S. farmers (just those who plant GM crops for the purpose of the diagram) are affected by consumers; they buy the products the farmers produce (not directly-must be processed first). At present, farmers are only truly being affected by consumers outside of the U.S. (primarily in Europe). U.S. consumer rejection is not large enough at this time to make a difference. It is because of this fact that supermarkets do not play a significant role in the U.S. network as yet. Supermarkets serve the consumer directly and since GM food products are selling at the same rate there is no need for them to take a stand on the issue.

This is a general characterization of the network and the relationships between the actors. It is necessary to keep it in this form, as elaborating further would only serve to confuse things.

5.2 Danish Network

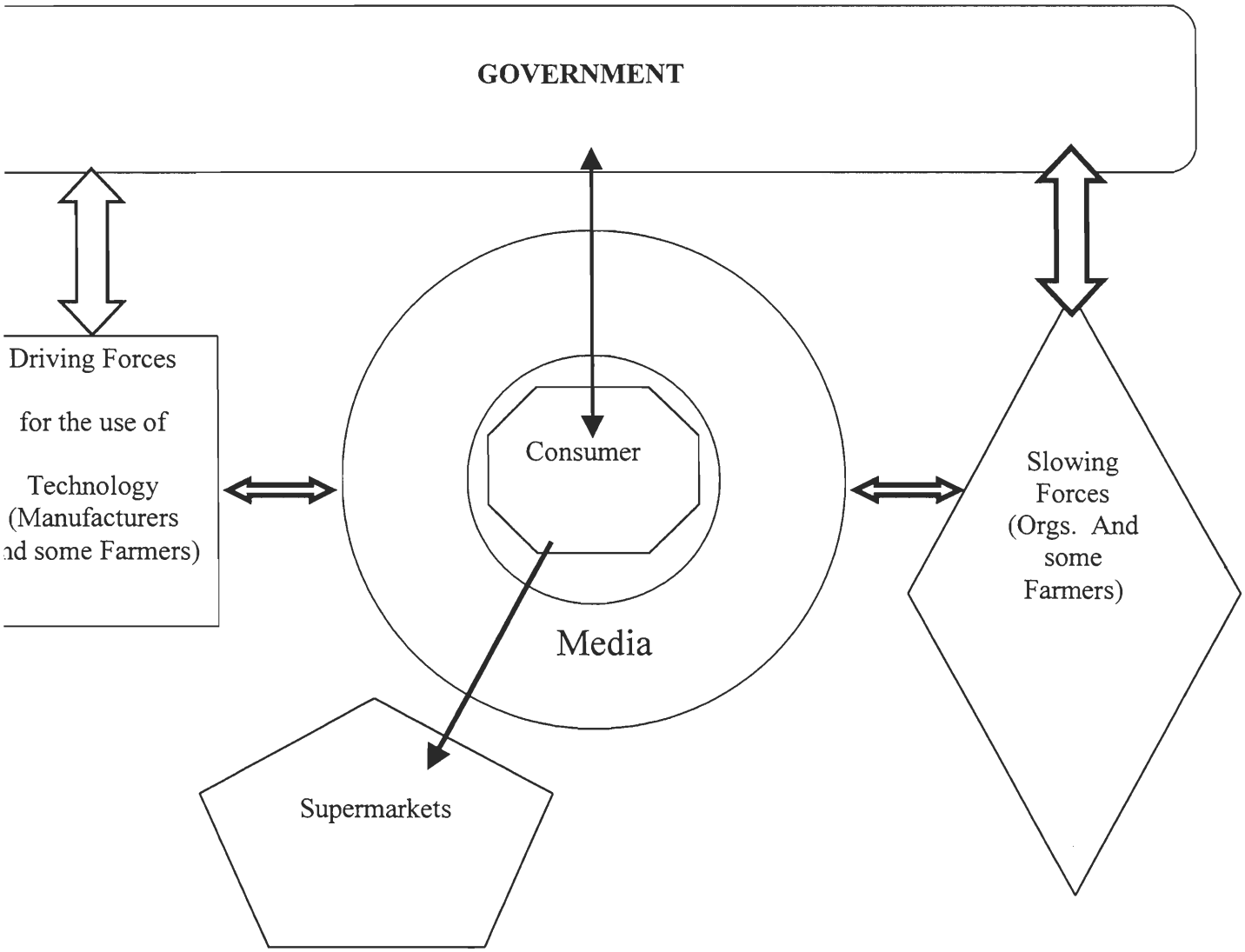

Fig. 15: The Danish Network. As in the U.S. network the consumer is in the center, being affected by and affecting each of the key forces. In this diagram however, the media surrounding the consumers is much larger than in the U.S. and the arrows going to the driving and slowing forces are much darker because though the relative amounts of the arrows are difficult to determine, the Danish consumer is provided more information from both sides through a more active media, creating a much stronger influence over their attitude. The relative sizes of the driving force is smaller than the slowing force in this diagram because the slowing forces have a larger influence in Denmark. They also seem to have a stronger influence on government (demonstrated through the darker arrow). The farmers in Denmark have mixed attitudes in, some are driving and some are slowing and the supermarkets are clearly significant in the Danish network because they have banned the products from the shelves and this is a direct result of consumer attitude (demonstrated by the arrow).

This network is organized in much the same way as the U.S. network, but it is the nature of the relationships between groups that is different.

As shown in the graphic, the scheme of the network is conceptualized in the introduction above, positioning the consumers as the target of the two 'forces' and the center of attention. The media is portrayed as surrounding the consumer, and because of the extensive coverage this issue receives in Denmark it is a large circle. The media is the carrier of the majority of the information, which enables the consumer to make decisions and forms their opinion.

The slowing forces in Denmark have a greater voice to the consumer than do the driving forces. This is because Danish environmental organizations have a stronger voice in politics and are well covered by the media. It is also stronger because the driving forces are not as strong in Denmark, largely because none of the major manufacturers are located there. The groups that are advocates of the technology, such as Dansk Industri and some farmers who would like to utilize it, just do not have the public voice that the environmental organizations do.

The government has a two-way relationship with all three of the above groups. First, the affect the groups have on government. The driving forces have less input into the government. As mentioned above, there are no powerful companies in Denmark to influence policy-making. There are only organizations like Dansk Industri. For every new piece of legislation, a hearing is required and all consumer and environmental organizations have the option of participating in this hearing. This gives the variety of organizations, most of which are in the slowing forces category, a chance to publicly voice their opinions/concerns. On top of this, there are special hearings set up that apply to GM foods only. These two are deliberate release into the market and food approval. This gives the slowing forces ample opportunity to be heard. Consumers

affect the government/legislation because they elect the members of Parliament who vote on the legislation. This issue is more prevalent in Denmark and is therefore part of candidate and party platforms. Consumers can then elect politicians that support their beliefs.

The government affects all three groups with the legislation they pass and the policies of the significant government organizations (Food Ministry, Ministry of the Environment and Energy). If the driving forces are told by the government they cannot produce a certain product, or plant a GM crop, they obviously will not. The existing legislation determines what the opposing forces push for. When legislation changes, the aim of this group changes with it. Finally, legislation can affect the consumer in a variety of ways. Legislation has the power to alter the consumer's attitudes about GM products and some forms of legislation have a direct effect on the consumer.

Farmers can not be considered as one in this network because they do not have the option of growing GM crops. For the purposes of this network, they are included as part of both of the 'forces.' Some are advocates of the technology while others are opposed to it (this is of course true for American farmers as well, but the farmers in that network are just those that plant GM crops – they are directly affected by GM technology).

Supermarkets are directly affected by consumers. It is the consumers that purchase the products from the shelves which, according to sales, determine if the supermarket will continue to stock that item. The consumer fears that grew as a result of the soybean separation controversy in 1996 caused Danish supermarkets to merge as one on the GM food issue. They are extremely concerned with consumer acceptance because their livelihood depends on it more so than other actors in the chain from production to consumption.

These two networks demonstrate how the interactions and the strengths of the influences of each group affect the debate. Many of the differences in the knowledge, attitudes and practices of the various actors stem from the differences in the two networks presented. The two networks are compared directly in section 6.7.

6.0 Comparison of the United States and Danish Attitudes

This section will expound upon the information given in previous chapters. The purpose of doing a comparison between Denmark and the United States for each category is to expose the different aspects found that show similarities or differences specifically in that area. At the end of the section the reader will be able to find a final idea of the general comparison of the debate in the two countries.

6.1 Manufacturers

The views of the United States and Danish Manufacturers are essentially the same. This is probably due in part because the one major company that is researching the use of gene technology, Danisco, works in close contact with two of the largest GM producers, Monsanto and Novartis.

The manufacturers of both countries advocate and support the use of GM food because they see the benefits and the potential the technology has to better society. They are proud of their products and are willing to stand by them no matter how much controversy surrounds them. They believe that they are improving society by researching and developing these products and they feel that the technology may be the way to solve many problems that the farmer faces such as insect pests and weeds in a more economical way. They think that the technology is going to play a critical role in the future of science, agriculture and health care.

These manufacturers are listening to the views of others, but they mostly attribute the image of the technology to public fear towards a new and misunderstood industrial tool due to a lack of unbiased, accurate information. They feel that they should provide information to the public, but for the most part the information that they provide (through web sites, informational e-mail addresses and phone numbers) must be sought out by the public, which the public will not

do if they are not aware of the issue. These manufacturers are very adamant that government approval is important and they support labeling of food if it is done in a reasonable way and only foods that are significantly changed are labeled.

The major argument that these companies provide for the appropriateness of this technology is that it is a more specific way of using traditional crossbreeding methods. They also say it is more controlled than simple breeding, which makes it a more efficient agricultural method. They are convinced that an eventual agreement will be reached and that plant biotechnology will be completely accepted in the long term, but until that point they are willing to engage in an open, civilized discussion that recognizes all opinions in the debate. It is quite clear however, that if these companies want this technology to be accepted, they are going to have to research and develop a new generation of products that is directly beneficial to the consumer. They are going to have to convince the general public that the technology is useful and is truly an asset. Currently, many do not feel that it is benefiting society as a whole and that there are much better ways to solve the problems that these companies have set out to solve with this first generation of GM crops.

Danisco does have some slightly different interests than the larger corporations such as Monsanto. Danisco says that their main reason for pursuing the technology is because they think it is necessary to ensure that they remain competitive in the global market. They also think that the debate is slightly different as far as they are concerned because they are only genetically modifying sugar, not crop plants, and sugar results in refined products that do not contain any genetic material. Danisco is also informing the public in a slightly more forceful way than the other corporations researched for this project. They are actively publicizing their views in

newspapers, providing lectures and aggressively trying to make the public aware in a manner they can access easier.

The major controversy surrounding these corporations is that no matter what they say or do they will always have an ulterior motive. Because they are a business, they are trying to turn a profit from something that the public does not understand and is not ready to accept. This creates a lack of trust. One of the main causes for this lack of trust comes from their claim that they care and listen to public thought and opinion. They say this but fail to demonstrate that they have listened and taken those views to heart. They simply continue to research, develop and sell the products despite opposition. This is not to say that these companies do not investigate risks, because they do by taking part in governmental approval processes and doing in depth risk assessment. They are mainly concerned that the short-term laboratory result is clear of problems rather than the long-term unknown impact of the technology on society as a whole. It is apparent from many actions that these manufacturers have taken, such as being willing to take part in the discussion and having the government approve all of their products, that they do not want genetic modification to harm anyone in society. Everyone sees different ways to make the world better and the manufacturers believe that genetic modification could play a role in improving people's lives. First and foremost however, they are running science and technology based businesses and they feel that biotechnology is an essential tool that will ensure the future success of their companies.

6.2 Farmers

Farmers and farming in the two countries are very nearly opposites of each other. There are few similarities beyond the universal similarities that all farmers share. These include the fact that farming is not a very lucrative profession, farmers are subject to an ever-changing market, and they are at the mercy of nature and its unpredictability.

The glaring difference between the two countries is the fact that the U.S. is the leading producer of GM foods on the planet and Danish farmers produce no GM crops whatsoever. The reason the situation developed this way can be explained by a popular opinion. This opinion being, Americans in general are more accepting of new technology than are Europeans. Various interviewees expressed this opinion (see Appendix B). American farmers were quick to begin planting GM crops, while European farmers had a wait-and-see attitude. This attitude, with the help of Monsanto pushing their products on the European market, is the root of the present situation in Denmark.

Attitudes of farmers in both countries are widely varied. Some are advocates of the technology, some are skeptical of it and some are completely opposed to it and there are many that are in between. There is no way to quantify this and any attempt would be pure speculation. This is a similarity, but could be a difference depending on the percentage of farmers that fall into each category.

A variance in attitude and practice shows up with those farmers that support the technology, however. Farmers in the U.S. who advocate the technology may not utilize it because of the fear that there will not be a market for it. Farmers in Denmark who advocate the technology, of course, do not even have this option. However, it is in the code of practice for

farmers in Denmark that, if someday GM crops are allowed to be planted, the first thing the farmer should do is to ensure himself that a market for his crop exists. Farmers in the U.S. are just now beginning to take this approach, which explains why, for the first time, there will be a decline in GM crop plantings in 2000. The Danes have learned from the situation American farmers are currently facing.

The farmers in the two countries both would like to make more money and be more successful. Many believe that GM crops will do this for them as long as there is a market for them. On the flipside, farmers in both countries are taking advantage of the GM debate and switching to organic farming. It needs to be stated that not all organic farmers were motivated to switch to organic because of concern for the environment. Organic farming has the potential to be more profitable; the reason for this is discussed below. Farmers believe they will earn higher profits this way because of the premium prices generated by consumer demand.

The fact that consumers are more concerned about, and more aware of GM foods in Denmark (discussed fully in section 6.4) has a significant effect on farming. Organic farming is a benefactor of consumer concern. Organic farming has created a significantly larger market in Denmark because of the added concern. The numbers, as far as percentage of farmland covered by organic farms, are 5.5% in Denmark and only 0.2% in the United States. The Danes also enjoy higher market shares for organic products (e.g. 20% market share for milk).

6.3 Supermarkets

The supermarket industry itself is quite different in the two countries. This disparity is the root of many of the differences concerning GM food between American and Danish supermarkets. The differing attitudes and levels of knowledge of the general consumer in each country also facilitate the action or non-action of supermarkets in regard to the GM food issue.

The majority of the market in Denmark is controlled by two organizations – FDB and Dansk Supermarked. This is not the case in the U.S. There are many different supermarket chains in competition with one another, usually three or four in every region of the country, and the majority of companies are only regional. FDB and Dansk Supermarked are national, albeit in a much smaller country. FDB is a consumer co-op and also the industry leader in Denmark with a 35% of the market share. Consumer co-ops do exist in the United States, but could never dream of possessing such a large market share. Another thing is that the majority of American supermarkets are very large stores. Most of them have just about every food item a shopper could need, in addition to other needs (personal items, pet supplies, etc.). This is not the case in Denmark. Supermarkets are smaller and more specialized

So far in the United States, the issue has only come up in the smaller specialty-food stores. There are currently two specialty-food chains in the U.S. that have banned GM foodstuffs in their store-brand products. The combined total number of food stores in these two chains is just 214 nationwide, next to nothing in the grand scheme of things. This is compared to Denmark in which all of the country's supermarkets do not allow GM foodstuffs in their store-

brand products and just recently removed GM products made by outside producers from their shelves.

When the issue really hit Denmark in 1996, the various organizations that represent the supermarkets decided to work together to solve problems created by GM foods. This was partly due to the fact that two organizations make up more than half of Denmark's retail food sales (FDB and Dansk Supermarked). The fact that FDB is a consumer co-op also had an effect on this. They have around 1.3 million members in the organization and it is a democracy that elects officials to make decisions and form positions. These two mechanisms are not in place in the American retail food industry. The leading companies in America are all privately owned and would most likely use the issue the same way that London supermarkets have- as competitive ammunition. The consumer loses if the issue is being used as a marketing tool because the information they receive may not be as accurate. Stating that American supermarkets will end up like London's have is just speculation at this point, because GM food is not an issue among America's leading supermarket chains.

Finally, Danish supermarkets have an official position on the issue. American supermarkets do not. The Danish supermarkets are not against the technology; they are for consumer choice. They would provide this choice with outside products, however, and not their own.

The way that consumers influence the supermarkets in both countries is touched upon in section 6.4.

6.4 Consumers

6.4.1 Introduction

All of the comparisons made in this section that are based on the survey use only the e-mail survey conducted in Denmark. This is necessary because it allows the comparison of two surveys that were publicized in exactly the same way. An e-mail asking people to fill out the survey was sent to approximately 2500 students at a technical school in each country. It was these students and others that they passed it on to that make up each survey. The purpose of the survey that was conducted on the train was to work towards validating the e-mail survey as a good sample of the population and to ensure that there was not a response bias. Similar results were achieved from the train survey (see section 4.4). This suggests that the rather large error associated with a response rate of 20% is not necessarily valid. The survey can be found in Appendix A.

As a side note, question five did not produce significant results for comparison between the two countries. The group believes this was the case because of the possible answers to the question (the respondent was given too many choices). Question six was determined to be worded poorly and the results for this question will not be used in this section. If interested, the reader can still find the results of these two questions in Appendix A.

6.4.2 News Stories

This section should be started with the results of question eight as this result can be applied to the results of all the other questions. It asked the respondent how many news stories he/she has heard, seen, or read in the past six months. The results are presented below in Figure 16.

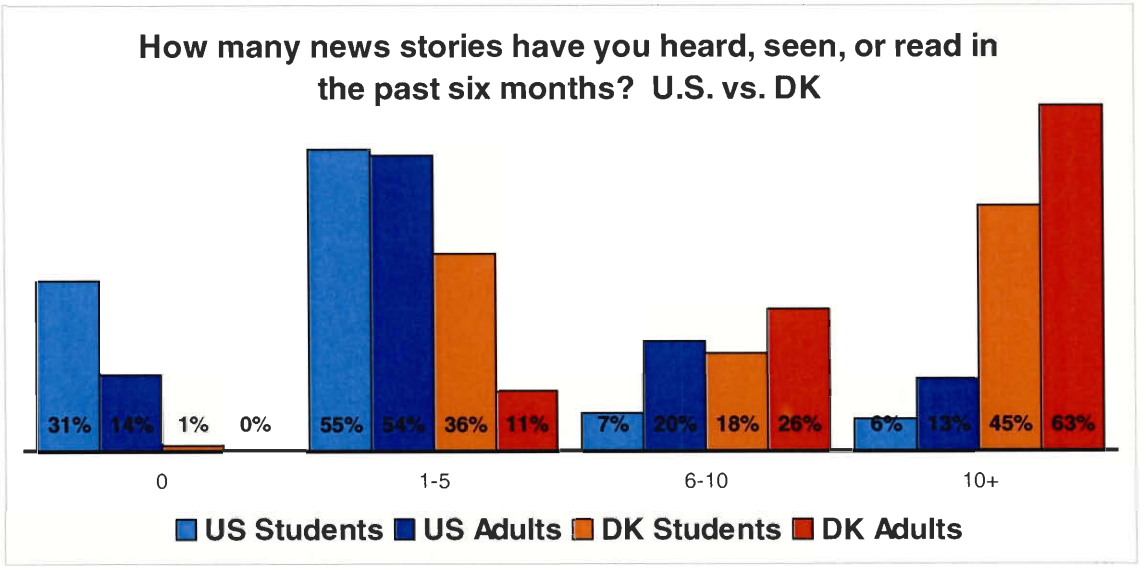

Fig. 16: Question 8 – U.S. vs. DK
The respondent was given the choice of answering
0, 1-5, 6-10, and more than 10

The differences between the two countries is substantial. The most significant result is the amount of respondents who answered '0.' Nearly a third of American students had not seen a single news story on the subject, and about one in seven adults hadn't. This is compared to a nearly unanimous result in Denmark. Only three persons out of the 350 respondents claimed they had not seen a single news story. The amount of people answering '10+' is also significant. Sixty-three percent, a strong majority, of Danish adults claim to have seen more than ten news stories concerning GM food in the past six months, and 45% of Danish students made the same declaration. This is compared to 13% and 6% respectively in the United States. The survey for this project does have its limitations, but these discrepancies are so vast that these limitations do not matter. It is clear that the Danes are more exposed to media coverage than are Americans.

The above result combined with the results to question one lead to the conclusion that nearly everyone in Denmark is somewhat informed on the issue. Question one supports this

argument, it asks the respondent if he/she was aware of the existence of GM food. The result of this question in Denmark was unanimously 'yes.' There were three respondents that answered no, but all three of them contradicted themselves by answering that they had seen more than ten news stories on the subject in the past six months. Therefore, these three surveys were thrown out. On the other hand, ten percent of American respondents did not even realize that GM foods existed. This is an even larger difference than the ten percent differential, because the response was unanimous in Denmark.

The results also say a lot about the media coverage in the two countries. The coverage is so extensive in Denmark that the majority of the adult population has been exposed to numerous stories in recent months and only three of 350 respondents have not been exposed to any. The coverage so blankets Denmark that even the casual follower of the news is aware of the issue. It is this casual follower of the news that knows little to nothing about GM food in the United States. The results of the U.S. survey imply that the media coverage of the topic is very sparse. In the case of U.S. adults, more respondents have seen no news stories than have seen more than ten. The adult sample for both surveys was primarily affluent and educated people as well, which makes this result even more surprising.

It is easy to conclude from the above results that the Danish public is more informed on the issue. The amount of news coverage can be used as a barometer of consumer knowledge because the majority of consumers will only receive information from the media on the topic. This is a key aspect to the rest of the comparisons made between the countries. Keeping this fact in mind will allow other conclusions to be drawn beyond the obvious ones. Consider the following argument. Manufacturers of GM products argue that the more informed the consumer

is, the more likely he/she will be to accept the technology. Others will argue that the opposite is true. The remaining results of the survey will address this argument.

6.4.3 The Consumer Information Argument

Question seven asked the respondent if he/she was concerned about possible changes to the environment/ecosystem due to GM foods. The results are presented below in Figure 17. There is a very large discrepancy on this question between the two countries. Ninety percent of Danes are concerned while only 60% of American adults are and only 49% of students.

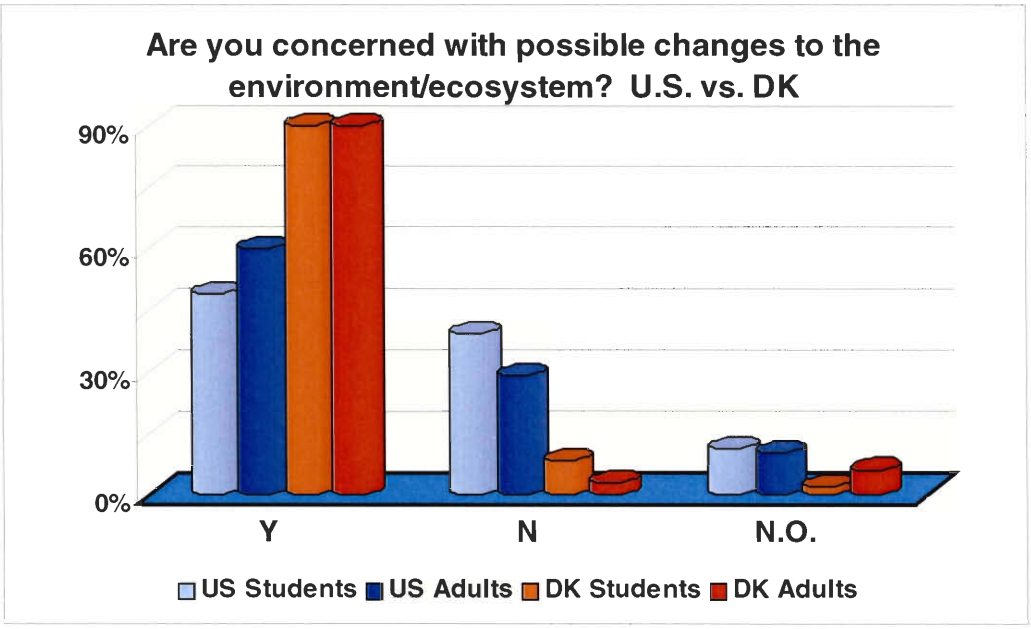

Fig. 17: Question 7 – U.S. vs. DK
'Yes' values are 90% for both Danish groups,
49% and 60% for the U.S. groups

The results to this question lead to one of two possible conclusions. The first of which is that it validates a belief that Europe is ahead of the U.S. in the GM food debate and the environment is more of an issue. The following two examples back up this argument as well. European NGO's discuss more issues, in a broader sense, than do American NGO's and biodiversity, an

environmental issue, is currently the primary focus of the Danish NGO's (see section 4.5). This belief is centered on the premise that Americans are still concerned mostly with the food safety issue, while the European concerns have shifted to environmental safety issues. This is considered an advancement in the debate. For example, the Danish Consumer Council's primary focus currently is on the environment and potential benefits from GM food [50]. A year or two ago they focused on the food safety issue.

The other possibility comes from the fact that the Danes have been exposed to more information on the subject of GM food. The correlation would then be that more information creates greater concern. The reason for the disparity could well be a combination of these two possibilities and not one or the other.

Questions three and four concern shopping. Three asks the respondent if they would specifically look for non-GM food if foods were labeled. Four asks if the consumer would pay more for food that is non-GM. The results are shown graphically in Figures 18 and 19. An answer of 'no' to either question implies neutrality towards (an "I don't care" attitude) or support of the technology. A 'yes' answer implies that the consumer is concerned about the possible risks associated with the technology, or that the consumer is against the technology outright. This is especially true for question four because it concerns money. The only way a consumer would pay more for something that looks and tastes the same is if they are concerned of or against the technology.

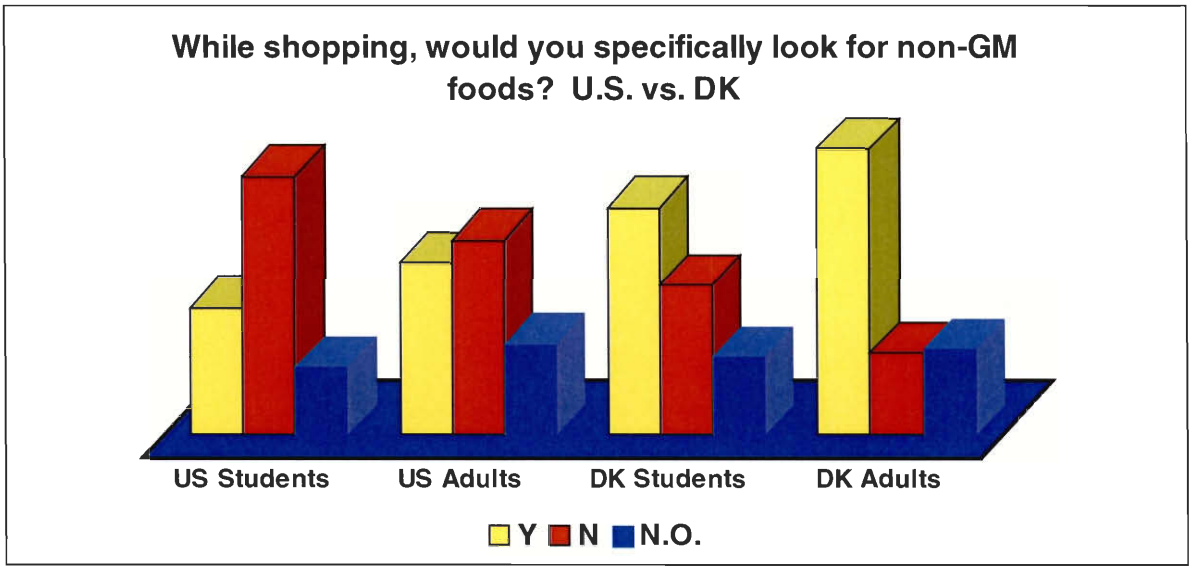

Fig. 18: Question 3 – U.S. vs. DK
The 'yes' columns get larger and larger from left to right.
This is also the order in which the amount of news
stories the respondent has seen increases.
'Yes' values are 28%, 38%, 50%, and 63%

The results to both questions follow the same pattern. Recall from section 6.42, based on question eight, that American students have been exposed to the least media coverage of the topic, followed by American adults, then Danish Students, while Danish adults have been exposed to more media coverage than any group. When the results to these two questions are organized in the same order, as they are in Figures 18 and 19, an interesting pattern arises. The 'yes' answers to both questions increase right along with the amount of media coverage the group has been exposed to.

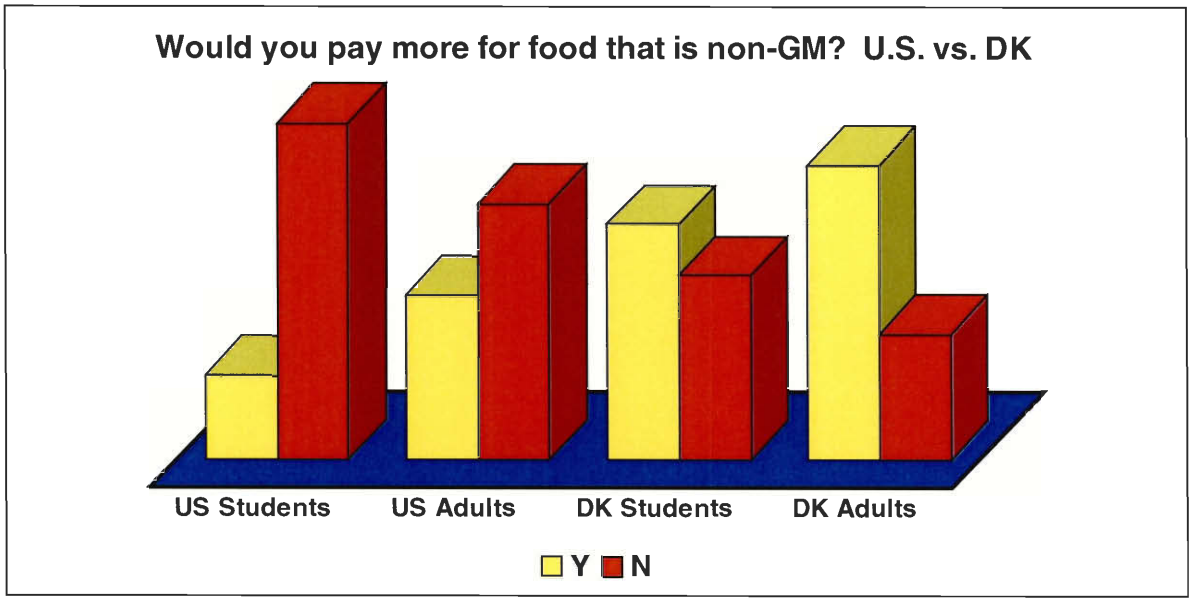

Fig. 19: Question 4 – U.S. vs. Denmark
The 'yes' columns get larger and larger from left to right.
This is also the order in which the amount of news
stories the respondent has seen increases.
'Yes' values are 20%, 39%, 56%, 70%

This leads to the conclusion that when the consumer is more informed, he/she is more likely to either be opposed to the technology or to be concerned about the risks of the technology. This is what the 'yes' answer implies as mentioned above.

Now, recall the argument of whether being exposed to more information will turn the public for or against GM food technology. The results to questions three, four, and seven presented above point to: the more information the public receives, the more opposed to or concerned about the technology they become.

This conclusion is in opposition to the manufacturer's belief that a more informed consumer is a more supportive consumer. The manufacturers chief argument against this conclusion is that the consumer has not received the right information. This brings a number of intangibles into the argument.

The intangibles in this argument must be stated, because they could make this a less conclusive result. First, the type of media coverage consumers are exposed to in the two countries could be different. If consumers are only seeing sensationalistic articles/stories they are going to have different opinions than if they are exposed to a number of feature articles/stories that just provide facts in an unbiased manner to supplement the sensationalistic articles/stories. The balance of the two types of stories is important. If the consumer is exposed to a lot of negative coverage and only rarely sees an article/story with a positive spin, it is more likely that they would be against or skeptical of the technology. However, it was not within the scope of this project to research the type of media coverage that is prevalent in each country. This intangible, the type of media coverage, is not a strong argument in this case though. The reason for this is that within each country adults have been exposed to more media coverage than students have. In turn, the discrepancy between adults and students within each country was significant on questions three and four in Denmark and on all three questions in the United States.

The content of the articles/stories is also important. This applies to question seven and, as was mentioned, some feel that the environmental issue is more prevalent in Denmark. This could certainly be responsible for the discrepancies in that question, but has no bearing on questions three and four.

Another intangible is the type of knowledge the consumer has as a result of his/her exposure to the issue. Question nine addresses this, it asked the respondent if he/she was interested in learning more about GM food. The results followed the exact same pattern that questions three, four, and seven did (see Fig. 20), but with less differentiation. This leads to the conclusion that the more informed the consumer is, the more he/she wants to know about the

issue. This says that the people of Denmark are not growing tired of hearing about it, even though they have been heavily exposed to the issue in the media (question 8). It also says that the topic is still a mystery to most consumers. If they knew everything about the issue they would not be interested in learning more about it. The manufacturers believe the consumer is not receiving the right kinds of information (i.e. facts about the technology). This result supports that argument. The manufacturer wants the consumer to know the ins and outs of the technology so they can make their decision based on an understanding of it.

This result also shows why this is such a hot debate, it is a very interesting topic and many people are interested in it.

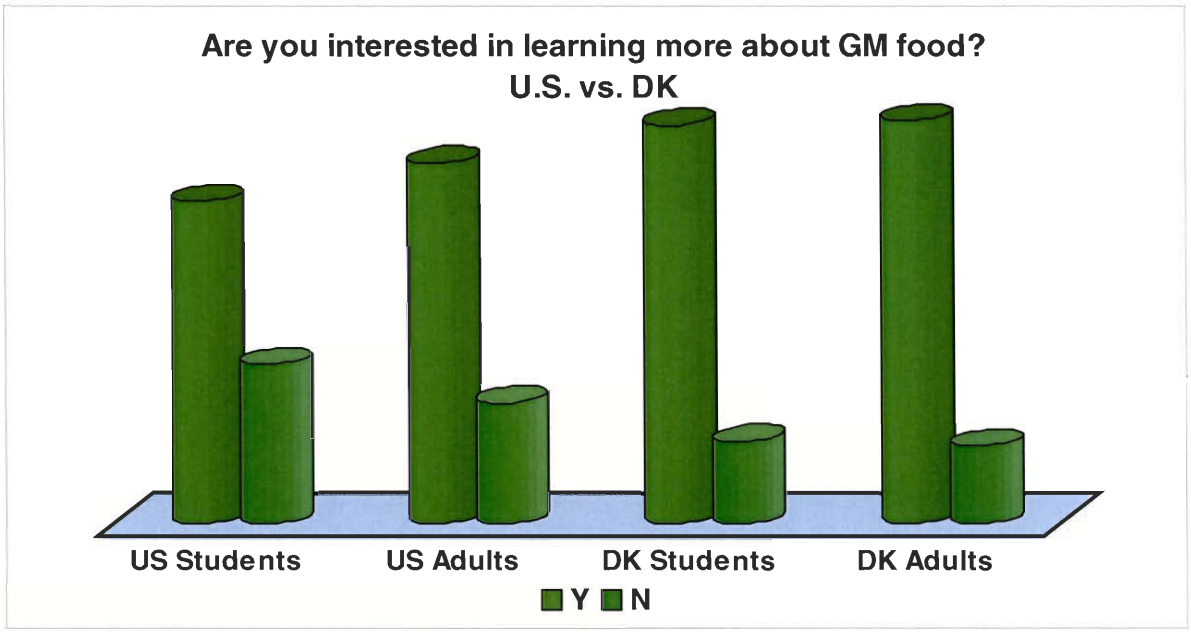

Fig. 20: Question 9 – U.S. vs. DK
'Yes' values are 67%, 75%, 83%, 84%

There is error in this survey, as with any survey, so it cannot be assumed to be a precisely accurate representation of the population. The differences in the results for questions 1, 3, 4, 7, and 8 were all substantial though (i.e. it would take a very large error to alter the relationships used for comparison). These five questions were utilized in forming the above argument. The

minimum difference country-to-country in 3, 4, and 7 was 22%, and most were over 30%. The result for question one was unanimous in Denmark while 10% of Americans answered 'no.' This is qualitatively a larger difference than 10% because the Denmark results were unanimous. The discrepancies in question nine were not large but that was not important to the argument, the fact that over 80% of Danes were still interested in learning more about the topic was. The differences in question 8, which was the result this argument was based on, are fully discussed in section 6.4.2.

6.4.4 Conclusion

Consumer knowledge is important to analyze because it helps to shape a consumer's attitude. However, a consumer's values can be more important. For example, if a consumer has deep-seated value(s) that cause him/her to be against gene technology, no amount of information could be given to this person to sway him/her. There is a segment of the population on each side of the debate who, because of their values, will not change their minds on the topic. It is the aim of the opposing sides of the debate then, to influence the middle segment of the population. For purposes of argument only, say that 40% of the public is against the technology and another 40% of society is for the technology and neither of these groups are going to change their minds. This leaves 20% of the population to be influenced. The two sides of the debate would then be fighting to persuade just 11% of the population to their side to achieve a majority, which is a small percentage of the masses. The preceding numbers are merely used to illustrate a point and are in no way meant to represent the GM debate.

In conclusion, it would appear that the way the issue is being presented to the public today, consumers will continue to become more concerned about the issue. It is up to the supporters of the technology to educate the public and try to change this trend. This may or may not work, but it is clear that the supporters must take some more action in their public relations (particularly the manufacturers). Those that are opposed to the technology appear to be influencing more of the middle segment of the population at present. It should also be pointed out that the opposition had the first-mover advantage in influencing the public. They began their campaign against GM food before the manufacturers began their public relations.

The consumer holds a lot of power in this debate because they are the end user. If it should happen that consumers in all of the developed countries of the world today become opposed to the technology, the supermarkets would stop stocking GM foods, which would cause the food processors to quit accepting GM foods, which would cause the farmers to quit growing GM foods, which would cause the manufacturers to halt production of GM products. None of the others in this chain possess this power. In other words, they are the first domino in a string of them and the only one that can be tipped over. If the consumer is buying a product the supermarkets will stock it, and the food processors will produce it. The farmers will grow GM crops as long as there is a market for it because of the benefits that GM crops can produce for a farmer. This is why informed choice by the consumer is so important and why it will protect the integrity of the biotechnology and food industries.

6.5 Environmental and Consumer Organizations

The Danish and U.S. Environmental and Consumer Organizations have, for the most part, the same point of view and as a whole have many of the same concerns about GM food. These organizations lobby on behalf of the rights of the consumer and the environment and they have a clear set of coinciding possible risks and issues that they feel it is important to inform others about. These concerns include: antibiotic resistance, allergic reaction to a GM product, gene transfer and that it might reduce biodiversity and create plants and insects that are resistant to pesticides and insecticides, that these manipulations may affect the environment and beneficial insects, that herbicide and pesticide resistant plants encourage pesticide use and finally and most importantly that there are unknown risks associated with this technology.

These organizations educate the public about these issues and take action at the political level in order to fight for legislation that supports alternatives to genetic manipulation. They are not necessarily against the technology in all areas; they simply want to see that it truly provides a useful benefit to society that solves a problem. They also want to make sure that if GM food is going to be part of the world that legislation is acquired that protects nature, the environment and the consumer. Many also accuse the manufacturers of trying to control the debate, food production and in the U.S., the legislative process.

All of these groups are fighting for mandatory labeling of all GM products, including meat and other animal products that have been obtained from animals fed with GM feed. Recently, this has become one of the primary topics in the debate in Denmark because all GM products have been taken off of supermarket shelves and there is not any chance of any products being put on the market any time soon. They believe that labeling is one of many things that are

crucial to protecting the rights of consumer choice and the consumers' right to know what is in their food.

All of the groups researched practice and believe in the Precautionary Principle, which is the critical idea that it is better to be cautious with a new technology especially when there are unknown risks involved. This ideal characterizes much of the debate because the debate is about whether the risks of the technology outweigh the benefits and vice versa. This principle says that the world should wait to implement the technology until there is a complete understanding of its impact in all areas. However, the debate is essentially shaped by the supporters of this point of view clashing with those that are promoters of technology (e.g. the manufacturers) and feel that technology cannot be stopped, is essential for the progression of society and that technology itself can fix any problem that results because of technology. Essentially, it is all a question of what characterizes true progress, supporting technology at all costs or taking the time to evaluate each technology and taking the risk of being left behind those that openly embraced it.

In Denmark, there are some additional aspects that have been brought into the debate because the debate is older than in the U.S., which is most likely due to an increased consumer awareness of the issue. First of all, the debate seems to be focused on the environment in Denmark and less on possible health risk to humans because the most frequent concern that was voiced was the concerning genetic manipulation's affect on biodiversity. Unique to Europe is the 1% rule, which says that if a product has less that 1% of genetic contamination it does not have to be labeled. Most of the Danish organizations researched were not in favor of this recommendation. They either feel that the recommendation is too high or that any amount of GM is still GM and should be labeled regardless. Another unique aspect to the Danish groups is the involvement of workers' unions and their fight to get a risk assessment process that identifies

any hazards working with these products might cause for the food worker. The other issue that is very prevalent in Denmark that did not seem to come up in the U.S. is the problem of liability. The Danish Consumer and Environmental Organizations would like to see legislation passed that holds the companies liable for any damages that are done due to the implementation of the technology.

The major problem these groups face in terms of the debate is being heard. They have a much easier time in Denmark than in the U.S. because they are included in the legislative process where they are asked to evaluate and comment on any legislation that their organization has a particular interest in, especially legislation concerning GMO's. However, these groups in both countries have tools that enable them to be heard that manufacturers and scientists cannot use if they want to remain credible, which are public action, demonstration and persuasive campaigns. These groups are concerned with persuading government and the public to accept their point of view, but the variable in the case of both countries is how much influence they really have and how seriously they are taken. They seem to have more influence in Denmark because they are involved in the legislative process, where they are not involved in the U.S.; it is also easier for them to have their opinion to be listened to by a larger segment of the population because Denmark is a small country with a relatively homogeneous population. These organizations have a much more difficult time reaching the bulk of the population in the U.S. because the country is so large and the population so diverse.

Most of these groups work mainly on a political level but they do feel an obligation to inform the public of these issues. But in doing so they promote consumer activism because it is critical that they understand the views of the public and have their support in order to make an impression at the political level.

6.6 Regulation and Legislation

The regulation and legislation of GM food in the United States and Denmark will present several differences in procedures, but also many similarities in the application. The following text will reiterate information from the two government systems while addressing the similarities and differences.

First of all, it is necessary to mention the main difference between the two systems, and it is that Denmark as part of the European Community agreed with the other Member States to harmonize their processes, while the United States makes their own decisions without the consent of other countries. Law in Denmark will be enforced in two different levels, a national level and an international cooperative level. Countries that are members of the EU are required to regulate the deliberate releases into the environment because any effects can easily cross national boundaries.

Because of the extensive communication experienced in countries from the European Union (EU), the process turns into a very complex issue, where private organizations are invited to give opinions. In the United States, these public hearings do not happen. The agencies (the FDA, the EPA and the USDA) in charge of regulating biotechnology work by themselves in order to make a decision and they are quite autonomous. The U.S. tends not to publicize the issues, alarm the population or take them into account in the decision making process. Under the European Union guidelines the public hearings are well stated and communication is a critical part of the decision making process.

Even though there is no need for the United States Agencies to look for consensus at the time of publicizing their policies, the Policy of 1992 (mentioned in section 4.6) expresses

principles that are consistent with the principles for safety assessment. Organizations including National Research Council in the U.S., the World Health Organization, the Food and Agriculture Organization of the United Nations, and the Organization for the Economic Cooperation and Development agreed upon these assessments.

It is very important to note that the U.S. government places full legal duty on the manufacturers to ensure that the products are safe for society. Even though permission for the release into the market is given by the government, the private company still has the responsibility for the product and that is clearly stated in the U.S. statutes.

In the area of market authorizations for the deliberate release of GMO's into the environment, the U.S. and Denmark have different procedures to follow. The EU regulation states that an application has to be submitted every time a product wants to be grown, while the U.S. has a flexible form to shorten the procedure if the product is accepted as generally recognized as safe (GRAS). The food approval notification procedure is very similar, the U.S. and the EU have a simplified food approval procedure that applies when substantial equivalence is found.

Both Denmark and the United States perform tests to prove the stability of the genetic material introduced into the process, this is the Danish procedure of adding the product to the seed list.

The labeling issue is handled differently in the two countries. U.S. law requires the products to be specifically labeled only if the product has suffered a substantial modification. In this case, the product will receive another name.

A very crucial difference between the two systems is the form that biotechnology is addressed in legal documents. The United States puts genetically modified food in the same

legal frame as traditionally grown food under the U.S. Code, while the EU has the specific directives and documents that regulate the market approval and food approval of the products. The agencies in the U.S. have the power to work autonomously and develop the procedures to be followed in order to approve any kind of release of GM food. Both systems update their procedures continuously, the EU does it through amendments to the 90/220/EEC Directive and the U.S. issues Federal Registers.

6.7 Overview of the Controversy

The GM food controversy can be characterized by the attitudes of the actors that have an affect on the arena. In order to utilize this and analyze the GM food debate in the United States and Denmark the key groups of actors that affect and are affected by the debate were determined to be the manufacturers, farmers, supermarkets, the general consumer, the consumer and environmental organization and the government through legislation and regulation. The attitudes and practices were determined for all of these groups and an overview of the legislative process in both countries was researched to gain an overall understanding of the debate. Using the attitudes and practices it was possible to make direct comparisons of each of the categories in both countries as one way of analyzing the controversy (see sections 6.1-6.6).

The controversy was also analyzed from a network perspective in the two countries to show how the groups relate in the countries and illustrate their relative influence on each other. The networks are a way of representing the intimacies between the actors within the network.

The structure of the networks is virtually the same in the two countries. There are the two opposing bodies, which are driving forces (advocates for the technology-primarily manufacturers) and slowing forces (primarily organizations). The consumer is in the center, but is surrounded by the media as consumer knowledge is largely filtered by the media. The government that regulates the debate oversees everything and deals directly with each group. The position of supermarkets and farmers vary between the two countries.

There are several noteworthy differences between these networks. First of all, although the consumers are the center of both networks, the media surrounding them are much more

involved and utilized in Denmark, which results in a different level of consumer knowledge in the two countries. This is discussed at length in section 6.4.2.

Another difference is the relative influence of the driving and slowing forces in the two countries. In the U.S., the manufacturers have a much stronger influence over government because some of them are headquartered in the states and because their financial resources allow for lobbying efforts. On the other hand, there are currently no manufacturers in Denmark and the multi-national companies do not have a political voice. The major driving forces in Denmark are Dansk Industri and Danisco. The environmental and consumer organizations are not very strong in the U.S. but are very influential in Denmark because it is a smaller country and they are involved in the legislative process. Finally, both groups in Denmark have more influence than the groups in the U.S. over the consumer because there is more media coverage.

The government in both countries is in virtually the same position, it must regulate the use of this technology to the best of their ability as they see is best for the society as a whole. The government also influences the slowing and driving forces and the consumer in much the same way, through the legislation it passes. The consumer in both countries can affect the government by choosing elected officials. Because the issue is of greater importance in Denmark, this affect is more prevalent there.

The place of the supermarkets and farmers is quite different between the two countries. In the U.S., the supermarkets are insignificant in the debate because they are not involved in the discussion at all, except for a few health food stores. In Denmark, the supermarkets have developed a consensus position in the debate, which includes a ban of GM foods in their store brand products. This is a direct result of consumer disapproval.

Finally, the farmers in the U.S. have mixed opinions but are becoming hesitant to grow the crops, not because of the U.S. consumer but because of changes in worldwide (Europe especially) acceptance of GM food. The farmers of Denmark are in a different position because they are unable to grow GM crops. Because of this and the fact that they have mixed opinions as well, they are part of both the driving and slowing forces in the network.

Another way to analyze the controversy is by the major issues that are argued for and against the technology. These issues shape the controversy because they are the topics that the driving and slowing forces are debating over and the issues those indirectly involved hear about through the media. It is the discourse these issues bring about that shapes the opinions of those indirectly involved. The discourse gives them a chance to hear opposing views and develop their own attitude based upon the arguments presented along with personal feelings and beliefs. Presented below is a table, which contains the major issues in the debate as it currently exists in the United States and Denmark. These issues were decided upon as being the topics that were discussed the most throughout the research process.

Skeptics of (Environmental and Consumer Organizations)	Issues	Promoters of (Manufacturers)
Mandatory labeling for things that have been genetically modified anywhere in the production process; Not sure how or where on package.	*Labeling*	Support labeling but do not agree with labeling things that have not been substantially changed; Not in favor of negative labeling.
Say that the use of antibiotic markers may cause antibiotic resistance to humans and animals; Ban the use of antibiotic markers.	*Antibiotic Resistance*	Also saw the use of antibiotic markers as an issue; Have developed other methods of doing the technology without the use of antibiotic markers (e.g. mannose), many but not all companies are using these alternatives.
Say that GM crops are not a sustainable way to feed the world's hungry because they do not have access to food that is not produced in their countries and they are not dependant on the crops that are currently being modified.	*Feeding the World in the Future*	Say that genetic modification will result in higher yields and therefore it is the way to feed the world in the future.
Genetic transfer of genes via pollen, animals, soil etc. and movement of genes from one species to another threatens genetic diversity and will ultimately reduce biodiversity; Beneficial insects, top soil, water etc may be affected; The use of pesticides is encouraged and increased and agriculture should be moving to not using pesticides at all. Genetic contamination may occur and is irreversible.	*Affects on the Environment*	The genetic process is an extension of traditional breeding and evolution but in a more controlled and specific way; They feel that they are able to control the gene transfer issue in the laboratory and by promoting crop rotation and promoting regulated distances between GM and non-GM crops; More environmentally friendly pesticides are used.

Current method of risk assessment is not complete and there should be more in depth, long term assessments into the possible effects on health and the environment; Substantial equivalence testing is not enough and there may be problems with the GM products that do not create a testible difference from the non-GM product.	*Risk Assessment*	The current risk assessment is complete, thorough and complies with all government standards and regulations; Feel that substantial equivalence testing is a good, scientific way to assess if the genetic manipulation created any problems that may cause harm.
There have been no true benefits to society thus far, especially for the general consumer, the technology is unnecessary at this point in time; Eventually, there may be some true benefits that come of this technology.	*Benefits*	The products thus far have been geared to benefit the farmer but anything that benefits one segment of the population benefits the whole; Soon the consumer will see lower costs and products that have a direct benefit for them (e.g. foods with lower fat content); This technology is critical and will prove to be a tool that can help solve many problems.
Much of the public does not accept this technology and therefore there is no need for it.	*Public Disapproval*	Public disapproval is based on fear; People are afraid of what they do not understand, especially new technologies.
Feel it is important that there is a public dialogue that discusses all issues in order to increase awareness and provide information.	*Public Dialogue*	It is very important to inform the public and they have an obligation to do so; The dialogue must present all views in an open and honest way.
There are members of the population that feel that genetic manipulation is ethically wrong.	*Ethics and Morality*	??? Are unsure how to deal with ethical issues but some companies have ethical advisors that provide input.

Products have no benefit for the third world country as a whole because crops that they are modifying are not those that the third world is dependent on; The multinational corporations are trying to control third world farmers by persuading them to grow these products using economic means; Do not think agriculture should be controlled by multinational companies.	*Developing Countries*	They are helping farmers and the economy by allowing them to grow these products; Will help to feed the developing countries.
There are unknown risks to human health; Combining genes from different species may cause people to have allergic reactions or develop new allergies.	*May Harm Human Health*	Companies and the government test the products very completely for possible causes of health problems, especially allergens; Eventually there will be products were allergens and toxins are reduced; Do not want to cause any harm or create any health risks with this technology.
The consumer deserves the right to choose GM or non-GM; Can do this through labeling, segregation and documentation of all GM products and providing information to the public.	*Consumer Choice*	Consumers have the right to accurate information and the right to chose but they truly need to have the right to choose therefore both GM and non-GM products need to be on the store shelves.
There are unknown risks involved with the technology and it should not be integrated into society until all of possible risks are discusses and evaluated.	*Unknown Risks*	Every new technology has risks but this is a valuable technological tool that can be used to better the world. It would be a shame if it was lost or delayed.
Precautionary	*Overall Attitude*	Progressive and Supportive

Table 7: Major issues in the GM Food debate. This table shows the major issues in the GM food debate right now as well as the arguments from those that are promoters of the technology and skeptics of the technology.

These are the issues that characterize the debate and shape the controversy because they are the topics that the promoters and skeptics are lobbying for to be discussed and regulated. There is not a right or wrong way to look at or deal with the issues listed above, but each side feels that they have a viable solution to solve each problem. Everything is a balance; there must always be promoters and skeptics, loud voices and soft voices, those that are impulsive and those that are hesitant (Manufacturers and Consumer and Environmental Organizations). There are those in the middle that are affected by the world around them whether they want to be or not, but have clear influence on the others because they are the missing link (Consumers, Farmers and Supermarkets). Finally, there are those that attempt to control everyone else and do what they think is best for all so that there is a semblance of order (Government through Regulation and Legislation).

Each group hopes publicly that they are improving society and making a difference for the better in their practice but differences in attitude create roadblocks on the path to creating world harmony. Controversy is characterized by issues, the network of actors and how those actors perceive and react to those issues as well as the other actors in the controversy and finally by the fundamental differences between cultures themselves. Every actor has their place and is critical to shaping the arena. Ultimately, the debate about a new technology is about the risks and benefits of that technology and whether one outweighs the other, this is difficult to determine because everyone's perception of what is a benefit and what is a risk is different. The most critical aspect of the debate is that one exists, because that is the only way society will be improved; it weighs the risks and benefits until it leads to compromise and agreement.

The nature of the human race is to increase knowledge and along with that comes questions about the appropriateness, necessity and usefulness of any advancement. Everyone

develops an attitude toward a new technology and it is through debate and controversy that the various opinions are sorted out. The debate is shaped by individual attitudes and practices. Ultimately, everyone involved wants to create a better world for those around them (publicly), there are just different ways to reach the same end, but it is essential that everyone is heard because a truly better world is a compromise between all views, ideals, thoughts and attitudes.

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8.0 Appendices

Appendix A: Survey Results

This includes the complete results from the three surveys (U.S. and Denmark e-mail and Denmark train), broken down demographically, as well as the survey itself. It is important to note that the student population in Denmark overlapped into the 24-35 year old demographic. For comparison purposes students include only the 18-23 year old demographic in the U.S., and both the 18-23 and 24-35 year old demographic in Denmark.

GM Food/Fodder Survey

The first nine questions were asked in both surveys, the last three were only asked in the Denmark survey.

1) Were you aware of the existence of Genetically Modified Food?

Yes No

2) Do you feel that food labels should distinguish between Genetically Modified and Non-Genetically Modified Food?

Yes No No Opinion

3) If food labels were to distinguish between Genetically Modified and Non-Genetically Modified Food would you specifically look for products that did **NOT** contain Genetically Modified Food when you shop?

Yes No No Opinion

4) Would you pay more money for food that is **NOT** genetically modified?

Yes No

5) There are health risks involved with eating Genetically Modified Food.

Strongly Disagree Disagree Neutral Agree Strongly Agree

6) There are health risks involved in eating meat that was fed with genetically modified fodder.

Strongly Disagree Disagree Neutral Agree Strongly Agree

7) Are you concerned with possible changes in the ecosystem/environment due to Genetically Modified Food? (For instance, are you concerned with how this might affect the food chain?)

Yes No No Opinion

8) How many news stories have you seen, heard or read in the last 6 months that dealt with the issue of Genetically Modified Food?

0 1-5 6-10 10+

9) Are you interested in finding out more about Genetically Modified Food?

Yes No

10) Do you think that supermarket chains should reject selling GMO food in their stores, including meat from animals fed on GMO feed?

Yes No No Opinion

11) Did you know that many Danish farmers use GMO fodder?

Yes No

12) Do you find it satisfactory that up to 1 % of the ingredients in a product may be genetically modified and this product would not be labeled as GM food?

Yes No No Opinion

Results for the American Survey (N.O.=No Opinion)

MALES 18-23 (US) - Students

	YES	NO	N.O.		SA	A	N	D	SD
1	286	38		5	10	61	141	83	28
2	216	58	51	6	8	75	123	82	33
3	84	194	47						
4	62	258			0	1-5	6-10	10+	
7	149	137	36	8	108	169	26	18	
9	208	116							

	Y	N	N.O.		
1	88%	12%			
2	66%	18%	16%		
3	26%	60%	14%		
4	19%	81%			
7	46%	43%	11%		
9	64%	36%			
	SA	A	N	D	SD
5	3%	19%	44%	26%	9%
6	2%	23%	38%	26%	10%
	0	1-5	6-10	10+	
8	34%	53%	8%	6%	

FEMALES 18-23 (US) - Students

	YES	NO	N.O.		SA	A	N	D	SD
1	181	21		5	5	50	63	24	9
2	113	19	20	6	10	53	53	28	7
3	50	76	26						
4	32	120			0	1-5	6-10	10+	
7	84	50	18	8	40	88	9	12	
9	110	41							

	Y	N	N.O.		
1	90%	10%			
2	74%	13%	13%		
3	33%	50%	17%		
4	21%	79%			
7	55%	33%	12%		
9	73%	27%			
	SA	A	N	D	SD
5	3%	33%	42%	16%	6%
6	7%	35%	35%	19%	5%
	0	1-5	6-10	10+	
8	27%	59%	6%	8%	

TOTAL 18-23 (US) - Students

	YES	NO	N.O.		SA	A	N	D	SD
1	467	59		5	15	111	204	107	37
2	329	77	71	6	18	128	176	110	40
3	134	270	73						
4	94	378			0	1-5	6-10	10+	
7	233	187	54	8	148	257	35	30	
9	318	157							

	Y	N	N.O.		
1	89%	11%			
2	69%	16%	15%		
3	28%	57%	15%		
4	20%	80%			
7	49%	39%	11%		
9	67%	33%			
	SA	A	N	D	SD
5	3%	23%	43%	23%	8%
6	4%	27%	37%	23%	8%
	0	1-5	6-10	10+	
8	31%	55%	7%	6%	

MALES 24-35 (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	30			5	2	6	10	8	4
2	24	3	3	6	2	7	9	8	4
3	9	17	3						
4	9	20			0	1-5	6-10	10+	
7	15	14	1	8	8	10	8	4	
9	22	8							

	Y	N	N.O.		
1	100%	0%			
2	80%	10%	10%		
3	31%	59%	10%		
4	31%	69%			
7	50%	47%	3%		
9	73%	27%			
	SA	A	N	D	SD
5	7%	20%	33%	27%	13%
6	7%	23%	30%	27%	13%
	0	1-5	6-10	10+	
8	27%	33%	27%	13%	

FEMALES 24-35 (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	19	1		5	1	6	8	5	
2	19	1		6	4	3	9	4	
3	9	8	3						
4	7	13			0	1-5	6-10	10+	
7	12	5	3	8	4	13	2	1	
9	17	3							

	Y	N	N.O.		
1	95%	5%			
2	95%	5%	0%		
3	45%	40%	15%		
4	35%	65%			
7	60%	25%	15%		
9	85%	15%			
	SA	A	N	D	SD
5	5%	30%	40%	25%	0%
6	20%	15%	45%	20%	0%
	0	1-5	6-10	10+	
8	20%	65%	10%	5%	

TOTAL 24-35 (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	49	1		5	3	12	18	13	4
2	43	4	3	6	6	10	18	12	4
3	18	25	6						
4	16	33			0	1-5	6-10	10+	
7	27	19	4	8	12	23	10	5	
9	39	11							

	Y	N	N.O.		
1	98%	2%			
2	86%	8%	6%		
3	37%	51%	12%		
4	33%	67%			
7	54%	38%	8%		
9	78%	22%			
	SA	A	N	D	SD
5	6%	24%	36%	26%	8%
6	12%	20%	36%	24%	8%
	0	1-5	6-10	10+	
8	24%	46%	20%	10%	

MALES 36-50 (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	29	2		5	1	8	11	8	2
2	23	6	2	6	1	9	11	6	3
3	11	10	10						
4	10	21			0	1-5	6-10	10+	
7	16	9	6	8	2	17	5	7	
9	23	8							

	Y	N	N.O.		
1	94%	6%			
2	74%	19%	6%		
3	35%	32%	32%		
4	32%	68%			
7	52%	29%	19%		
9	74%	26%			
	SA	A	N	D	SD
5	3%	27%	37%	27%	7%
6	3%	30%	37%	20%	10%
	0	1-5	6-10	10+	
8	6%	55%	16%	23%	

FEMALES 36-50 (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	35	8		5	6	10	19	3	4
2	37	3	3	6	5	18	11	4	5
3	24	13	6						
4	23	19			0	1-5	6-10	10+	
7	35	5	3	8	7	23	7	6	
9	34	9							

	Y	N	N.O.		
1	81%	19%			
2	86%	7%	7%		
3	56%	30%	14%		
4	55%	45%			
7	81%	12%	7%		
9	79%	21%			
	SA	A	N	D	SD
5	14%	24%	45%	7%	10%
6	12%	42%	26%	9%	12%
	0	1-5	6-10	10+	
8	16%	53%	16%	14%	

TOTAL 36-50 (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	64	10		5	7	18	30	11	6
2	60	9	5	6	6	27	22	10	8
3	35	23	16						
4	33	40			0	1-5	6-10	10+	
7	51	14	9	8	9	40	12	13	
9	57	17							

	Y	N	N.O.		
1	86%	14%			
2	81%	12%	7%		
3	47%	31%	22%		
4	45%	55%			
7	69%	19%	12%		
9	77%	23%			
	SA	A	N	D	SD
5	10%	25%	42%	15%	8%
6	8%	37%	30%	14%	11%
	0	1-5	6-10	10+	
8	12%	54%	16%	18%	

MALES 50+ (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	22	2		5	1	8	8	4	3
2	17	4	3	6	1	8	5	5	5
3	4	13	6						
4	8	15			0	1-5	6-10	10+	
7	13	9	2	8	1	13	9	1	
9	17	6							

	Y	N	N.O.		
1	92%	8%			
2	71%	17%	13%		
3	17%	57%	26%		
4	35%	65%			
7	54%	38%	8%		
9	74%	26%			
	SA	A	N	D	SD
5	4%	33%	33%	17%	13%
6	4%	33%	21%	21%	21%
	0	1-5	6-10	10+	
8	4%	54%	38%	4%	

FEMALES 50+ (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	13	1		5		3	8	1	2
2	10	1	3	6		5	8		1
3	3	7	4						
4	5	9			0	1-5	6-10	10+	
7	7	5	2	8		11	1	2	
9	8	6							

	Y	N	N.O.		
1	93%	7%			
2	71%	7%	21%		
3	21%	50%	29%		
4	36%	64%			
7	50%	36%	14%		
9	57%	43%			
	SA	A	N	D	SD
5	0%	21%	57%	7%	14%
6	0%	36%	57%	0%	7%
	0	1-5	6-10	10+	
8	0%	79%	7%	14%	

TOTAL 50+ (US)

	YES	NO	N.O.		SA	A	N	D	SD
1	35	3		5	1	11	16	5	5
2	27	5	6	6	1	13	13	5	6
3	7	20	10						
4	13	24			0	1-5	6-10	10+	
7	20	14	4	8	1	24	10	3	
9	25	12							

	Y	N	N.O.		
1	92%	8%			
2	71%	13%	16%		
3	19%	54%	27%		
4	35%	65%			
7	53%	37%	11%		
9	68%	32%			
	SA	A	N	D	SD
5	3%	29%	42%	13%	13%
6	3%	34%	34%	13%	16%
	0	1-5	6-10	10+	
8	3%	63%	26%	8%	

MALES 24+ (non-students)

	YES	NO	N.O.		SA	A	N	D	SD
1	81	4		5	4	22	29	20	9
2	64	13	8	6	4	24	25	19	12
3	24	40	19						
4	27	56			0	1-5	6-10	10+	
7	44	32	9	8	11	40	22	12	
9	62	22							

	Y	N	N.O.		
1	95%	5%			
2	75%	15%	9%		
3	29%	48%	23%		
4	33%	67%			
7	52%	38%	11%		
9	74%	26%			
	SA	A	N	D	SD
5	5%	26%	35%	24%	11%
6	5%	29%	30%	23%	14%
	0	1-5	6-10	10+	
8	13%	47%	26%	14%	

FEMALES 24+ (non-students)

	YES	NO	N.O.		SA	A	N	D	SD
1	67	10		5	7	19	35	9	6
2	66	5	6	6	9	26	28	8	6
3	36	28	13						
4	35	41			0	1-5	6-10	10+	
7	54	15	8	8	11	47	10	9	
9	59	18							

	Y	N	N.O.		
1	87%	13%			
2	86%	6%	8%		
3	47%	36%	17%		
4	46%	54%			
7	70%	19%	10%		
9	77%	23%			
	SA	A	N	D	SD
5	9%	25%	46%	12%	8%
6	12%	34%	36%	10%	8%
	0	1-5	6-10	10+	
8	14%	61%	13%	12%	

TOTAL 24+ (non-students)

	YES	NO	N.O.		SA	A	N	D	SD
1	148	14		5	11	41	64	29	15
2	130	18	14	6	13	50	53	27	18
3	60	68	32						
4	62	97			0	1-5	6-10	10+	
7	98	47	17	8	22	87	32	21	
9	121	40							

	Y	N	N.O.		
1	91%	9%			
2	80%	11%	9%		
3	38%	43%	20%		
4	39%	61%			
7	60%	29%	10%		
9	75%	25%			
	SA	A	N	D	SD
5	7%	26%	40%	18%	9%
6	8%	31%	33%	17%	11%
	0	1-5	6-10	10+	
8	14%	54%	20%	13%	

Results for the Danish E-mail Survey (N.O.=No opinion)

The results of the two Danish surveys are presented next. The results of the e-mail survey are presented first. The format is different because of the three Denmark-specific questions that were added to the Danish survey. These questions are denoted as D1, D2, and D3.

MALES 18-23 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	70			5	5	18	17	20	10
2	59	9	2	6	2	44	11	1	12
3	21	33	16						
4	28	42			0	1-5	6-10	10+	
7	58	8	2	8		27	9	34	
9	51	18							
D1	9	55	6						
D2	30	40							
D3	23	42	5						

	Y	N	N.O.		Y	N
2	84%	13%	3%	1	100%	0%
3	30%	47%	23%	4	40%	60%
7	85%	12%	3%	9	74%	26%
D1	13%	79%	9%	D2	43%	57%
D3	33%	60%	7%			
	SA	A	N	D	SD	
5	7%	26%	24%	29%	14%	
6	3%	63%	16%	1%	17%	
	0	1-5	6-10	10+		
8	0%	39%	13%	49%		

FEMALES 18-23 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	50			5	5	15	17	11	2
2	45	2	3	6	6	26	16		2
3	28	13	9						
4	31	19			0	1-5	6-10	10+	
7	46	2	2	8		23	6	21	
9	44	6							
D1	18	23	9						
D2	18	32							
D3	11	28	10						

	Y	N	N.O.		Y	N
2	90%	4%	6%	1	100%	0%
3	56%	26%	18%	4	62%	38%
7	92%	4%	4%	9	88%	12%
D1	36%	46%	18%	D2	36%	64%
D3	22%	57%	20%			
	SA	A	N	D	SD	
5	10%	30%	34%	22%	4%	
6	12%	52%	32%	0%	4%	
	0	1-5	6-10	10+		
8	0%	46%	12%	42%		

TOTAL 18-23 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	120	0		5	10	33	34	31	12
2	104	11	5	6	8	70	27	1	14
3	49	46	25						
4	59	61			0	1-5	6-10	10+	
7	104	10	4	8	0	50	15	55	
9	95	24							
D1	27	78	15						
D2	48	72							
D3	34	70	15						

	Y	N	N.O.		Y	N
2	87%	9%	4%	1	100%	0%
3	41%	38%	21%	4	49%	51%
7	88%	8%	3%	9	80%	20%
D1	23%	65%	13%	D2	40%	60%
D3	29%	59%	13%			
	SA	A	N	D	SD	
5	8%	28%	28%	26%	10%	
6	7%	58%	23%	1%	12%	
	0	1-5	6-10	10+		
8	0%	42%	13%	46%		

MALES 24-35 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	107			5	5	32	31	22	17
2	94	11	2	6	7	51	29		20
3	58	34	15						
4	61	45			0	1-5	6-10	10+	
7	94	11	1	8	1	30	24	52	
9	86	21							
D1	37	55	15						
D2	48	57							
D3	24	69	12						

	Y	N	N.O.		Y	N
2	88%	10%	2%	1	100%	0%
3	54%	32%	14%	4	58%	42%
7	89%	10%	1%	9	80%	20%
D1	35%	51%	14%	D2	46%	54%
D3	23%	66%	11%			
	SA	A	N		D	SD
5	5%	30%	29%		21%	16%
6	7%	48%	27%		0%	19%
	0	1-5	6-10		10+	
8	1%	28%	22%		49%	

FEMALES 24-35 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	53			5	7	20	14	6	6
2	47	4	2	6	6	23	16		8
3	33	13	7						
4	37	16			0	1-5	6-10	10+	
7	50	1	1	8	3	20	12	18	
9	50	3							
D1	21	19	13						
D2	20	33							
D3	10	37	6						

	Y	N	N.O.		Y	N
2	89%	8%	4%	1	100%	0%
3	62%	25%	13%	4	70%	30%
7	96%	2%	2%	9	94%	6%
D1	40%	36%	25%	D2	38%	62%
D3	19%	70%	11%			
	SA	A	N		D	SD
5	13%	38%	26%		11%	11%
6	11%	43%	30%		0%	15%
	0	1-5	6-10		10+	
8	6%	38%	23%		34%	

TOTAL 24-35 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	160	0		5	12	52	45	28	23
2	141	15	4	6	13	74	45	0	28
3	91	47	22						
4	98	61			0	1-5	6-10	10+	
7	144	12	2	8	4	50	36	70	
9	136	24							
D1	58	74	28						
D2	68	90							
D3	34	106	18						

	Y	N	N.O.		Y	N
2	88%	9%	3%	1	100%	0%
3	57%	29%	14%	4	62%	38%
7	91%	8%	1%	9	85%	15%
D1	36%	46%	18%	D2	43%	57%
D3	22%	67%	11%			
	SA	A	N		D	SD
5	8%	33%	28%		18%	14%
6	8%	46%	28%		0%	18%
	0	1-5	6-10		10+	
8	3%	31%	23%		44%	

MALES 36-50 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	19			5	2	1	11	3	2
2	18	1		6	1	6	9		3
3	12	6	1						
4	12	7			0	1-5	6-10	10+	
7	18	1		8		3	5	11	
9	13	6							
D1	5	11	3						
D2	12	7							
D3	5	13	1						

	Y	N	N.O.		Y	N
2	95%	5%	0%	1	100%	0%
3	63%	32%	5%	4	63%	37%
7	95%	5%	0%	9	68%	32%
D1	26%	58%	16%	D2	63%	37%
D3	26%	68%	5%			
	SA	A	N		D	SD
5	11%	5%	58%		16%	11%
6	5%	32%	47%		0%	16%
	0	1-5	6-10		10+	
8	0%	16%	26%		58%	

FEMALES 36-50 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	12			5	1	2	7	1	1
2	11		1	6	1	6	5		
3	8	1	3						
4	10	1			0	1-5	6-10	10+	
7	10		2	8		1	4	7	
9	11	1							
D1	4	5	2						
D2	4	7							
D3	2	9	1						

	Y	N	N.O.		Y	N
2	92%	0%	8%	1	100%	0%
3	67%	8%	25%	4	91%	9%
7	83%	0%	17%	9	92%	8%
D1	36%	45%	18%	D2	36%	64%
D3	17%	75%	8%			
	SA	A	N		D	SD
5	8%	17%	58%		8%	8%
6	8%	50%	42%		0%	0%
	0	1-5	6-10		10+	
8	0%	8%	33%		58%	

TOTAL 36-50 (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	31	0		5	3	3	18	4	3
2	29	1	1	6	2	12	14	0	3
3	20	7	4						
4	22	8			0	1-5	6-10	10+	
7	28	1	2	8	0	4	9	18	
9	24	7							
D1	9	16	5						
D2	16	14							
D3	7	22	2						

	Y	N	N.O.		Y	N
2	94%	3%	3%	1	100%	0%
3	65%	23%	13%	4	73%	27%
7	90%	3%	6%	9	77%	23%
D1	30%	53%	17%	D2	53%	47%
D3	23%	71%	6%			
	SA	A	N		D	SD
5	10%	10%	58%		13%	10%
6	6%	39%	45%		0%	10%
	0	1-5	6-10		10+	
8	0%	13%	29%		58%	

MALES 50+ (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	23			5	1	5	14	2	1
2	19	3	1	6	1	8	13		1
3	13	4	6						
4	14	9			0	1-5	6-10	10+	
7	21	1	1	8		2	6	15	
9	22	1							
D1	7	10	6						
D2	11	12							
D3	4	14	5						

	Y	N	N.O.		Y	N
2	83%	13%	4%	1	100%	0%
3	57%	17%	26%	4	61%	39%
7	91%	4%	4%	9	96%	4%
D1	30%	43%	26%	D2	48%	52%
D3	17%	61%	22%			
	SA	A	N		D	SD
5	4%	22%	61%		9%	4%
6	4%	35%	57%		0%	4%
	0	1-5	6-10		10+	
8	0%	9%	26%		65%	

FEMALES 50+ (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	8			5	1	3	4		
2	8			6	3	3	2		
3	6		2						
4	6	1			0	1-5	6-10	10+	
7	7		1	8		1	1	6	
9	5	2							
D1	4	2	2						
D2	2	6							
D3		6	2						

	Y	N	N.O.		Y	N
2	100%	0%	0%	1	100%	0%
3	75%	0%	25%	4	86%	14%
7	88%	0%	13%	9	71%	29%
D1	50%	25%	25%	D2	25%	75%
D3	0%	75%	25%			
	SA	A	N		D	SD
5	13%	38%	50%		0%	0%
6	38%	38%	25%		0%	0%
	0	1-5	6-10		10+	
8	0%	13%	13%		75%	

TOTAL 50+ (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	31	0		5	2	8	18	2	1
2	27	3	1	6	4	11	15	0	1
3	19	4	8						
4	20	10			0	1-5	6-10	10+	
7	28	1	2	8	0	3	7	21	
9	27	3							
D1	11	12	8						
D2	13	18							
D3	4	20	7						

	Y	N	N.O.		Y	N
2	87%	10%	3%	1	100%	0%
3	61%	13%	26%	4	67%	33%
7	90%	3%	6%	9	90%	10%
D1	35%	39%	26%	D2	42%	58%
D3	13%	65%	23%			
	SA	A	N		D	SD
5	6%	26%	58%		6%	3%
6	13%	35%	48%		0%	3%
	0	1-5	6-10		10+	
8	0%	10%	23%		68%	

MALE Students (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	177	0		5	10	50	48	42	27
2	153	20	4	6	9	95	40	1	32
3	79	67	31						
4	89	87			0	1-5	6-10	10+	
7	152	19	3	8	1	57	33	86	
9	137	39							
D1	46	110	21						
D2	78	97							
D3	47	111	17						

	Y	N	N.O.		Y	N
2	86%	11%	2%	1	100%	0%
3	45%	38%	18%	4	51%	49%
7	87%	11%	2%	9	78%	22%
D1	26%	62%	12%	D2	45%	55%
D3	27%	63%	10%			
	SA	A	N		D	SD
5	6%	28%	27%		24%	15%
6	5%	54%	23%		1%	18%
	0	1-5	6-10		10+	
8	1%	32%	19%		49%	

FEMALE Students (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	103	0		5	12	35	31	17	8
2	92	6	5	6	12	49	32	0	10
3	61	26	16						
4	68	35			0	1-5	6-10	10+	
7	96	3	3	8	3	43	18	39	
9	94	9							
D1	39	42	22						
D2	38	65							
D3	21	65	16						

	Y	N	N.O.		Y	N
2	89%	6%	5%	1	100%	0%
3	59%	25%	16%	4	66%	34%
7	94%	3%	3%	9	91%	9%
D1	38%	41%	21%	D2	37%	63%
D3	21%	64%	16%			
	SA	A	N		D	SD
5	12%	34%	30%		17%	8%
6	12%	48%	31%		0%	10%
	0	1-5	6-10		10+	
8	3%	42%	17%		38%	

TOTAL Students (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	280	0		5	22	85	79	59	35
2	245	26	9	6	21	144	72	1	42
3	140	93	47						
4	157	122			0	1-5	6-10	10+	
7	248	22	6	8	4	100	51	125	
9	231	48							
D1	85	152	43						
D2	116	162							
D3	68	176	33						

	Y	N	N.O.		Y	N
2	88%	9%	3%	1	100%	0%
3	50%	33%	17%	4	56%	44%
7	90%	8%	2%	9	83%	17%
D1	30%	54%	15%	D2	42%	58%
D3	25%	64%	12%			
	SA	A	N		D	SD
5	8%	30%	28%		21%	13%
6	8%	51%	26%		0%	15%
	0	1-5	6-10		10+	
8	1%	36%	18%		45%	

MALE Adults (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	42	0		5	3	6	25	5	3
2	37	4	1	6	2	14	22	0	4
3	25	10	7						
4	26	16			0	1-5	6-10	10+	
7	39	2	1	8	0	5	11	26	
9	35	7							
D1	12	21	9						
D2	23	19							
D3	9	27	6						

	Y	N	N.O.		Y	N
2	88%	10%	2%	1	100%	0%
3	60%	24%	17%	4	62%	38%
7	93%	5%	2%	9	83%	17%
D1	29%	50%	21%	D2	55%	45%
D3	21%	64%	14%			
	SA	A	N		D	SD
5	7%	14%	60%		12%	7%
6	5%	33%	52%		0%	10%
	0	1-5	6-10		10+	
8	0%	12%	26%		62%	

FEMALE Adults (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	20	0		5	2	5	11	1	1
2	19	0	1	6	4	9	7	0	0
3	14	1	5						
4	16	2			0	1-5	6-10	10+	
7	17	0	3	8	0	2	5	13	
9	16	3							
D1	8	7	4						
D2	6	13							
D3	2	15	3						

	Y	N	N.O.		Y	N
2	95%	0%	5%	1	100%	0%
3	70%	5%	25%	4	89%	11%
7	85%	0%	15%	9	84%	16%
D1	42%	37%	21%	D2	32%	68%
D3	10%	75%	15%			
	SA	A	N		D	SD
5	10%	25%	55%		5%	5%
6	20%	45%	35%		0%	0%
	0	1-5	6-10		10+	
8	0%	10%	25%		65%	

TOTAL Adults (DK)									
	YES	NO	N.O.		SA	A	N	D	SD
1	62	0		5	5	11	36	6	4
2	56	4	2	6	6	23	29	0	4
3	39	11	12						
4	42	18			0	1-5	6-10	10+	
7	56	2	4	8	0	7	16	39	
9	51	10							
D1	20	28	13						
D2	29	32							
D3	11	42	9						

	Y	N	N.O.		Y	N
2	90%	6%	3%	1	100%	0%
3	63%	18%	19%	4	70%	30%
7	90%	3%	6%	9	84%	16%
D1	33%	46%	21%	D2	48%	52%
D3	18%	68%	15%			
	SA	A	N		D	SD
5	8%	18%	58%		10%	6%
6	10%	37%	47%		0%	6%
	0	1-5	6-10		10+	
8	0%	11%	26%		63%	

Results for the Danish Train Survey (N.O.=No Opinion)

The results from the personal survey conducted on trains are provided next. There were 136 people asked to take the survey, 70 of which did. It should be noted that a common reason for not taking the survey was "I'm getting off at the next stop," thereby further reducing the possibility for response bias.

MALES 18-23 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	4	1		5	1		2	2	
2	4		1	6			1	3	1
3	2	1	2						
4	1	4			0	1-5	6-10	10+	
7	4	1		8		3		2	
9	2	3							
D1		4	1						
D2	1	4							
D3	2	1	2						

	Y	N	N.O.		Y	N
2	80%	0%	20%	1	80%	20%
3	40%	20%	40%	4	20%	80%
7	80%	20%	0%	9	40%	60%
D1	0%	80%	20%	D2	20%	80%
D3	40%	20%	40%			
	SA	A	N		D	SD
5	20%	0%	40%		40%	0%
6	0%	0%	20%		60%	20%
	0	1-5	6-10		10+	
8	0%	60%	0%		40%	

FEMALES 18-23 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	9			5	2	3	3	1	
2	8		1	6	2	3	3	1	
3	6	1	2						
4	7	1			0	1-5	6-10	10+	
7	8		1	8		5		4	
9	9								
D1	4	1	4						
D2	3	6							
D3	2	3	4						

	Y	N	N.O.		Y	N
2	89%	0%	11%	1	100%	0%
3	67%	11%	22%	4	88%	13%
7	89%	0%	11%	9	100%	0%
D1	44%	11%	44%	D2	33%	67%
D3	22%	33%	44%			
	SA	A	N		D	SD
5	22%	33%	33%		11%	0%
6	22%	33%	33%		11%	0%
	0	1-5	6-10		10+	
8	0%	56%	0%		44%	

TOTAL 18-23 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	13	1		5	3	3	5	3	0
2	12	0	2	6	2	3	4	4	1
3	8	2	4						
4	8	5			0	1-5	6-10	10+	
7	12	1	1	8	0	8	0	6	
9	11	3							
D1	4	5	5						
D2	4	10							
D3	4	4	6						

	Y	N	N.O.		Y	N
2	86%	0%	14%	1	93%	7%
3	57%	14%	29%	4	62%	38%
7	86%	7%	7%	9	79%	21%
D1	29%	36%	36%	D2	29%	71%
D3	29%	29%	43%			
	SA	A	N		D	SD
5	21%	21%	36%		21%	0%
6	14%	21%	29%		29%	7%
	0	1-5	6-10		10+	
8	0%	57%	0%		43%	

MALES 24-35 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	10			5	1	3	4	2	
2	10			6	1	3	3	2	1
3	2	4	4						
4	5	3			0	1-5	6-10	10+	
7	9	1		8		1	1	8	
9	8	1							
D1	2	7	1						
D2	4	6							
D3	1	8	1						

	Y	N	N.O.		Y	N
2	100%	0%	0%	1	100%	0%
3	20%	40%	40%	4	63%	38%
7	90%	10%	0%	9	89%	11%
D1	20%	70%	10%	D2	40%	60%
D3	10%	80%	10%			
	SA	A	N		D	SD
5	10%	30%	40%		20%	0%
6	10%	30%	30%		20%	10%
	0	1-5	6-10		10+	
8	0%	10%	10%		80%	

FEMALES 24-35 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	13			5		6	7		
2	12	1		6		5	7	1	
3	11	2							
4	10	3			0	1-5	6-10	10+	
7	12	1		8		5	2	6	
9	11	2							
D1	8	2	3						
D2	8	5							
D3	3	8	1						

	Y	N	N.O.		Y	N
2	92%	8%	0%	1	100%	0%
3	85%	15%	0%	4	77%	23%
7	92%	8%	0%	9	85%	15%
D1	62%	15%	23%	D2	62%	38%
D3	25%	67%	8%			
	SA	A	N		D	SD
5	0%	46%	54%		0%	0%
6	0%	38%	54%		8%	0%
	0	1-5	6-10		10+	
8	0%	38%	15%		46%	

TOTAL 24-35 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	23	0		5	1	9	11	2	0
2	22	1	0	6	1	8	10	3	1
3	13	6	4						
4	15	6			0	1-5	6-10	10+	
7	21	2	0	8	0	6	3	14	
9	19	3							
D1	10	9	4						
D2	12	11							
D3	4	16	2						

	Y	N	N.O.		Y	N
2	96%	4%	0%	1	100%	0%
3	57%	26%	17%	4	71%	29%
7	91%	9%	0%	9	86%	14%
D1	43%	39%	17%	D2	52%	48%
D3	18%	73%	9%			
	SA	A	N		D	SD
5	4%	39%	48%		9%	0%
6	4%	35%	43%		13%	4%
	0	1-5	6-10		10+	
8	0%	26%	13%		61%	

MALES 36-50 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	7			5	1	2	4		
2	6	1		6	1	1	4	1	
3	5	1	1						
4	5	2			0	1-5	6-10	10+	
7	7			8		1	1	5	
9	7								
D1	4	3							
D2	4	3							
D3	2	5							

	Y	N	N.O.		Y	N
2	86%	14%	0%	1	100%	0%
3	71%	14%	14%	4	71%	29%
7	100%	0%	0%	9	100%	0%
D1	57%	43%	0%	D2	57%	43%
D3	29%	71%	0%			

	SA	A	N	D	SD
5	14%	29%	57%	0%	0%
6	14%	14%	57%	14%	0%
	0	1-5	6-10	10+	
8	0%	14%	14%	71%	

FEMALES 36-50 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	9			5	2	4	2	1	
2	9			6	2	4	2	1	
3	9								
4	8				0	1-5	6-10	10+	
7	9			8		1	1	7	
9	8	1							
D1	7	1	1						
D2	6	3							
D3	1	7							

	Y	N	N.O.		Y	N
2	100%	0%	0%	1	100%	0%
3	100%	0%	0%	4	100%	0%
7	100%	0%	0%	9	89%	11%
D1	78%	11%	11%	D2	67%	33%
D3	13%	88%	0%			

	SA	A	N	D	SD
5	22%	44%	22%	11%	0%
6	22%	44%	22%	11%	0%
	0	1-5	6-10	10+	
8	0%	11%	11%	78%	

TOTAL 36-50 (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	16	0		5	3	6	6	1	0
2	15	1	0	6	3	5	6	2	0
3	14	1	1						
4	13	2			0	1-5	6-10	10+	
7	16	0	0	8	0	2	2	12	
9	15	1							
D1	11	4	1						
D2	10	6							
D3	3	12	0						

	Y	N	N.O.		Y	N
2	94%	6%	0%	1	100%	0%
3	88%	6%	6%	4	87%	13%
7	100%	0%	0%	9	94%	6%
D1	69%	25%	6%	D2	63%	38%
D3	20%	80%	0%			

	SA	A	N	D	SD
5	19%	38%	38%	6%	0%
6	19%	31%	38%	13%	0%
	0	1-5	6-10	10+	
8	0%	13%	13%	75%	

MALES 50+ (Train)

	Y	N	N.O.		Y	N

	YES	NO	N.O.		SA	A	N	D	SD
1	7			5	2		3	2	
2	5	1	1	6	1	1	3	1	1
3	3	2	2						
4	5	2			0	1-5	6-10	10+	
7	5	1	1	8			2	5	
9	6	1							
D1	4	1	2						
D2	2	5							
D3	2	2	3						

2	71%	14%	14%	1	100%	0%
3	43%	29%	29%	4	71%	29%
7	71%	14%	14%	9	86%	14%
D1	57%	14%	29%	D2	29%	71%
D3	29%	29%	43%			
	SA	A	N		D	SD
5	29%	0%	43%		29%	0%
6	14%	14%	43%		14%	14%
	0	1-5	6-10		10+	
8	0%	0%	29%		71%	

FEMALES 50+ (Train)

	YES	NO	N.O.		SA	A	N	D	SD
1	10			5	4	1	4	1	
2	9		1	6	4	2	3	1	
3	7		3						
4	5	5			0	1-5	6-10	10+	
7	9		1	8		2	4	4	
9	10								
D1	7	1	2						
D2	3	7							
D3	1	8	1						

	Y	N	N.O.		Y	N
2	90%	0%	10%	1	100%	0%
3	70%	0%	30%	4	50%	50%
7	90%	0%	10%	9	100%	0%
D1	70%	10%	20%	D2	30%	70%
D3	10%	80%	10%			
	SA	A	N		D	SD
5	40%	10%	40%		10%	0%
6	40%	20%	30%		10%	0%
	0	1-5	6-10		10+	
8	0%	20%	40%		40%	

TOTAL 50+ (Train)

	YES	NO	N.O.		SA	A	N	D	SD
1	17	0		5	6	1	7	3	0
2	14	1	2	6	5	3	6	2	1
3	10	2	5						
4	10	7			0	1-5	6-10	10+	
7	14	1	2	8	0	2	6	9	
9	16	1							
D1	11	2	4						
D2	5	12							
D3	3	10	4						

	Y	N	N.O.		Y	N
2	82%	6%	12%	1	100%	0%
3	59%	12%	29%	4	59%	41%
7	82%	6%	12%	9	94%	6%
D1	65%	12%	24%	D2	29%	71%
D3	18%	59%	24%			
	SA	A	N		D	SD
5	35%	6%	41%		18%	0%
6	29%	18%	35%		12%	6%
	0	1-5	6-10		10+	
8	0%	12%	35%		53%	

MALE Students (Train)

	YES	NO	N.O.		SA	A	N	D	SD

	Y	N	N.O.		Y	N
2	93%	0%	7%	1	93%	7%

1	14	1		**5**	2	3	6	4	0
2	14	0	1	**6**	1	3	4	5	2
3	4	5	6						
4	6	7			**0**	**1-5**	**6-10**	**10+**	
7	13	2	0	**8**	0	4	1	10	
9	10	4							
D1	2	11	2						
D2	5	10							
D3	3	9	3						

3	27%	33%	40%	**4**	46%	54%
7	87%	13%	0%	**9**	71%	29%
D1	13%	73%	13%	**D2**	33%	67%
D3	20%	60%	20%			
	SA	**A**	**N**		**D**	**SD**
5	13%	20%	40%		27%	0%
6	7%	20%	27%		33%	13%
	0	**1-5**	**6-10**		**10+**	
8	0%	27%	7%		67%	

FEMALE Students (Train)									
	YES	**NO**	**N.O.**		**SA**	**A**	**N**	**D**	**SD**
1	22	0		**5**	2	9	10	1	0
2	20	1	1	**6**	2	8	10	2	0
3	17	3	2						
4	17	4			**0**	**1-5**	**6-10**	**10+**	
7	20	1	1	**8**	0	10	2	10	
9	20	2							
D1	12	3	7						
D2	11	11							
D3	5	11	5						

	Y	**N**	**N.O.**		**Y**	**N**
2	91%	5%	5%	**1**	100%	0%
3	77%	14%	9%	**4**	81%	19%
7	91%	5%	5%	**9**	91%	9%
D1	55%	14%	32%	**D2**	50%	50%
D3	24%	52%	24%			
	SA	**A**	**N**		**D**	**SD**
5	9%	41%	45%		5%	0%
6	9%	36%	45%		9%	0%
	0	**1-5**	**6-10**		**10+**	
8	0%	45%	9%		45%	

TOTAL Students (Train)									
	YES	**NO**	**N.O.**		**SA**	**A**	**N**	**D**	**SD**
1	36	1		**5**	4	12	16	5	0
2	34	1	2	**6**	3	11	14	7	2
3	21	8	8						
4	23	11			**0**	**1-5**	**6-10**	**10+**	
7	33	3	1	**8**	0	14	3	20	
9	30	6							
D1	14	14	9						
D2	16	21							
D3	8	20	8						

	Y	**N**	**N.O.**		**Y**	**N**
2	92%	3%	5%	**1**	97%	3%
3	57%	22%	22%	**4**	68%	32%
7	89%	8%	3%	**9**	83%	17%
D1	38%	38%	24%	**D2**	43%	57%
D3	22%	56%	22%			
	SA	**A**	**N**		**D**	**SD**
5	11%	32%	43%		14%	0%
6	8%	30%	38%		19%	5%
	0	**1-5**	**6-10**		**10+**	
8	0%	38%	8%		54%	

MALE Adults (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	14	0		5	3	2	7	2	0
2	11	2	1	6	2	2	7	2	1
3	8	3	3						
4	10	4			0	1-5	6-10	10+	
7	12	1	1	8	0	1	3	10	
9	13	1							
D1	8	4	2						
D2	6	8							
D3	4	7	3						

	Y	N	N.O.		Y	N
2	79%	14%	7%	1	100%	0%
3	57%	21%	21%	4	71%	29%
7	86%	7%	7%	9	93%	7%
D1	57%	29%	14%	D2	43%	57%
D3	29%	50%	21%			
	SA	A	N		D	SD
5	21%	14%	50%		14%	0%
6	14%	14%	50%		14%	7%
	0	1-5	6-10		10+	
8	0%	7%	21%		71%	

FEMALE Adults (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	19	0		5	6	5	6	2	0
2	18	0	1	6	6	6	5	2	0
3	16	0	3						
4	13	5			0	1-5	6-10	10+	
7	18	0	1	8	0	3	5	11	
9	18	1							
D1	14	2	3						
D2	9	10							
D3	2	15	1						

	Y	N	N.O.		Y	N
2	95%	0%	5%	1	100%	0%
3	84%	0%	16%	4	72%	28%
7	95%	0%	5%	9	95%	5%
D1	74%	11%	16%	D2	47%	53%
D3	11%	83%	6%			
	SA	A	N		D	SD
5	32%	26%	32%		11%	0%
6	32%	32%	26%		11%	0%
	0	1-5	6-10		10+	
8	0%	16%	26%		58%	

TOTAL Adults (Train)									
	YES	NO	N.O.		SA	A	N	D	SD
1	33	0		5	9	7	13	4	0
2	29	2	2	6	8	8	12	4	1
3	24	3	6						
4	23	9			0	1-5	6-10	10+	
7	30	1	2	8	0	4	8	21	
9	31	2							
D1	22	6	5						
D2	15	18							
D3	6	22	4						

	Y	N	N.O.		Y	N
2	88%	6%	6%	1	100%	0%
3	73%	9%	18%	4	72%	28%
7	91%	3%	6%	9	94%	6%
D1	67%	18%	15%	D2	45%	55%
D3	19%	69%	13%			
	SA	A	N		D	SD
5	27%	21%	39%		12%	0%
6	24%	24%	36%		12%	3%
	0	1-5	6-10		10+	
8	0%	12%	24%		64%	

Appendix B: Interviews

All of the interviews conducted as part of the research are written up in this appendix. They are arranged in alphabetical order.

Contact: Kim Carstenson
Position: Secretary General
Organization: World Wildlife Federation (WWF)
Personal Interview
Date of Interview: 4 April, 2000
Interviewed by: Jesse Finke, Maegan V. Rivard

Personal Background:

He specializes in cultural sociology that works with environmental and development issues and has been with WWF for ten years. He is the leader of the Conservation Department and recently became secretary general. The secretary general deals with international and global environmental issues and he deals specifically with Danish environmental assistance to developing countries.

WWF Background:

The WWF- Denmark is mainly interested in biodiversity protection and management. They currently have projects in southeast Asia, central and eastern Europe dealing with forest management. They are also looking at some wetland issues in eastern Europe and Africa. The WWF is funded by the government as well as by membership and donations.

Concerns:

Their only concern in the GMO debate is for biodiversity protection and management. The rest of the debate does not apply directly to their organization. Their chief interest in Denmark is in nature and the forests.

Activity:

They were a part of the creation of the Biosafety Protocol along with other key environmental groups such as Greenpeace. This protocol will be signed on by countries and, once ratified, will become law in these countries. Its main concern is international trade regulation and biosafety, specifically dangers to biodiversity that GMO's might cause. They lack the technical expertise in the field to be too active in the debate. They have, however, developed position papers on the topic. The WWF does have a short policy statement that Kim provided us with the recommends the Precautionary Principle in the area of GM food and feels that in it is important to weigh the benefits of the technology against the risks. They don't feel that they are not able to decide whether or not to accept the technology because they think that they know too little about the uses proposed. They are not planning on taking a more active role in the debate in the future because they do not feel that they have the expertise needed. This is the collective WWF-international decision.

Personal Views:

He believes the debate has been "unfruitful" thus far. He thinks that the technology could be useful, but that it hasn't been so far. He thinks Monsanto has been unwise in respect to public relations and that they made a large mistake when they tried to push the technology on Europe. He believes the bullying of American companies has largely influenced the debate.

Contact: Raffaella Cristanetti
Position: Biotechnology Issue Manager
Organization: DuPont Corporatio
Telephone Interview
Date of Interview: 11 February, 2000
Interviewed by: Maegan V. Rivard

Background:

Raffaella is on DuPont's committee to research the benefits and risks of genetically modified food. She assists in making recommendations to the company when decisions must be made concerning the company's views and opinions on the subject. She is also partly responsible for conducting discussions with other companies and organizations about the topic. Raffaella also helps the company respond to public requests for information about DuPont's biotechnological standing.

DuPonts view of biotechnology in general:

Raffaella immediately made reference to a speech made by the chairman of DuPont, where he talks about DuPont's official position on the subject. .DuPont views biotechnology as a tool like many other tools. They feel that it offers tremendous potential that allows them to maintain their commitment to reducing what they call the Environmental Footprint or their impact on the environment. DuPont is mainly concerned with sustainability as a company while reducing its presence in the environment. DuPont also feels that there is very little information available to the consumer about the benefits of biotechnology while there is a lot on the risks. Ultimately, DuPont is interested in facilitating and taking part in a valid, legitimate and reasoned debate of the benefits and risks of the technology with all of the stakeholders involved.

DuPont's research interests:

Though DuPont is interested in GM food, Raffaella wanted to make it clear that they are interested in other areas where biotechnology will be useful such as nutrition, health care and biosensors. Down the road DuPont feels that health care will benefit from biotechnology in particular by the use of gene therapy to cure diseases. Biotechnology is also useful because it allows producers to make sufficient quantities of drugs, to test without human trials, to make proteins in the laboratory such as insulin and improve pharmaceuticals. DuPont is interested in using biotechnology to produce industrial materials such as using corn starch instead of hydrocarbons (fossil fuels) to

make polyesters. They are also interested in using it to make biosensors for example, right now they are working on a watch that can be worn by diabetics to measure their sugar level through their skin.

DuPont and Food Biotechnology:

Raffaella says that GM food is the center of the biotechnology industry right now and it is causing consumers to question science. Products on the market right now are called agronomic and mainly benefit the farmer. Farmers have found the products useful. Due to herbicide resistant products farmers do not have to use as much herbicide and they are able to use it without having to fear that they are harming their crops. DuPont feels that farmers have been supportive of the new technology. Raffaella explains that they feel that the consumer objections stem from that they have not seen direct benefits for themselves and therefore see no reason for the technology. However, the next generation of GM food will have direct benefit for the consumer such as products that interrupt the process that leads to saturated fat production creating food with lower oil content. DuPont has a soybean that does this which is currently being evaluated. Raffaella says the consumer will see other products like this one in 3-7 years.

Providing information to the public:

DuPont feels that many times their view is thought of as suspect when they really only want to provide accurate and useful information. They feel that they have a responsibility to provide information along with other companies because the consumer has the right to have helpful information. She says that there is a technical challenge involved. They feel that labeling may not be the best way to provide information. She stressed the fact that labeling is not black and white because there are so many people that need to be involved in the labeling process. There would need to be a shift in the labeling policy of this country from one of product to one of process. They feel that simply labeling process would create fear, which is the situation in Europe where they simply decided to not use the products. Labeling must be informative and helpful and it must inform the consumer about the product.

Testing:

Raffaella explains that before commercialization, all products are tested for their potential to become a weed, their potential to go into animal feed, their potential to affect the environment and their nutritional value. She explained that DuPont tests products on the basis of "substantial equivalence", which compares the GM-food with a non-GM equivalent for any differences in health affects, difference in content, difference in taste etc. Analysis is also done on any new proteins that might be expressed and how they interact with the original proteins in the organism. DuPont conducts feeding tests on birds and mammals (mice), soil trials, water tests, effects on beneficial insects (ladybugs) among others. Raffaella ensured me that the FDA has tested all DuPont products and they will continue to do so. They claim that they would not commercialize anything that was not tested by the FDA.

Regulation:

The USDA has to review all new crops. This is a mandatory process. The FDA is involved in food safety and their assessment is voluntary. There is a "decision tree" that a company uses to determine whether or not they must send a product to them. If enough questions are answered "wrong" then it is mandatory to send the product to the FDA for testing. The EPA is mainly concerned with pesticide resistant properties of the food.

DuPont's commitment to safety:

DuPont says that it has an obsession with safety and safety in all aspects. In their biological research in the next century they are committed to safety for humans and the environment. They feel that there is no reason to rush into anything. To help them achieve this they have designed an external advisory board that will look at everything from testing to product design. The board will be comprised of experts from all areas of interest such as religion, ecology, science and ethics. This group will be able to access everything and anything that DuPont does concerning biotechnology and they will make comments as to what they are doing right and wrong. They also are responsible for making reports that are available to the public.

Concerns:

DuPont is mainly concerned with the possible creation of a "superbug" that is resistant to insecticides. Raffaella explained that industry is making recommendations to the FDA of steps that must be taken to prevent a the existance of a "superbug." DuPont feels that human antibiotic resistance is not an issue but because of this concern they and other companies are getting away from using antibiotics in the genetic engineering process. They are currently looking for other ways to determine whether or not the DNA has gotten into the cell.

Additional Information:

DuPont owns Pioneer Hybrid, which is the largest seed producer and distributor in the U.S.. They mainly distribute soybeans and corn. DuPont itself is not in the business of exporting GM grain. However Pioneer exports it on their behalf and farmers are their only customers. Currently farmers are buying their seeds for this years crop so it is hard to tell whether or they are not they are buying GM seeds. But so far Pioneer has not seen any ordering differences when it comes to GM products.

Contact: Anja Eberhardt
Position: Secretary of Agriculture
Organization: Red/Green Party
Personal Interview
Date of Interview: 3 April, 2000
Interviewed by: Maria Soledad Gil, Maegan V. Rivard, Jesse Finke

Background:

Anja has a degree in Biology from the University of Copenhagen. Her job includes research and she has the ear of the members of the party in Parliament.

Party Background:

The Red/Green party is a Socialist party. They are the furthest left of any party in Denmark. They work closely with organizations such as NOAH and Greenpeace closely for information. One of their goals is an organic society and they believe that this cannot be achieved without Socialism. Their reason for this is the belief that a Democratic society does not allow everyone into a debate, only the experts. Every other party's official policy in Parliament is pro-EU in the GMO debate, making them the lone dissenters. They think the issue should be settled in Denmark alone with no outside influence. They feel that the issue should be decided directly between the countries and not through the EU. The Red/ Green party educated the public with leaflets and articles in the press concerning agriculture.

The Party's Position:

The number one concern of the Red/ Green party is pollen (gene) transfer. They believe there is no need for GMO's, that organic farming is the way to go. They also think that there are other solutions for the improvements (for farmers) that GM foods create. They think that genetic engineering is worse than chemical use because it can create a permanent change in an organism (if a reproductive gene is altered). Their position on the labeling issue is that non-GM foods should be labeled and meat from animals fed with GM fodder should also be labeled. They are against the one percent rule; think there should be no gene pollution whatsoever. The are also against EU control and feel that every country should have a choice. The group does not discuss the use of gene technology for medicine.

Activity/Goals:

One month prior to the interview they made a suggestion to Parliament against GMO's. They are focusing mostly on labeling right now and want to see GM foods banned in Denmark. The party hopes to get labeling implemented so that the population has the opportunity to act, they also hope to stop the growth before any products go commercial.

Contact: Mogens Eliasen
Position: Economist, Staff Member and Secretariat to the Chairman (President) of NNF
Organization: Danish Food and Allied Workers' Union
Personal Interview
Date of Interview: 14 April, 2000
Interviewed by: Maegan V. Rivard

Background:

Mogens is educated as and economist and along with Carsten Elert is a secretariat and staff member for the chairman (President) of NNF.

Background of NNF:

NNF is a worker's union for members of the food industry. Currently it has approximately 40,000 members. These members are manual workers in all aspects of food production such as workers in the dairies and slaughteries, confectionary areas such as sugar and chocolate and many other areas. Their members and considered unskilled workers and they join on an individual basis. Their funding is solely from their member fees. Some companies have agreements with the union in terms of employment but not many. NNF has agreements with employer's organizations such as the Danish Slaughtery, and they work together to provide good working conditions for the members of the union. Mogens mentioned that there are a lot of unions in Denmark and unions had a fairly strong voice in many areas. They are a member of the International Union of Food Workers (IUF). NNF also works along with consumer organizations such as the Danish Consumer Council. NNF works mostly on working conditions and wage issues such as insurance but they also work on lobbying against public authorities on the part of the workers they represent. NNF works for the rights of their members in all areas. Mogens said that NNF works on a more political level than unions in the U.S. and this may be because they originally were a part of the Social Democratic political party and still are in contact with them now that they are a completely independent organization. NNF works mostly at the political level but also works at the consumer level as well, because the consumer opinion and response directly affects their members.

Information for their members and the public:

Throughout the interview we referred to a booklet entitled *A short cut to better food: About genetic engineering* that NNF published for it's members and for others that wanted to know their view on the GM food issue. The booklet includes general background information as well as specific information on the opinion of NNF. Mogens said that their role is to inform their members and they feel that they are in contact with a large portion of them. Each member has a chance to meet the President at a seminar during the education process that informs them about the union, during this seminar they discuss the future of the union and food industry. Every member is also free to call or write at any time. They think that the public authorities have an obligation to fully inform the public and should be held responsible to do so. However, they inform the

public of their organization through a magazine and through their homepage and they write articles and press releases wherever they can get space.

Position towards GM food:

The NNF is not against the technology but they would like to have the time to evaluate whether or not there are benefits for society, consumers and if there are any risks for their members. Their perception is that consumers in general do not want GM food and their interest is that companies provide consumers with what they want in order to ensure that their members keep their jobs. Essentially, they want sustainable employment for their members and they think that the best way to do this is to use technology that can last for decades and not merely result in a short-term increase in profit. They are in favor of using new forms of technology in food production but they feel that there are no shortcuts for good food and proper hygiene during the production process. The point is that if the consumer is provided with the highest quality products then higher prices can be asked, which increases profit and the wages of the workers. They want to ensure job security and do not want to lose jobs at any price including the environment, consumer acceptance and a proper working environment for their members. GM is just another issue that the NNF is getting involved in that will hopefully make companies and people think about the health and safety of the worker. NNF does not want to prevent progress, in fact, they see that eventually there might be some advantages for their members because gene manipulation could lead to fewer chemicals in the food that their workers have to deal with. For example, they might see a reduction in the amount of preservatives, additives and pesticides in food.

Labeling:

One of NNF's top priorities is complete labeling of all GM containing products. They think that this is a key issue for the consumer and essential for them to sell products. However, this is not just a Danish issue but an EU issue and right now a product is labeled if GM can be found in the product. NNF thinks that the product itself should not simply be labeled, but rather it should be an issue of labeling the process by which it was made. If the process included a GM product in any way it should be labeled. This takes a lot "paper control" and documentation but this type of process is critical to appropriate labeling. Mogens says that the issue is not about dangers from consuming GM products but ethical issues, meaning that the production process matters. He thinks that the way something is produced is very important to the consumer.

Opinion of the Workers:

Mogen's colleague Carsten Elert does a lot of traveling and holds small discussion groups at various companies so that NNF stays in contact with its members. However, they are constantly in contact with committees in order to stay updated on the thoughts of the workers. Mogens says that when the booklet was distributed to their members, the workers were a little bit concerned about what this technology was going to mean for them and their jobs. He said that they were particularly concerned about acquiring allergies and possibly being harmed in the production process.

Action Plan and protecting the safety of the worker:

An action plan was decided upon as part of a convention that is held every four years, which is where the highest authorities in the union are elected (e.g. Chairman, secretaries etc.). It is here that they decide on what the union is going to focus on for the next four years and there are usually about 350 delegates present. The entire convention lasts about one week. At the most recent convention they decided that they were going to focus on getting a risk assessment for the safety of the workers that work with GM food in place. Right now the approval process for a food involves a risk assessment for society and the environment but not but there is no risk assessment for the safety of the worker that must work with very high concentrations of these GM products. NNF would like to know what impact GM food is going to have on the workers' health and safety. When the EU published its most recent paper on food safety NNF got a chance to reply and asked that the EU think about the safety of the workers. They have also brought this issue up to the Food Ministry as they are a member of an advisory committee there. They also speak to their contacts in Parliament about the issue whenever possible. NNF tells their point of view wherever possible and they do not feel that these attempts are futile because they think that organizations have great influence in Denmark. They have also talked to researchers to see if anyone would be willing to come up with a model that would determine any risks to the worker. Unfortunately, they do not feel that their view is being heard because many think that it would be too complicated to involve a new assessment process for the safety of the workers. He thinks this is because the production process is usually taken for granted and overlooked in the matters of food, he referred to them as the "black box" that is in the background. No one pays attention to the workers and do not think about any issues that they might be faced with. He thinks that eventually their thoughts will be listened to because competitiveness depends on the work force a company employs. If a company has an educated work force they have the tools to run smoothly and grow on the other hand one bad worker can affect the entire company when it comes to food production. For instance, if one worker does not know how to wash his/her hands properly it could ruin the whole factory because food production is so integrated therefore a company needs good workers to produce good food. In their contact with employer's organizations on the issue they felt like they do not want to complicate the risk assessment either because it only delays the process of putting the foods on the shelf. They are concerned about the workers but are only willing to discuss in small committees and NNF is not really informed on their opinion.

Monopolies and Liability:

NNF is concerned that GM food production could create a monopoly in the food industry that may result in the loss of jobs for any workers that are not a member of the company that has the monopoly on the industry. They also think that the company that employs the work should be responsible for any damages that occur that are proven to be caused by genetic modification of a foodstuff because they were the ones to decide to produce and market these products. The company then can look for compensation from the company that supplied them with the GM product if they so chose.

Their thoughts on the future:

In the future, NNF hopes that sustainability of the worker will be a concern and that people will consider the role of the worker an important one. They are most concerned about the risk assessment for their workers, next they would like to find a way to truly make better products for the consumer and the environment, finally and most importantly for the worker themselves they would like to see antibiotic resistance markers banned and the safest, not the easiest, possible methods used in the laboratory. They are also concerned with the impact gene technology might have on the natural world around them. Ultimately, they do not want to lose the technology but they want to find ways to use it that are beneficial and safe for everyone involved. Mogens says that it is important that the union takes up these difficult issues because it is a way for the people in the union to have a platform and this results in better working situations for the workers. They feel that working in the political process is as important as traditional union work

Contact: Annegrethe Hansen
Position: Professor and researcher
Organization: Department of Technology and Social Science, DTU
Personal Interview
Date of Interview: 23 March, 2000
Interviewed by: Maegan V. Rivard, Jesse Finke, Maria Soledad Gil

Personal Background:

Annegrethe is a professor at DTU in the Department of Technology and Social Science. She has been working for several years on researching the GM food debate in many areas.

Current project:

Annergrethe is working on a project sponsored by the EU that studies the genetic engineering of plants and how the controversy affects their production. She is working on this project along with other researchers from various universities and research institutions around Europe. It is a comparison between four of the European countries. She is specifically looking at the historical dimension of the debate and how the issues are different today then they were when the debate started. Annegrethe provided the group with information on her project and a paper that she has written on biotechnology policy.

Relevant information:

Annegrethe provided us with some general information that helped us to start thinking about the GM food issue in Denmark. She informed us of the Eurobarometer Surveys, which are a series of surveys done to gauge the public awareness and feeling on a variety of issues, including GM food.

The group was also informed that in Denmark there is only one crop that is being researched heavily as a possible GM crop and that is the sugar beet. The sugar company

Danisco in collaboration with a seed company DLF Trifolium is doing this research. There are currently test fields and they are inviting concerned groups and individuals to come and study these fields.

She informed us of the *de facto* moratorium that is currently in place in Europe, meaning there is a temporary cease of all marketing of GM food until more research has been done on possible risks. She also mentioned that if a company applies for a GM product to be put on the market, it is a law in Denmark that 45 organizations must be heard from before it is approved.

Annegrethe also informed us of some organizations that would be useful to contact such as the Forest and Nature Agency, NOAH, and Nature Conservation. She mentioned Rikke Bagge Jorgensen, a researcher at Riso that has been working on gene technology and the FDB supermarket alliance as well.

Contact: Dan Hindsgaul
Positition: GMO Campaigner
Organization: Greenpeace- Nordic
Telephone Interview
Date of Interview: 28 March, 2000
Interviewed by: Maegan V. Rivard

Background:

Dan is a part of the ongoing GMO campaign. He is an active member of the group and is very involved in defining the goals and actions of the GMO group within Greenpeace. He has been with Greenpeace since October 1998 and has a Master's degree in political science.

Greenpeace's Position toward GM food:

Greenpeace is not opposed to the use of genetic modification in all areas but is strongly opposed to the use of genetic manipulation in terms of the environment. Greenpeace does not feel capable of having an informed position about issues that they are not directly involved in, for example, the use of genetics in the fields of health care and pharmaceuticals. But it does however, feel that it is capable of stating the genetic modification creates a threat to biodiversity and the environment in general. Greenpeace practices the Precautionary Principle.

Greenpeace's goals in Denmark and ultimately Europe:

Greenpeace hopes that there will be no commercial release of any GM product into the environment. They are also hoping to stop any new test fields from being planted in Denmark, and ultimately Europe, and hope that the ones that currently exist will be phased out of use. Ultimately, Greenpeace feels that they act to protect consumer interest.

Current Projects:

Because there are not any GM products currently on supermarket shelves, Greenpeace has shifted its focus to the GM fodder issue. They would like particular legislation to be passed concerning the labeling and testing of animal feed, particularly Soya meal, because currently there is nothing regulating the use of GM fodder in the production of any meat product. They would like feed producers and distributers to separate GM from non-GM feed and feel that farmers should have the option of feeding their livestock with what they choose. Currently, all soya meal is shipped in bulk and is a mixture of non-GM and GM feed.

Labeling:

Greenpeace is very clear that if a GM product is on the market- the end product, including meat, should be labeled. They want both labeling and segregation to be required of all GM products.

Recent Actions:

In Zealand, Greenpeace recently held an action against a GM potato test crop that was modified to have a reduced starch content. Greenpeace felt that this was not a necessary use of the technology. They are also currently campaigning for EU legislation for antibiotic marker abolishment. This is pending in Parliament. Greenpeace is also lobbying for more comprehensive testing of GM products, they feel that current testing procedures are not thorough enough. Recently, they sampled 8 different types of soya fodder, all made by different companies and all containing GM soya, two types of fodder contained 55% GM soya.

Other Concerns:

Greenpeace is concerned that 2/3 of all GM crops right now are made to be pesticide resistant and they feel that agriculture should not be moving in a direction that promotes pesticide use, rather, agriculture should be moving to abolish it. They also feel that there is a significant risk of gene transfer through soil and pollen and that gene technology using antibiotic marker genes creates the problem of antibiotic resistance. The primary question they pose is: "How much risk should we accept?"

Where does Greenpeace see the future of GM?

They think that the products currently on the market are going to be phased out and ultimately rejected by the public, as is the trend in Europe and other countries that have just learned of GM food, such as Thailand and Japan. Greenpeace feels that these products are not going to be accepted, because they have no direct benefit for the consumer, the only benefits are for the farmer. The future of GM food is going to be functional products that have a direct benefit to the consumer, such as increased content of a particular amino acid or vitamin or even foods that contain vaccines.

Contact: Ole Jepsen
Position: Labarotory Director
Organization: FDB
Phone Interview
Date of Interview: 11 April, 2000
Interviewed by: Jesse Finke

Background:

Ole has a PhD in Food Chemistry from DTU. He is their lab director and he has been working there for 18 years.

FDB Background:

FDB is a consumer co-op. Their members own the company. They have 1.3 million members and, for an annual meeting and other responsibilities, 400 delegates are elected to represent different areas of Denmark. They have the largest market share in Denmark with 35%. They are consumer driven.

Position on GMO's:

FDB's position on the GM food issue was decided upon in their annual meeting conducted in June 1999. They are not against the technology. They would like for consumers to have a choice. They would offer this choice by making the co-op foods non-GMO and selling GM food supplied by outside companies. They believe that consumers want to know if the technology has been used in the creation of their food. They can make a half promise to consumers at this point. They can promise non-GMO for ingredients of food, but cannot promise that meat is GMO free because of the possibility that the animals were fed GM fodder. They think it is a bad idea to label things non-GM because it is difficult to make such a guarantee. They agree with the 1% threshold for labeling.

Focus:

They are focusing on informing the consumer about GM food. They would like consumers to have all of the information about the issue available to them. They believe that the current legislation is unsatisfactory for consumers. The legislation does not have enough legal requirements such as identity preservation.

Action taken on the GM food debate:

In 1996, when GM soya was being "forced" upon Denmark the debate became a large issue at FDB. Soon after this, all but one (Aldi- a German-based company that Ole termed as "unorganized" when compared to theirs and other organizations) of similar organizations agreed to work together to solve the problems that GM food would create. Ole pointed out that this is in stark contrast to the UK where companies are using the GM debate as competitive ammunition against one another. They believe that this is the best way to satisfy consumers and that GM food should not be made a competitive arena.

Contact: Ole Linnet Juhl
Position: Member of the Food and Drink Federation
Organization: Dansk Industri
Personal Interview
Date of Interview: 29 March, 2000
Interviewed by: Maria Soledad Gil, Maegan V. Rivard, Jesse Finke

Background:

Ole has a Master's in Political Science, before working at Dansk Industri, Ole worked with the Danish Commission. Ole has been working at Dansk Industri for one year in the Danish Food and Drink Federation as the director.

Dansk Industri Background:

The Dansk Industri covers 220 companies in Denmark. They are the chief business organization in Denmark. Their 6,000 members make up 55% of the private labor market. It is their responsibility to inform industry of the technology and talk with interest groups that are interested in having a dialogue. They provide general information to those that seek it and engage in individual dialogue with their various members. They also publish a small magazine for their members and are a member of the European food industry in Brussels. The Food and Drink Federation, of which he is a part of, is made up of seven people within Dansk Industri. The press seeks the opinion of DI and is well respected by the media.

Position on GMO's:

Dansk Industri is supportive of GM food and companies like Danisco, which are interested in marketing GM products. The Dansk Industri does not look specifically at the safety of these products. They wish that they could have a discussion that does not put so many demands on the technology. They feel that the current ethical guidelines created by the Business Ministry restrict the growth of the technology. However, Ole did stress that the Dansk Industri is willing to discuss the Precautionary Principle but the promoters need to define its uses. Ole also mentioned that, in addition to calculating general risks and benefits for the whole of society, the risks and benefits must also be calculated for doing something and not doing anything in regards to a technology. They want food to be labeled if its GMO content is above 1%. They are against negative labeling, meaning labeling that points out "non-GM" products. They do not discuss the safety issue because it is a given that the individual companies are producing safe products (i.e. it's up to the individual companies to handle safety). They believe that GMO technology should continue to be researched because it could be very beneficial to industry.

Benefits to the Technology:

Ole mentioned how Denmark has reduced the spraying of pesticides by approximately 60% since the use of GM crops with no reduction to the yield. He mentioned that the Dansk Industri does not want to have to use pesticides at all but unfortunately they are a necessity. He feels that a benefit to the current Round Up

resistant products is that less can be used and Round Up appears to be more environmentally friendly than other pesticides.

Labeling:

Dansk Industri feels that the best way to inform the public is through labeling. They say that the label should say that the product was made using a GM product, including any meat and milk made from animals that have been fed GM feed. They are not sure what exactly to put on the label but they are concerned that it could be too extensive or assume too much public knowledge.

Personal Views:

Ole stressed that the discussion is a very emotional one and that a technology with zero risk does not exist. The people that are against the technology feed on this emotional aspect of the debate in order to touch the feelings of the public. He stated that you can't just stop this technology, it is going to be used in food and farming. He also thinks that retailers are preventing consumers from having an economic benefit that will arise from the commercialization of these products. By completely removing them from all supermarket shelves, the right of consumer choice is completely taken away.

Ole believes in the technology and openly promotes it. He stated "The technology develops everywhere around the world except in Europe," with disappointment. He also said that GMO's create a problem and when that problem is solved it just creates a new problem and so on. In other words, the GMO problem may never be solved. His view towards environmental organizations is that the organizations should make demands as to how the technology should be used instead of being completely opposed to it. This would be a more effective means because he believes that the technology will never become extinct. Finally, he predicted that in the next 3-5 years there will be a breakthrough in gene technology that will achieve a wider acceptance. This whole new generation of products is going to appear on the market, and the benefits of these products are going to move from only benefiting the farmer to benefiting the consumer as well. In order for GM food to be accepted, Ole feels that the product is going to have to be more functional, for example, foods that are nutrient rich.

Contact: Jesper Lassen
Position: Assistant Professor
Organization: Department of Development and Planning, Aalborg University
Personal Interview
Date of Interview: 4 April, 2000
Interviewed by: Maegan V. Rivard and Jesse Finke

Background:

Jesper Lassen has been researching the social aspects of the GM food debate for the last 20 years. He began working on it in the 1980's when he did a project on the technical issues with the use of genetic modification. He received his Ph.D. from Roskilde University and his thesis was on consumer influence on food production and

some case studies were included that dealt with the influence of biotechnology. Then he received an EU grant and collaborated with other European researchers to study biotechnology and public opinion. This research was done by studying biotechnology in the media, political response to the technology and public opinion using the Eurobarometer surveys. Currently, he is conducting focus group interviews in order to try to understand the results from the surveys, specifically the result that "moral concerns are the main issue." He is collaborating with approximately 50 people on this project, which are broken down into national groups of between two and four people. He mentioned that the future of his work may involve looking at the role of the Environmental/ Consumer Organization or industry. The main focuses of Jesper's research are technology assessment, biotechnology and food production.

Some History of Biotechnology in Denmark:

Jesper gave a quick overview of the history of the biotechnology debate in Denmark. GM technology was first introduced into the environment in the mid-1980s, this caused the first peak in the debate in Denmark. The general opinion was against food biotechnology so they proceeded to assess the consequences of including in meat, dairy products, bread and fish. Then there was a brief lull in the debate and now there is the current debate.

Research Results and General Conclusions:

During the food biotechnology portion of Jesper's research his group asked the public to rate the various types of biotechnology in order of acceptance from most accepted to least accepted. The most accepted use for biotechnology is in the medical field, while food was last as the least accepted use for biotechnology.

Jesper mentioned that the main reason given for the lack of acceptance was "moral concerns". They are currently trying to understand this reasoning, he says that this is hard to decipher because morality is not fixed and much of the time this reason is given when a person is unable to really put into words the specific reasons of what they are feeling about the technology.

When dealing specifically in food, Jesper identified three specific groups of people that describe the negative attitudes toward the debate. The first group are the Fundementalists. These people are completely against biotechnology because they think that it is disrupting the Natural world that has been made by God. They generally completely reject all forms of biotechnology. The second group of people have a lack of utility or usefulness for the technology and do not see any benefits in the technology. They have not seen any useful application of the technology and feel that there is "no need for the technology in Denmark." Finally there are those that are ambivalent toward the technology. These people are personally assessing the technology and feel that some applications are fine but others are not. This "ambivalent" group encompasses a majority of the world's population.

Jesper has not studied the issue of GM feed/fodder and what that means to society in terms of meat production and labeling. However, he said that based on his studies many of people feel that gene technology is simply ethically wrong and they are just rejecting the technology for any use and want labeling on any product that has been made using genetic modification.

Thoughts on Industry, NGO's and other organizations:

He said that industry feels that there is no risk to the technology. He thought that Monsanto unfairly tried to force the product on Europe and was not willing to rationally discuss the technology or the products themselves. In the Eurobarometer survey the public was asked whom they trusted the most from a list of groups including Environmental/ Consumer Organizations, Industry and Public Authorities. At the top of the list were consumer organizations followed by other NGO's and at the very bottom were industry and the public authorities. When asked who should regulate the technology, the public placed the Scientific Community and Ethical Councils at the top of the list for those who should and public authorities such as the EU at the bottom showing that people think they are not capable of adequately regulating this technology.

Why this doubt in public authorities? Jesper says that the public feels that the regulation that has been passed does not reflect the public opinion on the issue. He says that the public opinion is not being represented in the EU and therefore the public trusts any other organization (such as NGOs) that are representatives of their opinion. This similarity between the opinion of the public and the NGO's is probably because the NGO's have a direct line to the public and other local groups and because the public only sees a confused political reaction with no real focus. However, Jesper makes it clear that the whole situation shows that the NGO's have no real influence in the political arena because if they did, regulation would be more representative of the public view. Jesper mentioned an interesting point though, that when the public was asked how many NGO's they could identify from a list of the nine most important in Denmark, most people had no idea what a majority of the groups lobbied for particularly in the biotechnology area.

The future of GM foods:

Next we discussed what would need to happen in order to make the middle group of people, those that do not see any direct need or benefit to the technology, change their mind and accept the technology. Jesper said that there would need to be a complete shift of the products that we are currently seeing on the market but he does not know what those new products would have to be. He said that in general, the Danes are not particularly fond of functional foods such as those foods that may have a higher vitamin content. He thinks that the general Danish citizen feels that all nutritional needs should be provided by a person's diet. He thinks that people would rather take a lot of supplements and have pure food than be forced to eat food modified to have a property they do not want. He said that in order for the industry to convince people they want GM food, industry is going to have to research what the public wants and their attitude toward functional foods. He stated that ultimately, the Danes do not want the technology at all, or they want a choice between GM and non-GM products in the supermarket. This involves labeling and segregation of GM products, he said that in a Gallup Poll done about the attitudes toward food biotechnology a majority of the people said that the would like the food banned, but if the food was going to be marketed 80-95% of Danes want the food labeled.

Jesper mentioned that food biotechnology might be accepted if it could serve a clear purpose that truly benefited needy members of society. But currently the use of genetics in plants for food is accepted by a minority of Danes, use of biotechnology in

animals is rejected by virtually everyone and the use of gene technology in humans is simply not being discussed due to lack of understanding and information.

The interview concluded with Jesper mentioning that Denmark can see the world moving toward gene technology and the only way they are going to survive as a producer and exporter of food is to do one of two things: either supply the world with the alternative to GM products through natural and organic agriculture (this is hard for a small country like Denmark) or to produce both so that they can remain competitive in the world market in all areas. Jesper mentioned that if a decision is not made soon Denmark will probably be left behind and will not be competitive in world agriculture.

Contact: Rikke Lundsgaard
Position: Resident Agronomist working on Organic Agriculture
Organization: Nature Conservation
Personal Interview
Date of Interview: 11 April, 2000
Interviewed by: Maria Soledad Gil and Maegan V. Rivard

Background:

Rikke is an Agronomist and worked in organic agriculture as a consultant to farmers for many years. She has done international work on organic agriculture, in charge of setting up standards for the use of this organic farming. She has been working at Nature Conservation for three years now and works mostly on promoting organic agriculture as a tool for improving the environment as well as water quality issues and has recently become interested in the GM issue. She is a member of the standing committee for Agriculture in Parliament and has been a member of other *ad hoc* committees dealing with water and pesticides.

Nature Conservation Background:

Nature conservation was founded in 1911 and was originally providing the public with access to nature. Their main activity was conservation of specific areas. There are no national parks in Denmark because the country is so small and because the country is approximately 65% agricultural. However, approximately 45% of the country is now under some type of conservation clause. Recently, the organization has moved to water and air quality as well as chemical pollution but is continuously working on conservation; the issue the organization was first founded to deal with. Currently, the organization as about 200,000 members, these members are families and individuals and about 90% of the funding for the organization comes from the membership fees. Nature Conservation is provided with a little money from the government for various conservation projects. Rikke says that because of the many members their opinion holds weight in Parliament but because they are so old and large they must be very careful about what they say and make sure they do not state anything that is not true. They are always careful not to undermine their credibility.

Nature Conservation gets to have a say on any papers and legislation that are written concerning the topics they are concerned with and they are frequently asked to

write and speak in reply to legislation in Parliament. Sometimes they agree with the legislation but most of the time they make recommendations and provide administrative bodies with a list of problems that they feel might be caused by the legislation.

Position on GM food:

Nature Conservation does not have a policy paper about GM food because the issue is changing so rapidly but they have done a lot of work with it. The most important thing to Nature Conservation is that those consumers and farmers that want non-GM food should be able to have it; therefore, segregation is a key to GM food production. They feel that any GM product should be kept separate and that everyone should have a completely free choice. They are also concerned with gene transfer through pollen. Ultimately, they are concerned that all food will eventually be mixed and segregation will not be possible. The Nature Conservation feels that GM food is not necessary but if GM food is going to be a part of the world it is key and possible to get legislation that protects nature, the environment and the consumer. They do not think GM food is a viable scenario for a democratic society. Rikke also mentioned that they were concerned that GM food may create a monopoly in the food industry.

Nature Conservation and the EU:

Along with Greenpeace and NOAH, Nature Conservation made suggestions for the current EU directive under discussion 90/220 but these had no effect. Nature Conservation wanted a three-year moratorium on the release of GM food so that they could look more into the risks of the technology. They managed to get the *de facto* moratorium that currently underway.

Current Concerns:

First they would like to do what they can to make the directive 90/220 as precautionary as possible. Then they have three other main focuses for the directive:

1) Establish sufficient insurance that says that if damage were to be done, the companies would be responsible. They do not feel they really have a say in this but this is what they are hoping.
2) Make sure that any GM characteristic is not spread to natural flora. Some of their suggestions are by distance and making sure that there are not any related species close to the crop to avoid blending.
3) Banning of the use of Antibiotic Markers.

One of their hopes is that Biotechnology companies will not want to grow GM crop Europe because the insurance will be so high.

Labeling:

The Nature Conservation would like clear and unambiguous labeling of any food that has any relation to a GM crop or feedstuff including anything that has been made with a GM material. They also feel that any product that comes from an animal that has eaten GM feed should be labeled as well (e.g. eggs, milk and meat). In terms of the 1% rule, they do not think that the percent of GM matters, it is only important that GM

products are segregated. Their feeling is that if organic products can be segregated so can GM products.

Actions:

Any actions that Nature Conservation does is at the political level. They make recommendations, write suggestions and make speeches at both the Danish and EU levels but mainly with Danish/EU parliamentarians because it is difficult to get members outside of the Danish government to listen.

Public Relations:

They do provide information to the public through newspaper articles, they are often quoted and they speak on the radio and on television. The main way they provide information is through their 200,000 member households, a very large part of the entire Danish population. They have contact with their members through letters and e-mail and Nature Conservation publishes a quarterly magazine that every member gets. Overall, they do have the resources to do research into the public opinion on the GM issue but they do get feedback from their members and they seen very mixed and confused opinions.

Current Problems with GM food:

Rikke says that it is possible to see positive outcomes but there are obvious problems with the release and safety of these products that are not being explored adequately. Currently herbicide resistant crops create a biological desert and rid the field of all biodiversity. Herbicide resistance can spread to other weeds and then control is lost. Insecticide resistant crops can cause insects to become resistant very quickly. It usually takes quite awhile for insects to become resistant because farmers only spray approximately one time per season. However, insecticide resistant crops are like constantly spraying with insecticide, which causes insects to become resistant at a faster rate. The other issue is that these insecticide resistant crops also affect beneficial insects in the soil.

Long Term Goals:

Their main goal is not to have to spend any time fighting the GM issue; they want it to be over. They do not see a use for fighting an issue that there is no need for in the first place.

Contact: Mette Meldgaard
Position: Policy Analyst
Organization: IFOAM
Telephone Interview
Date of Interview: 4 April, 2000
Interviewed by: Maria Soledad Gil

Background:

Mette Meldgaard has been a Policy Analyst in IFOAM since 1998, and has been part of IFOAM since 1993 as a small farmer. She is an economist and has a background in marketing. She works at IFOAM in connection with authorities and press. She promotes organic farming and also has contact with international groups. She is the secretary of the Danish Association for Organic Farming and deals with most of the political issues.

The organization:

The organization gathers smaller groups of farmers, for example egg producers or vegetable producers, it is the representative of their interests and provides support to farmers. IFOAM has helped their members to find GM-free foodstuffs. They also partner with other organizations in order to express their points of view and create policies that influence the market politically. They have issued documents that work as environmental policy tools and have also influenced the government decisions about test fields in Denmark.

Their interests:

The organization promotes organic farming and defends themselves against some other groups with different criteria. They show themselves open for the development of methods that improve the agriculture, but have strong opinions about effectiveness of some procedures. Even though researchers are promoting GM seed use in organic farming, they find it is another way of farming. They are focused in handling a clean product and are also focused on the development of the process.

Their focus in the GMO debate:

IFOAM is against GMO's and find no viable way of supporting them. Half an hour after the phone interview, Mette had to do an announcement about GM maize. They are also against test fields in Denmark. They took part in a campaign when test fields were to be planted, and their effort caused the work to be delayed for one year. The government asked the firms interested in growing test fields to get licenses before working. The organization is worried about cross-pollination and its effects and is taking part in the discussion on ethical criteria.

Active work:

IFOAM issues its own magazine called "Organic Farming" twice a month, it discusses different topics in organic farming, one of them being GMO's. Some articles issued by IFOAM have been publicized in magazines. They also do political work, they

have worked on papers with the Social Democrats and have debated the issue with other groups. They maintain discussions with other organizations and have done analysis on GM food. Mette said they have worked together with organizations like NOAH and Greenpeace. They teamed up with the Agricultural Council and made a policy paper on which they both agree completely.

Contact: NERI - Henrik Sandbech and Ulrich Karlson
Position: Henrik is the Director General of NERI and Ulrich is a Senior Scientist in the Department of Microbial Ecology and Biotechnology
Organization: National Environmental Research Intitute (NERI), Ministry of the Environment and Energy
Personal Interview
Date of Interview: 12 April, 2000
Interviewed by: Maegan V. Rivard and Jesse Finke

Henrik's Background:

Henrik is the Director General at NERI. His responsibility is to manage the day-to-day activities of the institute.

Ulrich's Background:

Degrees

1984 Ph.D., Soil Microbiology, Dept. of Land, Air and Water Resources, University of California at Davis

1981. M.S., Soil Science, Dept. of Land, Air and Water Resources, University of California at Davis.

1980. Vordiplom, Agricultural Sciences, Universität Göttingen, Germany.

Research Experience

1992 - present. Senior Scientist. Dept. of Marine Ecology and Microbiology, National Environmental Research Institute, Ministry of Environment and Energy, Roskilde, Denmark.

1989 - 1991. Wissenschaftlicher Mitarbeiter. Gesellschaft für Biotechnologische Forschung, Braunschweig, Germany

1988 - 1989. Assistant Research Soil Microbiologist, Dept. of Soil and Environmental Sciences, University of California at Riverside.

1985 - 1988. Postdoctoral Research Assistant, Dept. of Soil and Environmental Sciences, University of California at Riverside.

Research Interests

Soil microbial transformations of organic compounds, nutrients and trace elements; microbial degradation of environmental pollutants; soil-microbe-plant relationships; low-input agriculture; soil salinity effects.

Background of NERI:

NERI is an independent research institute under the Danish Ministry of Environment and Energy. They are one of the six major bodies under the Department of the Ministry of Environment and Energy, which is immediately under the Minister. NERI has a Board of Governors that strategically manages NERI while the day-to-day management of the institute is the responsibility of the Director General. NERI is completely funded by the state but if additional money is needed they apply to the agencies. NERI is always asked about GM releases into the environment. Generally, if the Minister needs a quick answer concerning GM the Danish Environmental Protection Agency is consulted, however, if scientists need to get involved to answer science specific questions, NERI is immediately contacted. Of the six bodies under the Department of the Ministry, NERI is the body that almost solely deals with the GM issue with a little bit of assistance from the National Forest and Nature Agency. It is the responsibility of the EPA to write up the opinion of the Ministry and other administrative issues are split between the EPA and the Forest and Nature Agency because the issue would become too large politically if one agency handled all of the issue. It is the job of NERI to answer any questions that come up concerning the technology. They do this by completing a paper evaluation and indoor use of the application. Most of the time they take the information provided about the GMO and see what they can find in literature and determine whether or not the information seems reasonable and makes a determination as to the environmental risks involved if any. In order to understand the science behind this evaluation they perform indoor experiments with genetically modified organisms. Within NERI, the Department of Microbial Ecology and Biotechnology deals with genetically modified microorganisms while the Department of Terrestrial Ecology deals with GM plants (crops) but both departments work closely with one another. Between the two departments at all sorts of questions dealing with GMO's are looked at, they perform ecological experiments (e.g. soil), they look at the issue of gene spreading (by pollen at the plant level), survival of GM bacteria and impact of GMO's on the environment (e.g.insects). Because of the ongoing research NERI is prepared to evaluate a case without doing any experiments because they are constantly keeping up with information.

Fodder Beet experiment:

Henrik and Ulrich told us about an experiment that was done on the effects of the use of a pesticide in conjunction with GM fodder beets on insects. Two farmers were willing to plant GM fodder beets in their fields. Farmer 1 was a traditional farmer that used traditional spray methods with the GM crop, Farmer 2 was more of a experimental farmer and accepted some scientific input and tried a new method by spraying later in the season and with smaller doses of spray. When the number of insects and insect species were counted in both fields it was found that Farmer 2's field, the farmer that utilized the GM technology, was full of insects because there were some weeds present in the field; biodiversity was actually increased. Another observation was made that the insects that were present in Farmer 1's field were eating the fodder beets because they had no other plant life to live off of due to the traditional spraying methods. However, the insects in Farmer 2's field ate the weeds NOT the fodder beets and natural weed control took place. Essentially, the GM fodder beets required much less spraying and actually preserved

biodiversity when the proper spraying methods were used in conjunction with the GM crop. It must also be noted that the experimental farmer did not show a yield reduction. These results are no published yet but they will be appearing in *Nature* very soon. Other experiments like this one are being planned that will look at non-GM crops versus GM crops and may even include an organic farmer as well.

Release applications:

If any GMO is going to be released into the environment it must go through a trial release first before it can be allowed to go through market approval. The national authority on this issue is the Forest and Nature Agency, so when a deliberate trial release comes up in Denmark, the Forest and Nature Agency makes the final decision, however they must hear comments from all other EU member states, who have 90 days to send comments. If a member state does not object at the trial level then they automatically forfeit the right to object during the market approval. A trial may be in multiple member states at one time but most of the time an application is made in only one member state at a time. Trial and market release are standard for the entire EU.

A release application within Denmark will receive a lot of input from very different entities within the country in addition to the recommendations of the other EU member states, which are generally just a response using a standard form. Within Denmark, various consumer and environmental organizations, county authorities (the local environmental authorities) as well as various members of parliament are generally heard from. The Forest and Nature Agency is in charge of collecting all of these recommendations and providing the Minister of the Environment with the information. The final decision is made as to whether or not to release the GMO is made by the Minister. The Minister has the obligation of informing parliament of his/her decision before it is made and he/she generally does this by consulting with the Parliamentary Committee for the environment.

Attitude in Denmark:

Ulrich says that the attitude in Denmark depends on what type of genetic modification is being done. GM is considered fine for uses in medicine (e.g. insulin), the Danes do not want GM crops/ food at all and the attitude toward the use of genetic modification of microorganisms to address environmental issues is still uncertain.
He mentioned the continuous discussion about labeling and said that he does not understand the 1% labeling rule because the idea of genetic contamination seems odd because genetic material is being mixed constantly so that must mean everything is genetically contaminated.

Bt tests:

Ulrich mentioned some soil tests that are currently underway in order to find out the amount of *Bacillus thuringiensis* (Bt) already in the soil. They came up with a DNA test to differentiate between the various species of *Bacillus* bacteria in the soil. They found that the major Bt species in Denmark was the same as a species in Canada. This has lead to a discussion of the possibility of microorganisms being transferred through the air.

Ulrich's Application to release a GM bacterium:

No one had applied to release a GM bacterium into the environment but recently, Ulrich applied himself. Ulrich genetically modified the bacterium *Pseudomonas fluorescens* to be used in bioremediation. The fact that Ulrich was applying created a problem in the system because normally if anyone were to apply to release a GMO the application would be sent to him and his team for evaluation. The fact that he was applying posed the question of who to send the application to. He noted that there are a number of people that would like to prevent the release of his bacterium. He commented that personally he did not care whether it was released or not because if it were released he would work on that if it were not released he would do something different. However, scientifically speaking he thinks it would be a pity if it were not approved because he thinks that it could benefit society.

Ulrich first made the point that any newspaper article with the letters GM in the headline is a seller but most of the time journalists misquote the person they are interviewing for a more exciting story. He said that the press has turned from arguing about the genetic modification aspect of the bacterium to arguing against the bacterium itself.

Ulrich told a story about a journalist that went to a medical professor and asked him what he thought about the release of this GM bacterium. The professor said that he was concerned about it because he had seen an elevated level of that bacterium in Cystic Fibrosis patients. The journalist automatically called Ulrich and asked him about this, when Ulrich honestly answered that he hadn't heard about it the journalist instantly published a story saying that this bacterium could cause Cystic Fibrosis. It turns out that when Ulrich spoke to the professor and explained the bacterium he said that it wouldn't be a problem. The journalist had also asked Ulrich whom he could contact to about this issue, Ulrich recommended a colleague doing his Ph.D. thesis that works for an NGO (Bo at NOAH) and apparently Ulrich's colleague was very vocal about the issue. In another instance, Ulrich's application had been sent to the Health Agency for evaluation, they did a literature search and obtained a lot of abstracts that linked *Pseudomonas fuorescens* to health issues. They instantly rejected the application but neglected to notice that the bacterium is the most common bacteria in the soil and that it is used in three pest control agents in the U.S. Essentially, Ulrich feels that the media is feeding on public misunderstanding of the technology and creating fear.

Informing the Public:

When Ulrich was applying for the release of the GM bacterium he could have made his application confidential but he didn't. Instead, he made the entire application available to everyone because NERI is a public agency and they are obligated to inform the public of what is happening and what research their tax money is funding. They put the complete application on the web and said in the press release that the application could be found in its entirety on the internet. They did this for a couple of reasons, first they were asking for comments from various organizations and individuals and this was an easy way for them to provide them with the entire application because people were only allowed two weeks to comment about the application. Secondly, NERI avoided any scrutiny they might have received later for "hiding" information from the public. They

told the public about the application in a press release the day that it was officially accepted by the Forest and Nature Agency and it was on that day that they opened up the website. Consumer and Environmental organizations were also asked to comment and they were provided with the information through personal letters, they were provided with a summary of the application that is a standard form for the EU and were asked to comment in two weeks. Anyone is free to respond or comment through the website about the application and thus far there has not been any public response beyond a few minor questions. Ulrich said that there may have been major comments made directly to the Forest and Nature Agency that he does not know about.

Next, Ulrich told an interesting story about the media. He was asked to do a television interview with one of the major TV stations in Denmark. He agreed and they did the interview in his laboratory on the Monday that the public was informed of the application for the release of his GM bacterium. He was told that the story was to appear on the 9pm news but later discovered that the story on Mad Cow Disease came out on the same day and his interview was cut. He asked if it would appear on the following day and the journalist said she did not know because that depended on the developments of the Mad Cow story. Unfortunately, the story never appeared on TV.

Personal and Political Opinion:

Ulrich thinks that one of the main problems in agriculture is with farming overproduction in the EU. He mentioned that it is said that animals in Denmark are said to graze on the Mississippi because of the imported soybeans in the animal feed. People thought that by putting a tariff on the soy feed it would reduce the overproduction but a tariff can not be placed on something imported from the U.S. so it was thought that a tariff could be placed on the soy if it was genetically modified, resulting in higher profit. This necessitates saying that the feed is GM and this is where politicians "sit on the fence," they just do not know what to say about the issue.

Scientific opinion:

Ulrich says that there have not been any substantial studies up until now that genetic modification could be harmful to the environment or the health of humans. He made it clear that independent researchers would who are working on the issue would not want to hide the truth or any harmful effects because if they were to find something negative about the technology then they would instantly be published and acquire respect from the scientific community. In fact, Ulrich says that scientists have been testing and retesting anything and everything they can think of in an attempt to find a negative effect of the technology. As an example, he told a story involving a Ph.D. student that found out that GM rapeseed could hybridize with a natural variety and result in a native weed. From this result the student received instant recognition and his results were published in *Nature.*

Thoughts on the Future of Biotechnology:

Henrik says that the technology cannot be stopped. Ulrich accepts that there are forces at work in the public that have fixed opinions and that are not going to change regardless of what happens in the debate. He thinks that groups like Greenpeace are able to use weapons that scientists can't such as lying (e.g. misquoting in the media) and they

are able to launch political campaigns. He also says that they have a firm grip on the public attitude, which will make it impossible to market GM food as the situation is right now. He says that right now the consumer does not see a point in the use of genetic modification in food and they think that it is only a ploy to make money. He thinks that a direct benefit for the consumer may alter the aversion to the technology, for example when consumers in the UK were faced with GM and non-GM tomatoe paste the consumers bought the GM version because it was cheaper.

Henrik and Ulrich made it clear that the NERI is not expected to have an opinion on the issue because they are only trying to investigate the technology. They simply do their work, do honest research and tell the truth about what they find. Their feeling is that all they can do is continue to tell the truth in all cases, this is their focus in terms of the debate.

Contact: Bruno Sander Nielsen
Position: Dept. of Research and Food Legislation-Advisor
Organization: Agricultural Council
Personal Interview
Date of Interview: 7 April, 2000
Interviewed By: Jesse Finke, Maria Soledad Gil, Maegan V. Rivard

Background:

Bruno received a Master's in Biology from the University of Arhus. He taught for one year after graduation and has worked in the Agricultural Council ever since (ten years). He works primarily on organic production, gene technology and the use of renewable resources.

Organization Background:

The Agricultural Council is an umbrella organization that covers all of the farmer's organizations such as pigs, dairy, poultry, and crops. They control all natural foods in Denmark. Dansk Industri oversees produced food only, such as cookies, alcoholic beverages, frozen vegetables, etc. They also serve as suppliers to farmers. They supply seed, fertilizer, and fodder. They are an independent organization that receives funding from its members.

Position on GM food:

The following are part of their position paper formed in February 2000. They believe gene technology is a valuable technology, that it has positive effects for farmers (increased yield, less pesticide use, etc.) and consumers (lower prices). They do not want to allow anything that is dangerous to the environment or to people. They believe a discussion of a GM product should begin with what the product does, not with "this product is GM." This is part of the belief that products should be discussed individually. They are in favor of 1% labeling and non-GM labeling. They believe that pre-market approval (applying only to environmental and health risks, not agricultural problems) is very important. They think there should be risk assessment followed by risk management

and risk communication. Bruno pointed out that the U.S. agrees with risk assessment only. Risk management poses the question "Are the advantages greater than the disadvantages?" They do not want GM in organic production, but are willing to consider it if the technology can solve some of the problems that organic growing creates. Finally, they believe there should be some form of liability for GM products.

Actions taken:

As mentioned above, they formed a new position paper in February 2000. It was a revision of one formed in 1996 shortly after the separation of imported soya controversy arose. In 1998 they made an agreement with the Ministry of Environment that there would be no GM crops in Denmark in 1999. Their interest is to participate in the public debate and not to promote gene technology.

Code of Practice for farmers:

This code was created and is included in their policy paper. It applies to farmers who want to grow GM crops. The following items are included in this code. Any farmer wishing to grow GM crops must be sure that there is a market for the crop. Every farmer in Denmark must keep detailed records of what they plant every year. There must be a barrier between GM crops and non-GM crops (some as small as 5 meters, others as large as 5 km because of pollination concerns). Farmers should inform buyers of the fact that it is GM. Cross pollination is a major concern and must be prevented. Farm machinery must be thoroughly cleaned if used on different crops.

Opinions:

The Consumer Council will only discuss what goes in the mouth of the consumer and not what happens to the environment (e.g. less pesticide use). He believes that farmers mirror the rest of Danish society. He believes that Europe is losing an economic opportunity by opposing GM food. It's causing gene technology researchers from Europe to move to the United States, thereby weakening Europe's standing worldwide. He wonders why something that is beneficial to the environment is not seen as beneficial by the consumer.

Contact: NOAH - Bo Normander and Sofie Krogh Andersen
Position: Bo is an active member and Sofie is an employed campaigner
Organization: Gene Group, NOAH- Friends of the Earth, Denmark
Personal Interview
Date of Interview: 3 April, 2000
Interviewed by: Maria Soledad Gil, Maegan V. Rivard, Jesse Finke

Background:

Bo received a Bachelor's degree from DTU in Chemical Engineering where he also took classes in Biotechnology. Later, he got his Masters in Microbiology and is currently working on his Ph.D. in Microbial Ecology at DMU where he is studying the environmental risks of using GM bacteria for agriculture. Bo has been an active member

of NOAH for three years and is now a member of the "Gene Group", a group within NOAH that specifically works on gene technology. Sofie has been working with NOAH for four years. She just recently became a paid campaigner for the gene group with funding from grant money. Before working in the gene group Sofie mostly worked on NOAH's member magazine.

NOAH's position:

NOAH is not in favor of the technology but is trying the best they can to protect the environment and the consumer realizing the technology may not be able to be stopped. NOAH's main focus is that Europeans should always have the choice of buying GM free products. NOAH also fights for labeling that is on the front of packages, that is clear and is a recognizable sticker similar to the Organic product sticker. They want to label all things that contain GM products. NOAH is also fighting for segregation of all GM products in all aspects of production and marketing. NOAH has a policy paper and provides information to the public via pamphlets and their web-site.

Other concerns:

NOAH does not agree with the 1% rule, they think that this limit is too high. They feel that all companies should have to separate out the GM from non-GM products. NOAH is also concerned that GM feed/fodder is not labeled at all and they are taking this is going to become a new focus for them as an organization. They think that anything that has traces of GM should be labeled. They think that any products that deal with Antibiotic, Herbicide or Insect resistance should be banned and they are starting to feel confident that the antibiotic resistance will be abolished because the Parliament might ban the use of antibiotic markers in the laboratory process. They also would like to see a section on liability in the new directive, meaning that if damage is done, the companies, not the public have to pay to fix the damage (insurance companies do not agree with this directive). Bo and Sofie made it clear that there is always a risk with everything and in terms of GM crops gene transfer is the concern. If genetic material spreads throughout the environment there is no way to clean up genetic pollution. Biological pollution is irreversible.

Current projects:

Currently they are working on an internet project called the gene debate web page (www.gendebat.dk), where people can get information on all of the field trials that are underway in Denmark from what is being grown to where and how much. The web page also gives information on media coverage and it is first time that the public can find out a complete list of products that have been approved by the EU. They are also following the debate closely and frequently publish press releases on the issue, the press is very receptive to NOAH's opinion because it is a very respected organization in the Danish community that has been around for many years. NOAH is also keeping an eye on the 12th of April when the European Parliament is going to vote on a common position in terms of the GM issue that may or may not be passed.

Other information:

They mentioned that there are no GM products currently on the shelves in Denmark. They mentioned that Denmark was the first country to have a law concerning gene technology and some of the legislation in the EU has been based upon this original regulation. NOAH works with an unofficial network of NGO's such as Greenpeace, Nature Conservation, Organic Farmers and the Active Consumers and of course Friends of the Earth International.

Contact: Bjarne Pedersen
Position: Senior Advisor
Organization: Danish Consumer Council
Personal Interview
Date of Interview: 27 March, 2000
Interviewed by: Jesse Finke, Maria Soledad Gil, Maegan V. Rivard

Background:

Bjarne has a master's degree in Nutrition as well as in International and Environmental Policy. He has been working in his current position for about a year. At the time of the interview he was working chiefly on sustainable agriculture.

Danish Consumer Council's view on GMO's:

They do not choose a side in the debate, their main concern is for consumer welfare. They focus on the environment and benefits.

Danish Consumer Council's policy on GMO's:

Their official policy is the same as the consensus reached by the TACD (Trans-Atlantic Consumer Dialogue). The TACD policy paper can be found in Appendix E. Briefly, they believe in the precautionary principle and the labeling of GM products is their top priority.

About the Danish Consumer Council:

The DCC is the only consumer organization in Denmark. Because of this fact they have no trouble in getting their voice heard. They work a lot with the press and have a very good relationship with them. They are funded chiefly by Parliament (60%), although they are independent of the Danish government. The rest of their funding comes from membership fees and magazine sales. They have members throughout Denmark and meet four times a year. It is mandatory for the DCC to be consulted on all consumer matters, including legislation. They work a lot with BEUC (European Consumer's Organization) whose members include all of the EU countries as well as a few other European countries. BEUC's goal is to reach a consensus among all members to achieve a stronger position.

His personal opinions and insights:

He believes that in five years or so the GM food issue will be totally different than it is today. He thinks that first generation crops will die out and companies will begin producing products that have direct benefits for the consumer. He also believes that there will be a more active use of ethical criteria.

He stated that a few years ago the main issue in Denmark/Europe with GM food was food safety, and that today the main issue is protecting the environment. He talked about how companies say GM food will help solve the world hunger problem, when the truth is it will only create a surplus because the means to deliver this extra food to the hungry are not in place.

Contact: Thormund Schmidt
Position: Independent Advisor
Organization: none
Personal Interview
Date of Interview: 6 April, 2000
Interviewed by: Maria Soledad Gil, Maegan V. Rivard, Jesse Finke

Background:

Thormund is an independent advisor that does not work specifically with any group or organization. He is involved in various political movements and when a group, organization or political party asks him for advice or to step in he does. Most of Thormund's education is in biology but he has a strong background in politcal science and psychology. He has been a managing director in publishing companies and through this he has many contacts in the United States. Recently, he has become interested in international development and most of his current work is internationally oriented. The major fields that he consults in are education, agriculture, health and medicine. He writes and produces Danish radio programs on scientific and environmental problems. Thormund has advised groups, particularly some Danish political parties, on the GM food issue and has been following the debate and the progress of the technology for quite some time. Thormund says that he tries not to be biased in his relationships with clients; instead he tries to take a completely scientific approach.

Thormund's View of the Danish situation:

Thormund has broken the Danish situation into five main attitude categories: researchers, primary and secondary producers, distributers, consumers and politicians. He says that researchers of genetic engineering are mostly goal-oriented people and that approximately 90% of them are in favor of the technology while approximately 10% are hesitant but not completely against the technology. Thormund feels that there is a large hesitation in the medical community and that they feel more information needs to be published. According to Thormund, the primary producers are those in industry and the agricultural councils and he feels that they are almost as powerful in Denmark as the Parliament. He says that the agricultural sector openly and secretly promotes the technology and sees it as advantageous. The distributors are those that have direct

contact with the consumer such as the supermarket. Thormund says that the supermarkets are afraid because the consumers have recently been demonstrating against GM products. He thinks that the consumer is misinformed and that they do not realize that most of the produced food contains GM. He says that the Danes have a strong influence but this pull does not affect the primary producer. Thormund says that the Danish population does not appreciate GM food and that whether or not GM products appear on the supermarket shelves depends on how the consumer acts. The consumer does not see a need for the technology. Thormund says that the acceptance of genetic modification is different depending upon what is being modified. He says there is a strong opposition to GM food but the use of genetic modification in medicine is fine. Thormund says that politicians feel that if the public was to learn more about the technology then they would be more accepting. Thormund also mentioned that the NGO's play an immense role in the attitude of the Danish population; they have more members than the political parties combined but politically they are weak.

Thormund's short-term perspective:

He says that when it comes to GM food production there will be hesitation and retard of any new developments for a period of time. He thinks that supermarkets will be reluctant to promote any products for the time being and consumers will continue to be skeptical. He says that the politicians' views are related to those views of their party and that the conservatives never really know what to say while the socialists are against the technology for the most part. He made it clear the Denmark is in favor of gene technology for medical use.

Thormund's long-term perspective:

Thormund says that the EU movement on this issue will play a critical role. He says it is difficult to stop the technology but it is hard to predict the future because the long-term risks are just not known therefore research results are going to be very important.

Labeling:

Thormund feels that the Danes are normally suspicious when it comes to labeling GM food.

Other information:

The Danish government is currently working on a center that will supply the population with information about GM food. The goal of this center is to reduce negative attitudes toward GM food.

Contact: Per Sorensen
Position: Marketing Manager
Organization: Dansk Slagterier (Danish Bacon and Meat Council)
Personal Interview
Date of Interview: 29 March, 2000
Interviewed by: Maria Soledad Gil, Maegan V. Rivard, Jesse Finke

Background:

Per Sorensen graduated from the Business School in Arhus, and received a masters degree in Marketing. He has worked in the Dansk Slagterier for 10 years and is located in the marketing department. He communicates with other EU countries and has a lot of contact with farmers.

The organization:

The organization is an umbrella organization, which is formed by the four main slaughteries in Denmark. There are 450 people working in Dansk Slagterier and they do a joint marketing effort. Denmark exports 85% of its production. They produce over 20 million pigs a year. The organization gets its funding from levies charged to the farmers and to the slaughteries. They charge farmers 8kr.(roughly one dollar) per pig slaughtered and 4kr. is charged to the slaughteries. The organization follows the rules imposed by the government and makes them public to the farmers. The organization defends the farmer's interests and makes the government pronunciations public to the farmers in order to follow governmental impositions.

Their interests:

Per Sorensen said, at present, their focus will be on the cost side of the issue. The maize to feed the pigs is very expensive, and they use the soya mainly imported from the U.S.A., Brazil or Argentina, which inevitably contains GMO's. The countries they are exporting to are still buying the products, therefore it is good business to buy the cheaper feed and they won't change this policy until countries refuse to buy from them.

Their focus in the GMO debate:

The organization does not do any lobbying, they will wait and follow the regulation on products and labeling from the EU. At the moment there is no regulation that imposes labeling to pigs fed with GM soya. They wait for research to be done , but the won't do the research by themselves. They are aware of the traceability issue, but they are reluctant to conduct the investigations and/or to pay for them. They have no opinion on how it should be labeled.

Contact: Jens Streibig
Position: Professor
Organization: Royal Veterinary and Agricultural University (KVL)
Personal Interview
Date of Interview: 11 April, 2000
Interviewed By: Jesse Finke, Maria Soledad Gil, Maegan Rivard

Background:

Jens received a PhD from KVL. He is a professor of weed science there. He primarily researches the selectivity of herbicides and herbicide mixtures. He has been doing so for the past ten years.

Work with GM food:

He works on risk analysis of herbicide resistant plants. This includes what happens to the weed flora in an herbicide resistant crop.

Facts:

He said there was a study done in 1996 that asked consumers if they would accept GM crops if they increased yield and thereby helped reduce famine. He said that 53% of respondents answered no.

Opinions:

Europeans are not as quick to accept new technology as Americans are. The European media presents American farmers as being afraid of GM technology, when most of them are only afraid they will not be able to sell their GM crops (not of the risks). Weed control is the chief burden of many farmers. He believes that by not accepting GM crops and the use of pesticides, yields will not be sufficient to supply the world's growing population with food. He went on, that because of this, farmers will be forced to plow up more and more land.

He was quoted saying, "Ask Greenpeace how much money they have generated by selling fear (of gene technology) to the public." He stated that Greenpeace acts without thinking of the consequences of their actions. He made an example of their campaign to save seals. This affected trappers who relied on the seals for their livelihood. He said that some professors and researchers are also guilty of selling fear to the public. He said their reason for doing this is to generate grant money.

He believes that GM crops cannot be prevented and that herbicide resistant crops make farming easier (less time and money spent on weed control). He thinks other GM crops must be created to gain the favor of the general public such as crops that have frost, draught, or disease resistance. He believes that the more informed the public becomes the more negative they will be towards the technology. He backed up this statement with the logic that if a layman knows a little bit about a subject it is very easy to imagine the rest. He also mentioned that scientists lack credibility because of things gone wrong (he used three mile island as one of his examples).

Contact: Knud Vilby
Position: Chairman
Organization: Danish Writer's Association
Personal Interview
Date of Interview: 17 April, 2000
Interviewed by: Jesse Finke

Personal Background:

Knud Vilby graduated and began working as a journalist. He has worked in the media most of his life. He has worked for the National paper, Danish Radio and for the last 15 years has been freelancing. He recently became chairman of the Danish Writer's Association.

DWA Background:

The Danish Writer's Association is the oldest and largest writer's association in Denmark. They have 1400 members in all categories of writing (poets, authors, translators, etc.). They are not a trade union, they work for economic and social benefits of their members. Journalists have their own trade union, but there are some double members.

Knud's work:

Recently, Knud has done a lot of work in developing countries. He is involved in a NGO program in Ethiopia concerned with soil and water conservation. He has done work with introducing draught resistant crops. He is also working on eco-labeling. This would create a criteria for the environmental impact of certain non-food products. These projects are all concerned with the environment.

GM Foods and the Third World:

Multi-national companies like Monsanto are buying land in third world countries to test their crops. Knud believes this could be beneficial as farmland is becoming scarce in Asia (increased yields could help this problem) and that the technology could reduce environmental impacts. However, the types of crops that would be most beneficial, maize and rice, to Asia are not being researched heavily because they would not make the companies as much money. He believes that in the last 20 years or so the balance of research has shifted to privately funded projects and there is not enough public research being conducted. He thinks that the multi-national conglomerates are pushing the technology in the wrong direction. He also believes that the local communities need to have control over their natural resources, the corporations can not control the use of resources halfway across the world, and therefore there is higher risk to the local environment. The farmers in these countries receive a lot more money to plant these crops and therefore it is easy for the companies to test their products because the money they are spending is insignificant in the big picture.

GM Food development:

He thinks that if there is public control on how GM technology develops, it will be all right. If the control is limited to a few companies, however, there will be much higher risk. He also thinks that the large companies tried to develop the technology at such a speed that they would be able to conquer anti-GM sentiments.

Opinions on the GM issue:

He believes the risk associated with GM food is to the environment, and that the chance of risks in the end product are minimal. Consumers don't like the modification of food, but they think it is okay to be used in medicine. The Danish public is more likely to be supportive of a small national company like Danisco than of one of the large multi-national conglomerates. He does not want to see Europe get left behind if the technology does prove to be beneficial and risk-free.

The Media in Denmark:

The print media includes about 35 daily papers, ten of which are national. There are three large morning dailies aimed at all audiences and a variety of dailies are for certain target audiences.

The electronic media was public up until ten or fifteen years ago. At this time there was only one TV station that provided news and three radio stations. Today there are more and one or two of them are based out of England (that broadcast in Danish) where they do not fall under Danish regulation.

He thinks the media's coverage of the issue has been ad hoc. There always seems to be coverage when NOAH and/or Greenpeace are involved. There are a few feature articles in papers and radio programs that provide non-biased background information on the subject. He also stated that some articles are sensational, but not all of them.

Contact: Peter With from 92-Group
Position: Active Member
Organization: Danish Church Aid
Telephone Interview
Date of Interview: 30 March, 2000
Interviewed by: Maria Soledad Gil

Background:

Peter With is a member or the 92-Group. He participates in the discussions held by the organization and tries to reach an agreement to take position towards issues that affect the society in general. He is also a member of the Danish Church Aid, which provides help to developing countries in emergency.

The organization:

The 92-Group is an umbrella organization that gathers members from different environmental organizations and developing organizations like Greenpeace, NOAH, Danish Church Aid or the Danish Association for Emergency. They also participate in

discussions with other groups. Funding comes from the government and from private funds provided by members of the church.

Their interests:

Their internal debate focuses on improving sustainable development in developing countries and environmental concerns. In the field of GM food, the group is in their discussion time, so they do not have an official position yet. They plan to come up with a policy paper that will enable them to take a position and to support their point of view. But they have not publicised anything yet. They regularly participate in discussions and communicate with other groups. In the past they supported the motion motivating the moratorium to EU about the GMO regulation.

Current debate in the GMO field:

They have two main focuses into their agenda under the GMO issue. They are debating the current research done by private companies and the environmental effects that it might bring. They are reviewing the publications done by companies like Monsanto, Novartis, etc. about specific characteristics and how they address the world hunger issue. They are also debating the environmental issue and the possible spread risk to other plants.

Preliminary attitude:

Peter With expressed during the interview his skepticism towards the solution to world hunger through GM production of food. He seemed apprehensive to the results regarding the research done by private companies. He tends to think about possibility of using the issue as merely propaganda, and uses as an argument that it is not very probable that the technology will be available to the poor farmers in the Mozambique area. So that, the targeted market, poor areas, will seldom receive benefits from the technology even thought the idea could be beneficial for the population.

The group is also debating the risks that could be spread to other plants. He mentioned the effectiveness of markers and the use of antibiotics. The seemed worried about the danger the spread could signify, and is doubtful that it might be healthy.

Appendix C – Interview/ Information Contacts

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Appendix D : A collection of quotes from both sides of the GMO debate

Quotes from those who oppose genetically modified organisms

"With genetic engineering familiar foods could become metabolically dangerous or even toxic." Statement by 21 scientists including the following, Professor Brian Goodwin, Professor Jacqueline McGlade, Professor Peter Saunders and Professor Richard Lacey

Professor James (author of the "James" report on the structure and functions of the proposed UK Food Standards Agency) has commented on genetically engineered food: "The perception that everything is totally straightforward and safe is utterly naive. I don't think we fully understand the dimensions of what we're getting into."
Scientist, Gordon McVie, head of the Cancer Research Campaign:"We don't know what genetic abnormalities might be incorporated into the genome [the individual's DNA]. I'm more worried about humans than about the environment, to be honest. One of the problems is that because it's a long-term thing, you need to do long-term experiments."

Dr Mae Wan-Ho, of the UK Open University Department of Biology says: "Genetic engineering bypasses conventional breeding by using artificially constructed parasitic genetic elements, including viruses, as vectors to carry and smuggle genes into cells. Once inside cells, these vectors slot themselves into the host genome. The insertion of foreign genes into the host genome has long been known to have many harmful and fatal effects including cancer of the organism."

Dr Michael Antoniou, Senior Lecturer in Molecular Pathology at Guy's Hospital says, "The generation of genetically engineered plants and animals involves the random integration of artificial combinations of genetic material from unrelated species into the DNA of the host organism. This procedure results in disruption of the genetic blueprint of the organism with totally unpredictable consequences. The unexpected production of toxic substances has now been observed in genetically engineered bacteria, yeast, plants, and animals with the problem remaining undetected until a major health hazard has arisen. Moreover, genetically engineered food or enzymatic food processing agents may produce an immediate effect or it could take years for full toxicity to come to light."

Dr. George Wald, Nobel Laureate in Medicine or Physiology, and Higgins Professor of Biology, Harvard University, wrote "Up to now, living organisms have evolved very slowly, and new forms have had plenty of time to settle in. Now whole proteins will be transposed overnight into wholly new associations ..going ahead in this direction may be not only unwise, but dangerous. Potentially, it could breed new animal and plant diseases, new sources of cancer, novel epidemics."

"There is... a need to develop more effective and appropriate screening methods to alert companies and government agencies to the unexpected consequences of the often random insertion of genetic traits into plants."
From Professor Philip James' evidence to the House of Commons Select Committee on Science and Technology, March 1999.

"We all wish there was a test where you plug in a protein and out pops a 'yes' or 'no' answer."
Sue MacIntosh, a protein chemist with biotechnology company AgrEvo, on the difficulties of carrying out allergy testing on GM foods.

"At this time it is unlikely that molecular and compositional analysis can reasonably detect or predict all possible changes in toxicant levels or the development of new toxic metabolites as a result of gentic modifications introduced by the methods of biotechnology."
Dr. Samuel I. Shibko Director of Division of Toxicological Review and Evaluation, Department of Health and Human Services, Public Health Service U.S. - memorandum to Dr. James Maryanksi, FDA Biotechnology Coordinator

"There is a profound difference between the types of unexpected effects from traditional breeding and genetic engineering which is just glanced over in this document.....
Unexpected Effects - This is the industry's pet idea, namely that there are no unintended effects that will raise the FDA's level of concern. But time and time again, there is no data to backup their contention, while the scientific literature does contain many examples of naturally occurring pleitropic [multi-response] effects. When the introduction of gene's into [a] plant's genome randomly occurs, as in the case of the current technology (but not traditional breeding) it seems that many pleiotropic [multi-response] effects will occur. Many of these effects might not be seen by the breeder because of the more or less similar growing conditions in the limited trials that are performed...introduced proteins (enzymes) that while acting on one specific, intended substrate to produce a desired effect, will also affect other cellular molecules, either as substrates, or by swamping the plant's regulatory/metabolic system and depriving the plant of resources needed for other things. It is not prudent to rely on plant breeders always finding these types of changes (especially when they are under pressure to get a product out)."
Dr. Louis Priybl of the U.S. Food and Drug Aministation Microbiology Group - internal memorandum on FDA GM food safety testing policy document

"But we realize that with any new and powerful technology with unknown, and to some degree unknowable - by definition - effects, then there necessarily will be an appropriate level at least, and maybe even more than that, of public debate and public interest."
Bob Shapiro, Chief Executive of Monsanto, admitting that the effects of genetic engineering are unknown and "to some degree" unknowable (SWF News interview, San Francisco, 27 October 1998).

"...the public are ahead of many scientists and policy advisors in their instinctive feeling for a need to act in a precautionary way."
The Economic and Social Research Council (ESRC) (funded by the UK government), report on "The politics of GM food: Risk, science & public trust"

"The genetic modification of food is intrinsically dangerous. It involves making irreversible changes in a random manner to a complex level of life about which little is

known. It is inevitable that this hit-and-miss approach will lead to disasters. It must disrupt the natural intelligence of the plant or animal to which it is applied, and lead to health-damaging side-effects."
Dr Geoffrey Clements, leader of the Natural Law Party, UK.

"We believe the time has come for the technology to be assessed on how safe it is for the environment and for sustainable farming. The current research is not designed to evaluate risk, only to find out how to make it work."
Dr Neil Macgregor, a soil microbiologist, is an academic member of the Soil & Earth Sciences group in the Institute of Natural Resources, Massey University, New Zealand.

"A further area of concern has to do with plants that are modified to contain genes from viral pathogens of crops which might exchange these genes with other viral pathogens, creating entirely new viral strains with unknown properties. An epidemic of African Cassava Mosaic Virus currently devastating the cassava crop in East Africa has been shown to be the result of natural recombination. Researchers need to make sure that viral genes added to a plant to confer resistance do not also lead to the creation of new viruses..."
"...The question of allergic reactions to new proteins is more theoretical [than the creation of antibiotic resistance]. It comes, of course, from transplanted genes producing proteins in the plants which may cause allergic reactions in people eating the food. There is a lot of rhetoric about allergies, but there appears to be a real rise in the number of allergic reactions in industrialized countries. The extent and the etiology are the subject of heated debate amongst specialists. Is it possible that new plant varieties could create new allergies or exacerbate existing ones? Of course."
Professor Gordon Conway, President of the Rockefeller Foundation and former vice-chancellor of the University of Sussex

"An ecosystem, you can always intervene and change something in it, but there's no way of knowing what all the downstream effects will be or how it might affect the environment. We have such a miserably poor understanding of how the organism develops from its DNA that I would be surprised if we don't get one rude shock after another."
Professor Richard Lewontin, Professor of Genetics, Harvard University

"Genetic modification of food is a dangerous game of ecological roulette. To take one example, I'm sure there will be a significant increase in deaths from certain types of cancer. If that is the only adverse effect we will have been lucky.
We simply cannot predict the ecological effects of genetic modification. GM forces evolution to take place in one generation rather than hundreds.
Manipulating DNA creates a new substance and it may not behave in the same ways as the origninal version. And existing tests, which only detect already-known toxins, may not reveal man-made ones. We simply do not know what we are doing."
Samuel Epstein, M.D., Professor of Environmental Medicine at the University of Illinois School of Public Health and Chairman of the Cancer Prevention Coalition

"Over the last fifteen years, I and other scientists have put the FDA on notice about the potential dangers of genetically engineered foods. Instead of responsible regulation we

have seen bureaucratic bungling and obfuscation that have left public health and the environment at risk."

Dr. Philip Regal, Professor of Ecology, Evolution, and Behavior at the University of Minnesota and an internationally recognised plant expert, on the decision (May 1998) by concerned scientists and consumers to sue the U.S. Federal Department of Agriculture (FDA) for failing to protect public health and provide consumers with relevant information about GM foods.

"There is no process - across all U.S. federal agencies - to evaluate the hazards of GE organisms as we have for chemicals. For chemicals, we have formal risk assessment guidelines; science policies; conferences where scientific issues are debated. That's not the case with GE...In the U.S. each risk assessment for GE organisms is done on an ad hoc basis by different scientists in different departments of different agencies....There is rarely any formal peer review. When peer review panels are put together, they are not necessarily unbiased. They can be filled with GE proponents or confined to questions which avoid the important issues, so that a predetermined decision can be justified.

This technology is being promoted, in the face of concerns by respectable scientists and in the face of data to the contrary, by the very agencies which are supposed to be protecting human health and the environment. The bottom line in my view is that we are confronted with the most powerful technology the world has ever known, and it is being rapidly deployed with almost no thought whatsoever to its consequences."

U.S. Environmental Protection Agency (EPA) toxicologist, Suzanne Wuerthele.

"...farmers are likely to be weaned from pesticides to be force fed biotech seeds, in other words, taken off one treadmill and set on a new one!"
"The trend towards a quasi-monopolization of funding in agricultural development into a narrow set of technologies is dangerous and irresponsible. Also, too many hopes and expectations are being entrusted in these technologies, to the detriment of more conventional and proven technologies and approaches that have been very successful and which potential lies mostly unused in the developing countries.
It is only too obvious to concerned scientists, farmers and citizens alike that we are about to repeat, step by step, the mistakes of the insecticide era, even before it is behind us. I would even argue that these new miracle technologies are mostly not necessary, let alone desirable, to solve the world's food security problem. I am not denying that in some instances they may be of use in increasing the qualities and agronomic characteristics of food crop varieties, but these improvements must remain a within family or genus 'engineering' affair, that merely speeds up nature's own evolutionary path."
Hans R.Herren, Director General, The International Centre of Insect Physiology and Ecology Nairobi, Kenya, and winner of the 1995 World Food Prize

Quotes from supporters of Genetic Engineering Technology [45]

"It is the policy of the AMA to (1) endorse or implement programs that will convince the public and government officials that genetic manipulation is not inherently hazardous and that the health and economic benefits of recombinant DNA technology greatly exceed any risk posed to society; (2) where necessary, urge Congress and federal regulatory agencies to develop appropriate guidelines which will not impede the progress of agricultural biotechnology, yet will ensure that adequate safety precautions are enforced; (3) encourage and assist the state medical societies to coordinate programs which will educate physicians in recombinant DNA technology as it applies to public health, such that the physician may respond to patient query and concern; (4) encourage physicians, through the state medical societies, to be public spokespersons for those agricultural biotechnologies that will benefit public health; and (5) actively participate in the development of national programs to educate the public about the benefits of agricultural biotechnology." -(CSA Rep. D, A-90) American Medical Association Policy Position H-480.985 Biotechnology and the American Agricultural Industry

"From the standpoint of the Food and Drug Administration, the important thing for consumers to know about these new foods is that they will be every bit as safe as the foods now on store shelves. All foods, whether traditionally bred or genetically engineered, must meet the provisions of the Federal Food, Drug, and Cosmetic Act." - FDA Consumer magazine article: "Genetic Engineering Fast Forwarding to Future Foods" published April 1995 and revised February
1998

"We have spent considerable amount of time and resources examining the science of gene technology and how it would impact on the food supply and have concluded that, provided that companies take the proper steps to examine the important safety issues, these foods should be as safe as other foods on the market...In addition to those steps that breeders normally take, for products of gene technology, companies are doing far more extensive testing than has
ever been done on commercial varieties. They are doing chemical analyses for important nutrients, for toxicants. They are examining the new substances, such as proteins that have been introduced into these foods, in terms of possible toxicity and allergenicity and taking other steps under the guidance of our scientists in the government to ensure proper adequate testing before they go to consumers." -U.S. Food and Drug Administration Biotechnology Coordinator James Maryanski, Ph.D., May 26, 1999 Worldnet interview.

"I have absolutely no anxiety.... I am worried about a lot of things, but not about modified food." "To argue that you don't know what is going to occur is true about everything in life. People wouldn't get married, have children, do anything..." -James Watson, Ph.D., co-discoverer of DNA structure and Nobel Laureate from the Daily Telegraph of U.K. February 25, 1999.

"One of the great consumer questions of our time is: Will the world accept biotechnology? From a purely scientific perspective, it's an odd question. We already have. Biotechnology's been around almost since the beginning of time. It's cavemen

saving seeds of a high-yielding plant. It's Gregor Mendel, the father of genetics, cross-pollinating his garden peas. It's a diabetic's insulin, and the enzymes in your yogurt...Our best scientists have searched for risks. Without exception, the biotech products on our shelves have proven safe." -U.S. Agriculture Secretary Dan Glickman. March 13, 1997

"The overwhelming scientific evidence argues against the supposition that DNA from transgenic plants will somehow contaminate bacteria in humans and animals and in some way cause mutations in people that eat foods from genetically modified plants. The concern approaches the ridiculous when critics propose that remnants of DNA that are found in soy meal or soy oil will cause harm in humans." -Roger N. Beachy, Ph.D., president of the Donald Danforth Plant Science Center on behalf of the Council for Agricultural Science and Technology. March 3 1999 testimony before the House Agriculture Subcommittee on Risk Management, Research and Specialty Crops.

"I can imagine some of biotechnology's most vocal critics saying this - but in fact, this was a criticism of Luther Burbank's genetic research in 1906 -technology that we now accept and benefit from." -U.S. Grains Council President and CEO Kenneth Hobbie speech embargoed until its presentation at the International Grains Council Grains Conference in London on June 10, 1999.

"The issues involved are ideological and emotional, not scientific. The scientific consensus holds that the risks associated with new biotechnology products are fundamentally the same as for other products...Scientists around the world agree that new "gene-splicing" technology lowers even further the already minimal risk associated with introducing new plant varieties into the food supply. Dozens of new plant varieties improved with traditional techniques of genetic modification such as hybridization enter the marketplace each year without special labeling or premarket review. Many products on the market are from "wide crosses," hybridizations in which genes are moved from one species or genus to another to create a variety of plant that does not and cannot arise in nature....Thanks to (bio)technology, it is now possible to introduce pieces of DNA that contain one or a few well-characterized genes, while older genetic techniques transferred a variable number of genes haphazardly. The result is a final product that is even safer for the consumer." -Henry I. Miller, M.D., Senior Research Fellow, Hoover Institution, Stanford University (As stated in The San Diego Union-Tribune Aug. 13, 1999)

"It is the position of The American Dietetic Association that biotechnology techniques have the potential to be useful in enhancing the quality, nutritional value, and variety of food available for human consumption and in increasing the efficiency of food production, food processing food distribution, and waste management." -Position statement adopted by the American Dietetic Association on October 18, 1992 and reaffirmed on September 9, 1994.

"We have confidence in the findings of our Food and Drug Administration that these [biotech] foods are safe. And if we didn't believe that, we wouldn't be selling them and we certainly wouldn't be eating them...I would never permit an American child to eat anything I thought was unsafe," -President Clinton, conference call with farm radio broadcasters from Hermitage, Arkansas (As reported by Reuters on November 5, 1999)

"Specifications for equivalence have been the subject of several reviews we have completed through the World Health Organization's Joint Expert Committee on Food Additives and Contaminants. Equivalence allows us to look at what is nutritionally important. The use of precision tools to insert genes carrying only the trait that you want has significant human health and agronomic advantages that traditional cross breeding does not." -Barbara Petersen, Ph.D. Nutrition Biochemist, Novigen Sciences, Member of World Health Organization Joint Expert Committee on Food Additives and Contaminants

"In conclusion, we reaffirm our view that (biotechnology) crops represent an important new technology which ought to have the potential to do much good in the world provided that proper safeguards are maintained or introduced." -The UK-based Nuffield Council on Bioethics 1999 report.

"I believe (food biotechnology) has the potential to increase yield and increase quality in ways which have not been available to us before. We should not throw out the baby with the bath water." -Professor Chris Payne, chief executive of Horticultural Research International, a public sector research center. June 7, 1999 Washington Times.

"We can expect that the next generation of biotechnology crops will offer many new benefits in terms of added nutritional value, for example, through increased vitamin content or the elimination of food allergens. It is important that consumers are not denied the potential benefits of such developments," -Professor Ray Baker FRS, Chief Executive of the U.K. Biotechnology and Biological Sciences Research Council, established in 1994 by Royal Charter as a public body principally funded through the Office of Science and Technology of the Department of Trade and Industry.

"Biotechnology allows us to provide raw materials for industrial uses. Further, it is important for us to begin supplementing our oil use with renewable resources. Biotechnology will be critical to this effort as well as providing numerous other far-reaching benefits." -National Corn Growers Association President Roger Pine. March 3, 1999 testimony before the House Agriculture Subcommittee on Risk Management, Research and Specialty Crops.

"Agricultural biotechnology holds promise for a hungry and ecologically fragile world. The development of new crop varieties that offer increased yields, reduced inputs, and offer specialized traits that meet end-user needs is merely the starting point," -American Soybean Association Chief Executive Officer Stephen S. Censky speech. May 26, 1999 before the American Bar Association Biotech Roundtable.

"Scientists are gaining the ability to insert genes that give biological defense against diseases and insects, thus reducing the need for chemical pesticides, and convey genetic traits that enable crops to better withstand drought conditions. With this powerful new genetic knowledge, scientists have the capability to pack large amounts of technology into a single seed." -Norman Borlaug, Ph.D., Nobel Peace Prize Laureate. July 31, 1997 testimony before the U.S. Senate
Agriculture Committee.

"American Agri-Women supports the development and incorporation of biotechnological tools into agricultural research and production. Reducing input costs, increasing crop yields, promoting integrated pest management and providing environmental protections to our natural resources, biotechnology will give the producer greater flexibility in making management decisions." -Policy Statement of American Agri-Women.

"...what everyone must understand is to maintain the productivity of agriculture, we must continue to improve the agricultural seeds that are used. We have been doing this for generations. We are now blessed through research and technology with new methods of actually speeding up the process of improving the seeds and the products we get from them... The most important thing we have to do is get the message out about the benefits of these (biotech) products" -Acting Assistant Secretary of State for Oceans and International and Environmental Scientific Affairs Melinda Kimble. May 26, 1999 Worldnet interview.

"Biotechnology differs from crossbreeding in that one gene is inserted into an organism to achieve the desired effect. With traditional crossbreeding, every gene of an organism is potentially mixed with another. The one desirable trait that breeders want can be passed on, but so will some undesirable ones. With biotechnology, scientists are able to focus on the desired gene and subject it to extensive testing before and after it is inserted into the new organism." -Dr.
Steve Taylor, Dept. of Food Science and Technology, Univ. of Nebraska, Lincoln (As stated in Letter to the Editor, Wall Street Journal, July 21, 1999)

"More than a decade of safety evaluation and introduction of genetically engineered plants has provided evidence and assurance that the risks to the environment posed by genetically engineered plants are no different from those of plants genetically modified using other methods." -Conclusion of the Institute of Food Technologists.

"If imports like these (biotechnology crops) are regulated unnecessarily, the real losers will be the developing nations. Instead of reaping the benefits of decades of discovery and research, people from Africa and Southeast Asia will remain prisoners of outdated technology. Their countries could suffer greatly for years to come. It is crucial that they reject the propaganda of extremist groups before it is too late." -Jimmy Carter, the 39th President of the United States in an August 26, 1998 New York Times editorial.

"As a church commissioner, I will soon have to decide whether to allow the use of Church of England land for trials of genetically modified crops. My inclination is to support these trials. After all, genetic modification is only a logical extension of the long-established processes of selective breeding of animals and the development of high-yielding species that has gone on for centuries. Genetic modification uses nature's own God-given techniques for improving crops. There may also be some environmental gain if their development reduces the need for chemical pesticides...For me, as a Christian, there is an overriding reason for continuing with the trials. Every year, millions of people die because, carefully nurtured crops have been wiped out by
disease, drought or pests. Crops that can better resist these enemies have the potential to transform the lives of whole countries. We are called to love our neighbours and we owe it to them to explore this way of helping them." -Rev. Bob Baker, Priest for the Church

of England, Parish of Brundall, Braydeston and Postwick, in Norfolk, England (As printed in Letter to the Editor, The London Free Press, Nov. 6, 1999)

"We are increasingly encouraged that the advantages of genetic engineering of plants and animals are greater than the risks. The risks should be carefully followed through openness, analysis and controls, but without a sense of alarm...We cannot agree with the position of some groups that say it is against the will of God to meddle with the genetic make-up of plants and animals." -Bishop Elio Sgreccia, Vice President of the Pontifical Academy for Life, referring to
the Academy's report on ethics and genetic technology, presented Oct. 12, 1999, Vatican City, Rome, Italy (As reported by the St. Louis Review, Oct. 22, 1999)

"I think it's all fascinating. There's no one-minute answer. The technology's here. If they can give us a better tomato, I'm for it." Julia Child, speaking about food biotechnology to the Toronto Star, October 27, 1999

"The uproar over biotech and genetically modified food will continue, and that's unfortunate. People are reacting without understanding what it's all about. Biotechnology is not a threat to organic farming. It is an opportunity to improve conventional farming. We have the ability to reduce our reliance on pesticides and fertilizers. We have the tools to produce higher crop yields and more nutritious foods for the rapidly expanding population. It would be unethical NOT to use our knowledge." Irena Chalmers, culinary expert

Appendix E: TACD Policy Paper [51].

TACD

TRANS ATLANTIC DIALOGUE
CONSUMER DIALOGUE

TRANSATLANTIQUE
DES CONSOMMATEURS

DOC NO. FOOD-5PP-00

DATE ISSUED:
FEBRUARY, 2000

CONSUMER CONCERNS ABOUT BIOTECHNOLOGY AND GENETICALLY MODIFIED ORGANISMS (GMOS)

(see resolution on Genetically Modified Organisms issued in April 1999 Doc. Food-5-99)

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1. Introduction

2. Consumer Health and Safety risks

   food allergies
   antibiotic resistance
   toxicity
   nutritional content

3. Consumer right to know and to choose

   labeling-information
   labeling-freedom of choice between genetically modified (GM) and non-GM food

4. Environmental and ecological consequences

5. Ethics

6. Recommendations

Introduction:

TACD insists that genetically modified organisms (GMOs) should offer real benefits to consumers and not harm health or the environment. Consumers have a fundamental right to know what they are eating, which means that all genetically modified (GM) foods and foods made using genetically engineered ingredients should be labeled.

Consumer health and safety risks:

The main consumers' concern about GM foods is safety.

Considering the following consumers' concerns, the long term impact of GMOs on human and animal health and the environment should be carefully assessed before their commercial introduction and release into the environment, and monitored and assessed after their release. A mandatory assessment should also examine the suitability of the GMOs for use in food production prior to marketing. Long term monitoring of the use GM foods should be a legal requirement and efforts are required to develop appropriate mechanisms for doing this.

Food allergies:

Consumers wish to express concerns about the potential impact of GM foods on people with food allergies. New allergens could be developed unintentionally and known allergens could be transferred from traditional foods into genetically modified variants (e.g. gene from the Brazil nut introduced into the soybean). In addition, new allergies might emerge after genetic material from different organisms has been mixed. Transfers of any known allergens which can cause fatal anaphalactic shock, such as peanuts, should not be permitted. As a general rule, gene transfers from plants known to cause allergy should be avoided. To protect against uncommon or unknown allergen transfers, all genetically modified food should be labeled.

Antibiotic resistance:

Consumers are concerned that use of antibiotic resistant marker genes could lead to increased antibiotic resistance. In view of the worldwide problem of bacterial antibiotic resistance, consumers stress that the antibiotic resistant marker genes should not be used within genetic modification.

Toxicity:

Consumers are concerned about the unwanted side-effects of genetic modification which might be the creation of new toxins, or increased levels of toxins in food for example. Use of genetic modification could also result in "natural" toxins in foods appearing in unexpected places. All GM products should be tested for levels of natural toxins and any GMOs with hazardous levels should be prohibited.

Nutritional content:

Consumers are concerned that genetic modification could increase or decrease the nutritional content of food. It could for example, alter protein, starch, vitamin or fatty acid levels. Any products with significantly altered nutritional content should be labeled as to the change. The impact of consumption of such foods must be carefully monitored.

It is important to consider the limitations of an approach based on 'substantial equivalence' and consider whether more robust methods for assessing the unintended consequences of genetic modification are available or could be developed.

Consumers' right to know and to choose:

Right to know:

Genetic modification has important implications in the spheres of health, the environment, ethics, religious beliefs and the economy. TACD believes that consumers have a fundamental right to know what they are eating. Therefore, all GM food including food produced from GM ingredients which do not remain detectable in the final product should be labeled. Consumer concerns relate to the process of GM and not to the end product.

In order to enjoy their right to know about biotechnology and GM foods, consumers want information which includes the full disclosure of all aspects of the safety evaluation of GM foods, as well as the clear and truthful labeling of any approved products that come on to the market.

Consumer attitudes and values relating to GM must be incorporated into the approval and decision-making processes regarding these foods.

Governments should also consider developing an internationally recognized symbol indicating that the product has been produced using genetic modification. This should not only apply to foodstuffs, but also to feeding-stuffs which have been produced using genetic modification.

Right to choose:

The choice of whether to eat or not to eat GM foods should remain with consumers, but this right to choose is being undermined by the mixing of GM products (namely soya and maize) with conventional varieties.

Consumers consider that labeling of the final product should depend on the presence of GMOs in the raw materials from which the product is made. Such an accurate and rigorous labeling requires complete traceability of GMOs throughout the entire production, processing and distribution chain.

Therefore, it is fundamental to ensure traceability through the segregation of GM products from traditional products. As long as the manufacturer can not have full knowledge of the genetic status of the ingredients, the consumers' right to be informed and to choose will not be guaranteed.

It is crucial to preserve a non-GM supply for crops. Consumers find the non-segregation unacceptable. When GM crops are cultivated they must be segregated and consumers call on official authorities to play an active role to assist in the establishment of the necessary facilities in this respect. Rigorous and robust controls must be put in place at all subsequent stages of the food chain to ensure this is maintained. For consumers to have a meaningful choice, an alternative to GM must be available. Identity preserved non-GM supplies should ideally be extended to include animal feed and ultimately genetically modified processing aids.

There is the risk that consumers will infer wrongly that unlabelled foods do not contain products from GM sources. Traceability should be ensured throughout the food chain, based on documentation, so that the original source can be identified. Therefore, sensitive and reliable test methods should be developed and validated to confirm whether or not a product has been genetically modified. A threshold must be agreed by U.S. and EU governments that allows for unintentional contamination of Identity Preserved non-GM supplies. Such a threshold must be kept to an absolute minimum and should be reviewed with the intention of further reduction as experience of control methods develops.

Consumers should not be asked to pay more for non-GM food, since they have not asked for it. Much more than traceability of non-GM ingredients, segregation and traceability of GM crops and ingredients should be the rule.

Traceability is essential for safety reasons as well as for ensuring choice - it is essential that action can be taken should a food safety problem arise in the future.

Environmental and Ecological Consequences:

The long-term consequences of releasing transgenic species into the environment are difficult to predict, particularly if they start crossbreeding with other species. The scientific methodologies to carry out comprehensive environmental risk assessments are not yet available, and there are still some uncertainties about the real consequences on the environment and human health.

Therefore, consumers call for a strict long term impact of GMOs on the environment to be carefully assessed before their release, and monitored and assessed after their release. In making decisions on release, the Precautionary Principle should be paramount.

Ethics:

As mentioned above genetic modification can raise ethical and moral concerns for consumers, particularly those with strong religious beliefs. It is important to ensure that these concerns are taken into account when genetically modified foods are assessed and decisions are made as to whether they should be approved.

Animal health and welfare is also an issue that causes concern for some consumers given the potential for genetic modification to be applied to animals. For example, genes coding for growth hormones have been introduced in animals like pigs or salmon, in order to replace growth hormone implants or growth promoters in animal feed. As long as the use of growth hormones in meat is not unanimously considered as safe by scientists, the Precautionary Principle should prevail and this technique should not be permitted.

Recommendations:

1. TACD calls for the establishment of a system of mandatory human health evaluation that will screen all foods produced using genetic engineering including GM food processing aids and prevent commercialization of any GM products that contain hazardous levels of natural toxins, reduced levels of important nutrients, or a known common allergen that can cause anaphaltic shock in a sensitive individual, or that causes any other significant health problem. International agreement should be reached on a suitable approach and the TACD considers that the Codex ad-hoc Intergovernmental Task Force on Biotechnology is the most appropriate place for this to take place. Such a system should be based on the principles of openness and transparency, and should enable effective public participation throughout the risk analysis process. (see TACD recommendations on risk analysis and the Precautionary Principle.)

2. TACD calls for the development of strong methods for assessing GM foods, which unlike 'substantial equivalence' can help to give a clearer idea of the potential unintended consequences of genetic modification.'

3. TACD stresses the need to conduct consumer research to gain a clearer understanding of consumer attitudes towards the potential for future uses of biotechnology and the measures required if their acceptability is to be ensured.

4. TACD calls for the setting of a strong system of environmental safety evaluation that will screen GMOs and prevent release of any products that will have negative environmental effects, such as increasing toxic pollution, reducing the effectiveness of natural pesticides, harming wildlife or natural enemies of plants or animal pests, reducing biodiversity, increasing the vigor of weeds or insect pests, altering the genetic makeup of non-engineered living things, or disturbing important ecological balances. Such a system should include a requirement for long-term monitoring.

5. TACD calls for a ban on antibiotic resistance genes in genetically modified crops

6. TACD requires labeling of all GM food sold in Europe and the U.S., including ingredients of processed food, and food where GM ingredients have been used in production even if they are no longer detectable in the final product. Labeling of animal feed that contains GM ingredients should also be required.

7. TACD stresses the need to establish a system of government to government notification that is shipment-specific when GMOs are shipped in international commerce.

8. TACD calls for the establishment of strict rules for corporate liability and mandatory insurance for companies that want to release GMOs into the environment.

9. TACD underlines the importance of developing common standards for ensuring identity preserved supplies of non-GM ingredients should be developed so that consumers can have confidence that they are consistent. Mechanisms should be developed for monitoring the long-term consequences of consumption of genetically modified foods and ingredients.

Appendix F: Glossary of Acronyms

APHIS	Animal and Plant Health Inspection Service
BEUC	European Umbrella Consumer Organizatio
BBEP	Biotechnology, Biologics, and Environmental Protection
CA	Competent Authority
CI	Consumer's International
DCC	Danish Consumer Council
DNA	deoxyribonucleic acid
DI	Dansk Industri
DTU	Danish Technical University
EC	European Commission
EP	European Parliament
EU	European Union
EPA	Environmental Protection Agency
ERA	Environment Risk Assessment
FDA	Food and Drug Administration
FFDCA	Federal Food, Drug, and Cosmetic Act
FIFRA	Federal Insecticide, Fungicide and, Rodenticide Act
FPPA	Federal Plant Pest Act
FoE	Friends of the Earth
GM	Genetic Modification/Manipulation or Genetically Modified
GMO	Genetically Modified Organism
GRAS	Generally Recognized as Safe

IFIC	International Food Information Council
IFOAM	Danish Organic Farming Association
NEPA	National Environmental Policy Act
NERI	National Environmental Research Institute
NGO	Non-Government Organization
NNF	Danish Food and Allied Worker's Union
OPP	Office of Pesticide Programs
SNIF	Summary Notification Information Format
TACD	Trans-Atlantic Consumer Dialogue
TPS	Technology Protection System
TSCA	Toxic Substances Control Act
UCS	Union of Concerned Scientists
USC	United States Code
USDA	United States Department of Agriculture
WPI	Worcester Polytechnic Institute
WTO	World Trade Organization
WWF	World Wildlife Federation