CHANGING KNOWLEDGE INTO ***ACTION***

THE 1998 NCBA RESEARCH ANNUAL REPORT

TABLE OF CONTENTS

VISION STATEMENT

A DYNAMIC AND PROFITABLE BEEF INDUSTRY,

WHICH CONCENTRATES RESOURCES AROUND A UNIFIED PLAN,

CONSISTENTLY MEETS CONSUMER NEEDS AND INCREASES DEMAND.

CHAIRMEN'S MESSAGE

Dear fellow beef producers,

Thanks to research, the beef industry has produced a wealth of valuable information over the years. But how has it been used?

Actually, it's all around us. Research findings have helped create the nutrition messages… driven food safety efforts… identified targets for consumer promotions… improved the quality of animals bound for market… shown marketing channels how to enhance the efficiency of their operations and become better beef marketers… has led to new products that increase the value of lower-valued beef cuts.

In fact, all beef industry programs depend, to one degree or another, on research for their results. Research knowledge makes everything we do credible, powerful and more effective.

Beef producers will benefit from research funded in 1998, just as we're benefiting today from results of research conducted through the years. As we develop plans for future research projects, it's important that we continue to focus on research that will provide us with the greatest return for our research dollar investments.

It's easy for us as producers to focus on the information itself and lose sight of what that information does. We hope that, after reading this report, you'll better appreciate what's being done with the information being generated with your research dollars.

Yours truly,

Walt Rowden, Chair
Quality Group

Ray Gerringa, Chair
Science & Technology Committee

Van Amundson, Chair
Beef Safety Committee

Nancy Pellett, Chair
Consumer Marketing Group

Lyle Gray, Chair
Communications Group

Dave Bateman, Chair
Nutrition & Health Committee

NOTES FROM STAFF

CHUCK SCHROEDER, CEO
NATIONAL CATTLEMEN'S
BEEF ASSOCIATION

"Knowledge is Good." This motto of a fictitious college in a popular 1970s movie is, sadly, the only way some in our society see the acquisition of information.

The fact is, though, most knowledge is good only if it leads to a useful purpose. Research being conducted on behalf of the beef industry fits into that category.

Research studies are initiated by NCBA on behalf of the industry only if they address specific needs identified by producers. And results from research funded by the industry are applied to the everyday challenges we face.

In other words, our research efforts are not simply exercises in scientific paper shuffling. They're projects conducted by dedicated researchers looking for ways of solving the problems facing our industry today. With the product of that research, the beef industry can build strong, effective and believable programs that best serve all producers.

JIM GIBB, VICE PRESIDENT
CENTER FOR QUALITY
NATIONAL CATTLEMEN'S
BEEF ASSOCIATION

It's our pleasure to present the 1998 Research Annual Report, providing information on recent state and national research efforts benefiting the beef industry. "Changing Knowledge into Action" also explains how the information from this research benefits our industry, from beef producers to consumers.

It would be impractical to completely describe each of the research projects listed in this report. Those wishing to learn more about any project can contact the appropriate researcher or state council, listed in this report. We also encourage you to contact us if you have any questions about either the funded projects or the direction of our overall research program.

We want to thank the dedicated researchers who conduct these projects. Your skill and experience have made enormous contributions to the industry.

Special recognition is due the grassroots leaders who give freely of their time and energy to determine needs and direction of programs and assess their results. These volunteers are the cornerstone of our efforts to move knowledge gained from research into action to benefit beef producers.

Your comments on the research program are welcome.

PRODUCT ENHANCEMENT

PROGRAM OBJECTIVES:

- Identify/evaluate parameters related to customer satisfaction with beef products, helping characterize the type of product that will maximize the demand for beef in the marketplace;
- Develop technologies that will enhance beef products and address value-based marketing issues;
- Provide critical information to be used to produce the type of cattle that will maximize customer satisfaction and carcass value;
- Develop technology to measure and assess product quality and yield.

INTRODUCTION:

Making a great product even better takes customer understanding, creativity, research skills and persistence. These elements, in the proper proportions, are key to improvements in beef products.

The beef industry has the capability to influence all of these factors. Through Product Enhancement research programs, we're finding those attributes of beef that have the biggest impact on beef demand, and addressing those attributes in ways that improve the product in the eyes of consumers. Those efforts are being made at all stages of beef production and marketing.

Consumers are faced with an almost endless number of choices when it comes to the food they will put on their dinner tables. Having "new and improved" beef products available strengthens the chances that beef will be among those choices. Product enhancement is crucial to increasing beef's share of the consumer's plate.

FEATURED PROJECTS:

The National Beef Instrument Assessment Plan

Begun in 1994, the National Beef Instrument Assessment Plan's objective is to develop, test and implement electronic instrumentation systems that will support establishment of truly objective, value-based marketing systems. It focuses on technologies that accurately predict both the composition and eating quality of beef cuts.

Initial studies revealed that USDA Yield Grades are being applied by graders with about a 60 percent accuracy rate. They also found that the current USDA Yield Grade formula is accurate in predicting carcass yield if all of the grade factors — hot carcass weight, fat thickness, ribeye area and percent kidney, pelvic and heart (KPH) fat — are accurately estimated.

A promising technology designed to estimate carcass yield is the Australian Visual Image Analysis (VIA-Scan) System, which was very accurate in predicting ribeye area, a factor found to be less precisely determined visually by graders today. This instrument appears to be an excellent tool for supplementing the grader's capabilities by providing accurate estimates of ribeye area.

(continued)

"Basic research provides tools for beef industry innovation. The kind of research conducted through NCBA is available from no other source. This information — which must be effectively communicated to the rest of the industry — can help re-engineer products to better fit consumer needs and maximize customer satisfaction."

Steve Harper, Vice President
Meat/Seafood Marketing,
Procurement & Product Developement,
H-E-B Food Stores

(continued)

A similar unit is the Canadian Computer Vision System, which may better predict carcass yield and quality grade even more accurately. Results of a study with the CCVS unit are expected in early 1999.

The Hunter BeefCam System has shown promise in predicting eating quality. Similar to a system used in the textile industry to measure fabric color, the system predicts which carcasses may be marginal in tenderness. Results suggest this tool might reduce the number of undesirable USDA Select loin steaks reaching consumers by more than half. The Koohmaraie Tenderness Classification System classifies beef carcasses as either Tender, Probably Tender or Probably Tough by mechanically evaluating a cooked steak from a carcass. The system has proven to accurately segment carcasses, but estimated implementation costs may be prohibitive.

The first on-line system for estimating carcass yield should be implemented within the next year. Although progress is being made in objective systems for estimating eating quality, implementation of such a system is somewhat further in the future.

Carcass Merit Traits: Development of EPD's and Marker Validation

A 42-month project currently in progress may create meaningful changes in the eating quality of beef from U.S. cattle. About 12,000 head of cattle representing 16 breeds are being used in the study; DNA samples are being gathered on more than half of the carcasses. Data obtained will be used to validate important genetic information identified in previous checkoff-funded research on marbling, tenderness and composition. The study should help producers make selection decisions in breeding programs to ultimately assure product satisfaction for consumers.

Optimizing Palatability of Retail Beef

A multi-faceted project evaluating consumer response to various beef processing treatments is helping retailers better define their product specifications based on consumer desires and potential market applications. Phase I of the research supported the concept that consumers would respond to products that were "guaranteed" tender, depending on individual cooking habits and preference for degree of doneness. Based on this information, Phase II of the study used both in-home and in-store evaluations to evaluate the differences between heavy and light beef users relative to product preferences. Final results will be available in early 1999.

BEEF SAFETY

"Usually, researchers at universities and companies can expect less than 20 percent of their published research results to be executed in the field. Compare that to more than 80 percent of food safety research recently conducted through NCBA that has immediately been implemented. That's a phenomenal statistic!"

Dave Theno, Vice President of Quality Assurance and Product Safety, Foodmaker, Inc.

PROGRAM OBJECTIVES:

- Conduct research in detection/control intervention systems and improved sampling procedures that will contribute to the reduction/management of food-borne pathogens in the food chain;
- Support studies and assist in information dissemination that will maintain consumer confidence in beef as a safe and wholesome food.

INTRODUCTION:

A consumer study conducted for NCBA in September 1998 provided some sobering information for the nation's beef industry. While confidence in the safety of steaks and roasts is relatively high (81 percent say they are somewhat or very confident), four in 10 say they are not confident in the safety of the ground beef they buy. By contrast, 69 percent say they have similar confidence in the chicken they eat.

While there will never be 100 percent confidence in any product, the beef industry must do everything in its power to strengthen the trust that Americans have in the beef they eat. Pathogens — both known and emerging — have the potential to erode that trust and put the beef industry at a tremendous disadvantage in the marketplace.

Research being conducted in laboratories, at packing and processing plants, in meat coolers and at other locations is identifying where pathogens enter the beef supply, and targets ways to prevent or control them. The approach confirms beef's existing excellent safety record, while developing ways of making it even better.

Consumers don't purchase beef based on its safety; they expect a safe food supply. Without this confidence, beef producers will have no market for their animals.

FEATURED PROJECTS:

Interventions/Technologies

Results of research conducted through Microbial Mapping I, which investigated possible entry points for pathogens in the harvesting process, was important in the development of USDA's Hazard Analysis/Critical Control Points (HACCP) regulations for packers nationwide. Now, Critical Entry Points (CEPs) for pathogens at later stages of beef processing, distribution and marketing are being studied to determine where additional safeguards are warranted.

Once the points of entry are identified, interventions are designed to address them. Ground beef production is one area of key importance, with studies being conducted to discover techniques that will work to reduce bacteria loads and reduce potential contamination of beef on its way to consumers.

Emerging Pathogens Symposium

E. coli O157:H7 was not an issue for the beef industry 20 years ago. Are there other pathogens that might become a problem 20 years from now? Bringing together 80 of the most knowledgeable food safety experts in the industry in December, 1997, the Emerging Pathogens Symposium helped identify organisms that might be of potential concern to the beef industry. It also helped identify time frames for the emergence of the organisms and developed strategies for dealing with the potential problems.

Microbiology Advisory Panel

Composed of prominent industry leaders from key industry segments, the Microbiology Advisory Panel meets on a periodic basis to determine how the industry should react to the microbiological issues currently challenging it. At its 1998 meeting, the panel discussed and recommended a list of the top priorities for the industry.

Beef Industry Food Safety Council

The Beef Industry Food Safety Council was formed in October, 1997, to address food safety issues across all industry segments, and has targeted five areas for action: Crisis Communications, Research/Science, Public Policy, Consumer Education and Industry Education. The Council also has developed a comprehensive plan to eliminate or greatly reduce the public health risk of **E. coli** O157:H7 and other food-borne pathogens at all stages of beef production.

QUALITY ASSURANCE

"The Food Safety and Inspection Service supports the implementation of Hazard Analysis and Critical Control Points-type preventive approaches from farm to table to reduce potential food borne hazards.The Beef Quality Assurance program is an important step by the cattle industry to encourage farmers and ranchers to follow the program in order to prevent illegal chemical residues in beef."

Bonnie Buntain, D.V.M., M.S., Director, Animal Production Food Safety Program, USDA Food Safety and Inspection Service

1998 PROGRAM OBJECTIVES:

- Assist beef producers with programs that will result in safe, wholesome beef that provides a great beef experience every time;
- Maximize consumer confidence in beef by focusing the industry's attention on beef quality assurance through science, research and education initiatives.

INTRODUCTION:

The production of a safe, wholesome and high quality beef supply begins on the farm. For more than 10 years the Beef Quality Assurance (BQA) program has focused the industry on combining science, technology, education and communications programs to heighten awareness of, and provide solutions to, the safety and quality challenges faced by beef producers.

Actual implementation of the program focuses at the grass-roots level, with the state cattlemen's associations and extension services directly implementing the educational components of BQA. Their efforts and involvement in the program are evident in the program's success: 98 percent of cattle going through feedlots and at least 90 percent of cattle on farms and ranches are from states with BQA programs.

Animal health, environmental management, record keeping and sampling procedures for feed and feed ingredients are but a few of the areas covered by BQA. Extensive communications vehicles and hands-on training demonstrations are used to assure that producers receive the most helpful, effective guidelines for their operations.

FEATURED PROJECTS:

BQA Certification/Verification

Many state BQA programs — such as those in Arizona, California, Nebraska, North Carolina and South Dakota — are incorporating guidelines for producer BQA certification/verification. Texas Cattle Feeders Association has revised a program to closely follow a HACCP-based format for feedyards. Alabama, Colorado, Iowa, Montana, North Dakota and Wyoming are developing certification components. Based on the interest by states, it appears that producer certification/verification soon will become a standard format for the industry's BQA initiative.

Residue Reduction Program

Educational efforts conducted at the state level continue to prevent drug residue violations for slaughter steers and heifers. Reports by the USDA National Residue Monitoring Program confirm that violations are nearly zero. BQA program focus is on proper drug use, adherence to product label withdrawal periods and the need for good record keeping and inventory management of animal health products and chemicals.

Injection Site Audit

Seven years ago, top sirloin injection site lesions and scars occurred at a rate of 22.3 percent. Thanks to aggressive efforts implemented through the BQA program, the rate of occurrence of these quality defects has been reduced to less than 5.6 percent. In addition, data are now being collected at cow fabrication plants to assess the injection-site lesion incidence rate in the round region of carcasses from cull beef and cull dairy cows. The results from the preliminary data show the incidence of lesions in the rounds of cull beef cows was 45.1 percent and 71.3 percent in cull dairy cows.

BQA State Coordinators Annual Seminar

The eighth annual BQA state coordinators seminar was held in Memphis, Tenn., in June, 1998. Twenty-eight states participated in the seminar. The primary purpose of this annual function is to provide a forum whereby state BQA programs can share information and educational materials along with assisting in setting the direction and priorities of the industry's BQA initiative.

"Dietitians and other health professionals value the research-based nutrition information they get from NCBA. They recognize that the beef industry is not only promoting beef, but also promoting the benefits of a healthy eating style that everyone can enjoy." Dayle Hayes, M.S., R.D., Nutrition Consultant, Billings, Montana

HUMAN NUTRITION

INTRODUCTION:

Nutrition and health issues are primary concerns of consumers when considering the inclusion of beef in their diets. These nutrition concerns are a significant barrier to the beef industry in regaining market share. Nutrition research serves as the basis for gathering scientifically sound information that can be used in the beef industry's education and information programs to put nutrition and health issues in proper perspective.

Beef's beneficial aspects sometimes go unrecognized by consumers, who focus on negatives associated with too much fat and ignore the healthful implications of beef fats and other nutrients. They also overlook the fact that beef is leaner than ever before and there is a greater selection of leaner beef at the supermarket.

Beef is an excellent source of protein, zinc, iron, and B-vitamins, and the taste and enjoyment of eating beef gives it a key advantage over other food choices. While other foods may provide these nutrients, beef's significant role in promoting good health makes it a logical choice for consumers.

FEATURED PROJECTS:

Health Benefits of Conjugated Linoleic Acid (CLA) & Other Beef Lipids

CLA continues to be an exciting discovery for the beef industry. It occurs predominantly in beef and dairy products and has been shown to be anti-carcinogenic, as well as having other beneficial properties. In 1998, NCBA funded several new projects exploring other potential health attributes of CLA.

A recently completed study found that CLA prevented the onset of diabetes in laboratory animals. The results of this study — which were widely reported on the Cable News Network (CNN) and other networks, as well as newspapers nationwide — provided the basis for a short-term human pilot project. The goal of these CLA studies is to initiate a longer term, dietary intervention study using CLA-enriched foods on Type II diabetic individuals.

There are six new studies exploring possible health benefits of CLA and other beef lipids. These studies include an examination of CLA's function in relation to beef's fatty acids and cholesterol, as well as ways of influencing the content of CLA in beef muscle.

In addition to studies looking at CLA, other beef lipids such as stearic acid are being investigated. At the University of Kentucky, for instance, researchers are studying stearic acid's anti-atherogenic properties.

Beef as a Balanced Source of Health and Nutrition

Depending on the age group and diet consumed, the intake of essential nutrients associated with beef can become critical. Beef is high in iron and zinc, and both of these minerals provide a positive and beneficial interaction unique to the beef industry.

NCBA has initiated five new studies looking at the role of beef as a source of vital nutrients in healthy diets. A study at the University of Arkansas is determining whether dietary beef combined with resistance training could induce changes in body composition

(continued)

1998 PROGRAM OBJECTIVES:

- Conduct research that will provide a scientific basis to convince consumers that beef is an important component of healthy diets and long-term health;
- Continue to investigate the health benefits of CLA and other beef lipids using beef as the dietary source;
- Demonstrate that beef, which is high in protein, nutrient dense, and a natural source of nutrients, has an advantage over other dietary protein or supplement sources when incorporated into the diet at recommended levels;
- Continue to demonstrate the use of beef through parity study diet plans, and through special population studies focusing on beef's nutrients and nutrition recommendations that can promote health;
- Update nutrient values for retail beef cuts that will offer additional strategies to promote lean beef products.

(continued)

and muscle size of older men. Additionally, one pilot project is studying the effect of high protein diets on individuals with type II diabetes.

The body needs both nutrients from, and other properties of, a balanced diet to stay healthy. The inclusion of lean beef contributes to improved diet quality. It is a good source for many key nutrients including protein, iron, zinc and B-vitamins, and it simplifies meeting the nutrient needs for all age groups. Checkoff-funded studies being conducted through NCBA will reinforce beef's potential as a major source of essential nutrients.

Special Population Parity Studies

Three parity studies have been initiated where beef is incorporated into the diet at recommended levels and then compared to chicken or plant based diets. Two studies are a direct comparison between beef and chicken, while the third is comparing a beef diet to one based on plant protein. Since nutrition and health can be both a barrier and opportunity for beef consumption, parity studies will demonstrate that beef consumed at recommended levels can be included in diets targeted at various health/disease conditions.

PRODUCTION EFFICIENCY

"Once we tied the production and finances together on our ranch, it turned things around. I don't see how anybody can expect to be profitable without that kind of bookkeeping."

Minnie Lou Bradley
Bradley 3 Ranch
B3R Country Meats
Memphis, Texas

1998 PROGRAM OBJECTIVE:

- Evaluate the inefficiencies in production and prescribe corrective action to ensure maximum profitability and competitiveness through optimum utilization of all farm/ranch resources.

INTRODUCTION:

Integrated Resource Management (IRM) has been in existence for more than 10 years. The program encourages effective, efficient production through analysis of farm and ranch operations and improvement of management practices through organization and advanced technology. The systems are developed by a team of industry experts and producers.

FEATURED PROJECTS:

IRM Redbooks

IRM Redbooks are handy pocket-size resource books that support the adage "you can't manage what you don't measure." Since the start of the program over 10 years ago, Redbook distribution has grown from 700 to nearly 100,000 books. In 1998, producers across the country used the Redbook as an important tool for recording and tracking performance data.

Along with the IRM Redbook, the IRM program provides beef producers with other educational materials — such as the IRM Desk Recordbook and the Natural Resource Desk Record — to improve their operations.

IRM Regional Working Groups

In 1998, four regional working groups began meeting to exchanges program ideas, identify critical control points and discuss the possibility of creation of regional databases. These groups will continue to meet in 1999 and provide information to producers throughout their regions.

IRM Mini-Educational Seminars

IRM educational seminars were offered during the 1998 Cattle Industry Annual Convention & Trade Show. The seminars were grouped by topic, such as cow calf nutrition or animal health, and were short in length, allowing attendees to attend various seminars and still visit the Trade Show. Seminars will be held during the 1999 Trade Show at the convention.

IRM Decision Evaluator for the Cattle Industry (DECI)

DECI, a comprehensive bio-economic simulation model that helps with management decisions, is being distributed to producers and used in various university research projects. Beef cattle instructors are among the many groups that were trained to use the model in 1998. Agricultural Research Service (ARS) scientists and others at the Meat Animal Research Center will further develop the forage and economic sections of the model in the coming year.

"Thanks to the framework created by NCBA's Value-Based Meat Management program, we're now able to more accurately quantify the value of innovative retail beef and meat marketing programs."

Bill Kuecker, National Accounts Coordinator, Cryovac

VALUE-BASED MEAT MANAGEMENT

INTRODUCTION:

Value-Based Meat Management (VBMM) is designed to enhance the beef industry's marketing efforts. It does this by giving retailers tools and technology to develop accurate marketing plans that include economic information, such as costs and profits on a per cut basis and accurate meat department scan data. Retail economic information helps the industry evaluate merchandising programs and new product offerings, and provides critical information to identify and transmit the retail value of beef products back through the chain to the beef producer.

Among beef industry-created programs that support VBMM are the Uniform Retail Meat Identity Standards (URMIS), updated in 1995, which allows meat retailers to use scanning technology with Universal Product Codes (U.P.C.s). The industry also developed Computer Assisted Retail Decision Support (CARDS) software that provides retailers with a meat buying evaluation tool.

1998 PROGRAM OBJECTIVES:

- Support and encourage the introduction of value-added beef products;
- Develop and encourage marketing and operating strategies that are more favorable to beef, particularly value-added, case-ready and convenient food products;
- Develop innovations and management techniques that improve retailers' efficiency and strengthen consumer preferences for beef;
- Develop a feedback system that transmits consumer needs and customer specifications back through the production chain;
- Promote a free exchange of information among industry segments to foster and enhance product improvement and efficiency through mutual understanding.

FEATURED PROJECTS:

Comparative Retail Economics for Case-Ready Ground Beef

Successful implementation of NCBA's Value-Based Meat Management program made this study, which determined the true advantages of case-ready products, possible. Conducted by Cryovac in cooperation with NCBA, the study combined consumer attitudes about case-ready ground beef packaging and a real world analysis of in-stock position, shrink and profitability. It was conducted in a major metro area with both city and suburban stores, and provided a representative sample with respect to shopper demographics, geographic location, sales volume, product mix, etc.

Consumers in the study preferred case-ready ground beef over traditionally packaged product by a nearly 3 to 1 margin. Reasons for the preference included no leakage in case-ready packages, better presentation, durability, better view, ease of freezing and fresher appearance.

The study also found that the ground beef display was 30 percent fuller during peak shopping hours when the case-ready package was used, and converting to a case-ready package resulted in an 83 percent reduction in shrink (mark-down and discount cost) for ground beef grinds.

Retail Case Study Research

Three waves of both qualitative and quantitative consumer analysis were designed to measure consumer attitudes toward three marketing programs and the impact of these programs on beef purchases. Wave I gathered baseline information on consumer cooking and eating habits for beef; Wave II gauged customer response to Beef Cooking Basics and Further Prepared (Heat-and-Eat) products; and Wave III measured customer response to an On-Pack Recipe Label marketing program.

According to study results, 51 percent of shoppers would be more likely to buy unfamiliar cuts of meat if cooking instructions or recipes were available near the meat, while more than half (52 percent) of those who noticed Beef Cooking Basics Cards took one home with them. Fourteen percent of those shoppers said they purchased a cut of beef associated with the card.

Results also found that of those who had sampled heat-and-eat products, 4 in 10 said the taste led to product purchase, and 85 percent said they would buy the product again even if it were not on sale. Nearly one in 5 shoppers who sampled the product said they did not purchase the products because they did not meet expectations for quality or price.

Finally, 44 percent of people purchasing beef with on-package recipe stickers said the picture on the sticker encouraged them to purchase that cut of meat. Eight in 10 in the study said they would be influenced to purchase a cut of meat they do not normally buy because of the stickers.

As a result of this qualitative research, as well as quantitative data that showed a 10-fold increase in sales as a result of product sampling, this retailer installed a further prepared meat section and decided to feature heat-and-eat products in all of its 100+ stores. It's expected that as more convenience-type products become available for sale, they will be stocked in this section of the meat case, giving consumers more opportunities to purchase them.

MARKET RESEARCH

1998 PROGRAM OBJECTIVES:

- Develop a more complete understanding of today's consumers;
- Tell how often, when, where and in what form Americans are eating beef;
- Track changes in at-home preferences and away-from-home eating habits and apply this information to beef marketing programs.

"We have a commitment to our readers to provide them with the very latest research and data available. Our editors rely on the NCBA and other respected industry sources for current consumption figures and foodservice beef information, allowing those readers to utilize beef effectively."

Steven Mayer
Vice President, Publisher
Restaurants & Institutions

INTRODUCTION:

Educating and motivating consumers is impossible if we don't know what those consumers are all about. Market research helps provide that knowledge about how Americans are eating — and buying — our products.

What goes into a consumer's meat purchasing decision? How much are they willing to spend? When they go out to eat, what meals catch their interest? What new dishes are they trying? The answers to these and many other questions are crucial for developing the kinds of marketing programs that will have the biggest potential for affecting beef demand.

FEATURED PROJECTS:

Single Source Analysis of Beef Consumers

This comprehensive study was conducted on a representative sample of 7,900 U.S. consumers to understand the behaviors and attitudes that affect beef consumption. Incorporating both foods eaten at home and away from home, the study covered general attitudes about health and food preparation, as well as opinions about specific cuts of beef, poultry, pork and fish.

On the short term, data collected show that differences in market share and growth for each cut of meat relate to differences in how consumers perceive the cut. To be competitive, beef products must deliver across all dimensions important to consumers: taste, convenience, healthfulness, price, quality and value. Perceptions about each cut are dramatically different, so marketing efforts to increase beef demand must address each cut's strengths and weaknesses individually.

On the long term, the study showed that beef consumption has declined across all ages and sexes, as well as across those who are health concerned or unconcerned. There is a great opportunity, however, to increase beef demand with specific efforts targeted to chuck/pot roast and round/chuck steak, where consumers do not have any strong reasons for — or strong reasons against — buying and serving.

1998 Meat Purchase Diary

The most recent Meat Purchase Diary found that while volume and sales remained flat for total supermarket meat during the past year, beef experienced 1 percent gains for each. In contrast, chicken suffered 3–4 percent losses during this time.

Premium steak enjoyed the most growth, with volume and expenditure gains of 6 and 8 percent, respectively. The volume gain occurred despite a slight increase in price for premium steak (+1 percent), at a time when prices for most other proteins were stable or down. Ground beef purchases also grew by 2 percent during this time. Penetration, or the percent of households purchasing, of premium steak and 90+ percent lean ground sirloin increased vs. year ago levels.

NEW PRODUCT INITIATIVES

1998 PROGRAM OBJECTIVES:

- Increase the value of chuck and round primals by encouraging development of new, more convenient consumer products;
- Serve as a catalyst for new product development and innovation.

INTRODUCTION:

The beef industry is faced with a paradox going into the next century. Today's consumer wants consistency and convenience — properties not offered by all products available from the beef industry. What makes it worse for the industry is that the biggest offenders are cuts from the chuck and round — primals that are creating a "drag" on the beef carcass.

To improve the overall market for beef, cuts that are lower in desirability must have their value enhanced. To do this, new products must be developed and promoted.

Industry efforts to encourage the development of new products that make use of underutilized cuts will benefit beef producers by making the entire animal more desirable by consumers and thus more valuable. At the same time, they will demonstrate to consumers that the beef industry is on the cutting edge, making products that address their needs today and tomorrow.

"We were impressed by NCBA's new product concepts and were anxious to work with them and their new product specialists to develop these product lines."

Robert C. Thurber, Vice President
of Merchandising, SYSCO Corporation

FEATURED PROJECTS:

New Product Team

To help create new beef product concepts, a New Product Development Team was named in 1998 to work with beef manufacturers in developing exciting new products that are convenient and will increase overall demand for beef. The 12 member team includes proven new product innovators as well as people with extensive beef industry and food processing experience. The team anticipates having as many as 10 new products in development at various locations across the U.S. at any one time.

Rotisserie Beef

First tested successfully in supermarkets in 1997, rotisserie roasts began getting a closer examination by the supermarket industry in 1998. Rotisserie roasts were developed through NCBA with beef checkoff support, and are produced from the beef knuckle, top blade, triceps and deep pectoral muscles. They're fully cooked, with moisture added, creating a product that can stand up to the rotisserie oven environment. The rotisserie roast has been widely praised by consumers in taste tests. Rotisserie beef gives the beef industry another tasty, convenient product for supermarket and restaurant applications, while adding value to an underutilized cut.

Marketing Initiatives

NCBA assistance to the SYSCO Corporation, the country's largest foodservice distributor, resulted in 30 new beef and veal products being offered through SYSCO units throughout the country. All of the items, from oven ready roasts to veal bacon, as well as beef and veal appetizers, were developed from the chuck and round. SYSCO sells more than 3 percent of the nation's total beef, and expects the new beef and veal product lines to have a positive impact on its total sales (which hit $15 billion in 1997). Each of the product lines will be available to SYSCO's individual operating units.

PRODUCT TECHNOLOGY RESEARCH

COMPLETED AND ONGOING PROJECTS 1996, 1997, 1998

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Beef Composition			
An Evaluation of the Dual Component Video Image Analysis System as a Predictor of Beef Carcass Red Meat Yield Percentage for Augmenting Application of USDA Quality and Yield grades, and as an on-line Testing Device for Use in Sorting Beef Carcasses According to Tenderness and Palatability *95, 96, 106	J.D. Tatum, Ph.D. Colorado State University	1997-1998 Completed	$49,660
Biochemcial Characterization of Meat Tenderness	J.T. Keeton, Ph.D. Texas Ag Exp Station	1997-1998 Ongoing	$50,000
Determining the Value of Tenderness Classified Beef Cuts	M. Koohmaraie, Ph.D. US Dept of Agriculture, ARS	1998 Ongoing	$26,044
Development of a HunterLab Beef Carcass Color Vision System to Augment USDA Quality Grade Application and For Use in Predicting Palatability Attributes of Beef Carcasses *97, 136	K.E. Belk, Ph.D. Colorado State University	1997-1998 Completed	$50,000
Effectiveness of Using the Hunterlab BeefCam System to Sort Beef Carcasses into Differing Product Lines, Across Four Different Packing Facilities and From Both Source Verified and Non-source Verified Fed Cattle, Based on Projected Tenderness of Subsequently Aged and Cooked Product *117–119	K.E. Belk, Ph.D. Colorado State University	1998-1999 Ongoing	$99,460
Mechanisms of Genetic Control of Beef Carcass Merit Traits — Year 5	J.F. Taylor, Ph.D. Texas A&M University	1995-1996 Completed	$350,000
Mechanisms of Genetic Control of Beef Carcass Merit Traits — Year 6	J.F. Taylor, Ph.D. Texas A&M University	1996-1997 Completed	$150,000
Mechanisms of Genetic Control of Beef Carcass Merit Traits — Year 7 *98–105, 107, 108, 110, 112–116, 120–135	S.K. Davis, Ph.D. J.F. Taylor, Ph.D. Texas AgExp Station	1997-1999 Ongoing	$200,000
National Beef Instrument Assessment Plan (NBIAP)	H.G. Dolezal, Ph.D. Oklahoma State University	1995-1996 Completed	$200,000
Objective Assessment of Beef Quality by Color Computer Vision *109, 111	J. Tan, Ph.D. University of Missouri	1997-1998 Ongoing	$40,250
Using Measurements of Muscle Color/pH/Water-Holding Capacity to Augment the Current USDA Beef Carcass Quality Grading Standards and Improve the Accuracy and Precision of Sorting Beef Carcasses into Palatability Groups	D.M. Wulf, Ph.D. The Ohio State University	1997-1998 Completed	$46,421

*See pages 28–32 for published research findings.

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Beef Quality			
Customer Satisfaction II	J.O. Reagan, Ph.D. National Cattlemen's Beef Association S. Courington, Ph.D. Wirthlin Worldwide J.W. Savell, Ph.D. Texas A&M University	1995-1998 Ongoing	$607,000
Customer Satisfaction II: Value of Beef Palatability	J.C. Lundeen Sterling-Rice Group	1997-1998 Ongoing	$224,000
Domestic and International Shelf-life Strategic Alliance *64, 65, 67, 76, 77, 79, 84–87, 92–94	K.E. Belk, Ph.D. Colorado State University J. B. Morgan, Ph.D. Oklahoma State University T.P. Ringkob, Ph.D. University of Nevada S.M. Combs, Ph.D. D.M. Schaefer, Ph.D. University of Wisconsin-Madison	1996-1997 Completed	$200,000 CO Beef Council TN Beef Industry Council MO Beef Industry Council OK Beef Industry Council WI Beef Council
Effect of Several Strategies to Control Variation in Beef Tenderness on Consumer Satisfaction	M. Koohmaraie, Ph.D. US Dept of Agriculture, ARS	1997-1998 Completed	$50,000
Enhancement of Beef Quality and Palatability Traits Through Beef Carcass Vascular Infusion of Calcium Chloride, Vitamin E, and Ascorbic Acid	D.L. Scott North American Meat Processors Association	1997-1998 Completed	$133,000
Genomic Workshop/Symposium *60, 61, 63, 66, 68–73, 75, 78, 80, 88–91	J.F. Taylor, Ph.D. Texas Ag Exp Station	1997-1998 Ongoing	$30,000
International Segment, Domestic and International Shelf-life Strategic Alliance	S.W. Neel, Ph.D. USMEF	1996 Completed	$60,000
1997 National Beef Tenderness Survey	J.W. Savell, Ph.D. Texas Ag Exp Station	1997-1998 Ongoing	$135,000
Optimizing Palatability of Retail Beef	T. Jukam, Ph.D. AustinTrends	1997-1998 Completed	$29,851
Recommended Aging Guidelines for Different Beef Subprimal Cuts *62, 74, 81–83	K.E. Belk, Ph.D. Colorado State University	1998 Ongoing	$3,000
Tenderness CCP's — Data Analysis and Product Handling	J.W. Savell, Ph.D. Texas Ag Exp Station	1997-1998 Ongoing	$25,000

*See pages 28–32 for published research findings.

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Beef Safety			
A Natural Intervention - the Reduction of Fecal Contamination of Ground Beef by the Use of Natural Bacteriocins	E.A. Zottola, Ph.D. University of Minnesota	1996-1997 Completed	$47,740
A Microbial Profile of Domestic and Imported Beef Raw Materials Destined for Use in Ground Beef Production	G. Bellinger, M.S. Agri-West Laboratories	1997-1998 Completed	$97,850
Adaption of Models of Human Behavior Change to Develop Effective Food Safety Education for Consumers *3, 4	V. Hillers, Ph.D. Washington State University	1995-1997 Completed	$2,272 WA Beef Comm
Analysis of **E. coli** Removal from Beef Tissues Using Laser Scanning Confocal Microscopy *1	L.A.McLandsborough, Ph.D. University of Massachusetts	1997-1998 Ongoing	$22,000
Application of Edible Coating Technology in Microbial Safety/Quality Beef Products *9, 59	H. Chen, Ph.D. University of Vermont	1996-1997 Completed	$50,420
Association of Viable But Non-Culturable **Escherichia coli** O157:H7 With Beef and Beef Products	K.R. Matthews, Ph.D. Rutgers University	1997-1998 Ongoing	$39,642
Characterization of Growth Potential of **Escherichia coli** O157:H7 in Irradiated Beef Patties During Storage, and Effect of Packaging Material on Quality of the Product *43, 44	E.A. Murano, Ph.D. Texas A&M University	1997 Completed	$65,668
Detection of **Escherichia coli** O157:H7 in Frozen Retained Product Using a Greatly Increased Sample Size	W.P. Pruett, Ph.D. R. Flowers, Ph.D. Silliker Laboratories Group	1998-1999 Ongoing	$23,812
Development of Interventions to Reduce Pathogens on Beef Trimmings	R.K. Miller, Ph.D. Texas A&M University	1996-1997 Completed	$41,496
E. coli Fingerprint (Microbial Mapping I)	M. Samadpour, Ph.D. University of Washington	1995-1997 Completed	$10,728 WA Beef Comm
Ecological Superiority and Inhibition of Growth of Pathogens In Ground Beef Chubs Produced from Carcasses Decontaminated with Various Intervention Technologies *42	G.R. Acuff, Ph.D. Texas Ag Exp Station	1997-1998 Ongoing	$49,486
Evaluation of Diagnostic Tests for Detection of **Escherichia coli** O157:H7 in Feces of Cattle *2, 46	R.A. Moxley, DVM, Ph.D University of Nebraska	1996-1997 Completed	$30,000
Evaluation of Multiple-Hurdle Microbiological Interventions to Include Pre-evisceration Spray-Washing and Other Technologies for Beef Carcass Decontamination *17, 38, 39, 51, 55, 56	J.N. Sofos, Ph.D. Colorado State University	1997-1998 Ongoing	$121,740
Evaluation of Steam-Vacuuming as a Pre-Evisceration Intervention to Decontaminate Beef	J.N. Sofos, Ph.D. Colorado State University	1995-1996 Completed	$34,000 CO Beef Council
Evaluation of Trimming and Washing Techniques Designed to Improve the Microbiological and Visual Profiles of Beef Carcasses	J.O. Reagan, Ph.D. National Cattlemen's Beef Association	1994-1997 Ongoing	$221,430
Hot Water Decontamination of Beef Carcasses *7, 8	G. Acuff, Ph.D. Texas A&M University	1995-1996 Completed	$73,570 CA Beef Council
Identification and Implementation of Critical Control Points (CCPs), and Detection and Control of External Pathogens, Through Microbial Mapping — Phase I *16, 54	G.C. Smith, Ph.D. Colorado State University	1995-1996 Completed	$91,400 CO Beef Council
Identification and Implementation of Critical Control Points (CCPs), and Detection and Control of External Pathogens, Through Microbial Mapping — Phase I	G.R. Bellinger, M.S. Agri-West Laboratories	1995-1996 Completed	$280,787
Immunological Characterization of a Recombinant **Escherichia coli** O157:H7 Adhesin	P. Tarr, M.D. University of Washington School of Medicine	1995-1996 Completed	$24,177 WY Beef Council WA Beef Comm
Microbial Mapping II. Determining Microbiological Counts on Beef Carcasses, Wholesale Cuts and Retail Cuts, to Assist Those in the Fabrication, Distribution and Retailing Sectors to Deliver Safe Beef to Retail Customers. *41, 49, 50, 53, 57	G.C. Smith, Ph.D. Colorado State University	1997-1998 Ongoing	$264,125

*See pages 28–32 for published research findings.

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Microbiological Safety of Subprimals and Ground Beef from Beef Carcasses Contaminated with Pathogens after Receiving Hot Water, Alkaline and Organic Acid Wash Interventions *10–13	W.J. Dorsa, Ph.D. US Meat Animal Research Center	1996-1997 Completed	$47,200
Pasteurization of Beef Utilizing Superheated Steam	J.C. Williams, Ph.D. American Meat Institute	1994-1996 Completed	$200,000
Pilot Study for Microbial Mapping II *40, 47, 48, 52, 58	G.C. Smith, Ph.D. Colorado State University	1997-1998 Completed	$35,875
Prevalence of **Salmonella typhimurium** DT 104 (R-type ACSSuT) in Retail Ground Beef and Identification of Specific Cell Surface Markers	M.P. Doyle, Ph.D. University of Georgia Research Foundation, Inc.	1997-1998 Completed	$46,893
Prevalence of **E. coli** O157:H7 in Feedlot Cattle at Slaughter Plants *18–36	D.D. Hancock, Ph.D. Washington State University	1996-1997 Ongoing	$12,000 WA Beef Comm
Process Validation of Dry, Fermented Sausages for Control of **Escherichia coli** O157:H7 *37	J. Luchansky, Ph.D. Food Research Institute University of Wisconsin	1995-1996 Completed	$68,090 CA Beef Council
Process Validation of Dry, Fermented Sausages for Control of **Escherichia coli** O157:H7 *14, 15, 45	J. Luchansky, Ph.D. Food Research Institute University of Wisconsin	1996-1997 Completed	$28,500 CA Beef Council
Regional Distribution and Relative Prevalence of **Salmonella typhimurium** DT104 Compared with other **S. typhimurium** Types	T. E. Besser, Ph.D. Washington State University	1996-1997 Completed	$10,000 WA Beef Comm
Real Time/Near Real Time Detection of Microbial Pathogens in Beef and Beef Products by an Innovative Enrichment Broth/Biosensor Assay System	D.V. Lim, Ph.D. University of South Florida Research Foundation	1997-1998 Completed	$25,000
Reduction of Enteric Pathogens Contamination on Beef Products And Shelf Life Extension Using Radiant Wall Oven Heating	M.A. Harrison, Ph.D. University of Georgia Research Foundation	1997-1998 Ongoing	$25,000
Role of **Helicobacter pylori** as an Emerging Foodborne Pathogen in Beef	G.R. Acuff, Ph.D. Texas A&M University	1997-1998 Completed	$22,500
Role of Substrate Accelerated Death During Survival of **Escherichia coli** O157:H7 *5, 6	J.J. Byrd, Ph.D. C. Kasper, Ph.D. Food Research Institute University of Wisconsin	1997-1998 Ongoing	$14,210
Validation of a Compositing Method for Detection of **E. coli** O157:H7 in Salami Batter	R.S. Flowers, Ph.D. Silliker Laboratories	1997 Completed	$25,008

*See pages 28–32 for published research findings.

NUTRITION RESEARCH

COMPLETED AND ONGOING PROJECTS 1996, 1997, 1998

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Health Benefits of CLA			
Antiatherogenic Properties of Stearic Acid	B. Henning, Ph.D. University of Kentucky Research Foundation	1998-1999 Ongoing	$21,950
Beef Fat for Optimizing Bone Formation and Bone Architecture	B.A. Watkins, Ph.D. Purdue Research Foundation	1998-1999 Ongoing	$57,371
Can Conjugated Linoleic Acid Concentration in Beef Muscle be Significantly Increased?	A.H. Trenkle, Ph.D. Iowa State University	1998-1999 Ongoing	$50,100
Characterization of Conjugated Linoleic Acid (CLA) Intake, Plasma CLA Concentrations and the Relationships among CLA Intake, Plasma CLA and Body Composition in Young Adults	M.A. McGuire, Ph.D. University of Idaho	1997-1998 Ongoing	$59,362
CLA Function in Relation to Beef Fatty Acids and Cholesterol	K.C. Hayes, DVM, Ph.D. Brandeis University	1998-1999 Ongoing	$72,037
Effect of CLA on Fat Partitioning and Metabolism	M.W. Pariza, Ph.D. University of Wisconsin-Madison	1995-1997 Completed	$75,000
Effects of CLA on Body Fat and Energy Metabolism in the Mouse *177	J. Delany, Ph.D. D. West, Ph.D. Louisiana State University	1997-1998 Ongoing	$70,604
Factors Affecting Conjugated Linoleic Acid Production by Ruminal Microorganisms	S.A. Martin, Ph.D. The University of Georgia	1997-1998 Ongoing	$30,213
Feeding Practices That Will Enhance the Conjugated Linoleic Acid Content of Beef	T.R. Dhima, Ph.D. Utah State University	1997-1998 Ongoing	$51,900
Influence of CLA on Regression of Atherosclerosis in Rabbits	D. Kritchevsky, Ph.D. The Wistar Institute	1998-1999 Ongoing	$64,784
Modulation of Diabetes by Conjugated Linoleic Acid *175	J.P. Vanden Heuvel, Ph.D. Pennsylvania State University	1997-1998 Completed	$52,000
Modulation of Mammary Gland Preneoplastic Lesions by Conjugated Linoleic Acid	C. Ip, Ph.D. Health Research Inc.	1998-1999 Ongoing	$49,080
Serum levels of Conjugated Linoleic Acids in Free-Living Men and Women Consuming Red and White Meats	B.A. Watkins, Ph.D. Purdue Research Foundation	1997-1998 Completed	$22,500
Health Benefits of Beef's Nutrients			
Adaptation in the Absorption of Iron from Beef	J.R. Hunt, Ph.D., R.D. US Dept of Agriculture, ARS	1997-1999 Ongoing	$65,077
Contribution of Beef Intake to Iron and Zinc Status and Immune Function in Homebound Elderly Women *165, 166, 176	N. Ahluwalia, Ph.D. Pennsylvania State University	1997-1998 Ongoing	$46,210
Determination of Folate in Beef Products Using Tri-Enzyme Treatment *167–169	T. Tamura, M.D. University of Alabama at Birmingham	1997-1998 Completed	$34,663
Effect of Increased Consumption of Dietary Lean Beef on Iron and Zinc Status of Adolescent Cross Country Runners Compared to Controls	R.M. Lyle, Ph.D. Purdue University	1997-1998 Ongoing	$59,953

*See pages 28–32 for published research findings.

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Effects of Dietary Beef on Resistance Training-Induced Changes In Body Composition and Muscle Size of Older Men	W.W. Campbell, Ph.D. University of Arkansas	1998-1999 Ongoing	$115,462
Pilot Study — The Effect of a High-Protein, High Monounsaturated Fat Diet on Lipids, Lipoproteins, and Glucose in Subjects with Type II Diabetes and Dyslipidemia	L.W. Scott, M.A., R.D. Baylor College of Medicine	1998 Ongoing	$32,550
Separable Lean Data for Beef Fat ⅛ Inch External Fat Trim	J.W. Savell, Ph.D. Texas Ag Exp Station	1998-1999 Ongoing	$84,000
The Role of Beef as a Source of Vital Nutrients in Healthy Diets *164	J.S. Douglass, M.S., R.D. Tas-Environ	1998 Ongoing	$70,000
Where's the Fat? Trends in US Fat Consumption 1965-96	B.M. Popkin, Ph.D. Carolina Population Center	1998-1999 Ongoing	$31,000
Diet Health Issues			
Association Between Dietary Nutrient Intake and Red Meat Consumption Among ACS CPS II Nutrition Survey Validation Study Participants *172	W.M. McClellan, Jr., M.D., M.P.H. Emory University School of Public Health	1995-1996 Completed	$49,991
A Comparison of Dietary Beef and Plant Protein on Risk of Calcium Oxalate Kidney Stones in Stoneformers	L.K. Massey, Ph.D., R.D. Washington State University	1998-1999 Ongoing	$78,897
A Comparison Study Evaluating the Long-Term Lipoprotein Responses of Red vs. White Meat — Year 3 of 3 *170, 171	M. Davidson, M.D. Chicago Center for Clinical Research	1995-1998 Completed	$1,858,380
Dietary Pattern and Serum Ferritin in the Framingham Heart Study *173, 174, 179, 180	R. Wood, Ph.D. Tufts University	1994-1996 Completed	$73,380
Dietary Treatment for Hyperlipidemia in Adolescence	L. Snetselaar, Ph.D., R.D. University of Iowa	1998-1999 Ongoing	$164,864
Effects of Beef and Chicken Consumption on Weight Loss in Overweight Women	J.M. Rippe, M.D. Center for Clinical and Lifestyle Research	1998-1999 Ongoing	$135,701
Iron Stores in Humans: Is there a Dietary Connection?	P. Garry, Ph.D. University of New Mexico Medical Center	1994-1996 Completed	$41,600
Level of Meat Intake in Relation to Heart Disease Risk Factors and Outcomes	J.A. Marshall, Ph.D. University of Colorado School of Medicine	1995-1996 Completed	$47,629
Meat Intake, Iron Status and Oxidative Damage	G. Block, Ph.D. University of California-Berkeley	1994-1996 Completed	$85,000
Reversal of the Cognitive Effects of Marginal Iron-Zinc Nutrition in Adolescents Adding Meat to the Diet	M.S. Golub, Ph.D. University of California-Davis	1996-1997 Completed	$116,772
Zinc and Iron Status, Physical Growth and Cognitive Development of Breast-fed Infants Fed Beef as a First Weaning Food *178	N.F. Krebs, M.D. University of Colorado	1996-1998 Completed	$125,000
Meat Nutrient Composition			
Determination of the Nutrient Content of Veal Breast and Veal Shank	D.R. Buege, Ph.D. University of Wisconsin-Madison	1995-1996 Completed	$16,000

*See pages 28–32 for published research findings.

MARKET RESEARCH

COMPLETED AND ONGOING PROJECTS 1996, 1997, 1998

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Advertising and Attitudes Tracking Study 1996	The Gallup Organization	1995-1996 Completed	$66,000
Consumer Choice Dynamics	Numerous	1995-1996 Completed	$93,500
Consumer Pulse Study 1996	The Gallup Organization	1995-1996 Completed	$72,000
Consumer Purchasing Trends	The NPD Group TRU Unlimited Technomic IRI, Inc.	1998-1999 Ongoing	$600,000
Crest Study 1996	The NPD Group	1995-1996 Completed	$42,500
Crest Research and Net Study '97	The NPD Group	1996-1997 Completed	$80,500
Crest Research and Net Study '98	The NPD Group	1997-1998 Ongoing	$84,500
Deli Meats Purchase Diary	The NPD Group	1995-1996 Completed	$43,644
Foodservice Studies	Numerous	1995-1996 Completed	$6,000
Gallup Advertising Tracking Study '97	The Gallup Organization	1996-1997 Completed	$94,029
Gallup Advertising Tracking Study '98	The Gallup Organization	1997-1998 Ongoing	$94,000
Meat Purchase Diary 1996	The NPD Group	1995-1996 Completed	$346,000
Meat Purchase Diary 1997	The NPD Group	1996-1997 Completed	$355,000
Meat Purchase Diary 1998	The NPD Group	1997-1998 Ongoing	$370,000
Net Study 1996	The NPD Group	1995-1996 Completed	$38,500
Research Dissemination	Numerous	1996-1997 Completed	$30,000
Research Dissemination	Numerous	1997-1998 Ongoing	$110,000
Single Source Study	The NPD Group	1998-1999 Ongoing	$200,00

MEAT SCIENCE/INDUSTRY INFORMATION RESEARCH

COMPLETED AND ONGOING PROJECTS 1996, 1997, 1998

PROJECT	RESEARCHER INSTITUTION	DURATION STATUS	TOTAL GRANT/ COOPERATORS
Beef Cattle Tenderness Characterization	M.F. Miller, Ph.D. Texas Tech University	1997-1998 Ongoing	$37,000
Beef Cattle Value Video User's Guide *149	D. Hale, Ph.D. Texas Ag Ext. Service	1998 Completed	$12,350
Communicating Beef Value to the Food Service Industry	H.K. Johnson, M.S. T.R. Dockerty, Ph.D. National Cattlemen's Beef Association D.B. Griffin, Ph.D. J.W. Savell, Ph.D. Texas Ag. Extension Service	1996-1998 Ongoing	$50,000
Communicating Veal Value to the Retailer and Foodservice *155, 156	H.K. Johnson, M.S. T.R. Dockerty, Ph.D. C.D. Lambert, Ph.D. National Cattlemen's Beef Association J.W. Savell, Ph.D. D.B. Griffin, Ph.D. Texas A&M University	1995-1996 Completed	$30,000
Determination of Sensory Panel Ratings of Beef Loin Steaks Aged 7, 14, 21 or 28 Days from Non-Stimulated and Electrically Stimulated Beef Carcasses	R.K. Miller, Ph.D. B.H. Johnson, Ph.D. J. Beverly, Ph.D. Texas A&M University	1996 Completed	$20,000
Developing Benchmarks, Educational Tools, and Sorting Strategies to Familiarize Cattle Producers with the Benefits and Risks Associated With Grid Pricing *137, 140–148, 151–154, 163	T.G. Field, Ph.D. Colorado State University	1997-1998 Completed	$38,250
Development of a Palatability Assurance "Critical Control Points" (PACCP) Model to Reduce the Incidence of Beef Palatability Problems *150, 157, 161, 162	G.C. Smith, Ph.D. J.D. Tatum, Ph.D. Colorado State University	1996 Completed	$96,200
Expanding Beef Quality Assurance Educational Initiatives Through Livestock Marketers	J. Floyd, DVM, M.S. Auburn University	1996 Completed	$45,100
Factors Contributing to the Incidence of the 'Dark Cutting' Condition in Beef Carcasses and Management Strategies to Prevent Reductions in Value as a Result of Their Occurrence *138, 139, 159, 160	M.F. Miller, Ph.D. Texas Tech University K.E. Belk, Ph,.D Colorado State University	1996 Completed	$50,000
Market Prediction Model for Feedlot Cattle: Validation of Feedlot Formulas	M. Whiteing Middle America Consulting, Inc.	1995-1997 Ongoing	$100,000
Value Based Marketing 1996 *158	H.K. Johnson, M.S. T.R. Dockerty, Ph.D. C.D. Lambert, Ph.D. National Cattlemen's Beef Association J.W. Savell, Ph.D. D.B. Griffin, Ph.D. Texas A&M University	1995-1996 Completed	$40,000

*See pages 28–32 for published research findings.

STATE-FUNDED PROJECTS

RESEARCH PROJECTS 1998

PROJECT	RESEARCH AREA	RESEARCHER/ INSTITUTION	STATUS	TOTAL GRANT/ COOPERATORS
Alabama				
Characterization of Variations in Calpastatin Expression and Postmortem Changes in Beef	Product Tech	S.M. Lonergan, Ph.D. Auburn University	Completed	$11,220
Color Stability and Tenderness Properties of Processed and Fresh Products from Beef from Vitamin E Fed Cattle	Product Tech	E.H. Lonergan, Ph.D. Auburn University	Completed	$11,000
Identification of Factors Contributing to Variation in Tenderness of Beef Top Loin Steak from Brangus Cattle	Product Tech	S. Lonergan, Ph.D. Auburn University	Completed	$13,500
Studies to Identify Potential Pre-harvest Strategies to Control ***E. coli*** O157:H7 in Beef Cattle	Beef Safety	T. McCaskey, Ph.D. Auburn University	Ongoing	$15,000
Arkansas				
Development of Microbiological Interventions for the Preservation and Safety Enhancement of Ground Beef	Beef Safety	F.W. Pohlman, Ph.D. University of Arkansas	Ongoing	$63,000
The Impact of Feeding Poultry Litter on Microbial Contamination of Beef Carcasses	Beef Safety	J. K. Apple, Ph.D. University of Arkansas	Ongoing	$40,500
Optimizing Quality and Consistency of Products from Cull Cows	Product Tech	J.K. Apple, Ph.D. University of Arkansas	Completed	$55,000
California				
Consumer Acceptance of Case-Ready Beef Entrees	Product Tech	H. Stone, Ph.D. Tragon Corporation	Completed	$16,500
Cow-Calf Quality Assurance Information System	Beef Safety	University of California	Completed	$9,800
Development of a California Beef and Dairy Quality Assurance Program Phase II	Beef Safety	J. O'Donnell, Ph.D. California Dairy Research Foundation, Davis	Ongoing	$30,000
Reconfirmation that Adult Beef Cattle Shed Trivial Amounts of ***Cryptosporidium parvum*** in Their Manure	Beef Safety	R. Atwill, DVM, Ph.D. University of California, Dept. of Veterinary Medicine, Tulare	Ongoing	$7,100
Validation of Dry Fermented Sausage Phase II	Beef Safety	NCBA - Coordinator	Ongoing	$10,000
Your Beef's at Stake:California Beef Cattle Improvement Association Workshop	Research Info	H. Stone, CA Beef Cattle Improvement Association	Ongoing	$10,000

PROJECT	RESEARCH AREA	RESEARCHER/ INSTITUTION	STATUS	TOTAL GRANT/ COOPERATORS
Colorado				
Dedicated Prion Research Laboratory — Surveillance Program	Beef Safety	T.A. Frank, DVM, Ph.D. Colorado State University	Ongoing	$44,000
Targeted Surveillance for CWD in Cattle	Beef Safety	T.A. Frank, DVM, Ph.D. J.L. Voss, DVM, M.S. B.E. Powers, DVM, Ph.D. D.H. Gould, DVM, Ph.D. Colorado State University	Ongoing	$44,000
Florida				
Genetic Control of Tenderness in Brahman Cattle	Product Tech	J.V. Yelich, Ph.D. University of Florida	Ongoing	$9,500 Year 2
Georgia				
Calcium Activated Tenderization of Loin, Top Sirloin and Round Steaks from Diverse Genotypes	Product Tech	T.D. Pringle, Ph.D. University of Georgia	Ongoing	$11,750
Consumer Response to the Introduction of Irradiated Beef Products	Beef Safety	K.H. McWatters, Ph.D. University of Georgia	Ongoing	$15,000
Destruction of Pathogenic Bacteria in Ground Beef Patties Using High Temperature Cookery	Beef Safety	S.E. Williams, Ph.D. University of Georgia	Completed	$10,500
Estimation of Genetic Relationships Between Live Animal Ultrasound and Other Measures of Growth and Carcass Merit in Yearling Seedstock with Carcass Measures in Related Finished Steers	Product Tech	J.K. Bertrand, Ph.D. University of Georgia	Ongoing	$6,250
Evaluation of Lactoferrin for Inactivation of **E. coli** O157:H7 in Ground Beef	Beef Safety	M.P. Doyle, Ph.D. University of Georgia	Completed	$8,500
Identification of Optimal Ranges of Ribeye Area for Portion Cutting of Beef Steaks	Product Tech	S.E. Williams, Ph.D. University of Georgia	Completed	$6,832
Utilization of Calcium Chloride and Spice Marination to Improve the Sensory and Textural Characteristics of Precooked Roast Beef	Product Tech	T.D. Pringle, Ph.D. University of Georgia	Ongoing	$4,750
Vitamin D Supplementation as a Means to Enhance Beef Tenderness	Product Tech	T.D. Pringle, Ph.D. University of Georgia	Ongoing	$3,000
Idaho				
A Diagnostic Survey to Determine the Prevalence of **Mycobacterium paratuberculosis** Infections in Non-fed Beef Cattle in Idaho	Beef Safety	B. Anderson, Ph.D. J. England, Ph.D. M. Kinsel, Ph.D. A. Ward, Ph.D. University of Idaho	Completed	$10,187
Cull Cows and Environmental Exposure to DDT Derivatives	Beef Safety	R. Roeder, Ph.D. G. Schelling, Ph.D. R. Battaglia, Ph.D. University of Idaho	Completed	$10,765
Growth and Resistance Characteristics of **E. coli** O157:H7, **Salmonella** and **Listeria monocytogenes** In Dark Cutting Beef	Beef Safety	P.M. Davidson, Ph.D. S. Duckett, Ph.D. University of Idaho	Ongoing	$17,744 Year 1 $16,744 Year 2
Preharvest Tenderization:Effects of Time, Dose Level, and Routes of Adminstration of Calcium Gel on Tenderness of Cuts from the Round, Loin and Chuck	Product Tech	S. Duckett, Ph.D. University of Idaho	Ongoing	$20,024

STATE-FUNDED PROJECTS

PROJECT	RESEARCH AREA	RESEARCHER/ INSTITUTION	STATUS	TOTAL GRANT/ COOPERATORS
Pre-Harvest Tenderization through Oral Calcium Gel Administration	Product Tech	S. Duckett, Ph.D. W. Sanchez, Ph.D. J. Thorngate, Ph.D. University of Idaho	Completed	$14,000
Protecting Product Quality in Cold-Pasteurized Meat Products	Beef Safety	R. Roeder, Ph.D. University of Idaho	Ongoing	$21,130
Studies on the Colonization, Transmission and Shedding of **Escherichia coli** O157:H7 by Ruminants	Beef Safety	C.H. Bohach, Ph.D. University of Idaho	Ongoing	$30,950 Year 1 $5,950 Year 2
The Effect of High Oil Corn on Content of Conjugated Linoleic Acid (CLA) in Beef and Its Acceptability by Consumers	Product Tech	M. McGuire, Ph.D. S. Duckett, Ph.D. C. Hunt, Ph.D. University of Idaho	Completed	$14,685
The Relationship Between Dietary Conjugated Linoleic Acid (CLA) and CLA in Various Hemotologic Fractions	Nutrition	Mark McGuire, Ph.D. Michele McGuire, Ph.D. University of Idaho	Ongoing	$5,695
Iowa				
Use of Vitamin D and its Metabolites to Improve Tenderness of Beef	Product Tech	D. Beitz, Ph.D. A. Trenkle, Ph.D. F.D. Parrish, Ph.D. Iowa State University R. Horst, Ph.D. NADC USDA/ARS	Ongoing	$15,831
Use of Vitamin D and its Metabolites to Improve Tenderness of Beef Phase II.	Product Tech	D. Beitz, Ph.D. A. Trenkle, Ph.D. F.D. Parrish, Ph.D. Iowa State University R. Horst, Ph.D. NADC USDA/ARS	Ongoing	$35,500
Kansas				
Development of an Instrument Capable of Measuring pH and Resistance of Muscle (Tenderness) Simultaneously During the Beef Harvest	Product Tech	J.L. Marsden, Ph.D. Kansas State University A.R. Elkoubysi Cypress Systems Inc.	Completed	$132,800
Effects of Short Pulsed Electron Beam Irradiation on Consumer Acceptance, Color and Shelf Life of Ground Beef	Beef Safety	D.Kropf, Ph.D. H. Hunt, Ph.D. J.L. Marsden, Ph.D. C.L. Kastner, Ph.D. E. Chambers IV, Ph.D. Kansas State University	Completed	$45,000
Establish the D-value of **Escherichia coli** O157:H7 and other Pathogens Using High Energy Pulse Electron Beam Irradiation	Beef Safety	D.H. Kropf, Ph.D. Kansas State University D. Olson, Ph.D. Iowa State University	Completed	$140,000
Establish the D-Value for **Salmonella** DT-104 Using High Energy Pulse Electron Beam Irradiation	Beef Safety	J.L. Marsden, Ph.D. R. Phebus, Ph.D. C.L. Kastner Kansas State University	Ongoing	$63,660

PROJECT	RESEARCH AREA	RESEARCHER/ INSTITUTION	STATUS	TOTAL GRANT/ COOPERATORS
Effect of Steam Pasteurization on **Escherichia coli** O157:H7, **Salmonella** and Generic Bacteria in Post-Slaughter Beef Processing Applications	Beef Safety	J.L. Marsden, Ph.D. R. Phebus, Ph.D. C.L. Kastner, Ph.D. Kansas State University	Completed	$45,000
Evaluate USDA Sponge Method for Sampling Beef Carcases for the Presence of Generic **Escherichia coli** and **Salmonella**	Beef Safety	J.L. Marsden, Ph.D. R. Phebus, Ph.D. C.L. Kastner, Ph.D. Kansas State University	Completed	$35,000
Evaluation of Standarized Sampling of **E. coli** O157:H7 Testing Protocol for Combos of Beef Trimmings and Beef Carcasses	Beef Safety	J.L. Marsden, Ph.D. R. Phebus, Ph.D. C.L. Kastner, Ph.D. Kansas State University	Ongoing	$53,260
Food Safety Risk Assessment of **E. coli** O157:H7 During Production and Cooking of Marinated Steaks	Beef Safety	R. Phebus, Ph.D. C.L. Kastner, Ph.D. J.L. Marsden, Ph.D. Kansas State University	Ongoing	$23,515
Food Safety Assessment of **E. coli** O157:H7 During Production and Cooking of Fibrinogen and Blade Tenderized Steaks	Beef Safety	R. Phebus, Ph.D. C.L. Kastner, Ph.D. J.L. Marsden, Ph.D. E. Boyle M.C. Hunt, Ph.D. D. Fung, Ph..D. Kansas State University	Ongoing	$61,035
Increasing Microbiological Safety and Extending Shelf Life of Ground Beef	Beef Safety	R. Phebus, Ph.D. D. Fung, Ph.D. J. Johnson, Ph.D. J. Kenyon C.L. Kastner, Ph.D. J.L. Marsden, Ph.D. Kansas State University	Completed	$20,000
In-Plant Verification of Water Soaking, Salting and Rinsing for Control **E. coli** O157:H7, **Salmonella** and Generic Bacteria in Beef Trimmings	Beef Safety	J.L. Marsden, Ph.D. R. Phebus, Ph.D. C.L. Kastner, Ph.D. Kansas State University	Ongoing	$29,920
Low Temperature Pasteurization of Packaged Beef Retail Cuts and Ground Beef Patties	Product Tech	J.L. Marsden, Ph.D. C.L. Kastner, Ph.D. N. Kutrola, Ph.D. S. Sporing, R.A. Kansas State University	Ongoing	$40,000
Use of Penetrating Needle/Blade Technology in the Beef Industry	Product Tech	J.L. Marsden, Ph.D. J. Unruh, Ph.D. Kansas State University J. Savell, Ph.D. Texas A&M University	Ongoing	$70,800
Validation of Dry Sausage for Control of **E. coli** O157:H7	Beef Safety	D. Fung, Ph.D. K. Karr C.L. Kastner, Ph.D. J.L. Marsden, Ph.D. H. Thippareddi R. Phebus, Ph.D. D. Kropf, Ph.D. R. Campbell Kansas State University	Completed	$60,000
Validation of Water Soaking, Salting and Rinsing for Control of **Escherichia coli** O157:H7, **Salmonella** and Generic Bacteria in Beef Sub-primals and Beef Trimmings	Beef Safety	J.L. Marsden, Ph.D. C.L. Kastner, Ph.D. R. Phebus, Ph.D. Kansas State University	Completed	$35,000

STATE-FUNDED PROJECTS

PROJECT	RESEARCH AREA	RESEARCHER/ INSTITUTION	STATUS	TOTAL GRANT COOPERATORS
Michigan				
Collection of Carcass Information, Boxed Retail Yield and Tenderness Evaluation to Assist Beef Producers in Determining True Market Value of their Fed Steers	Product Tech	S. Rust, Ph.D. Michigan State University	Ongoing	$2,000
Minnesota				
Effect of Beef and Tallow Consumption on the Development of Precancerous Lesions, Colon Cell Proliferation and ras Oncogene Activation in Rats	Nutrition	D. Gallaher, Ph.D. University of Minnesota	Ongoing	$30,000 Year 2
Effect of Ingestion of Beef on Plasma Glucose and Insulin Response in NIDDM	Nutrition	M. Gannon, Ph.D. F. Nuttall, M.D. University of Minnesota	Ongoing	$30,000
Evaluation of Various Methods for Measuring Calpastatin Activity in Beef from Half-sib Bulls and Steers	Product Tech	B. Woodward, Ph.D. University of Minnesota	Completed	$28,860
Influence of Information on the Acceptability of Irradiated Fresh Ground Beef Patties	Beef Safety	Z. Vickers, Ph.D. University of Minnesota	Ongoing	$18,281
Neutraceutical Beef Patties: Addition of Fiber, Starch and Antioxidants	Product Tech	P.B. Addis, Ph.D. R.J. Epley, Ph.D. University of Minnesota	Ongoing	$22,500
Protection of Dietary Beef Fat on Risk Factors for Disease	Nutrition	A.S. Csallany, Ph.D. University of Minnesota	Ongoing	$24,526 Year 1 $23,810 Year 2
Reduced Colonic Microbial Activity by Beef Fat-A Mechanism for Reducing the Risk of Colon Cancer	Nutrition	D. Galleher, Ph.D. University of Minnesota	Ongoing	$27,103
The Effect of Baseline Glucose Concentration on the Beef-Stimulated Increase in Insulin Concentration in Subjects with Type 2 Diabetes (Non-insulin Dependant **Diabetes Mellitus** (NIDDM)	Nutrition	M. Gannon, Ph.D. F. Nuttall, M.D. University of Minnesota	Ongoing	$17,876
Mississippi				
Accuracy Evaluation of Real-time Ultrasound for Predicting Carcass Composition and Quality	Product Tech	A.R. Williams, Ph.D. B. McKinley, M.S. R.W. Rogers, Ph.D. Mississippi State University	Ongoing	$57,229
Effects of rBST on Processing Characteristics and Sensory Attributes of Beef	Product Tech	R.W. Rogers, Ph.D. Mississippi State University	Completed	$12,500
Influence of Injectable Copper on the Occurrence of Carcass Injection Site Blemishes and the Immune Response of Bovine Respiratory Disease Complex	Product Tech	M.E. Boyd, Ph.D. J. Rountree B. McKinley Mississippi State University	Completed	$9,948
Reduced-fat, Low-fat, and Fat-free Beef Products	Product Tech	R.W. Rogers,Ph.D, Mississippi State University	Ongoing	$12,500

PROJECT	RESEARCH AREA	RESEARCHER/ INSTITUTION	STATUS	TOTAL GRANT/ COOPERATORS
Missouri				
Commercial Lactic Acid Solution, Polylactic Acid Solution, and Lactic Acid Culture Effects on the Shelf Life of Vacuum-packaged Fresh Beef	Product Tech	A. Clarke, Ph.D. A. Mustupha, Ph.D. University of Missouri-Columbia	Completed	$18,400 Year 1 $18,715 Year 2
Instrumental Measurements for Beef Tenderness Prediction	Product Tech	J. Tan, Ph.D. University of Missouri-Columbia	Completed	$20,400
Near-Infrared Machine Vision for Beef Tenderness Prediction	Product Tech	J. Tan, Ph.D. University of Missouri-Columbia	Ongoing	$21,400
Solid-Phase Microextraction:A Rapid Ex-Traction Method for Beef Flavor Compounds with an Emphasis on Warmed-Over Flavors	Product Tech	I.U. Gruen, Ph.D. University of Missouri-Columbia	Ongoing	$20,000
Synergistic Effects of Nisin and Vacuum-Packaging on the Shelf-Life of Fresh Beef	Product Tech	A. Mustapha, Ph.D. University of Missouri-Columbia	Ongoing	$21,100
Use of Polylactic Acid to Increase Shelf Life and Safety of Meats	Product Tech	G. Iannotti, Ph.D. University of Missouri	Ongoing	$18,000
Value Discovery in an Identity Preserved Coordinated System	Product Tech	V. Pierce, Ph.D. N. Kalaitzandonakes University of Missouri-Columbia	Ongoing	$19,500
North Carolina				
Effect of a Dietary Mineral on Carcass Quality And Muscle Fat and Cholesterol in Beef Cattle	Product Tech	J.W. Spears, Ph.D. North Carolina State University	Ongoing	$15,000
North Dakota				
Selenium Content of Beef	Nutrition	J. Finley, Ph.D. USDA/ARS Northern Plains Area	Ongoing	$13,500
Study of Human Adaptation to Control Iron Absorption from Meat	Nutrition	F.K.Roughead, Ph.D. USDA/ARS Northern Plains Area	Ongoing	$12,000
Oklahoma				
Carcass Quality:Impact of Metabolic Conditions at Slaughter	Product Tech	F. Owens, Ph.D. H.G. Dolezal, Ph.D. D. Gill, Ph.D. J.B. Morgan, Ph.D. Oklahoma State University	Completed	$21,000
Elevation of Live Animal Calcium Levels: A Unique Approach for Improving Beef Tenderness	Product Tech	J.B. Morgan, Ph.D. F. Owens, Ph.D. H.G. Dolezal, Ph.D. D. Gill, Ph.D. Oklahoma State University	Completed	$39,000
Freezing and Calcium Chloride Injection: Their Role in Improving Beef Tenderness	Product Tech	H.G. Dolezal, Ph.D. J.B. Morgan, Ph.D. F.K. Ray, Ph.D. Oklahoma State University	Completed	$31,000
Molecular Genetics Strategies for Identification Genes Involved with Marbling in Beef Cattle	Product Tech	R. Geisert, Ph.D. J.B. Morgan, Ph.D. H. G. Dolezal, Ph.D. Oklahoma State University	Ongoing	$43,000
Utilizing Pre-Harvest and Post-Harvest Technologies for Improving Beef Tenderness	Product Tech	J.B. Morgan, Ph.D. H.G. Dolezal, Ph.D. Oklahoma State University	Ongoing	$21,000

STATE-FUNDED PROJECTS

PROJECT	RESEARCH AREA	RESEARCHER/ INSTITUTION	STATUS	TOTAL GRANT/ COOPERATORS
South Dakota				
Effectiveness of Commercial Antioxidants In Reducing the Oxidative Rancidity Caused by Gamma Irradiation on Fresh Ground Beef	Product Tech	J.L. Julson, Ph.D. J.R. Romans, Ph.D. South Dakota State University	Completed	$62,000
The Influence of Body Weight and Marbling EPD on the Relationship of Intramuscular Fat Content and the Value of Lean Retail Product in Serially Slaughtered Angus Steers	Product Tech	R.H. Pritchard, Ph.D. K.W. Bruns D.L. Boggs South Dakota State University	Ongoing	$23,960
Texas				
Determination of An Aging Index	Product Tech	J. Savell, Ph.D. C.L. Lorenzen, Ph.D. B.H. Weatherly Texas A&M University	Ongoing	$18,550
Virginia				
Ultrasound Measurement of Carcass Traits	Product Tech	W.E. Beal,Ph.D. Virginia Polytechnic Inst/SU	Completed	$39,088
Wisconsin				
Dissemination of **E. coli** O157:H7 among Dairy Cattle-Sources and Control	Beef Safety	C. Kaspar, Ph.D. University of Wisconsin-Madison	Ongoing	$10,000
Horizontal and Waterborne Transmission of **Escherichia coli** O157:H7 Among Dairy Cattle	Beef Safety	C.W. Kaspar, Ph.D. University of Wisconsin-Madison	Completed	$10,000
Marbling Assessment with Ultrasound Technology	Product Tech	D.M.Schaefer, Ph.D. University of Wisconsin-Madison	Ongoing	$10,000
Postmortem Changes in Extracellular Matrix Proteins	Product Tech	M.L. Greaser, Ph.D. University of Wisconsin-Madison	Ongoing	$14,000 Year 1 $19,060 Year 2
The Role of Surface Chemical Equilibration In Determining the Physical Appearance of Beef	Product Tech	R.G. Cassens, Ph.D. University of Wisconsin-Madison	Ongoing	$5,000

PUBLISHED RESEARCH FINDINGS

RESEARCH FINDINGS PUBLISHED 1996-1998 / CONTINUING AND COMPLETED STUDIES

Beef Safety

1. Amaoko-Atta, C., L.A. McLandsborough. Surface characteristics of bacterial cells after anti-microbial wash treatments. Proc. 51st Ann. Recip. Meat Conf. 51:191; 1998; (Abstr.)
2. Berberov, E.M., D. Bailey, T. Kottom, S. Summer, R.A. Moxley. Evaluation of diagnostic tests for detection of **Escherichia coli** O157:H7 in bovine feces. Pres. at National Veterinary Research and Quarantine Service (Anyang, South Korea), Oct., 1998.
3. Bunde, J.R., V. Hillars. Assessing consumers observed and self-reported food safety behaviors. Ann. Mtg. Soc. Nutr. Educ.; 1998; (Abstr.)
4. Bunde, J.R., V. Hillars. Assessing consumers observed and self-reported food safety behaviors. Pres. at Tri-State Dietetic Meeting, (Coer d' Alene, ID); 1998.
5. Byrd, J.J., C.W. Kaspar. A product of autoclaved reducing sugars kills an rpoS mutant of **Escherichia coli** O157:H7. Ann. Mtg. Food Res. Inst., (Univ. of Wisc., Madison); 1998; (Abstr.)
6. Byrd, J.J., C.W. Kaspar. Defining substrate-accelerated death: A product of autoclaved glucose kills an rpoS mutant of **Escherichia coli** O157:H7. Ann. Mtg., Am. Soc. Microbiol. (Atlanta, GA); 1998; (Abstr.)
7. Castillo, A., L.M. Lucia, K.J. Goodson, J.W. Savell, G.R. Acuff. Aplicación de tratamientos con agua caliente en la descontaminación de canales de res (Application of hot water treatments for beef carcass decontamination). 13th Nat. Food Safety Conf. (Guadalajara, Mexico); 1996; (Abstr.)
8. Castillo, A., L.M. Lucia, K.J. Goodson, J.W. Savell, G.R. Acuff. Use of hot water for beef carcass decontamination. J. Food Prot. 61:19; 1998.
9. Chen, H. Whey protein-based edible film systems for enhancing food quality and safety in physico-chemical and biological properties of food systems. Vol 2. Technology Publishing (In Press); 1998.
10. Dorsa, W. J. New and established carcass decontamination procedures commonly used in the beef processing industry. J. Food Prot. 60(9):1146; 1997.
11. Dorsa, W. J., C.N. Cutter, G.R. Siragusa. Bacterial profile of ground beef made from carcass tissue experimentally contaminated with pathogenic and spoilage bacteria before being washed with hot water, alkaline solution, or organic acid then stored at 4 or 12°C. J. Food Prot. 61(9):1109; 1998.
12. Dorsa, W.J., C.N. Cutter, G.R. Siragusa. Long term effect of alkaline organic acid or hot water washes on the microbial profile of refrigerated beef contaminated with bacterial pathogens post-wash. J. Food Prot. 61(3):300; 1998.
13. Dorsa, W.J., C.N. Cutter, G.R. Siragusa. Long term bacterial profile of refrigerated ground beef made from carcass tissue experimentally contaminated with pathogens and spoilage bacteria after receiving hot water, alkaline, or organic acid washes. J. Food Prot. (In press); 1998.
14. Faith, N.G., N.S. Le Coutour, M.A. Bonnet, M. Calicioglu, D.R. Buege, J.B. Luchansky. Viability of a five-strain **Escherichia coli** O157:H7 inoculum in ground and formed beef jerky prepared at levels of 5 and 20% fat and dried 51.7, 62.8 or 68.3°C in a home-style dehydrator. Intl. J. Food Microbiol. 41:213; 1998.
15. Faith, N.G., N.Parniere, T. Larson, T.D. Lorang, C.W. Kaspar, J.B. Luchansky. Viability of **Escherichia coli** O157:H7 in salami following conditioning of batter, fermentation and drying of sticks, and storage slices. J. Food Prot. 61:377; 1998.
16. Graves-Delmore, L.R., J.N. Sofos, J.O. Reagan, G.C. Smith. Hot-water rinsing and trimming/washing of beef carcasses to reduce physical and microbiological contamination. J. Food Sci. 62:373; 1997.
17. Graves-Delmore, L.R., J.N. Sofos, G.R. Schmidt, G.C. Smith. Decontamination of inoculated beef with sequential spraying treatments. J. Food Sci. 63:890; 1998.
18. Hancock, D.D. An ecological approach to the investigation of pre-harvest food safety strategies. Pres. at Col. of Vet Med., Univ. of IL, (Champaign-Urbana); 1998.
19. Hancock, D.D. At the bottom of the food chain: Rationale and prospects for pre-harvest control of foodborne disease agents. Australian Soc. of Microbiol. Lecture. Univ. of Tasmania, (Launceston, Tasmania); 1998.
20. Hancock, D.D. At the bottom of the food chain: Rationale and prospects for pre-harvest control of foodborne disease agents. Plenary address, Pres. to the Australian Vet. Assn., (Sydney, Australia); 1998.
21. Hancock, D.D. Investigacion sanitaria de los ailimentos precosechados en Estados Unidos. Pres. at XXVI Journadas Uruguayas de Buiatria, (Paysandu, Uruguay); 1998.
22. Hancock, D.D. On-farm ecology of **E. coli** O157:H7. Pres. at Gov. Conf. on Cont. Education, (Lincoln, NE); 1998.
23. Hancock, D.D. On-farm control for **E. coli** O157:H7. Pres. at Ann. Mtg. of Am. Assn. of Bovine Practitioners, (Spokane, WA); 1998.
24. Hancock, D.D. On-farm control of **E. coli** O157:H7 and **Salmonella typhimurium** DT104. Pres. at Emerging Antibiotic Resistant Foodborne Enteropathogens Conf., (Athens, GA); 1998.
25. Hancock, D.D. Pre-harvest food safety. Pres. at Dept. of Vet. Pathobiology, Univ. of IL, (Champaign-Urbana, IL); 1998.
26. Hancock, D.D. Pre-harvest food safety. Pres. at Montana Stock Growers Assn., (Billings, MT); 1998.
27. Hancock, D.D. Pre-harvest food safety and **E. coli** O157:H7. Pres. at Ohio Vet. Med. Assn., (Columbus, OH); 1998.
28. Hancock, D.D. Pre-harvest food safety interventions on cattle farms. Pres. at USDA-CSRES Research Priorities Mtg., (Alexandria, VA): 1998.
29. Hancock, D.D. Research summary on **E. coli** O157:H7. Pres. at Northwest Chap. of Am. Soc. for Micrbiol., (Post Falls, ID); 1998.
30. Hancock, D.D. Risk Management. Pres. at Conf. on Comparative Risk Assessment. Michigan State Univ., (East Lansing, MI); 1998.
31. Hancock, D.D. The ecology of **E. coli** O157:H7 and prospects for on-farm control. Australian Soc. of Micrbiol. Lecture. Univ. of Melbourne, (Melbourne, Australia); 1998.
32. Hancock, D.D. The ecology of **E. coli** O157:H7 and prospects for on-farm control. The Snowdon Lecture. Pres. at Australian Anim. Health Lab., (Geelong, Victoria, Australia); 1998.
33. Hancock, D.D. The ecology of **E. coli** O157:H7 and prospects for on-farm control. Pres. at Conf. on New and Emerging Diseases, Univ. of IL, (Champaign-Urbana, IL); 1998.
34. Hancock, D.D. Update on **E. coli** O157:H7 research. Pres. at Food Sci. Australia Lab., (Tingalpa, Australia); 1998.
35. Hancock, D.D. Update of **E. coli** O157:H7 research. Pres. at Western States Meat Assn., (San Francisco, CA); 1998.
36. Hancock, D.D. Update on **E. coli** O157:H7 research at WSU. Pres. at Food Safety from Farm to Table, Univ. of Idaho, (Moscow, ID); 1998.
37. Hinkens, J., N.G. Faith, T.D. Lorang, P. Bailey, D. Buege, C.W. Kaspar, J.B. Luchansky. Validation of pepperoni processes for control of **Escherichia coli** O157:H7. J. Food Prot. 59:1260; 1996.

38. Kain, M.L., S.L. Kochevar, J.N. Sofos, K.E. Belk, C. Rossiter, J.O. Reagan, G.C. Smith. Condition and cleanliness of live animals in relation to microbiological counts on cow carcasses. J. Anim. Sci. 76(1):142; 1998; (Abstr.)

39. Kain, M.L., S.L. Kochevar, J.N. Sofos, C. Rossiter, K.E. Belk, G.C. Smith. Live animal characteristics and carcass contamination in cull dairy cows. Beef Program Report. Colorado State University (Fort Collins, CO); 1998.

40. Kain, M.L. J.N. Sofos, K.E. Belk, G.C. Smith. Time and temperature effects on bacterial numbers detected on sponges used to sample beef carcass tissue. Ann. Mtg. Inst. of Food Technol., (Abstr. 9-16); 1998; (Abstr.)

41. Kain, M.L., J.N. Sofos, G.C. Smith. Recovery of **E. coli** pure culture suspensions from sponges following shaking or stomaching. IAMFES Ann. Mtg. JFPRDR 61(A):62 (Abstr.)

42. King, A.K., G.R. Acuff. Ecological superiority and inhibition of growth of pathogens in refrigerated ground beef chubs produced from carcasses decontaminated with various intervention technologies. IFT Ann. Mtg. (Atlanta, GA); 1998; (Abstr.)

43. Lopez-Gonzalez, V., E.A. Murano. Effect of vacuum packaging on survival of **E. coli** O157:H7, and quality change due to irradiation in ground beef. Pres. at Ann. Mtg. Amer. Soc. for Microbiol., (Miami Beach, FL); 1997.

44. Lopez-Gonzalez, V., P.S. Murano, R.E. Brennan, E.A. Murano. Influence of various commercial packaging conditions on survival of **Escherichia coli** O157:H7 to irradiation by electron beam v. gamma rays. J. Food Prot., (In Press); 1998.

45. Luchansky, J.B. Survival of **Escherichia coli** O157:H7 in full- and reduced-fat pepperoni after manufacture of sticks, storage of slices at 4ºC or 21ºC under air and vacuum, and baking of slices on frozen pizza at 135, 191, and 246ºC. J. Food Prot. 61:383; 1998.

46. Norby, M.M. Scientists seeking answers to food safety questions: Focus on stopping harmful **E. coli** early. Research Nebraska! Univ. of Nebraska-Lincoln, Agr. Res. Div.; April 1998.

47. Schmidt, G., J. Sofos, G. Smith. How to keep the hot box clean. Meat Processing (Feb); 1998.

48. Smith, G.C. Beef, **E. coli** and food safety: New safety initiatives. Proc. Safe Food 2000: Food Safety from Farm to Table Conf. (Phoenix, AZ); 1998.

49. Smith, G.C. Reducing microbial contamination in the plant: Implementing HACCP and technological alternatives. Proc. World Food and Sustainable Agr. Symp. (Urbana, IL); 1998.

50. Smith, G.C., J. N. Sofos, K.E. Belk. Interventions from the farm or feedlot to the food store: Minimizing microbiological food safety risks. Proc. Alltech's 14th Ann. Symp. (Lexington, KY); 1998.

51. Sofos, J. N. Carcass intervention/decontamination technologies. Ontario Cattlemen's Assn. Newsletter; 1998.

52. Sofos, J.N. Carcass intervention/decontamination technologies. Proc. of Tech. Symp. on Intervention Technol. and Biotechnol. for the Canadian Meat Industry. (Banff, Alberta, Canada); 1998

53. Sofos, J.N. Hurdling: Evaluating red meat pathogen reduction technologies. Meat & Poultry (April); 1998.

54. Sofos, J.N., M.L. Kain, S.L. Kochevar, K.E. Belk, R.C. Cannell, G.C. Smith, D.R. Buege, S.C. Ingham, D.D. Hancock, J.B. Morgan, G.R. Bellinger, J.O. Reagan. Microbial mapping of beef carcasses during slaughter-Phase I. Beef Program Report. Colorado State University (Fort Collins, CO); 1998.

55. Sofos, J.N., G.C. Smith. Evaluation of various treatments to reduce contamination on carcass tissue. Proc. Intl. Conf. Meat Sci. and Technol. (Barcelona, Spain); 44:316; 1998; (Abstr.)

56. Sofos, J.N., G.C. Smith. Nonacid meat decontamination technologies: Model studies and commercial applications. Int. J. Food Microbiol. 44(3):171; 1998.

57. Ware, L.M., M. Kain, J.N. Sofos, K.E. Belk, G.C. Smith. A comparative evaluation of sponging and excising as sampling procedures for microbiological analysis of beef carcass tissue. IAMFES Ann. Mtg. JFPRDR 61(A):61; 1998; (Abstr.)

58. Ware, L.M., M.L. Kain, J.N. Sofos, K.E. Belk, G.C. Smith. Influence of sampling procedure and stage of sampling on the microbiological status of fresh beef. J. Anim. Sci. 76(1):142, 1998; (Abstr.)

59. Zutara, S.M., E. Ryser, C.W. Donnelly, H. Chen. Development of whey protein films of low pH for improving the quality of beef frankfurters. IFT Ann. Mtg., (Atlanta, GA); 1998 (Abstr.)

Beef Quality

60. Benyshek, L.L., K. Andersen, J.M. Bradford, M.J. Engler, P. Genho, J. Gibb, G.C. Smith. Industry panel round table discussion. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf. Texas A&M Univ., p. 40, 1997; (Abstr.)

61. Benyshek, L.L., I. Misztal, C. Baile, F. Grignola. Implementation and future directions. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 34, Texas A&M University, 1997; (Abstr.)

62. Boleman, S.L., S.J. Boleman, W.W. Morgan, D.S. Hale, D.B. Griffin, J.W. Savell, R.P. Ames, M.T. Smith, J.D. Tatum, T.G. Field, G.C. Smith, B.A Gardner, J.B. Morgan, S.L. Northcutt, H.G. Dolezal, D.R. Gill, F.K. Ray. Natl. Beef Quality Audit-1995: Survey of producer-related defects and carcass quality and quantity attributes. J. Anim. Sci. 76:96; 1998.

63. Bradford, J.M. Implementation and future directions. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 39. Texas A&M Univ., 1997; (Abstr.)

64. Cabedo, L., J.N. Sofos, G.R. Schmidt, G.C. Smith. Changes in bacterial counts of vacuum-packaged beef from animals fed high vitamin E. Proc. Intl. Cong. Meat Sci. and Tech. Barcelona, Spain); 44:322; 1998; (Abstr.)

65. Cabedo, L., J.N. Sofos, G.C. Smith. Bacterial growth in ground beef patties made with meat from animals fed diets without or with supplemental vitamin E. J. Food Prot. 61:36; 1998.

66. Davis, S.K. Positional cloning and marker assisted selection. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 30, Texas A&M University, 1997; (Abstr.)

67. Delmore, R.J., G.R. Schmidt, J.D. Tatum, J.N. Sofos, G.C. Smith. Supplementation of vitamin E to bovine females in "white cow," mature beef, upgrading programs. J. Muscle Foods 9:153; 1998.

68. Engler, M.J. Genetics of carcass quality: Industry needs — Feeder's perspective. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 10, Texas A&M University, 1997; (Abstr.)

69. Frahm, R.R. Genetics of carcass quality: Industry needs — USDA perspective. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 13. Texas A&M University, 1997; (Abstr.)

70. Genho, P. Genetics of carcass quality: Industry needs — Breeder's perspective. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 11. Texas A&M University, 1997; (Abstr.)

71. Grobet, L., D. Poncelet, L.J. Royo Martin, D. Pirottin, B. Brouwers, M.A.J. Georges. Positional cloning and marker assisted selection. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf. Texas A&M Univ., p. 28; 1997; (Abstr.)

72. Hetzel, J., G. Davis. Mapping quantitative trait loci: A new paradigm. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 24. Texas A&M University, 1997; (Abstr.)

73. Holm, T. Implementation and future directions. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 37. Texas A&M University, 1997; (Abstr.)

74. Morris, C.A., J.W. Wise, K.E. Belk, R.R. Jones, G.C. Smith, H.C. Abraham. The USDA beef quality grading system B-Maturity grade change. Proc. of the Intl. Cong. of Meat Sci. and Technol. (Auckland, New Zealand); 1997.

75. Rawlings, E.L., L.A. Drake, J.B. Smith, B.J. Cook, M.W. Murphey, J.W. Turner. Genetics of carcass quality: Results from quantitative approaches. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf. p. 18; Texas A&M Univ.; 1997. (Abstr.)

76. Ringkob, T.P. Beef Tenderness. Pres. at Nevada Cattlemen's Assoc. Ann. Mtg., (Reno, NV); Nov.; 1998.

77. Ringkob, T.P., Y. Chiang. Image analysis to measure color change over time on fresh retail beef. Proc. Ann. Recip. Meat Conf. 51:186; 1998 (Abstr.)

78. Rouse, G., D. Wilson. Genetics of carcass quality: Results from quantitative approaches. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 15. Texas A&M University, 1997; (Abstr.)

79. Smith, G.C. Economic implications of improved color stability in beef. Proc. Dietary Strategies for Improving Muscle-Based Food Products (Madrid, Spain); 1998; (Abstr.)

80. Smith, G.C. Genetics of carcass quality: Industry needs — Packer's perspective. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 7. Texas A&M University, 1997; (Abstr.)

81. Smith, G.C. Holy cow, beef is back!! Proc. Hospitality 98 Stir It Up-Colorado Restaurant Assn. Conv. (Denver, CO); 1998.

82. Smith, G.C. Meat Science 101: Flavor, juiciness and tenderness of beef. Proc. Certified Angus Beef™ Roundup-Food Service Sales Seminar (Fort Collins, CO); 1998.

83. Smith, G.C. Meat Science 101-The taste and tenderness of beef. Pres. at the Certified Angus Beef Program. Synergy Magazine (Aug); 1996.

84. Smith, G.C., K.E. Belk, J.N. Sofos, J.D. Tatum, S.N. Williams. Economic implications of improved stability in beef. Proc. Dietary Strategies for improving Muscle-Based Food Products (Madrid, Spain); 1998.

85. Smith, G.C., J.B. Morgan, J.N. Sofos, J.D. Tatum. Supplemental vitamin E in beef cattle diets to improve shelf-life of beef. Anim. Feed Sci. and Technol. 59:207; 1996.

86. Smith, G.C., S.N. Williams, J.N. Sofos, K.E. Belk, J.D. Tatum. Supplementation of cattle diets with vitamin D_3 to improve beef tenderness or with vitamin E to improve beef color and caselife. Proc. Meat Ind. Res. Conf. (Philadelphia, PA); 1998.

87. Sofos, J.N., L. Cabedo, H. Zerby, K.E. Belk, G.C. Smith. Potential interactions between antioxidants and microbial meat quality. Proc. Dietary Strategies for Improving Muscle-Based Food Products (Madrid, Spain); 1998.

88. Stone, R. Mapping quantitative trait loci: A new paradigm. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 22. Texas A&M University, 1997; (Abstr.)

89. Sugimoto, Y. Mapping quantitative trait loci: A new paradigm. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 26. Texas A&M University, 1997; (Abstr.)

90. Taylor, J.F., S.K. Davis. Mapping quantitative trait loci: A new paradigm. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., p. 20. Texas A&M University, 1997; (Abstr.)

91. Womack, J.E., M. Amarante, C. Rexroad III, J. Schlapfer, Y. Yang. Positional cloning and marker assisted selection. Proc. of the Beef Cattle Genomics: Past, Present and Future Conf., Texas A&M Univ., p. 32; 1997; (Abstr.)

92. Zerby, H.N., K. E. Belk, J.N. Sofos, L.R. McDowell, S.N. Williams, G.C. Smith. Caselife of seven retail beef products from the carcasses of beef cattle supplemented with alpha-tocopheryl acetate. Beef Program Report. Colorado State University (Fort Collins, CO); 1998.

93. Zerby, H.N., K.E. Belk, J.N. Sofos, L.R. McDowell, S.N. Williams, G.C. Smith. Effects of initial microbiological contamination level on appearance and retail caselife of fresh beef steaks derived from cattle fed diets with different levels of vitamin E. Beef Prog. Rpt., Colorado State University (Fort Collins, CO); 1998.

94. Zerby, H.N., K.E. Belk, J.N. Sofos, L.R. McDowell, S.N. Williams, G.C. Smith. Effects of vitamin E and initial microbiological counts on beef caselife. Proc. Intl. Cong. Meat Sci. and Technol. (Barcelona, Spain); 44:490; 1998; (Abstr.)

Beef Composition

95. Belk, K.E., R.C. Cannell, J.D. Tatum, G.C. Smith. Video imaging systems for composition and quality. Proc. of the Meat Ind. Res. Conf. (Arlington, VA); 1997.

96. Belk, K.E., J.A. Scanga, J.D. Tatum, J.W. Wise, G.C. Smith. Simulated instrument augmentation of USDA yield grade application to beef carcasses. J. Anim. Sci. 76:522; 1998.

97. Cannell, R.C., K.E. Belk, C.D. Bunting, J.D. Tatum, G.C. Smith. Ability of the Hunterlab Color Vision System to augment grading accuracy and to predict the tenderness of beef. Proc. of the 50th Ann. Recip. Meat Conf. 50:158; 1997; (Abstr.)

98. Davis, S.K., J.F. Taylor. Interval mapping and positional cloning of growth ETL's in cattle. Pres. at XXVI Intl. Soc. of Anim. Genet. (Auckland, New Zealand); 1998.

99. Davis, S.K., J.F. Taylor. Positional cloning and gene diagnostics in animals. Pres. at 4th Asia-Pacific Conf. on Ag. Biotechnol. (Darwin, Australia); 1998.

100. Davis, S.L.S., J.F. Taylor, D.R. Stillwell and S.K. Davis. Comparative mapping of bovine 1q and human 21q: Is there a human homologue for horns? Proc. 10th International Genome Sequencing and Analysis Conference. The Institute for Genomic Research (Miami Beach, FL); 1998; (Abstr.)

101. De Donato, M., S.K. Davis, Y. Ji, J. Burzlaff, N. Islam-Faridi, J.E. Womack, H.J. Price, D.M. Stelly, J.F. Taylor. Integration of the bovine physical and genetic chromosome maps. Proc. Plant and Anim. Genome VI. (San Diego, CA); 1998; (Abstr.)

102. De Donato, M., S.K. Davis, Y. Ji, J. Burzlaff, N. Islam-Faridi, J.E. Womack, H.J. Price, D.M. Stelly, J.F. Taylor. Physical assignment of 24 microsatellite-containing BACs to bovine chromosomes 1 through 10, 21, and 23. Proc. of the 25th Ann. Mtg. of the Texas Genetics Society. (Austin, TX); 1998; (Abstr.)

103. Gallagher, D.S., S.K. Davis, J.F. Taylor. Molecular cytogenetic applications in the bovidae: Cattle genomics to comparative cytogenetics. Proc. Plant and Anim. Genome VI; (San Diego, CA); 1998; (Abstr.)

104. Gallagher, D.S., R. McShane, S.K. Davis, J.F. Taylor, L.C. Skow. Ordering of BoLa genomic sequences by high resolution FISH. Proc. XXVI Intl. Soc. for Anim. Genet. (Auckland, New Zealand); 1998; (Abstr.)

105. Gallagher, Jr. D.S., Y.-P. Yang, J.D. Burzlaff, J.E. Womack, D.M. Stelly, S.K. Davis, J.F. Taylor. Physical assignment of six type I anchor loci to bovine chromosome 19 by fluorescence in-situ hybridization. Animal Genet. 29:130; 1998.

106. George, M.H., H.G. Dolezal, J.D. Tatum, J.B. Morgan, J.W. Wise, C.R. Calkins, J.O. Reagan, G.C. Smith. USDA Yield grades, total body electrical conductivity and video image analysis technologies for predicting cutability of sides of steer/heifer carcasses. CSU Beef Program Report, Colorado State University (Fort Collins, CO); 1996.

107. Gill, C.A., S.K. Davis, J.F. Taylor, N.E. Cockett, C.D.K. Bottema. A complete set of ovine bacterial artificial chromosomes for accurate physical mapping in Bovidae. Proc. XXVI Intl. Soc. for Anim. Genet. (Auckland, New Zealand); 1998; (Abstr.)

108. Grosz, M.D., S.K. Davis, J.F. Taylor, L.C. Skow. MHC-linked HSP70 gene cluster architecture is conserved in cattle. Proc. XXVI Intl. Soc. for Anim. Genet. (Auckland, New Zealand); 1998; (Abstr.)

109. Hatem, I., J. Tan. Determination of skeletal maturity by image processing. Am. Soc. Agr. Eng. Ann. Intl. Mtg., (St. Joseph, MO); No. M983019; 1998; (Abstr.)

110. Kim, J.-J., S.K. Davis, J.F. Taylor. Detection of QTL allele effects between and within breeds for chromosome 19 (BTA19) in Bos indicus/Bos taurus cattle. Proc. 8th World Conf. on Anim. Prod. (Seoul, Korea); 1998; (Abstr.)

111. Lu, J., J. Tan, X. Gao, D. Gerrard. USDA beef classification based on image processing. Am. Soc. Agr. Eng. Mid-Central Conf., (St. Joseph, MO); No. MC98131; 1998; (Abstr.)

112. Rocha, J.L., J.O. Sanders, D.M. Cherbonnier, T.J. Lawlor, J.F. Taylor. Blood groups and milk and type traits in dairy cattle: After forty years of research. J. Dairy Sci. 81:663; 1998.

113. Rocha, J.L. J.O. Sanders, D.M. Cherbonnier, T.J. Lawlor, J.F. Taylor. Trait-based analysis in dairy cattle using blood group polymorphisms. J. Dairy Sci. 81:1681; 1998.

114. Schlapfer, J., D.S. Gallagher, J.D. Burzlaff, S.K. Davis, J.F. Taylor, J.E. Womack. Physical mapping of the Endothelin Receptor Type B to bovine chromosome 12. Mamm. Genom. 8:380; 1997.

115. Schlapfer, J., D.S. Gallagher., J.D. Burzlaff, J.E. Womack, D.M. Stelly, J.F. Taylor, S.K. Davis. Comparative mapping of bovine chromosome 13 by fluorescence in situ hybridization. Anim. Genet. 29:265; 1998.

116. Shay, T.L., C. Garbett, C.D.K. Bottema, S.K. Davis, J.F. Taylor, N.E. Cockett. Further characterization of the callipyge region in sheep. Proc. Plant and Anim. Genome VI. (San Diego, CA); 1998; (Abstr.)

117. Smith, G.C. Meat Science-The palatability piece. Pres. at 1996 Ann. Conf. of the American Wagyu Assn. American Wagyu Magazine (Sep); 1996.

118. Smith, G.C. Understanding today's customers and marketing to their needs; Industry trends and projections for the future; Current and future food safety issues-staying ahead. Proc. Fresh Solutions Seminar (Edison, NJ); 1998.

119. Smith, G.C., J.B. Morgan. Technology: Changing the meat you sell. Proc. Ann. AMI/FMI Meat Marketing Conf. (Nashville, TN); 1998.

120. Song, Y., D.K. Stillwell, S. Sunden, J.F. Taylor, S.K. Davis. Genetic and physical mapping of the poll locus to BTA1 in a **Bos indicus** x **Bos taurus** cross. Proc. 25th Ann. Mtg. of the Texas Genetics Society. (Austin, TX); 1998; (Abstr.)

121. Sunden, S.L.F., X. Wu, D.S. Gallagher, J.F. Taylor, S.K. Davis. Integrated comparative cytogenetic, linkage and radiation hybrid maps of human and bovine chromosome 2 reveal numerous macro and micro rearrangements. Cold Spring Harbor Genome Mapping and Sequencing; 1998; (Abstr.)

122. Taylor, J.F. Internationalization of Livestock Breeding Science. Pres. at Sixth World Congress on Genetics Applied to Livestock Production (Armidale, Australia); 1998.

123. Taylor, J.F., L.L. Coutinho, K.L. Herring, D.S. Gallagher Jr., R.A. Brenneman, N. Burney, J.O. Sanders, J.W. Turner, S.B. Smith, R.K. Miller, J.W. Savell, S.K. Davis. Candidate gene analysis of GH1 for effects on growth and carcass composition of cattle. Anim. Genet. 29:194; 1998.

124. Taylor, J.F., S.K. Davis. Bovine gene mapping, gene markers and marker assisted selection in the beef industry. Texas A&M University 44th Beef Cattle Short Course and Trade Show. (College Station, TX); 1998.

125. Taylor, J.F., S.K. Davis. Detection of quantitative trait loci influencing growth and carcass quality traits. Pres. at Challenges for the Meat Industry in the New Millenium. (Maldahide, Ireland); 1998.

126. Taylor, J.F., S.K. Davis. DNA markers for beef quality. Pres. at 4th International Murray Grey Congress. (Billings, Montana); 1998.

127. Taylor, J.F., S.K. Davis. Gene mapping for carcass quality in beef cattle. Cactus Feeders Inc. Field Day. (Amarillo, TX); 1998.

128. Taylor, J.F., S.K. Davis. Gene mapping for carcass quality in beef cattle. Pres. at Texas Retail Seminar: Beef Quality 2000. Texas Beef Council. (College Station, TX); 1998.

129. Taylor, J.F., S.K. Davis. Genetic markers for tenderness. Pres. at Intl. Livestock Cong. (Houston, TX); 1998.

130. Taylor, J.F., S.K. Davis. Report of the First Workshop on the Genetic Map of Bovine Chromosome 2. Pres. at XXVI Intl. Soc. of Anim. Genet. (Auckland, New Zealand); 1998.

131. Taylor, J.F., S.K. Davis, J.O. Sanders, J.W. Turner, J.W. Savell, R.K. Miller, S.B. Smith. Identification of QTL's for growth and carcass quality in a cross between **Bos indicus** and **Bos taurus**. Proc. Plant and Anim. Genome VI. (San Diego, CA); 1998

132. Taylor, J.F., A. Eggen, A. Aleyasin, S.M. Armitage, W. Barendse, J.E. Beever, R.A. Brenneman, B.M. Burns, S.K. Davis, K. Elo, B. Harlizius, S.M. Kappes, J.W. Keele, S.J. Kemp, B.W. Kirkpatrick, H.A. Lewin, R.Z. Ma, R.A. McGraw, D. Pomp, R.T. Stone, Y Sugimoto, A.J. Teale, D. Vaiman, J. Vilkki, J.L. Williams, C.-C. Yeh, M.C. Zanotti. Report of the First Workshop on the Genetic Map of Bovine Chromosome 1. Anim. Genet. 29:228; 1998.

133. Taylor, J.F., J.L. Rocha. QTL analysis under linkage equilibrium. Chapter 7 in Molecular Dissection of Complex Traits. (A.H. Paterson., ed); CRC Press. Inc. (Boca Raton, FL); 1997.

134. Wu, X., D.S. Gallagher, J.F. Taylor, S.K. Davis. Comparative mapping and positional candidate cloning of economic trait loci on bovine chromosome 2. Proc. 25th Ann. Mtg. of the Texas Genetics Society (Austin, TX); 1998; (Abstr.)

135. Wu, X., J.F. Taylor, S.K. Davis. Comparative mapping and positional candidate cloning of economic trait loci on bovine chromosomes 2 and 4. Proc. Plant and Anim. Genome VI. (San Diego, CA); 1998; (Abstr.)

136. Wulf, D.M., S.F. O'Connor, J.D. Tatum, G.C. Smith. Using objective measures of muscle color to predict beef **longissimus** tenderness. J. Anim. Sci. 75:684; 1997.

Meat Science/ Industry Information

137. Anonymous. Producing for demand. Drover's Journal. (November); 1998.

138. Brooks, J.C. Characterization of economically important carcass traits in the selection of herd sires. M.S. Thesis. Texas Tech University (Lubbock, TX); 1997.

139. Cook, T.W. Factors contributing to the incidence of "Dark Cutting" conditions in beef carcasses and management strategies to prevent reductions in value as a result of their occurrence. M.S. Thesis. Texas Tech University (Lubbock, TX); 1998.

140. Doherty, R.L. Developing benchmarks to familiarize cattle producers with the benefits and risks associated with grid pricing. M.S. Thesis. Colorado State University; 1998.

141. Doherty, R.L., T.G. Field, J.D. Tatum, K.E. Belk, G.C. Smith. Developing benchmarks to familiarize cattle producers with the benefits and risks associated with grid pricing. Natl. Cattlemen's Beef Assn., Final Report; 1998.

142. Field, T.G. Understanding grid pricing and the associated benefits and risks. Pres. at NCBA Cattlemen's College (Denver, CO); 1998.

143. Field, T.G. Understanding grid pricing and the associated benefits and risks. Pres. at Beef Improvement Center Field Day and Cattlemen's Seminar (Saratoga, WY); 1998.

144. Field, T.G. Understanding grid pricing and the associated benefits and risks. Pres. at Red Angus Association of America Annual Convention (Sheridan, WY); 1998.

145. Field, T.G. Understanding grid pricing and the associated benefits and risks. Pres. at Colorado Beef Quality Assurance Symposium (Fort Collins, CO) 1998.

146. Field, T.G. Understanding grid pricing and the associated benefits and risks. Robert E. Taylor Cattlemen's Seminar (Fort Collins, CO); 1998.

147. Field, T.G., J.D. Tatum. Gambling on the grid: Educational video. Wahoo Productions; 1998.

148. Field, T.B., J.D. Tatum, K.M. Kimsey. Grid pricing: A workbook. Natl. Cattlemen's Beef Assn.; 1998.

149. Hale, D.S. Beef cattle valve video and user's guide. Natl. Cattlemen's Beef Assn.; 1998.

150. Hilton, G.G., J.D. Tatum, S.E. Williams, K.E. Belk, F.L. Williams, J.W. Wise, G.C. Smith. An evaluation of current and alternative systems for quality grading carcasses of mature slaughter cows. J. Anim. Sci. 76:2094; 1998.

151. Ishmael, W. Beating the grid. Beef Today. (February); 1998.

152. Ishmael, W. Partnering. Western Cowman. (July/August); 1998.

153. Kimsey, K.M. An educational tool for understanding grid pricing of cattle. M.S. Thesis. Colorado State University (Fort Collins, CO); 1998.

154. Maday, J. Defining value. Drover's Journal. (May); 1998.

155. McNeill, M.S. Communicating the value of veal to retail and food service. M.S. Thesis. Texas A&M Univ. (College Station, TX); 1997.

156. McNeill, M.S., D.B. Griffin, T.R. Dockerty, J.P. Walter, H.K. Johnson, J.W. Savell. Retail yield and fabrication times for veal as influenced by purchasing options and merchandising styles. J. Anim. Sci. 76:1613; 1 998.

157. Samber, J.A., J.D. Tatum, M.I. Wray, W.T. Nichols, J.B. Morgan, G.C. Smith. Implant program effects on performance and carcass quality of steer calves finished for 212 days. J. Anim. Sci. 74:1470; 1996.

158. Savell, J.W., J.P. Walter, R.P. Garrett, C.L. Lorenzen, D.B. Griffin, T.R. Dockerty, H.K. Johnson. A value-based meat marketing program. Proc. Recip. Meat Conf. 48:91; 1995.

159. Scanga, J.A., K.E. Belk, J.D. Tatum, T. Grandin, G.C. Smith. Factors contributing to the incidence of dark cutting beef. J. Anim. Sci. 76:2040; 1998.

160. Scanga, J.A., K.E. Belk, J.D. Tatum, T. Grandin, G.C. Smith. Managing dark cutters in the feedlot. Beef Program Rpt., Colorado State University (Fort Collins, CO); 1998.

161. Smith, G.C. Assurances the industry must provide-now and in the future-to consumers of US beef. Proc. Farm-to-Beef Conf. (Kansas City, MO); 1998.

162. Smith, G.C., T. Grandin. Animal handling for productivity, quality and profitability. Am. Meat Inst. Ann. Conv. (Philadelphia, PA); 1998.

163. Tatum, J.D., T.G. Field. Economic implications of sorting finished cattle for 'Grid Marketing." Natl. Cattlemen's Beef Assn., Final Report; 1998.

Nutrition Research

164. Agrawal, S., J.T. Heimbach, M.M. Amann, F. Mohammedshah, J.S. Douglass. Relative intakes of conjugated linoleic acid (CLA) from meat and dairy products as a function of sex and age. J. Am. Coll. Nutr. 17(5):526; 1998; (Abstr.)

165. Ahluwalia, N., D. Krause, M. Miles, S. Leach, A Mastro. Aging and immune function in well-nourished women. Pres. at 4th Nat Symposium Basic Aspects of Immunology (Bethesda, MD); 1998.

166. Ahluwalia, N., D. Krause, M. Miles, S. Leach, A Mastro. Cell-mediated immunity (CMI) and bactericidal function in apparently healthy, well-nourished elderly vs. younger women. FASEB J. 12(5):A872; 1998; (Abstr.)

167. Aiso, K., Y. Mizuno, K.E. Johnston, T. Tamura. Food folate analysis: Trienzyme treatment. Vitamins 72(9):429; 1998.

168. Aiso, K., T. Tamura. Optimal conditions of trienzyme treatment for food folate analysis. FASEB J. 12:A549; 1998.

169. Aiso, K., T. Tamura. Trienzyme treatment for food folate analysis: Optimal pH and incubation time for a-amylase and protease treatments. J. Nutr. Sci. Vitaminol. 44:361; 1998.

170. Davidson, M.H., D. Hunninghake, P.O. Kwiterovich, K.C. Maki, M.R. Dicklin, S.D. Kafonek. Effective incorporation of lean red meat into an NCEP Step 1 diet. J. Am. Heart Assn. 71:I-584; (Abstr.)

171. Davidson, M.H., D. Hunninghake, K.C. Maki, P.O. Kwiterovich, S. Kafonek. A long-term, randomized clinical trial to compare the effects of lean red meat vs. lean white meat on serum lipids among free-living persons with hypercholerterolemia. Arch. Intern. Med. (In Press); 1999.

172. Flagg, E.W., K. Huang, R.J. Coates, W. McClellan, J. Boring, J. Calle, M. Thun. Asso-ciation of food groups with red meat consumption. FASEBJ. 12(5): A842; 1998; (Abstr.)

173. Fleming, D., P. Jacques, P. Wilson, R. Wood. Heme and supplemental iron intake increase the risk of high iron stores in a free-living elderly population: The Framingham Heart Study. FASEB J. 12(5):A821; 1998; (Abstr.)

174. Fleming, D.J., P.F. Jacques, G.E. Dallal, K.L. Tucker, P.W.F. Wilson, R.J. Wood. Dietary determinants of iron stores in a free-living elderly population: The Framingham Heart Study. Am. J. Clin. Nutr. 67:722; 1998.

175. Houseknecht, K.L., J.P. Vanden Heuvel, S.Y. Moya-Camarena, C.P. Portocarrero, L.W. Peck, K.P. Nickel, M.A. Belury. Dietary conjugated linoleic acid normalizes impaired glucose tolerance in the Zucker diabetic fatty fa/fa rat. Biochem. and Biophys. Res. Comm. 244:678; 1998.

176. Sun, J., N. Ahluwalia, E. Morse, N.R. Haley, C. Lammi-Keefe. Ratio of serum transferrin receptor (s-TFR) to serum ferritin (s-FT) in diagnosis of iron deficiency in elderly women. FASEB J. 12(5):A877; 1998; (Abstr.)

177. West, D.B., J.P. Delany, P.M. Camet, F. Blohm, A.A. Truett, J. Scimeca. Effects of conjugated linoleic acid on body fat and energy metabolism in the mouse. Am. J. Physiol. 275:R667; 1998.

178. Westcott, J.L., N.B. Simon, N.F. Krebs. Growth, zinc and iron status, and development of exclusively breast-fed infants fed meat vs. cereal as a first weaning food. FASEB J. 12(5):A848; 1998; (Abstr.)

179. Wood, R.J., Iron: Too much of a good thing. Eating Well Magazine (Sept.); 1998.

180. Wood, R.J., D.J. Fleming, P.F. Jacques, P.W.F. Wilson. Iron status of the elderly Framingham Heart Study cohort: An iron-replete population with a high prevalence of elevated iron stores. FASEB J. 12(5):A846; 1998; (Abstr.)

NCBA RESEARCH LEADERS

Quality Group

Walt Rowden, Chairman
Greg Ibach, Vice Chairman

Consumer Marketing

Nancy Pellett, Chairman
Steve Henshaw, Vice Chairman

Communications Group

Lyle Gray, Chairman
Bob Schmidt, Vice Chairman

COMMITTEES/SUBCOMMITTEES

Science and Technology Committee

Ray Gerringa, Chairman
Myron Openshaw, Vice Chairman
Terry Dockerty, NCBA Staff

Animal Disease Subcommittee
Bob Bohlender, Chairman
Glenn Blodgett, Vice Chairman
Terry Dockerty, NCBA Staff

Product Enhancement Subcommittee
Dave Nichols, Chairman
Rodney Nelson, Vice Chairman
J.O. Reagan, NCBA Staff

Production Efficiency Subcommittee
Barry Dunn, Chairman
Eric Davis, Vice Chairman
Renee Lloyd, NCBA Staff

New Market Initiatives Committee

Lee Hall, Chairman
Coney Burgess, Vice Chairman
Mark Thomas, NCBA Staff

Beef Safety Committee

Van Amundson, Chairman
Jay Wolf, Vice Chairman
Mike Smith, NCBA Staff

Beef Quality Assurance Subcommittee
Ran Smith, Chairman
Bob Kerschen, Vice Chairman
Gary Cowman, NCBA Staff

Beef Safety Research Subcommittee
Ernie Reeves, Chairman
Jim Wright, Vice Chairman
J.O. Reagan, NCBA Staff

Nutrition and Health Committee

Dave Bateman, Chairman
Patty Clark, Vice Chairman
Mary Young, NCBA Staff

Human Nutrition Research Subcommittee
Burke Healey, Chairman
Ron Bieber, Vice Chairman
Mary Young, NCBA Staff

NCBA RESEARCH STAFF

Center for Quality

Jim Gibb, Ph.D.
Vice President

Gary Cowman, Ph.D.
Executive Director of Quality Assurance

James O. Reagan, Ph.D.
Executive Director of Science and Technology

Terence R. Dockerty, Ph.D.
Director of Research Information

Renee Lloyd, M.S.
Director of Production Systems

Michael Smith, M.S.
Assistant Director of Quality Assurance

Michele Melody
Grants Administrator

Mary Ann Yanik
Administrative Coordinator

Ingrid Bendzsa
Administrative Assistant

Carrie Myhelic
Administrative Secretary

Center for Consumer Marketing

Mary M. Adolf, M.S., R.D.
Vice President, Consumer Marketing, US

Mark W. Thomas, M.S.
Vice President, New Marketing Initiatives

Michael Uetz, M.S.
Executive Director of Meat Marketing Technology

Carl Blackwell
Executive Director of Product Development

Annette Robbins, M.B.A.
Director of Market Research

Center for Communications

Mary Young, M.S., R.D.
Director of Nutrition Research and Information

Richard Staack, Ph.D.
Assistant Director, Human Nutrition Research

Center for Public Policy

Gary Weber, Ph.D.
Executive Director of Regulatory Affairs

Chuck Lambert, Ph.D.
Chief Economist

Appreciation is expressed to Carrie Myhelic, Michele Melody and Mary Ann Yanik for their assistance in assembly of this report. Special thanks to Carrie Myhelic for her diligence and attention to detail needed for its completion.

T. R. Dockery, Ph.D., Editor

THIS REPORT WAS DEVELOPED BY THE NATIONAL CATTLEMEN'S BEEF ASSOCIATION AS PART OF A COORDINATED EFFORT WITH STATE BEEF COUNCILS AND THE BEEF BOARD. MANY OF THE RESEARCH PROJECTS OUTLINED IN THIS REPORT ARE FUNDED THROUGH THE $1-PER-HEAD BEEF CHECKOFF AND CONTRIBUTE TO THE DEVELOPMENT OF DEMAND-BUILDING PROGRAMS.

Denver Office
5420 South Quebec
Greenwood Village, CO 80111

Chicago Office
444 North Michigan Avenue
Chicago, IL 60611

Washington D.C. Office
1301 Pennsylvania Avenue NW, Suite 300
Washington, D.C. 20004