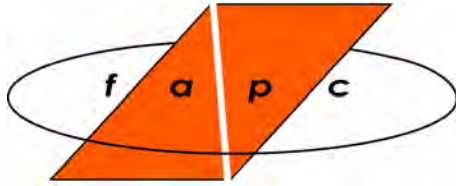


Annual Report 2002



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Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990, and other federal laws and regulations, does not discriminate on the basis of race, color, national origin, sex, age, religion, disability, or status as a veteran in any of its policies, practices or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services.

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Executive Summary

J. Roy Escoubas | director

The Food and Agricultural Products Research and Technology Center is a state-of-the-art research and development, business development and business and technology outreach laboratory. This 96,000 square-foot facility has research laboratories, pilot plant facilities, offices and conference rooms that support a faculty and professional staff that fosters growth of value-added food and agricultural products processing in Oklahoma.



J. Roy Escoubas, Director

This faculty and professional staff represent the disciplines of agricultural economics, business and marketing development, horticultural food science, food process engineering, food microbiology, oil seed chemistry, food grain science, forest products science, food safety and quality technology, food harvesting and processing technology and food sensory science. Center faculty and staff work to discover value-added products and

processes to enhance the value of Oklahoma agricultural commodities. The Center has participated in more than 850 client projects for Oklahoma and the region bringing more than 80 start-up companies into Oklahoma and scores of new products for the market. Center faculty and staff assist food industry and entrepreneurial clients identify, develop and commercialize products, as well as help them train and educate their staff and

develop business plans to expand their businesses.

Finally, Center faculty and staff have scientific research projects that contribute to fundamental science knowledge in agricultural commodities and food products. In five short years, the Center has developed a research program based on more than \$2 million of annual extramural funding. Because of the high impact nature of Center research, the extramural funding base will continue to increase.

I am very pleased with the contributions of the Center. It has demonstrated success in increasing the value of Oklahoma agricultural commodities and food products and success in contributions to scientific knowledge in food science, food safety and food processing.

I believe you should consider a working relationship with the Center for your needs in business, technology and science.

Research Projects

Research projects

The Oklahoma Food and Agricultural Products Research and Technology Center houses approximately 20 faculty and staff members in a variety of technical areas. Center faculty and staff perform scientific research projects that contribute to the knowledge of agricultural commodities and food products. These research projects are funded through grants from agencies, such as the U.S. Department of Agriculture, the Oklahoma Agricultural Experiment Station and the Oklahoma Center for the Advancement of Science and Technology, as well as through private funding.

“Our Center faculty and professional staff bring in over \$2,000,000 of extramural research funding; a truly incredible accomplishment for only five years from start-up with no equipment or instrumentation in our labs.”

J. Roy Escoubas, Director



Research projects

DANIELLE D. BELLMER, Ph.D.

Title: Improvement of Oxygen Transfer During Xanthan Gum Fermentation

Project Participants: Siobhan Reilly, FAPC

Funding Sources: OSU Center for Energy Research, Food Research Initiative Program

Objectives: 1) Develop and test a microbubble generation system for use in enhancing mass transfer during xanthan gum fermentation 2) Investigate the potential use of an ultrasonic treatment system for use in enhancing mass transfer during xanthan gum fermentation

Executive Summary:

Commercial production of xanthan gum occurs in a conventional aerobic batch fermentation process and as fermentation proceeds, the viscosity of the broth limits oxygen transfer to the microbes. The focus of this work is to investigate new techniques for enhancing mass transfer in the system; specifically the use of microbubbles and the use of ultrasound. Experiments are being conducted in 14-L fermenters fit with dissolved oxygen, pH and temperature control. A microbubble generator has been designed and built and is operational. Initial runs indicate that the microbubbles are stable and pump able. Runs to date have been conducted in semi-batch

mode, to allow addition of microbubbles without the need for filtering of cells. Also, a flow-through ultrasonic cell has been obtained, and initial fermentation runs have been conducted for optimization of frequency and amplitude. Initial results look very positive, indicating that both methods have the potential to greatly improve mass transfer.

Work to be Completed:

Additional experiments will focus on quantifying the improvement in mass transfer attained by each type of system. In addition, a comparative study of the energy consumption with each type of process will be investigated. Both the microbubble and the ultrasonic systems will then need to be optimized.

Title: Conversion of Biomass to Ethanol

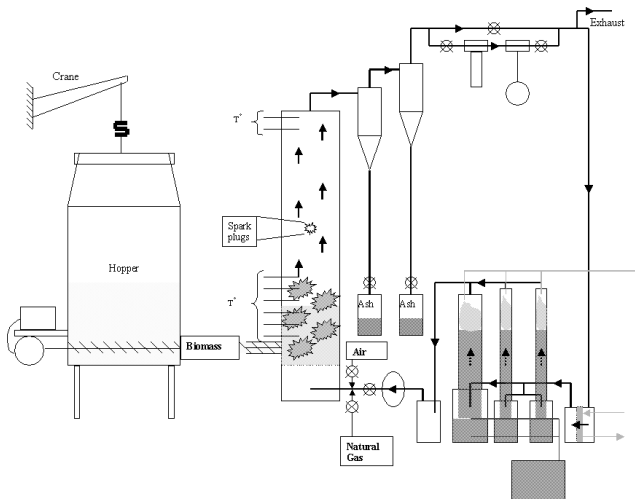
Project Participants: Ray Huhnke, Tim Bowser, Biosystems and Agricultural Engineering; Randy Lewis, A.J. Johannes, Chemical Engineering; Charles

Taliaferro, Plant and Soil Sciences; Francis Epplin, Agricultural Economics; Ralph Tanner, University of Oklahoma

Funding Sources: USDA IFAFS grant (2000-2004), CSREES special research grant (2000-2003), Williams Bioenergy Company (1999-2003)

Objectives: This project is a large multidisciplinary effort with the overall objective of investigating the production of ethanol from various biomass feedstocks via an unique gasification/bioreaction process. Our specific objectives involve optimization of the gasification of various biomass feedstocks in order to produce a high quality synthesis gas for use in a bioreactor.

Executive Summary: The main goal for the project is to be able to economically produce



This model shows a biomass-to-ethanol conversion system used to produce ethanol from various feedstocks.

Research Research projects, continued

ethanol from biomass using a novel gasification/fermentation process. The team is currently working on all aspects of the process, including biomass harvesting and storage, biomass gasification, bioreactor operation, microbial optimization and economic assessment. Work within Biosystems and Agricultural Engineering involves the biomass processing and gasification to generate a high quality producer gas. To date, switchgrass has been the feedstock of choice and has been successfully gasified in a fluidized bed gasifier to produce high-quality synthesis gas. This past year we were able to physically connect the gasifier to the bioreactor and prove that this process could be used to produce ethanol. In addition, we have incorporated an educational component in the project and have hired an agricultural education graduate student who has begun the development of several fact sheets, middle school educational materials and a survey about the use of ethanol and alternative fuels.

Work to be Completed: Continued work involves further optimization of each part of the process, and investigation of the

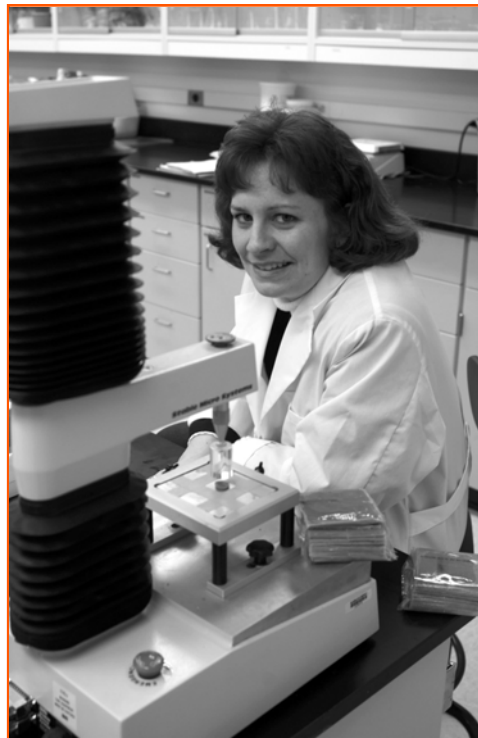
potential use of a range of biomass feedstocks, including Bermuda grass, corn stover and corn mash waste.

Title: Rheological Characterization of Semi-Solid Foods

Funding Sources: Oklahoma Agricultural Experiment Station

Objective: To evaluate and quantify the errors occurring due to normal force variations during dynamic rheological measurement of semi-solid foods

Executive Summary: The



The Center continues to provide assistance for PB Slices to help ensure a high-quality product.

dynamic rheological properties of several semi-solid food products, including various meats and cheeses, have been extensively studied. Results indicate that normal force during loading has a very large effect on dynamic rheological measurements taken thereafter. The effects of normal force have been quantified for various products. Results have been very exciting because this is an important new finding for the field of rheology. The errors, which have been identified as being caused by normal force, can help to explain a large amount of the variability seen in oscillatory data for many years. Knowledge of the importance of normal force has never been discussed in the literature, but rheometer companies realize its importance and have begun creating software to control the problem.

Work to be Completed: Journal publications are currently being completed.

Title: Development of PB Slices

Project Participants: William McGlynn, FAPC

Funding Sources: Past Sources: Oklahoma Peanut Commission (1999-2001), Food Research Initiative Program (2000-2001)

Objectives: 1) Provide ongoing research support for the new PB Slices product, which was developed at OSU, and 2) Examine potential PB Slices

Research Research projects, continued

product extensions

Executive Summary: The PB Slices product hit retail shelves this past year when Kennedy Foods began marketing and selling the product in various supermarkets and convenience stores around the South-Central United States. However, some process corrections had to be made because initial production runs created a product that was very hard to peel and had poor quality. Kennedy Foods has begun to receive orders nationwide, and very soon the product will be distributed nationally. Related research has involved the formulation of several modified slices, including reduced fat and calcium fortified slices. In addition, we have worked with a Soy Nut Butter Company to formulate a soy slice from their Soy Butter.

Work to be Completed:

Continue to provide assistance for the new PB Slices product to help ensure continued production of a high quality product. Follow up on the market potential of a soy slice.

Title: Osmotic Dehydration of Watermelon

Funding Sources: Oklahoma Agricultural Experiment Station, Wentz Research Project Scholarship (awarded to Mary Crawford, a biosystems engineering undergraduate student)

Objectives: Develop a new value-added dried product from watermelon

Executive Summary: This project is in its early stages and involves the development of a new product from watermelon. The idea is to create a chewy watermelon candy, similar to other products created from dried fruits. Watermelon has been one of the largest acreage crops in Oklahoma for a number of years, and each year a significant number of second-class melons are left in the fields, representing a large volume of sweet melon tissue, which is wasted. Other related research has shown that watermelon may be a good source of lycopene, giving it the potential to serve as a nutraceutical. Value-added products containing watermelon may become more valuable in the near future. Initial experimental results indicate that osmotic dehydration of watermelon tissue is a viable option for creating a sweet, chewy product. Product color, texture and flavor can all be greatly influenced by pre-processing and dehydration techniques, and these processing variables are currently being optimized.

Work to be Completed: Future work will involve evaluation of drying alternatives, retention of ideal colors and flavors and evaluation of product shelf life.

Title: Tensile Strength of Veterinary Sutures

Project Participants: Ellen Davidson and Chelsea Greenberg, Veterinary Medicine

Funding Sources: College of Veterinary Medicine House Officer Research Funds

Objectives: Evaluate the strength and durability of new suture products for use in veterinary intestinal fluid applications

Executive Summary: This is a texture analysis project in cooperation with researchers in Veterinary Medicine. It involves testing the tensile strength of various new suture materials after being soaked in diverse media (contaminated and sterile urine) for various time periods. An apparatus and method for securing and testing the sutures with the tensile rig on the texture analyzer had to be developed. Tests were conducted over a period of four months and included four different suture materials, five different types of media and five different soak times, lasting up to four weeks. Testing is complete and the data is being analyzed.

Work to be Completed: Texture analysis data is currently being statistically analyzed, and a journal article is being written for the Journal of Veterinary Surgery.

Research Research projects, continued

TIMOTHY J. BOWSER, Ph.D.

Title: Biomass Conversion to Ethanol (October 1999 to June 2004)

Funding sources: USDA 401 IFAFS Special Research Grants Program 2001, USDA CSREES 2001, The Williams Corp., Western Regional Biomass Energy Program 1999, OSU, FAPC FRIP program, OSU Vice President of Research

Objectives: Conversion of agricultural biomass to ethanol (and other useful industrial products)

Executive Summary:

Developments within the last decade have led to a process with the potential to produce liquid fuel, derived from agricultural biomass, at a price competitive with gasoline. In this process, biomass is pyrolyzed (gasified) to produce a syngas that is then converted to ethanol with a microbial catalyst. The biomass can be an existing residue or be produced on underutilized land such as rangeland or USDA CRP land. Such a biomass energy system would have a major impact on rural Oklahoma. Economic development in rural areas could be greatly enhanced as poorly utilized land and agricultural residues are given economic value. Income would also go directly to rural Oklahoma from biomass conversion

facilities and to the facility operators, as well as those who harvest, transport and process the biomass. Ethanol is an oxygenated fuel, burns cleanly and would have a positive impact on the environment. Two faculty members from the FAPC, Dani Bellmer and Timothy Bowser, are working on the gasification portion of the biomass conversion process. Their objectives are to pyrolyze the biomass to produce a high-quality synthesis gas that can be utilized by microbes to produce ethanol. They continue to work on the design, operation and optimization of a



Flames from ethanol gas are produced from pyrolyzed biomass. Ethanol is environmentally-friendly and burns cleanly.

fluidized-bed gasifier. This project is a multidisciplinary venture between OSU, OU, Mississippi State University and the Williams Cos.

Work to be completed: This ongoing project will be completed when enough data has been collected to design, build and test a full-scale biomass to ethanol conversion facility.

Title: Steam-Injection Heating

Funding sources: OSU, FAPC, OSU Agricultural Experiment Station

Objectives: Determine stable operating parameters and design information for steam injection heaters

Executive Summary: Industry uses steam-injection heating technology to cook many pumpable food products including meats, cereal grains and fruits. Steam-injection heating could potentially be used by many processors in Oklahoma, bringing tangible economic and quality benefits. A pilot-scale steam-injection heater is available in the FAPC laboratory. Timothy Bowser and Paul Weckler (Biosystems and Agricultural Engineering) have been assisting on research efforts involving sizing, vibration and noise reduction and process optimization of steam-injection heating.

Research Research projects, continued

Work to be completed: A paper has been presented at the ASAE 2002 annual meeting and for subsequent publication. A new M.S. student has been recruited to continue research in the spring of 2003.

Title: Biofuel from Hog-Slaughter By-products

Funding sources: OSU, FAPC FRIP

Objectives: Converting waste pork processing by-products to usable energy, using gasification technology

Executive Summary:

Tim Bowser, Paul Weckler (Biosystems and Agricultural Engineering), and Christina DeWitt (Animal Science), have teamed up to execute a two-year FRIP project. The project proposes the gasification of hog-slaughter by-products to help solve a burgeoning disposal problem of many food processors. Hog-slaughter by-products will be minimally treated and safely converted to a syngas which can be used to fire a boiler or co-generate electricity. Initial combustion experiments have confirmed the feasibility of this process. Current work includes the building of a prototype

gasifier. Chief benefits of the process will be a reduction in landfill operations, an improvement in plant sanitation and a valuable by-product from otherwise wasted or low-value materials.

Work to be completed: Feasibility study completed,



Tim Bowser works on converting hog-slaughter byproducts into a syngas which can be used to co-generate electricity and improve plant sanitation.

prototype gasifier designed and under construction.

Title: Development and Testing of Capability to Perform Preference Trials for Pet Food and Animal Feed Formulations

Funding sources: OSU, FAPC FRIP

Objectives: Establish the capability of animal food testing and evaluation using in-home preference trials

Executive Summary: Expertise and facilities for animal food and pet-treat testing were developed at OSU under this project. The ultimate purpose of the project is to add value to Oklahoma's meat and wheat byproducts by encouraging their transformation into high-profit pet foods. Tim Bowser and Charles Abramson (Psychology) are the leaders on this project.

Work to be completed: A model for pet-treat development and testing was successfully designed and executed.



"Citizen Scientists" conduct in-home taste tests on pet foods and treats composed of Oklahoma meat and wheat byproducts. The testing is done in cooperation with the FAPC to produce high-profit pet foods.

Research Research projects, continued

NURHAN TURGUT DUNFORD, Ph.D.

Title: Processing Options for Wheat Germ Oil Extraction and Refining

Objective: Develop environmentally benign novel processing techniques for wheat germ oil extraction and refining

Funding Sources: FAPC research funds

Executive Summary: Wheat germ oil has a number of nutritional and health benefits such as reducing plasma and liver cholesterol levels, improving physical endurance/fitness and delaying aging. These effects are attributed to the high concentration of bioactive compounds present in the wheat germ. Wheat germ is one of the richest natural sources of vitamin E. The first phase of this project was to examine the pressurized solvent extraction method as an alternative technique for conventional oil extraction methods. Our experimental results indicate that a pressurized solvent extraction technique reduces solvent consumption and extraction time with no adverse effect on the oil quality. Extraction efficiency of pressurized solvent-extracted wheat

germ oil was similar to that of extracts obtained using conventional hot hexane extraction. Effects of temperature (45-135°C at 1,500 psi pressure) and solvent type on the fatty acid, specifically omega-3 and omega-6 fatty acids, phytosterol, tocopherol and tocotrienol content of the wheat germ oil also were studied. It was shown that pressurized solvent extraction at high temperatures did not have any adverse effects on the bioactive components of the wheat germ oil. Nutritional quality of pressurized solvent-extracted wheat germ oil was superior to that of the soybean and rice bran oil and soxhlet-extracted wheat germ oil. The first phase of this research is complete. We are currently working with Jose L. Martinez of Thar Technologies (Pittsburgh,

Pa.), on scale-up properties and equipment design for a wheat germ oil extraction process. Thar Technologies is a company that designs, manufactures and does economic feasibility studies for industrial-scale high-pressure processing.

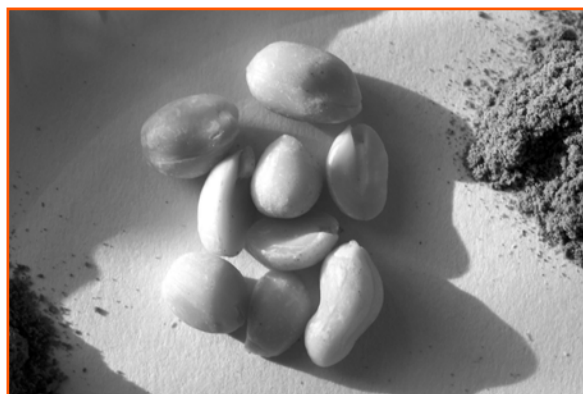
Work to be completed: Two invited oral presentations at the international scientific conferences and one oral and one poster presentation at local meetings were given on the research findings of this project. A manuscript on this subject is submitted to a journal for publication. A second manuscript is being prepared for publication. The next phase of this project will be the supercritical fluid extraction, fractionation and short-path distillation of wheat germ oil. Wheat germ oil will be refined, and nutritionally beneficial

compounds naturally present in the wheat germ oil will be concentrated in the refined oil, utilizing novel techniques.

Title: Effect of Oil Extraction Methods on Isoflavone Recovery from Soybeans

Objective: Examine the effect of oil extraction methods on subsequent isoflavone recovery from soybeans

Funding Sources:



Soybean oil, which is rich in isoflavones, can be extracted a number of ways. Isoflavones are in demand for their cancer-preventing, blood cholesterol-lowering and antioxidant properties.

Research Research projects, continued

Oklahoma Agricultural Experiment Station and FAPC funds

Executive Summary: Isoflavones are one class of compounds that possess cancer-prevention, blood cholesterol-lowering and antioxidant properties. Isoflavones are found in soybeans in large amounts. There is a great interest in products containing soy ingredients. Soy proteins and isoflavone concentrates are obtained from defatted soybeans. Knowledge on effect of oil extraction methods on isoflavone amount and form in the soybean meal is very important for the value of defatted soybean meal, which can be utilized to recover isoflavone/protein isolates/concentrates. In this project,

the effect of oil extraction methods such as enzyme-aided aqueous extraction, pressurized-solvent extraction, conventional hot-hexane extraction, mechanical pressing and supercritical fluid extraction on protein and isoflavones in the residual soybean meal is being studied. Analytical methods to extract and analyze isoflavones in soybeans have been developed. Currently enzyme-aided soybean oil extraction is being studied.

Title: Unintentional Changes in Lipophilic Bioactive Compounds Caused by Peanut Breeding and Genetic Engineering

Objective: Examine the unintentional changes in the composition of lipophilic bioactive peanut components

that may occur due to genetic modifications and breeding

Funding Sources: Oklahoma Agricultural Experiment Station, Plant and Soil Sciences student assistantship and FAPC funds

Executive Summary:

Biotechnology is widely used for modification of various crop and oilseed traits such

as fatty acid composition, insect and drought resistance, oil/protein ratio, etc. The effect of these modifications on the nutritionally beneficial bioactive plant components is usually overlooked unless these components are the specific targets for the modifications. However, genetic modifications and breeding may result in unintentional changes in the compositions of nutritional compounds naturally present in the plants. This project examines unintentional changes in the composition of lipophilic bioactive plant components that may occur due to the genetic modifications and breeding. Phytosterol, tocopherol, tocotrienol, phospholipids and resveratrol content of modified peanuts will be examined. Focus of this study will be the peanut varieties grown in Oklahoma. A Ph.D. student is working on this project toward his degree. This work is being carried out in collaboration with the Department of Plant and Soil Sciences peanut specialist and Kelly Chenault of USDA/ARS, Plant Science and Water Conservation Research Laboratory, Stillwater, Okla.

Title: Value-Added Product Development from Oklahoma-Grown Peanut and Pecan Shells

Objective: Evaluate the



Genetic modifications to insect and drought resistance or fatty acid composition during peanut breeding may cause unintentional changes in certain naturally-occurring nutritional components, such as lipophilic bioactive compounds. (Photo by Nikki Davis Brinlee.)

Research projects, continued

Research

potential of Oklahoma-grown peanut and pecan shells for value-added product development. The specific objectives include utilization of pecan- and peanut-shell ash for soap and adsorbent manufacturing

Funding Sources: FAPC/FRIP funds (2002-2003)

Executive Summary: Pecan and peanut shells are by-products of the nut processing industry. They are used in low-value applications such as mulch, fuel, sound insulation, poultry bedding, drilling mud components and wallboard production. Peanut and pecan shells offer an inexpensive and renewable source for adsorbent, i.e. activated carbon production. Most commercial-activated carbons are from non-renewable sources such as coal. Nut shells can be used as activated carbon and replace existing coal-based carbons. These products can be utilized in many industrial applications, including removal of color and odor compounds and sequestering metal ions from solutions. Soaps are the sodium or potassium salts of fatty acids. Today sodium or potassium hydroxide is commonly used for soap making processes. This project

deals with process development for extraction of sodium and potassium salts from pecan and peanut shells and use of these salts for manufacturing soap products, which would target “organic/all-natural minded” consumers. Currently, an undergraduate student is working on the project. A graduate student is expected to start on the project next semester.

Title: Oregano Oil Processing

Objective: Develop extraction and fractionation methods for essential oil recovery from oregano

Funding Sources: CIRENA-Center of Investigation of Natural Resources, Chihuahua, Mexico

Executive Summary: Oregano oil is used in cosmetics,

perfumery and pharmaceutical industries. It has been reported that oregano oil possesses antimicrobial and antioxidant properties. Oregano is an important crop for Chihuahua, Mexico. CIRENA-Center of Investigation of Natural Resources, which is part of the public education system in Chihuahua, Mexico, has great interest in novel processes for recovering essential oils from oregano. The head of the oregano program at the CIRENA will spend one year on sabbatical leave at the FAPC oil/oilseed research laboratories working with Dunford on the development of new processing techniques and identification and characterization of oregano components with antimicrobial and antioxidant properties.



Oregano oil, known for its uses in pharmaceuticals, perfumes and cosmetics, also possesses antioxidant and antimicrobial properties. These properties are being researched for novel process uses in Mexico.

Title: Value-Added Food Extract Processing with Membranes

Objective: Develop extraction and membrane processing methods to recover lycopene from watermelon flesh and juice

Funding Sources: FAPC/FRIP funds (2001-2002)

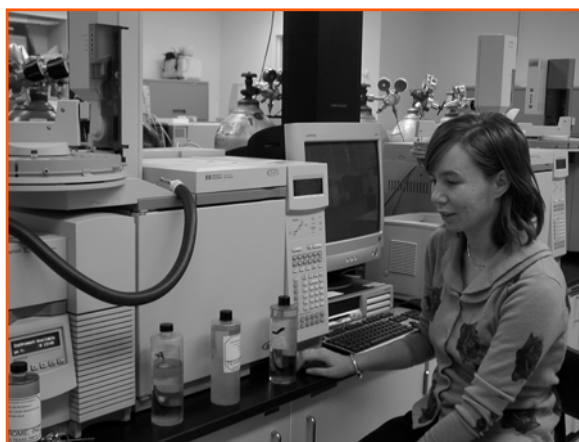
Executive Summary: Lycopene belongs to a group of compounds known as carotenoids. It has been reported that

Research projects, continued

Research

lycopene may provide protection from a wide range of cancers. Watermelon is mainly used as whole, fresh-cut or juice. Short shelf life of fresh watermelon (around 10 days) is a vital problem facing watermelon growers. Development of shelf-stable value-added products based on watermelon will help the expansion of this industry and benefit both growers and consumers. Our preliminary tests with enzyme treatment and membrane processing of watermelon pulp and juice, respectively, confirmed the efficacy of these methods for recovering/ concentrating lycopene in the final products. A membrane system has been purchased for this project. A set of membranes will be tested on the system and processing parameters for efficient lycopene recovery from watermelon juice will be optimized. The same membrane system will be utilized for herb-extract processing at a later date. Preliminary findings of this project were presented at the FAPC research symposium (April 11, 2002). We will also study supercritical fluid extraction of lycopene from watermelon pulp. This is a collaborative

project with Maness, McGlynn (Department of Horticulture and Landscape Architecture) and Brusewitz (Department of Biosystems and Agricultural Engineering). An undergraduate student is also working on this project.



Oil from Eastern red cedar, a coniferous tree common to Oklahoma, contains many value-added product possibilities, such as cold-remedy salves, room sprays and insecticides. New processing methods create economic benefits and increase utilization for Oklahoma producers.

Title: Processing and Characterization of Eastern Red Cedar Oil

Objective: Develop improved methods for cedar wood/cedar leaf processing and develop cedar-derived value-added products at the OSU/FAPC

Funding Sources: FAPC, FRIP funds (2002-2003) and Department of Forestry graduate student assistantship

Executive Summary: Cedar wood and leaves are important sources of essential oils.

Applications of cedar oil range from cold-remedy salves to room sprays and insecticides. Eastern red cedar is one of the most widely distributed indigenous conifers in Oklahoma. The development of new processing methods and value-added products based on Eastern red cedar would increase red cedar utilization and create economic benefits for Oklahoma. As a part of this project, a survey (literature, Internet, phone and mail-in) is being conducted to gather information on the number and size of the commercial cedar wood/leaf processing facilities, types of processing techniques used, product market supply/demand, trends and costs. Effect of

extraction methods and solvent types on the cedar wood oil quality also will be examined. A fractionation process will be developed to improve the quality of the crude oil and help to meet the national and international standards. A Ph.D. student, co-supervised by Dunford and Hiziroglu, is working on the project. Collaborators in this project are Hiziroglu, Dunford and Holcomb.

Research Research projects, continued



Title: Risk Information and Education for Producers Investing in Value-Added Businesses and New Generation Cooperatives

Objective: Develop risk information and education for producers investing in value-added businesses and new generation cooperatives

Funding Sources: USDA CSREES, RME (Risk Management Education) research grant

Executive Summary: Five resource publications, which will be distributed via 1) the National Education Risk Library, 2) state risk management coordinators and 3) the regional risk management centers will be developed on the subject. In addition to the development of educational resource material, four producer-training sessions will

be conducted across the United States. The key personnel involved in the project are: project coordinator Kenkel, OSU Department of Agricultural Economics; "Wheat Processing" leader Holcomb, OSU Department of Agricultural Economics and FAPC; "Beef Slaughter Facilities" leader Ward, OSU Department of Agricultural Economics; "Soybean and Oilseed Processing" leader Dunford, OSU Department of Plant and Soil Sciences and FAPC; and "Ethanol Production" leader Barton, Arthur Capper Cooperative Center director and Kansas State University Department of Agricultural Economics.

Title: Evaluation of Quality and Oxidative Stability of Ohmically-Heated Meat Products

Project Participants: Bellmer, McGlynn, Dunford, Sigfusson, Maness, Jaboc Nelson, Scott and Nelson.

Objective: Evaluate the effect of ohmic heating on color, texture properties and oxidative rancidity of comminuted meat products such as patties and meat sausages/emulsions

Funding Sources: FAPC/FRIP funds

Executive Summary: Ohmic heating is a direct heating method capable of rapidly cooking foods by passing electrical current through the product. This study will examine the effect of ohmic heating on the quality and oxidative stability of ground meat patties and sausages with and without antioxidant addition. We will provide lycopene as an antioxidant for this project.



Ohmic heating is a direct-heating method capable of rapidly cooking foods by passing electrical current through the product.

Research

Research projects, continued

STANLEY GILLILAND, Ph.D.

Title: Lactobacilli and Bifidobacteria as Beneficial Food Adjuncts (Oct. 1, 1996 to Sept. 20, 2002)

Funding Sources: Oklahoma Agricultural Experiment Station and Sitlington Endowed Chair Funds

Objectives: 1) Isolate new strains of lactobacilli and/or bifidobacteria having potential to control serum cholesterol levels 2) Enhance growth of *Lactobacillus acidophilus* and bifidobacteria in milk 3) Isolate new strains of *Lactobacillus lactis* that produce sufficient hydrogen peroxide to inhibit growth of undesirable bacteria on refrigerated foods.

Executive Summary: Feeding of a selected strain of *Lactobacillus acidophilus* (L-1) to hypercholesterolemic humans caused significant reductions in serum cholesterol. Selected cultures of *Lactobacillus casei* and *Bifidobacterium longum* isolated in our laboratory also have this potential. Both of these organisms deconjugate bile acids, which appears to be important in control of serum cholesterol. Some cholesterol is incorporated into the cellular membranes of

both *L. acidophilus* and *B. longum* but not *L. casei*. Growth of the selected cultures of *L. acidophilus* and *B. longum* but not *L. casei* was enhanced in milk in associative growth with yogurt cultures when the milk was supplemented with whey protein hydrolysate. Hydrogen peroxide produced by *Lactobacillus delbrueckii* ssp. *lactis* at refrigeration temperature is partially due to the action of lactate oxidase. Enough peroxide is produced by these lactobacilli to exert antagonistic action toward *Escherichia coli* O157:H7 and *Salmonella* on raw beef during refrigerated storage. The antagonism also was produced on surfaces of carcass samples of both beef and pork.

Work to be Completed: This five-year project terminates Sept.

30, 2002. From this project, 10 scientific papers have been published and three more are in preparation. In addition, 10 graduate student theses and/or dissertations have resulted from this project.

Title: Lactobacilli to Control *Salmonella* and *Escherichia coli* O157:H7 in Fresh Cut Produce. (Sept. 15, 1999 to Sept. 14, 2002)

Funding Sources: USDA/CSREES Special Grant and Sitlington Endowed Chair Funds

Objectives: 1) Select a strain(s) of *Lactobacillus delbrueckii* ssp. *lactis* having potential as biopreservatives for fresh cut produce based on hydrogen peroxide production at 5° C 2) Determine numbers of selected strain(s) of *L. delbrueckii* ssp. *lactis* required to retard growth of natural microflora of fresh cut

produce during refrigerated storage 3) Determine efficacy of selected strain(s) of *L. delbrueckii* ssp. *lactis* in control of *Salmonella typhimurium* and *Escherichia coli* O157:H7 on fresh cut produce at refrigeration temperature

Executive Summary: Raw vegetables including broccoli, cabbage, carrots and lettuce inoculated with selected food borne pathogens were treated



Various strains of Lactobacilli can potentially control serum cholesterol levels, and others can inhibit growth of undesirable bacteria in some refrigerated foods.

Research projects, continued

Research

with cells of a strain of *Lactobacillus delbrueckii* ssp. *lactis* selected for its ability to produce hydrogen peroxide at refrigeration temperature. Portions of each vegetable were separately inoculated with one of three pathogens: *Escherichia coli* O157:H7, *Salmonella choleraesuis* or *Listeria monocytogenes*. Prior to packaging, one portion of each was additionally inoculated with a cell suspension of the lactobacilli. The vegetables were stored at 7° C under conditions similar to ready-to-eat vegetables at retail. Samples were tested on days zero, three and six. Although populations of lactobacilli remained high throughout the storage and some antagonisms toward the pathogens were noted, none were significant. Further testing revealed that the vegetables had sufficient catalase or peroxidase activity to destroy enough of the peroxide produced by the lactobacilli to prevent any antagonistic action toward the pathogens.

Work to be Completed: We will determine whether or not the lactobacilli will exert antagonistic action toward the pathogens on fresh cut-melons. This project has resulted in two graduate student theses. Additionally, two scientific journal papers

are in preparation.

Title: *Lactobacillus acidophilus* as Probiotic to Control *Salmonella* in Swine. (April 1, 2001 to Nov. 1, 2002)

Funding Sources: National Pork Board & Sitlington Endowed Chair Funds

Objectives: Determine if a selected probiotic culture added to the diets of pigs will exert control of salmonella in the animals

Executive Summary: Five cultures of *Lactobacillus acidophilus* of pig intestinal origin were tested in laboratory media for inhibitory action toward *Salmonella typhimurium*.



Strains of *Lactobacillus acidophilus* are being studied to determine possible probiotic inhibition of *Salmonella* in swine. Strain L-23 shows promise, as previous studies indicated an increase in growth and performance of weaning age pigs.

All five were inhibitory toward the *Salmonella*. There was some variation among strains tested although the variation was not great. The largest amounts of inhibition were obtained from *L. acidophilus* 43121 and *L. acidophilus* L-23. Since strain L-23 was shown in a previous study to enhance the growth and performance of weaning age pigs, it was selected for further study. The fact that strain L-23 was able to increase the feed efficiency in the pigs in the earlier study, indicated that it does function in the live animal. Thus it seemed likely that it would be the best strain to use in feeding trials concerning the potential for inhibiting *Salmonella typhimurium* in the animals.

Work to be Completed:

Feeding trials will be conducted in 2002 to determine if *L. acidophilus* L-23 will control *Salmonella typhimurium* in swine. This research area will be continued and expanded in a new USDA/CSREES project which starts in 2002.

Title: Improved Detection of *Campylobacter jejuni* in Foods (June 1, 1999 to June 30, 2001)

Funding Sources: Food and Agricultural Products Center and Sitlington Endowed Chair Funds.

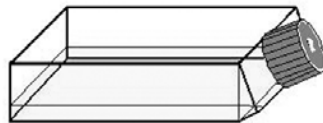
Objectives: 1) Refine the use

Research projects, continued

Research

of modified growth conditions discovered in an earlier project
2) Determine factors causing conversion of normally spiral shaped cells to coccoid forms that appear to be non-culturable

Executive Summary: These experiments were done in order to determine the conditions needed for growth while minimizing the production of the coccoid forms of *Campylobacter jejuni*. *Campylobacter* may change



Area = 2500 mm



Area = 154 mm



Area = 1385 mm

into what is known as 'coccoid' state marked by the physical change from a spiral, rod shaped morphology to a coccoid morphology. It has been suggested that this change results in formation of a "viable but non-culturable state." Obviously, this may impede detection and subsequently affect results in research studies and detection in food products. The morphological change was dependant on the type of growth vessel, incubation time and gaseous atmosphere.

1) The ability to maintain and grow *C. jejuni* was enhanced by the use of vented tissue culture flasks. 2) A modified atmosphere (CO_2 , O_2 and N_2) was needed for adequate growth and maintenance of the helical-rod for of *C. jejuni*. 3) After 24 hours of incubation at 37°C , cells of *C. jejuni* quickly transformed to the coccoid form. We have observed the production of the coccoid forms from the helical rod shape using scanning electron microscopy. Examination of the photomicrographs suggested that each helical rod produced at least one coccoid cell and then became a "spent" cell.
Work to be Completed: This project was completed in June 2001. This research area will be continued in a new USDA/CSREES grant starting in 2002.



Development of improved methods for detecting *Campylobacter jejuni* in foods requires use of an environmental control chamber.

Research projects, continued

Research



Value-added processing provides a new market for previously non-marketable Eastern red cedar. Production of one- and three-layer particle board utilizes the entire tree, giving landowners an outlet for the bothersome plant.

RODNEY B. HOLCOMB, Ph.D.

Title: Manufacturing Particleboard from Non-Marketable Eastern Red Cedar (*Juniperus virginiana* L.)

Project Participants: Salim Hiziroglu (FAPC/Forestry), Rodney B. Holcomb (FAPC/ Agricultural Economics) and Quinlin Wu (Forestry, Louisiana State University)

Funding Sources: FAPC FRIP project, completed in 2001

Objectives: 1) Finding a way to market the non-marketable Eastern red cedar 2) Generate an economical viable use for a plant that otherwise was deemed as a pest

Executive Summary: The primary result of this project was the development of processes for manufacturing one- and three-layer particleboard panels from non-marketable Eastern red cedar. These

processes utilize the whole tree – trunk, branches, small limbs, bark and needles – to generate value-added products from a plant commonly considered a pest by Oklahoma landowners. To date, this project has resulted in patent-pending

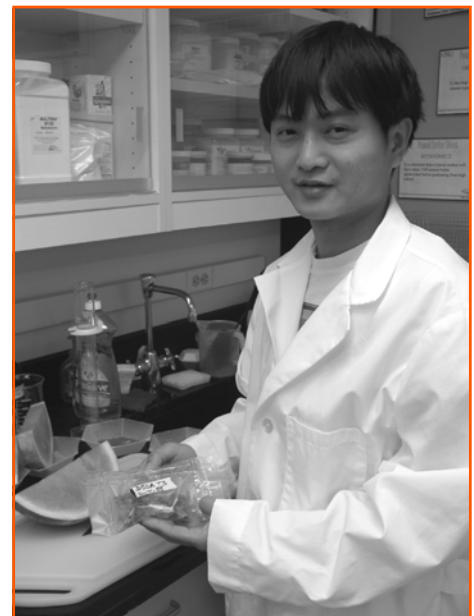
technology development, two presented papers at professional meetings and one publication.

Work to be Completed: As an extension of this project, a manufacturing economic model is being developed to assist in the commercialization of this technology. The model is based on a small particleboard manufacturing plant with the production capacity of 50 cubic meters of particleboard per day. An assessment of required capital, labor costs and utility costs have been configured to accommodate the essential size of the recommended manufacturing plant. All estimates are assumed and subject to change, but the

generated outcome of this study provides a basis to determine the profitability of the implementation of such a facility in Oklahoma.

Title: Production, Development and Marketing of Value-Added Horticultural Products from Crops Grown in Oklahoma

Project Participants: Rodney B. Holcomb (FAPC/Agricultural Economics), Tim Bowser (FAPC/ Biosystems and Agricultural Engineering), Stanley Gilliland (FAPC/Animal Science), Kathleen Kelsey (Agricultural Education), Niels Maness (Horticulture and Landscape



The Center helped to develop new products from horticulture crops, create processing technology and evaluate marketing strategies for these new products.

Research Research projects, continued

Architecture), William McGlynn (FAPC/Horticulture and Landscape Architecture), Darren Scott (FAPC); a host of participating colleagues at the University of Arkansas-Fayetteville, University of Arkansas-Pine Bluff, Mississippi State University and Alcorn State University

Funding Sources: USDA Initiative for Future Agriculture and Fiber Systems (IFAFS), three-year project started in 2001

Objectives: 1) Develop new products from horticulture crops from this area 2) Create new processing technology to generate these products 3) Evaluate marketing strategies for these value-added products

Executive Summary: This project is in collaboration with the University of Arkansas-Fayetteville, the University of Arkansas-Pine Bluff, Mississippi State University and Alcorn State University to examine value-added marketing alternatives for small fruit and vegetable producers in Oklahoma, Arkansas and Mississippi. OSU's contribution to the project is the development of new products from horticultural crops common to this region, the creation of processing technology to generate these products, the evaluation of marketing strategies for these products and the delivery of business-development training

workshops to producers.

Work to be Completed: A host of value-added products and smaller-scaled, portable processing equipment has been developed at FAPC, along with safety protocols and microbial evaluation criterion for these products/processes. While these products/processes will continue to be refined, additional work will take place in the areas of consumer evaluation of products, market assessments and training producers to collectively process and successfully market value-added products in the three states.

Title: Developing an Agricultural Marketing Resource Center

Project Participants: Rodney B. Holcomb (FAPC/Agricultural Economics), Philip Kenkel (Agricultural Economics), various members of the FAPC as needed for technical assistance; participating colleagues from Iowa State University, Kansas State University and the University of California-Davis

Funding Sources: USDA Value-Added Products Market Development Grant, three-year project started in 2001

Objectives: 1) Provide value-added processing knowledge and experience to agricultural producers 2) Examining producer-initiated processing ventures that the FAPC helped establish in Oklahoma

Executive Summary: The FAPC is a participant in the project at the request of the Iowa State University (lead institution), Kansas State University and the University of California-Davis, for the purposes of providing experience and knowledge related to value-added processing ventures initiated by agricultural producers. Progress made thus far include the examination of producer-initiated processing ventures that the FAPC helped establish in Oklahoma to serve as case studies for the Agricultural Marketing Resource Center (AgMRC).

Work to be Completed: As the AgMRC develops, the role of the investigators and FAPC will



Research Research projects, continued

expand to include assistance in feasibility assessment, identifying processing options and technologies and taking more of an "ask the expert" role for producer-controlled processing ventures. General information and case studies derived from these requests will become part of the AgMRC online library.

Title: Developing Plans for Sustainable Beef Marketing Strategies in the Southern Plains

Project Participants: Rodney B. Holcomb (FAPC/Agricultural Economics) and Clem Ward (Agricultural Economics)

Funding Sources: USDA Southern Region SARE, one-year project completed in 2001

Objectives: 1) Review the possibilities for partnerships with the Oklahoma meat processing industry 2) Collect data from consumers on natural beef perceptions and purchases 3) Examine the impacts of consumer characteristics on willingness to pay for natural beef in the Southern Plains

Executive Summary: A survey of Oklahoma meat processors provided the information on capacities and identified those packers with the greatest possibility for contract-processing natural beef for a collaboration of natural-beef producers. The Dichotomous

Choice Contingent Valuation Method (DC-CVM) was used in a survey of supermarket customers in regional metropolitan supermarkets to get information on natural-beef perceptions and purchasing behavior. The multinomial logit procedure was used to assess the effects of consumers' demographic characteristics on their willingness to pay for natural beef. In addition to the logit model, a descriptive statistical analysis on all of the survey questions was completed. Results from the study show that respondents who check labels more

frequently and by organic/natural-food products were more likely to purchase natural beef. To date there also have been two presented papers at professional meetings, one research report on the regional meat processing industry currently being printed and one paper from the descriptive statistical analysis of the survey data published in the *Journal of Food Distribution Research*.

Work to be completed: One paper is being completed on consumers' willingness to pay for natural beef from data collected by in-store surveys.



Oklahoma beef producers may have a new market when labeling their products as "natural beef." Demographic studies are being conducted in the Southern Plains to determine if organic/natural consumers would pay for the specially-marked food.

Research projects, continued

Research

WILLIAM G. MCGLYNN, Ph.D.

Title: Production, Development and Marketing of Value-Added Horticultural Products

Project Participants: Niels Maness (Horticulture and Landscape Architecture), Tim Bowser (Biosystems and Agricultural Engineering/FAPC) and Darren Scott (FAPC)

Funding Sources: USDA CREES Initiative for Future Agriculture and Food Systems

Executive Summary: The research is designed to facilitate marketing of new and improved value-added horticultural products by small producers/processors. The emphasis is on developing new products with a strong health-beneficial component. This study is part of a larger, multi-state initiative involving researchers from Arkansas and Mississippi. Our portion of the project involves developing of antioxidant-rich extracts from sage, creation of value-added products containing watermelon and creation of an

affordable, modular thermal processing system for formulated acid and acidified foods such as barbecue sauces, fruit preserves and salsas. Watermelon was chosen as a crop because it is naturally rich in the red pigment lycopene, which is a powerful antioxidant in the body and because there is a great deal of material currently grown for fresh-market consumption that goes to waste every year.



Horticultural products such as watermelon and sage contain many value-added products that are known for their health-promoting properties.



Good Agricultural Practices, or "GAPs," provide guidance for vegetable production and processing operations. The program is geared toward producers and educators alike.

Work to be Completed: Several new watermelon products such as condiment sauces and molasses are in preliminary testing. Further work in 2002 will focus on refining these products and testing them for lycopene content. Work is planned for testing the effectiveness of sage and watermelon extracts as natural antioxidants in meat products. In 2002 and beyond, we also will be evaluating the performance of a prototype thermal processing unit.

Title: Fresh Produce Food Safety Training Program for the Southeast

Project Participants: Lynn Brandenberger (Horticulture and Landscape Architecture) and B. Dean McCraw (Horticulture and Landscape

Research projects, continued

Research

Architecture)

Funding Sources: USDA CREES
National Food Safety Initiative

Executive Summary: The research is part of an on-going program to provide guidance on applying "Good Agricultural Practices" (GAPs) to fruit and vegetable production and processing operations. This material is designed to be useful to producers/processors, as well as educators such as extension personnel. Our program is part of a larger research initiative involving the states of the southeast region of the United States and is coordinated by researchers from North Carolina State University. To date we have developed educational materials and presented sessions at several in-state meetings for several commodities including grapes, pecans and watermelon.

Work to be Completed: Further workshops, presentations and extension publications

Title: Evaluation of Methods for Physical Separation of Lycopene-Rich Fraction from Watermelon Puree

Project Participants: Niels Maness (Horticulture and Landscape Architecture), Nurhan Dunford (Plant and Soil Sciences/FAPC), Penelope Perkins-Veazie (USDA ARS) and Darren Scott (FAPC)

Funding Sources: OSU FRIP



Lycopene, a naturally-occurring substance in watermelon, can be physically concentrated from fresh watermelon. Further studies are being conducted to determine the rate of lycopene-rich agglomerate formation. Lycopene also helps determine the isomeric components of watermelon using HPLC.

Program

Executive Summary: The research is part of an on-going effort to generate a lycopene-rich concentrate/extract from watermelon flesh. Our research to date has shown that the lycopene present in fresh watermelon can be easily concentrated using physical means. On-going work is examining the further purification of this material. Understanding what interactions occur during and after tissue maceration is key to furthering the design of an economically feasible lycopene concentration/purification system.

Work to be Completed: During 2002 and beyond, the effect of native tissue-sugar concentration on lycopene will be examined by correlating

°Brix in the melon to percent lycopene recovered in the lycopene-rich puree fraction. In addition, the chemical properties of the lycopene-rich fraction of watermelon puree will be evaluated. In particular, the rate of lycopene-rich agglomerate formation and changes in size will be determined over time using a particle size analyzer. Also, the lycopene present in the watermelon pulp will be characterized using HPLC to determine its isomeric components. Finally, the Oxygen Radical Absorbance Capacity (ORAC) assay for antioxidant activity will be refined for watermelon and other lipid soluble antioxidants by examining a combination of fluorophors, oxygen radical initiators and solvent systems.

Research projects, continued

Research



Peanut materials could successfully replace significant portions of meat in processed meat systems.

DAVID MOE

Title: Potential for Development of Value-Added Products from Peanuts

Project Participants: Hinds, Moe, Scott

Funding Sources: FRIP

Objectives: Evaluate the effects of processing parameters on 1) physical and functional properties and 2) fatty acid profiles of the peanut materials; Evaluate the effects of the major (peanut and meat) and minor (e.g., binders) ingredient ratio on 1) physical properties and cooked yield and 2) fatty acid profiles of finished products; Obtain preliminary information for production of peanut and/or peanut/meat combinations

Executive summary: It was demonstrated that "peanut materials" could successfully replace significant portions of

the meat in processed meat systems. Some peanut materials did not exhibit a characteristic "peanut flavor."

Work to be completed: 1) Evaluate increased levels of peanut materials in processed meats 2) Review flavor system alternatives 3) Complete fatty acid profiling

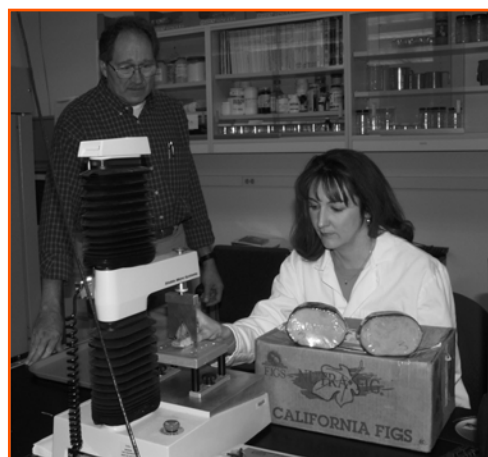
Title: The Utilization of Seedless Fig Paste in Meat and Poultry Products (Feb. 1, 2000 to May 1, 2001)

Funding Sources: California Fig Advisory Board

Objectives: Determine the feasibility of utilizing "seedless fig paste" as a functional ingredient in processed meat systems

Executive Summary: Seedless fig paste

possesses unique characteristics that make it a natural fit for enhancement of processed meat and poultry products (particularly reduced fat products) through functional and economic means. Seedless fig paste was incorporated into a range of processed meat products under "model" and "pilot" conditions. Addition of seedless fig paste resulted in texture breakdown of chopped, ground, or/and large chunk meat products upon cooking due to the "proteases" present in figs. Texture degradation could be controlled by inactivating the enzymes by heating the fig paste prior to incorporation into meat systems. Some functional properties demonstrated



Seedless fig paste studies combining processed meats look promising. While meat texture was affected negatively, moisture retention and possible antioxidant enhancement were positive attributes.

Research projects, continued

Research



The FAPC pilot program helps emerging Oklahoma processors and entrepreneurs "scale up" to the commercial processing level. Some products include jams, jellies, cooked sausages, salads and pickles. Nonedible items include specialty soaps and personal care products.

products for consumer and market testing. These included beef jerky, dry soup and dip mixes and frozen home-style chili. A third focus was to support various technical assistance projects, such as documentation of thermal processing cycles, testing alternative processing scenarios for cereal products used in snacks and evaluating shelf life for individual ingredients in a prototype food product. Research projects were also given support where processing activity was applicable.

included moisture retention, texture modification, unique sweet flavor and potential for enhanced nutritional and antioxidant profile. If seedless fig paste addition can be marketed to support product enhancement, then both formula savings and margin improvement appear possible. **Work to be completed:** No further work planned at this time.

Permission granted by Ron Klamm (California Fig Advisory Board) to include in the annual report.

Pilot processing: The pilot processing facilities of the FAPC are designed to be flexible in order to support the broad scope of food and agricultural processors and entrepreneurs in Oklahoma. Project activity focused on "adding value" to

various commodities. A primary focus was "scale up" and/or adapting products to commercial processing for emerging processors and entrepreneurs. Products included condiments, jams and jellies, pickles, salads, cooked sausage, specialty soaps, sauces and personnel care products. A second focus was to process



The FAPC pilot processing program processes items for consumer and market testing. Beef jerky, soup and dip mixes and frozen chili products are among the food items tested. Alternative processing methods, shelf-life studies and individual ingredient studies also are performed.

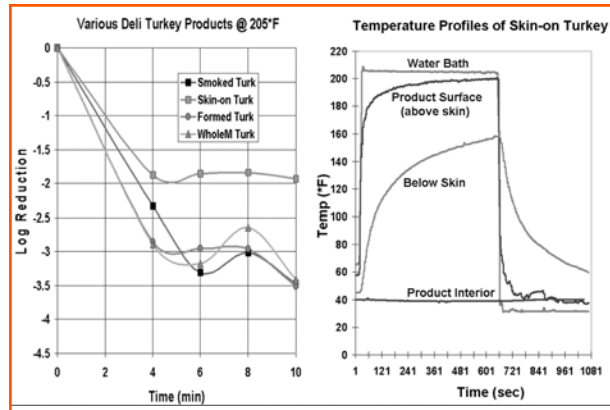
PETER M. MURIANA, Ph.D.

Title: Post-Package Pasteurization of Deli Meat Surfaces for Reduction of *Listeria monocytogenes*

Funding Sources: Food industry sources (Sara Lee, Cargill, Foster Farms, Perdue Farms, Unitherm Foodsystems Inc.)

Objectives: 1) Determine thermal processing parameters for post-package "surface pasteurization" of deli turkeys, hams and roasts by submersion heating 2) Quantify the reduction of *Listeria monocytogenes* on inoculated products

Executive Summary: A mixed "cocktail" of four *L. monocytogenes* strains was resuspended in product purge and used to surface-inoculate a variety of ready-to-eat (RTE) meat products including turkey, ham and roast beef. All products were vacuum sealed in shrink-wrap packaging bags, massaged to ensure inoculum distribution and processed by submersion heating in a precision-controlled steam-injected waterbath. On various *L. monocytogenes*-inoculated RTE deli meats, we were able to achieve two- to four-log cycle reductions when processed at either 195°F (90.6°C), 200°F (93.3°C) or 205°F (96.1°C) when heated from two to 10 minutes. High-level inoculation with *L. monocytogenes* (around 10⁷



These graphs show the results of post-package pasteurization of various turkey products with mixed strains of *L. monocytogenes*. This process helps reduce surface contamination during product packaging.

CFU/ml) ensured that cells infiltrated the least-processed surface areas such as surface cuts, folds, grooves and skin. Reduction of *L. monocytogenes* in product challenge studies showed much less reduction than was observed during the decimal reduction assays of cells suspended in clarified purge. This was attributed to a combination of surface phenomena including surface imperfections that may shield bacteria from the heat and the migration of chilled purge to the product surface. The current data indicates that minimal heating regimens of two minutes at 195° to 205°F can readily provide two-log reductions in most RTE deli meats processed and suggests that this process may be an effective microbial intervention against *L. monocytogenes* on RTE deli style meats. Currently, Sara Lee, Cargill Foods and

other processors have adopted some form of post-package pasteurization to produce safer RTE deli meat products that may acquire surface contamination during packaging.

Work to be completed: We have completed our determination of post-package pasteurization as an effective means of surface pasteurization of deli meats and have begun additional studies on pre-package pasteurization using a radiant heat oven alone and in combination with post-package pasteurization. The project will result in a graduate student thesis and a published manuscript. *Muriana, P.M., Quimby, W., Davidson, C., and J. Grooms. 2002. Post-Package Pasteurization of RTE Deli Meats by Submersion Heating for Reduction of Listeria Monocytogenes. J. Food Prot. 65:963-969.*

Research

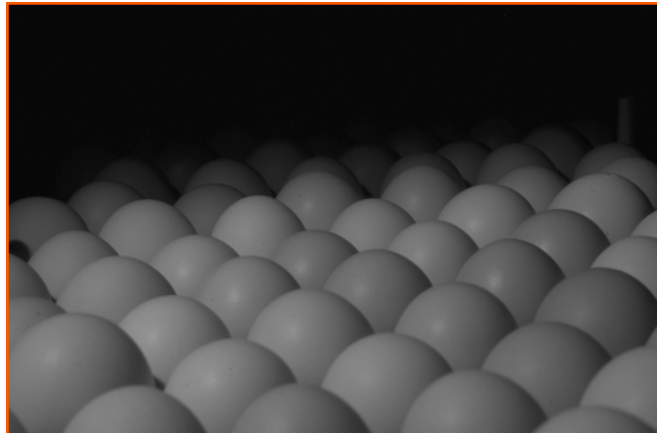
Research projects, continued

Title: Comparison of Armour and Standard Brands Hydrogen Peroxide Methods for Pasteurization of Egg White to Eliminate *Salmonella* spp.

Funding Sources: United Egg Producers

Objectives: 1) Compare the effectiveness of the Armour and Standard Brands methods against *Salmonella* spp. 2) Determine D- and Z-values for *Salmonella* at 125°, 127.5°, 130° and 132.5°F

Executive Summary: The current USDA Egg Pasteurization Manual (1968) indicates that the pH of egg whites should be pH 9 prior to pasteurization based on “their natural pH.” The suggestion of pH 9 as the natural pH of egg white matriculates back when shell eggs were often held for some time before processing (i.e., “off-line”), allowing sufficient time for loss of CO₂, which results in an increase in pH to approximately 9. However, there are now many “in-line” egg production/processing facilities capable of processing shell eggs soon after they are laid, whereby the pH of such fresh egg whites can be as low as 7.8 to 8.2 at the time of pasteurization that presents a concern for effective elimination of *Salmonella*. The effect of pH and processing temperatures on two commercial egg white



Studies show hydrogen peroxide may be helpful in decreasing the presence of *Salmonella* spp. in off-line egg processing, which causes a rise in pH to approximately 9.0.

pasteurization procedures (Armour and Standard Brands methods) were evaluated using a five-strain cocktail of *Salmonella*. We devised a bench-top pasteurization system that mimics these two commercial processes, both of which require hydrogen peroxide to be metered into the egg white stream between an initial preheat step and the main heating regimen. Both processes were evaluated at three pH levels (pH 8.2, 8.6, 9), at four temperatures (125°F, 127.5°F, 130°F, 132.5°F), and over four residence times to allow calculation of D-values at each temperature. When compared at the minimum allowable time and temperatures for each process (i.e., USDA-FSIS), our results showed a greater log reduction for the Standard Brands method than the Armour method. Almost all runs

at any given temperature showed more reduction at pH 9 than at pH 8.2, except for the Standard Brands method at 130°F, which showed the most consistent reduction levels at all three pH values. The data indicates that there is significantly less reduction of *Salmonella* with low pH egg white, typical of modern in-line facilities, than with high-pH egg white, typical of off-line egg processing, and will be used to suggest whether changes need to be made to the prior USDA-FSIS egg pasteurization manual. **Work to be completed:** The project has been completed and will result in a graduate student thesis. Additionally, one publication is in press (new USDA Egg Pasteurization Manual) and a research journal publication is in preparation. Graduate student Will Robinson was awarded first place in the

graduate paper competition at the 2002 Southern Poultry Sciences Symposium in Atlanta, Ga. (January 2002) for this work. *Froning, G.W., Peters, D., Muriana, P.M., Brashears, M., and K. Eskridge. 2002. Egg product pasteurization manual. U. S. Department of Agriculture, Washington, D.C. (In Press). Robinson, W., and P.M. Muriana. 2002. Comparison of Armour and Standard Brands egg white pasteurization methods. J. Food Prot. (manuscript in preparation).*

Title: Flash Pasteurization of Contaminated Streams Using a Direct Contact Gas

Funding Sources: Webco Industries, QuikWater Division (Sand Springs, Okla.)

Objectives: Evaluate the microbial lethality of processing contaminated streams through their direct-contact gas-fired water heater (i.e., QuikWater)

Executive Summary:

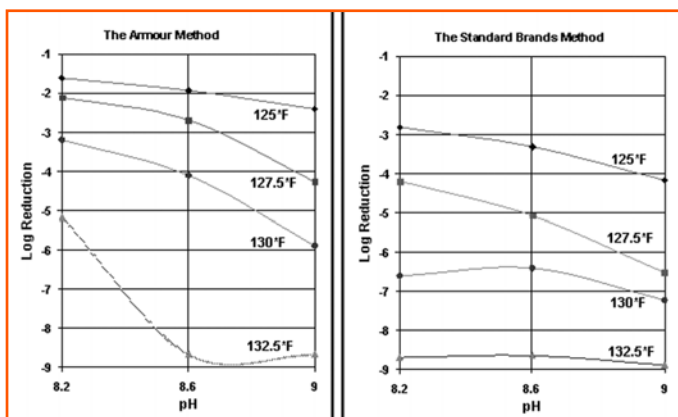
Food processing activities involving washing of nonedible (i.e., bottles) and edible raw materials (i.e., washing of fruits and vegetables) are often water-intensive processes. This is especially true when

food safety considerations are involved and require liberal rinses of water (beef and poultry carcass washing). Water usage may also be seasonally restricted in certain locations that are prone to water shortages. Therefore, methods and technologies that reduce water consumption or allow for water recycling and reclamation are becoming more appealing to many food processors. A commercial direct-contact gas-fired water heater was modified for in-lab evaluation of microbial reduction and temperature consistency at various water flow rates. The water heater was modified so that a contaminated input stream could be treated using 50-gallon (189.3-liter) bulk-feed tanks. A final reservoir tank was

bypassed using six sampling ports placed in pairs along three locations in the vertical heating column with which to test the efficacy of a single pass at different positions in the heating zone. Temperature probes were utilized to follow water temperature at 8, 10 and 12 gal./min. (30.3, 37.9 and 45.4 liters/min.). When using inoculated water streams, we obtained four- to seven-log₁₀ cycle reductions of various microorganisms tested, suggesting that this may have potential use in situations where water recycling is of interest in food processing environments.

Work to be completed: The project has been completed and Webco Industries (QuikWater Division, Sand Springs, Okla.) has made use of our research data to support

marketing of their QuikWater™ product. A research publication has been accepted for publication: *Muriana, P.M., Bowser, T., Davidson, C., Tilahun, M., and D.E. Gibbs. 2002. "Flash Pasteurization" of Contaminated Streams Using a Direct-Contact Gas-Fired Water Heater. Food Microbiology (In Press)*



The project tested for the pasteurization of egg whites to eliminate *Salmonella* spp. using Armour and Standard Brands methods. The Standard Brands method showed greater Log reductions than the Armour method.

Title: Application of Fluorescent-Tagged Primers for Non-Gel Detection of *Listeria monocytogenes* by PCR

Funding Sources: FRIP 2002 grant

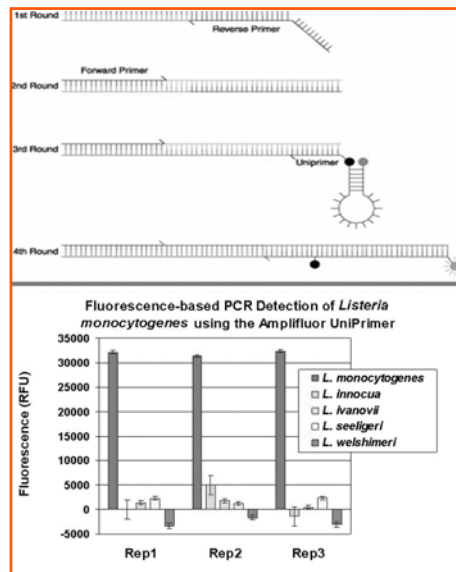
Objectives: Apply Amplifluor fluorescent-labelled UniPrimer™ technology for non-gel detection of *Listeria monocytogenes*

Executive Summary: *Listeria monocytogenes* is an important foodborne pathogen that has been responsible for numerous foodborne outbreaks, illnesses and deaths. *Listeria* spp. are commonly carried and shed by animals used in food production, thus causing contamination of raw meat during slaughter. Its high incidence on raw meat products has allowed *L. monocytogenes* to infiltrate processing environments of ready-to-eat meat products, which is a major area of concern because such products are consumed without need for further cooking. The use of rapid methods to detect *L. monocytogenes* will assist processors in reducing the time taken for testing. Recent advances in the application of fluorescent labels on primers have provided new prospects for “user-friendly” rapid PCR analysis of target

microorganisms (i.e., “non-gel” PCR). The UniPrimer™ system uses energy-transfer hairpin primers that allows universal application of the same primer for different PCR targets. It proposes a one-step closed-tube procedure for fluorescence-based PCR detection. Our objective is to optimize the Amplifluor UniPrimer™ for rapid detection of *L. monocytogenes* in food products. The UniPrimer™ has a 3-foot oligonucleotide tail (Z-sequence) and a 5-foot intracomplementary sequence that forms a hairpin, placing a fluorophore in close proximity to

a quencher molecule. The ‘Z’ sequence was added to the 5-foot end of several *Listeria*-specific primers. When used in PCR reactions, the ‘Z-tailed’ primers gave strong and specific reactions to *L. monocytogenes*. However, several primer combinations gave strong “primer-dimer” products. Others primers that gave specific products on agarose gels gave high background fluorescence with negative controls when no visible product was observed. We are continuing to evaluate primer pairs in conjunction with the UniPrimer™ system for non-gel detection of *L. monocytogenes*. Rapid detection of *Listeria* can facilitate an increase in microbial testing of sensitive foods where traditional “test-and-hold” practices have been the major cause of limited testing by food processors.

Work to be completed: The work cited resulted in the successful completion of a M.S. degree: Hannah Nayakanti (2001; Department of Biochemistry). Application of Fluorescent-Tagged Primers for PCR-Based Non-Gel Detection of *Listeria Monocytogenes*. Advisors: Muriana and Melcher.



Fluorescent-labelled Amplifluor UniPrimer™ (top) was incorporated into amplified DNA during PCR and detected by fluorescence and end-point assay (bottom).

Research Research projects, continued

PATRICIA RAYAS-DUARTE, Ph.D.

Title: Effect of Food Additives to the Quality of Frozen Dough Products and Rheological Properties of Dough

Funding Sources: Oklahoma Wheat Commission and Food and Agricultural Products Center

Executive Summary: The effects of a commercial dough conditioner (CDC) and methylcellulose- (MC), glutathione- (GSH) and heat-treated yeast on dough rheological properties and baking quality of bread sticks made from pre-proofed frozen dough were investigated. The properties of frozen dough and baked bread sticks were studied as a function of storage time (one day and up to 12 weeks). Rheofermentometer parameters showed significant correlations with baking quality and could be used to predict baking quality of bread sticks. Storage (G') and loss (G'') moduli obtained from dynamic rheological test of the dough showed the highest correlation with the total area of the extensibility test for the dough receiving a rest period of 26 minutes prior to testing. The ratio of maximum resistance to extension (R_{max}) to distance at maximum force (E) correlated with crust and crumb scores and crumb firmness but not with specific volume. The addition of



Studies show food additives, such as methylcellulose-treated yeast, improves crust qualities of bread sticks made from hard red spring flour. Others, such as hard red winter flour, did not respond as well.

MC and the mix of CDC and MC improved specific volume and crumb firmness of frozen dough. MC improved crust score of bread sticks made from hard red spring flour but not from hard red winter flour. Bread sticks containing heat-treated yeast showed pale crust color, dark brown spots, blisters and dense grain in fresh and frozen dough. Freshly baked breadsticks (no frozen storage time) containing GSH showed no apparent change in crust and crumb color including crumb grain, while small brown spots on the crust and coarse and yellowish crumb were observed when the dough was

frozen even for only one day. In conclusion, additives (MC and CDC+MC) improved dough properties and baking quality but could not prevent discoloration and brown spots in the crust at long-period time of frozen dough (eight to 12 weeks). GSH and heat-treated yeast cells produced different crust defects.

Work to be completed: This four-year project is completed; two scientific papers will be prepared.

Title: Correlation of Viscoelastic Properties of Glutenins and Molecular Association with Starch Using Capillary Zone Electrophoresis (CZE)

Funding Sources: Oklahoma Wheat Commission and Food and Agricultural Products Center

Executive Summary: Comparison of hydrophobicity, electrophoretic mobility and viscoelastic properties of gluten proteins can reveal specific molecular properties that relate to the functionality of wheat flour. The objective of this study is to quantitate the changes in contributions to the viscoelastic properties of gels by subfractions of High versus Low Molecular Weight Glutenin Subunits in the presence of maltodextrins. The glutenin subunits were extracted from two hard red winter wheat

Research Research projects, continued

cultivars of contrasting baking qualities. Reverse phase chromatography revealed nine Jagger cv. and eight Big Dawg cv. subfractions. These subfractions were collected and incubated with maltodextrins up to 5 percent (w/v). The apparent molecular weight was 100 to greater than 200 kDa and 30 to 60 kDa for the less and more hydrophobic fractions, respectively. The electrophoretic mobilities by CZE were correlated to the viscoelastic properties of gels via dynamic rheology. Results showed an absence of a peak at 38 percent to 40 percent acetonitrile and a missing 58 kDa band in Big Dawg cv. The more negative net surface charge, less hydrophobic character subfractions, containing the larger molecular weight polypeptides, contributed more to the viscous behavior of gels made with the glutenin subunits for both cultivars.

Work to be completed: This project is in progress. Fractionation of each subunit type will be obtained and characterized. The relationship

of each fraction with rheological properties will be determined. One scientific paper has been submitted.



Endosperm tissue samples were obtained from medium- and full-maturity grain-fill stages of plants grown at optimum conditions.

Title: A Proteomic Approach to the Identification of Endoplasmic Reticulum and Golgi Apparatus Membrane Proteins of Wheat Endosperm During Development

Funding sources: Oklahoma Wheat Commission and Food and Agricultural Products Center

Executive Summary: Major contributions to the understanding of proteins in mature wheat have been made recently. However, the biochemical processes

occurring during grain development, which may affect the end-user quality of wheat, are not well understood. Storage proteins in wheat

endosperm are synthesized in the endoplasmic reticulum (ER) bypassing the Golgi apparatus (GA). The objective of this study was to identify subsets of ER- and GA-membrane proteins during wheat grain development. Endosperm tissue samples were obtained from medium- and full-maturity grain-fill stages of plants grown at optimum conditions. Isolates of ER and GA were

obtained by density gradient centrifugation followed by triton X-114 phase partitioning. Enriched fractions of ER and GA will be lysed and fractionated using reverse phase (RP) and gel filtration chromatography (HPLC).

Work to be completed: This project was started in January 2002. Membrane proteins will be fractionated using RPC. Reference maps will be created for the major groups of membrane proteins whose expression varies more than 10

Research projects, continued

Research

folds during grain development. Mass spectroscopy will be used to identify membrane proteins differentially expressed.

Title: Development of Sorghum Food Products: Popped Sorghum and Instant Sorghum Meals

Funding Sources: National Sorghum Growers Association
Executive Summary: Red and white sorghum at three moisture levels were obtained using two tempering methods (direct and indirect). Their popping quality characteristics and sensory evaluation were studied. Red sorghum showed higher percent pop, expansion ratio and pop volume compared to white sorghum. The indirect

Bags of popped sorghum may find their way onto retail shelves for human consumption. Studies show sorghum is palatable to humans, adding value to producers' crops.



tempering method increased the percent pop in the white sorghum compared to the direct method, but it did not affect the percent pop level of

red sorghum. The pop volume of white sorghum was higher at the higher moisture content. Sensory evaluation indicated no differences of appearance scores when two levels of moisture contents were compared. This study provided a significant basic understanding of the popping behavior of two sorghum hybrids. Three soaking treatments and two sorghum types also were studied in the processing of an instant sorghum meal to be used in snack foods. Significant differences in viscosity and gel firmness were observed, indicating that tailored ingredients could be obtained.
Work to be completed: This two-year project is completed. Two scientific papers will be prepared.



Instant sorghum meals and popped sorghum show promise when used for human consumption in items such as snack foods.

Research Research projects, continued

Siobhan S. Reilly, Ph.D.

Title: Influence of Gaseous Atmosphere on Morphology and Cellular Fatty Acid Composition of *Campylobacter jejuni*

Project Participant: S. E. Gilliland
Funding Sources: Project H-2485, a Food Research Initiative Project, the Food and Agricultural Products Center and Sitlington Endowed Funds

Executive Summary:

Morphology and fatty acid profiles of *Campylobacter jejuni* (ATCC 29428 and 33560) during growth under various gaseous atmosphere conditions in Bolton broth at 37°C for 72 hours were studied. Enumeration was on campylobacter agar containing charcoal and deoxycholate (CCDA) using spiral-plating techniques.

Percentages of coccoid cells were determined microscopically. Following extraction, fatty acids were methylated and relative amounts of each compound was measured by gas chromatography. Most variation in percentage coccoid cells and fatty acid profiles were due to strains; however, treatments often

contributed to variability within strains. For strain 29428, there were no differences in percentages of coccoid cells (12 percent to 21 percent) for any gaseous treatments. Plate counts were similar among treatments (7 to 8 log CFU/ml) with exception of cells exposed to air (4 log CFU/ml). Predominant fatty acids in strain 29428 were 16:0 (33.8 percent to 39.6 percent) and 18:1ⁿ (35.7 percent to 42.4 percent); intermediate fatty acids (1.9 percent to 11.5 percent) were 14:0, 16:1ⁿ, and 19:0D; minor fatty acids found in cells from all treatments (0.4 percent to 3 percent) were 11:0, 12:0, 15:0 and 18:0; and 17:0D were detected in some treatments (0

percent to 0.4 percent). Percentages of coccoid cells in strain 33560 were greater than for strain 29428 and varied among treatments (13 percent to 87 percent). Plate counts varied among treatments and were least (2 log CFU/ml) when cells were exposed to air. Predominant fatty acids in strain 33560 were 14:0 (19.8 percent to 31.4 percent), 16:0 (26.2 percent to 33.8 percent) and 19:0D (18.3 percent to 21.9 percent); intermediate fatty acids (3.7 percent to 11.1 percent) were 16:1ⁿ, 17:0D and 18:1ⁿ; and minor fatty acids (0.4 percent to 1.8 percent) were 11:0, 12:0, 15:0 and 18:0. Using correlation analysis and stepwise regression to evaluate

the data, no apparent relationships were found to exist between percentages of coccoid cells and amounts of individual fatty acids either among or with strains.

Work to be completed: Completed and submitted for publication

Title: Improved Detection Methods for *Campylobacter jejuni*

Project Participant: S. E. Gilliland

Funding Sources: Project



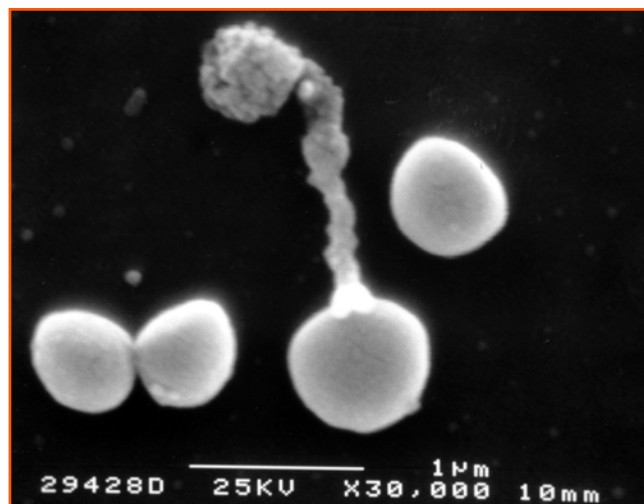
The bubbling system is designed to grow *Campylobacter jejuni*.

Research Research projects, continued

H-2485, a Food Research Initiative Project, the Food and Agricultural Products Center and Sitlington Endowed Funds

Executive Summary: Growth and morphology of *Campylobacter jejuni* when grown under various conditions in Bolton broth at 37°C were studied. Enumeration was on Campylobacter Agar containing charcoal and deoxycholate (CCDA) using spiral-plating techniques. Percentages of coccoid cells were determined microscopically. Consistent growth and maintenance of the helical-rod form of *C. jejuni* was dependent upon (1) the type of growth vessel used and, more importantly, a relatively large surface-to-volume ratio (250mm²/ml); and (2) exposure to a modified atmosphere (10 percent CO₂, 85 percent N₂ and 5 percent O₂). When *C. jejuni* was incubated for more than 24 hours, there was a large percentage (36 percent to 75 percent) of transformation to the coccoid form and fewer colony-forming units compared to incubation up to 24 hours. Strains of the organism behaved differently with respect to subculturing. In general, however, two successive subcultures may be performed without a change in growth or morphology. Decreased concentrations of

This graphic shows a scanning electron micrograph of *Campylobacter jejuni* cells.



colony forming units of *C. jejuni* commonly attributed to the production of the "viable but non-cultureable" form may also be due to cellular "clumping" as evidenced by scanning electron micrographs. Clumping was associated with inadequate surface-to-volume ratio and gas exchange in the growth medium. Techniques to improve growth and maintenance of *C. jejuni* in pure culture and detecting it in food products are described.

Work to be completed: Completed and submitted for Publication

Title: Improved Isolation of *Campylobacter jejuni* from Food Systems

Project Participant: S. E. Gilliland
Funding Sources: H-2485, a

Food Research Initiative Project, the Food and Agricultural Products Center and Sitlington Endowed Funds.
Executive Summary: Currently, we are evaluating our techniques to improve existing isolation methodology of *Campylobacter* from food. The food systems used in this study are milk, chicken and ground beef. Preliminary studies suggest that these techniques are highly successful in recovery of higher numbers of *Campylobacter jejuni* compared to existing methodologies.

Work to be completed: This project is currently in process.

Title: Effect of Ozone on *Listeria monocytogenes* and Shelf Life of Ready-to-Eat Meat Products

Project Participants: C. Goad, D. Scott, H. Sigfussion and S. E. Gilliland

Funding Sources: The National Pork Board and the Food and Agricultural Products Center

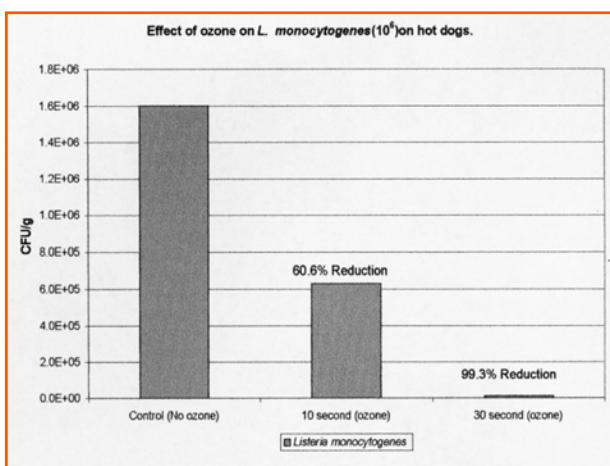
Executive Summary: Numbers of *Listeria monocytogenes* were reduced on hot dogs when exposed to ozone. The most effective treatment was exposure for 30 seconds (99 percent and 93 percent reductions for 10^6 and 10^3 inoculums, respectively). The 10-second exposure did reduce *L. monocytogenes* but not as effectively (60 percent and 30 percent reductions for 10^6 and 10^3 inoculums, respectively). *L. monocytogenes* was also reduced on ham slices when exposed to ozone. After a 30-second exposure, *L. monocytogenes* declined 42.4

percent and 56.1 percent for the 10^6 and 10^4 inoculum levels, respectively. A 10-second exposure resulted in only a 10.9 and 22.2 percent reduction for the same two inoculum levels. No differences were apparent between the control and ozone-treated hot dogs or ham slices with respect to microbial shelf life. The bacterial counts (total aerobic and lactic acid) remained similar for the treated/control samples when stored for 28 days under refrigeration conditions (5°C). Although in most cases there was not a statistically significant difference in the TBARS-values and color attributes between the control and ozone-treated hot dogs, there was a trend toward an increased formation of oxidation products and changes in color as storage

time progressed. This suggested that the ozone treatment may negatively affect some sensory attributes of hot dogs. However, sensory panelists could not detect a difference between ozonated hot dogs and non-ozonated hot dogs. For ham slices, the 10- and 30-second ozone treatments led to increased production of oxidation products when compared to the control (no ozone), but this did not adversely affect color. Sensory panelists were able to detect differences for both treated samples (10 seconds and 30 seconds) when compared to the control. Ozone gas may be an effective post-process treatment for controlling or eliminating *L. monocytogenes* on certain ready-to-eat meat products. In this study, ozone is clearly more effective in reducing more numbers of *L. monocytogenes* on hot dogs compared to ham slices. In addition, sensory characteristics for ozone-treated hot dogs remained unaffected; however, ham slices were negatively affected by the ozone treatment.

Work to be completed:

Completed and in preparation for publication



The graph shows the effect of ozone gas on *L. monocytogenes* seeded onto hotdog buns.

Research projects, continued

Research

HALLDOR SIGFUSSON, Ph.D.

Title: Controlled Partitioning of Exogenous Lipid-Soluble Antioxidants in (Value-Added) Meat Products (July 1, 2001 to June 30, 2002)

Funding Sources: Oklahoma Agricultural Experiment Station

Objectives: Evaluate the effect of adding vitamin E, dissolved in ethanol, on quality and stability of meat products

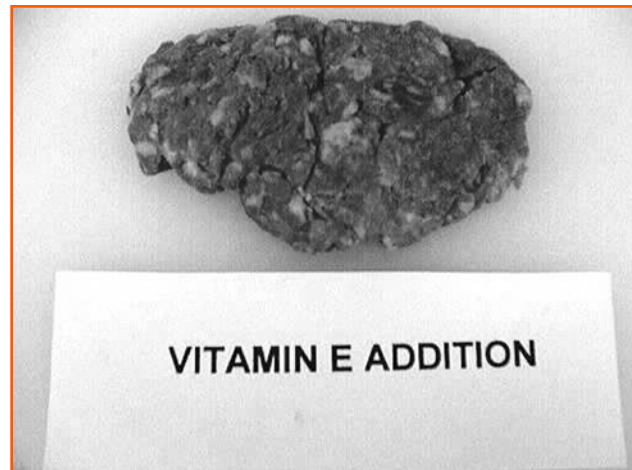
Executive summary: The quality and oxidative stability of pork patties stored at refrigerated temperatures was significantly improved upon addition of vitamin E dissolved in a small amount of ethanol. Control patties that received no vitamin E assumed the dull-brown metmyoglobin color after four days of storage, whereas the vitamin E patties displayed the characteristic fresh pork color throughout the eight-day storage period.

Work to be completed: This one-year project will terminate July 2002, but we will continue to compare various methods of adding vitamin E to meat products. From this project, one poster will be presented at the 2002 FAPC Research Symposium and a publication is in preparation. A graduate thesis will result from this project.



Vitamin E is dissolved in ethanol for use in a study testing shelf life of pork patties. The vitamin E reduced the appearance of metmyoglobin, which causes a dull-brown color in fresh meat.

This pork pattie, which has been treated with dissolved vitamin E, retained the color of fresh meat after eight days of storage. The control patties in the experiment turned brown due to metmyoglobin levels after only four storage days.



Service Projects Service projects

The Oklahoma Food and Agricultural Products Research and Technology Center provides business-related advice through pilot processing, technical assistance and business planning and marketing assistance to help producers, processors and entrepreneurs add value to Oklahoma's agricultural products. Center faculty and staff assist clients to identify, develop and commercialize products, as well as help them train and educate their staff and develop business plans to expand their businesses.

“Center faculty and professional staff have assisted Oklahoma clients with projects, assisting with start-up companies and contributing to adding jobs added to the Oklahoma economy. The Center is truly accomplishing its mission of supporting the growth of value-added products and processing for the Oklahoma agri-foods industry.”

J. Roy Escoubas, Director



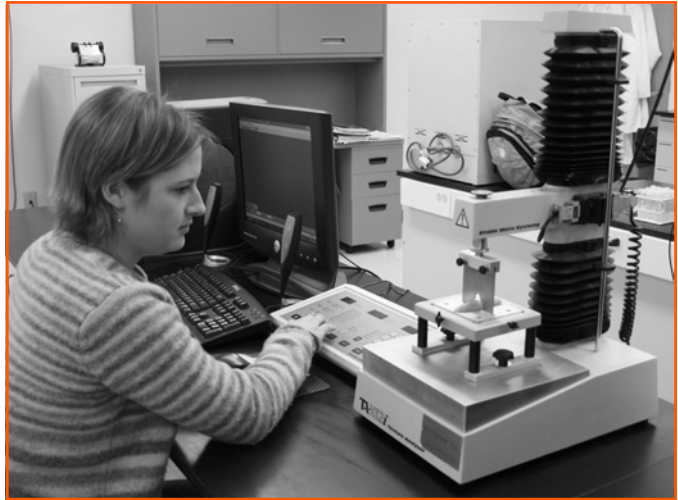
Service projects

DANIELLE D. BELLMER, Ph.D.

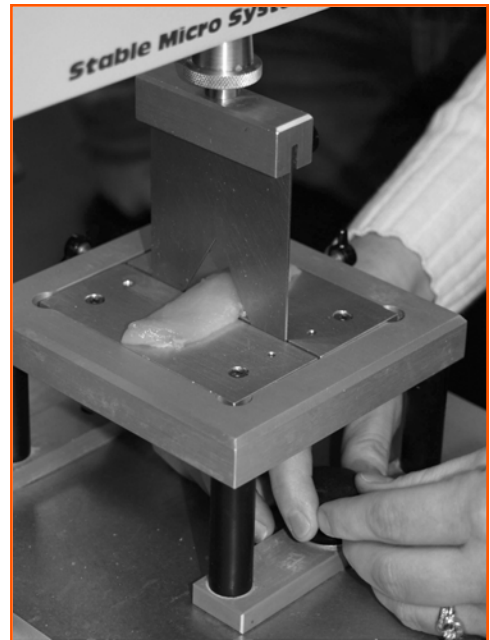
Assistance Requested: Texture evaluation of chicken breasts, which had been chilled for various times before de-boning. The client was interested in changing their process line, if possible, based on the texture results.

Work Performed: Warner-Bratzler shear and Texture Profile analysis tests were conducted on chicken breasts, which had been processed for various amounts of time. The study was completed and the results were sent to the client to allow them to speed their process lines.

Bellmer's lab assistant prepares to check a chicken breast for tenderness. Chicken breasts were processed at different lengths of time to determine texture changes. Bellmer used the Warner-Bratzler shear method to get information.



Danielle Belmer and her lab assistant conduct texture tests on processed, chilled chicken breasts. The client requested help in changing their process line according to texture results based on the Warner-Bratzler shear method.



A slice of processed chicken breast is measured for tenderness using the Warner-Bratzler shear method. The shear uses specific measurements to determine palatability of meats based on toughness.

TIMOTHY J. BOWSER, Ph.D.

Assistance Requested:

Three clients requested process-oven temperature profiles

Work performed: A slim-profile, six-channel data logger is used to record on-line process temperatures in food processes. The sensitive data logger is protected from heat and water damage by an insulated case. The data logger is placed directly onto the oven conveyor belt to record temperatures as it passes through the oven with the product. Temperature probes are placed into the product and/or can be exposed to the heating environment. A formal report of results is supplied to the owner of the oven. Processors can use the report and data collected to help maintain their ovens and to assist with product quality and energy issues.

Economic Returns:

Uncalculated improvements in product quality, energy conservation and process control

Assistance Requested: One client requested a process-freezer temperature profile

Work performed: A slim-profile, six-channel, data logger is used to record on-line process temperatures in food processes. The sensitive data logger is



A six-channel data logger passes through an oven to record actual cooking temperatures.

protected from freezing damage by an insulated case. The data logger is placed directly onto the freezer conveyor belt to record temperatures as it passes through the freezer with the product. Temperature probes are placed into the product and/or can be exposed to the environment. A formal report of results is supplied. Processors can use the report and data collected to help maintain their freezers and to assist with product quality and energy issues.

Economic Returns:

Uncalculated improvements in product quality and process control

Assistance Requested: Identify and develop a process for thawing frozen blocks of raw materials for further processing

Work performed: Tested alternative processes in the FAPC laboratory and prepared

a report describing the results

Economic Returns: Processor has installed new equipment that decreases labor and improves throughput

Assistance Requested:

Facility design and layout

Work performed: Assisted with design and layout of a shiitake mushroom production facility and an expansion of an animal feed facility

Economic Returns: Facilities are under construction

Assistance Requested: Facility design and layout

Work performed: Performed feasibility study for an expansion of a meat processing facility. The expansion effort was abandoned when it was found that insufficient space was available for wastewater treatment.

Economic Returns: Cost avoidance

Assistance Requested: Equipment design and improvement

Work performed: Provided design information and recommendations for a manufacturer of food processing equipment

Economic Returns: Improved product design resulted in unknown improvements in sales and reduced liability

Service projects, continued

Service

JIM W. BROOKS

Client: Bravo Foods—Tulsa, Okla.

Assistance Requested: Bravo is a new Oklahoma company that requested assistance in marketing their corn and flour tortillas to the foodservice industry.

Work Performed: Client has expanded with a new manufacturing facility having the capacity of producing 24,000 tortillas per hour. The Center assisted the client in assessing the manufacturing needs for the expansion, and equipment was ordered. The client was instructed in supply chain management for the Mexican foodservice market in Oklahoma for corn and flour tortillas. Further, the recommendations were given for trade association membership and partnerships. Consultations are continuing.

Economic Returns: Economic impact not completed. Forecasts are excellent for their products.

Client: Central Expanded Metals—Chandler, Okla.

Assistance Requested: Oklahoma client manufactures a single-use disposable charcoal grill. Client requested assistance in consumer marketing to include retail and convenience store sales and distribution.

Work Performed: The Center established focus groups to

evaluate the functional use, pricing, product name and probability of purchase. The focus groups addressed each topic and the results allowed sound marketing decisions to be made. The client was escorted through retail and convenience store buying shows to add strength to their decisions on methods of display. As the client networked in the buying shows, purchasing interest was high and many orders were taken.

Economic Returns: The client has made more than \$100,000 in the first two quarters of the sales year.

Client: Loeb's Legacy Sausage—Tulsa, Okla.

Assistance Requested: Client attended a Basic Training Workshop at the Center and focused to deliver a fundamental knowledge in

business start-up, product marketing, food regulations and labeling and the preparation of a business plan. The client had a family recipe for an "old fashioned" dinner sausage and requested assistance in formulating the recipe for volume production. Further, client needed assistance in sales and marketing to commercialize the product.

Work Performed: A variety of recipes were evaluated and product reflecting each recipe was manufactured in the Centers' pilot plant facilities. A final formulation was chosen and a co-packer was identified for commercial manufacturing. The Center assisted co-packer in locating required equipment for purchase to complete the project. The Center further assisted the client in focus studies on the best formulation to take to manufacturing.



Loeb's Legacy Sausage used the Center to start a business using an "old fashioned" family recipe. The FAPC assisted Loeb's Legacy with everything from Basic Training to co-packer identification and recipe formulation for manufacturing.

Service projects, continued

Service

Currently, the manufacturing phase has been completed, and the product is ready for volume production.

Economic Returns: The client has product orders for \$5,000. Sales are expected to grow through the next quarter.

Client: Oklahoma Cold Storage–Oklahoma City

Assistance Requested: A new freezer/refrigerated warehouse opened in July 2001. Client requested information on food manufacturers and processors in Oklahoma who utilize freezer and refrigerated public warehouses. Oklahoma Cold Storage has existing capacity of 2,700 pallets for frozen foods and 500 pallets for refrigerated products.

Work Performed: A complete list of food manufacturers and

processors was compiled that utilize public freezer/refrigerated warehouse facilities. In addition, a complete listing of retail, wholesale, foodservice distributors and refrigerated transport carriers were given to the client for consideration.

Economic Returns:

Client currently services 40 active clients who account for \$65,000 per month in billings. Plans for an expansion of 500 additional pallets are being considered for additional growth in the next two quarters.



Oklahoma Cold Storage services 40 active clients who account for \$65,000 per month in billings. Plans for an expansion of 500 additional pallets are being considered for additional growth.

Client: Poppin Glows Inc.–Tulsa, Okla.

Assistance Requested: Client asked for assistance and information on equipment specifications to wrap and package “glow stick” popsicles. The product uses a clear drinking straw rather than the traditional wooded stick, thus requiring specialized design and equipment.

Work Performed: One of the center’s engineers made a personal visit to the manufacturer to obtain information on the production process and existing packaging system. The Center then made a list of equipment specifications on various manufacturers that could be used for the client. Poppin Glows are currently testing two different designs and systems.

Poppin' Glows™, a “glowing” popsicle, entered the amusement and theme park (including Disney Land and Disney World), theatre and sporting arena markets in 2001. The popsicles use a plastic drinking straw instead of the traditional wooden stick.



Service projects, continued

Service

Economic Returns: Client is currently introducing the products to amusement and theme parks, theatres and sporting arenas for sales and distribution. Disney World and Disney Land have placed orders for the products, and sales should exceed \$90,000 by the end of the year.

Client: Redlands Community College—El Reno, Okla.

Assistance Requested: Agri-business department at community college interested in manufacturing goat cheese for fundraisers in conjunction with a research project on various varieties of goat milk. Requested a possible grant/loan to purchase equipment for the project.

Work Performed: The Center

advised the client about the “Enhancement and Diversification Program” regulated by the Oklahoma Department of Agriculture. They were advised by the Center to apply for a “Basic and Applied Research Grant.”

Economic Return: Redlands Community College submitted a business plan and made a presentation to the board and was awarded a \$40,000 research grant.



The Center helped Redlands Community College develop a business plan on manufacturing goat cheese for fundraisers. Redlands Community College received a \$40,000 research grant.

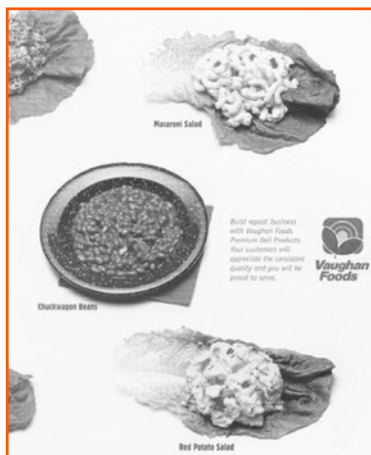
a research project if there are any value-added processes that could be initiated to eliminate the cost of current disposal.

Work Performed: The Center has established a team of faculty and staff members, including a retired horticultural professor, to initiate a proposal to the USDA for a research grant to evaluate the waste materials and their nutritional value for further processed ingredients.

Economic Return: Invitations to submit proposals by the USDA will be reviewed during the first quarter of 2003. Pending approval of proposal by the USDA, research work would begin in the second quarter.

Client: Vaughan Foods, Inc.—Moore, Okla.

Assistance Requested: Client has a substantial problem with waste products from their fresh vegetable processing rooms and currently pays to have material hauled from their plant. They would like to determine through



The Center is working with Vaughan Foods to initiate a grant proposal to evaluate waste materials and their nutritional value for further processed ingredients.

Service projects, continued

Service

NURHAN TURGUT DUNFORD, Ph.D.

Plan to offer a workshop on “Deep Fat Frying Technology” to Oklahoma-based food processors and foodservice facility and restaurant managers. Have prepared and posted a survey on the FAPC Web site to determine the interest for such a workshop. Visited two Oklahoma-based oil/oilseed processors and discussed potential collaborations.

Provided technical information and help to a number of companies and individuals on oil/oilseed related problems and questions. An example is given below.

Assistance Requested: A client requested assistance in improving their goat's milk laundry detergent formulation and large-scale production.

Work Performed: A batch of laundry soap was made based on the client's formula. Solubility, pH, moisture and foam capacity tests were performed on the product. A report, which summarized the test results along with a set of recommendations on



The FAPC assisted a client in developing a large-scale production of goat's milk-based laundry detergent. The laundry soap is available for sale through the Internet.

processing and formulation changes, was submitted to the client. Information on raw material suppliers and patent application process was also provided. The product is being marketed over the Internet. Currently, we are working on the process flow diagram and equipment and facility selection (Dunford, Willoughby, Bowser).

Economic Return: The client moved to Oklahoma from Kansas and plans to set up a production facility in Oklahoma.



Based on the client's original formula, the Center ran tests on solubility, pH, moisture and foam capacity of a goat's milk-based laundry soap, which is being produced in Oklahoma.

Service Service projects, continued

RODNEY B. HOLCOMB, Ph.D.

Assistance Requested: A company requested a marketing study be performed to pinpoint potential customers for a cold storage warehouse to be located at the old Tanger Outlet Mall site in Stroud, Okla.

Work Performed: Jim Brooks, Chuck Willoughby and Rodney Holcomb studied the potential customers for such a warehouse in Oklahoma and surrounding states, interviewing several food processors and distributors to provide an indication of the market potential for such a facility. The client accepted the final report in February 2001 and began planning the industrial park construction at Stroud with a freezer warehouse being part of the plan.

Economic Returns: The successful establishment of such a facility could generate in excess of 30 jobs for the Stroud area.

Assistance Requested: Examine the potential for a poultry litter-processing facility in Eastern Oklahoma

Work Performed: After visiting with a group of poultry producers as they determined an appropriate processing procedure, we agreed to examine the market potential for outputs of this procedure and examine the transportation costs associated with hauling

litter to one or more centralized processing locations.

Results: Dan Tilley (Agricultural Economics), Brian Adam (Agricultural Economics), Lawrence Mapemba (graduate student) and Rodney Holcomb worked with the group's technology advisor to develop a model identifying the costs of transporting litter (completed in 2002). This model provides the basis for determining the input costs for a processing facility. Further work will be done to determine the processing costs and expected returns to the plant.



A poultry litter-processing facility is in the works to provide a disposal system for hundreds of thousands of tons of litter in eastern Oklahoma.

Economic Return: While the development of a processing venture may create a number of jobs, the greatest impact of this venture would be the transformation and removal of hundreds of thousands of tons of poultry litter from sensitive watershed areas in eastern Oklahoma.

Assistance Requested: Assistance in developing a closed cooperative that would manufacture partially-baked, frozen artisan breads

Work Performed: Phil Kenkel (Agricultural Economics), Patricia Rayas (FAPC/Biochemistry) and Rodney Holcomb worked with the group in planning their cooperative, evaluating equipment and processes and examining marketing opportunities. Kenkel and Holcomb also presented information on the closed cooperative concept to groups of agricultural producers on behalf of the cooperative's planning committee.

Results: A closed cooperative was formed and an equity drive was held in the fall of 2001. Insufficient funds were gathered as a result of that equity drive, but the drive was extended into 2002.

Economic Returns: Too speculative at this point

Service projects, continued

Service

Assistance Requested:

Assistance in evaluating the market potential for non-pizza frozen dough products manufactured by VAP

Work Performed: VAP was provided with market information related to frozen dough products other than the self-rising pizza crusts they currently produce (i.e. sweet rolls, croissants, etc.). This information was used in the development of grant proposals submitted to state and federal funding agencies.

Results: VAP was successful in its efforts, receiving grants from both state and federal sources.

Economic Returns: Generating new products and finding customers for those products may allow VAP to add another production shift (roughly 30 employees).



The Center assisted in evaluating the market potential for non-pizza frozen dough products manufactured by VAP.

Results: ANB was successful in its pursuit of grant funds for the feasibility study and legal structuring of their proposed cow-kill plant. An equity drive is planned for the fall of 2002.

Economic Returns: Too

speculative at this point. However, if the business becomes established, the immediate results would include the generation of more than 200 jobs in southeastern Oklahoma.

Assistance Requested:

Assistance in the strategic planning and feasibility assessment of a cow-kill facility for southeastern Oklahoma

Work Performed: Phil Kenkel (Agricultural Economics) and Holcomb helped the American Native Beef (ANB) Cooperative find grant programs to get funds for a feasibility study and screen industry experts wishing to serve in a consulting capacity to help ANB get started. This is a long-term business development project that will extend through 2002.



This cow-kill facility, located in New Zealand, resembles one the American National Beef hopes to build in Hugo, Okla., located in the southeastern part of the state. The plant would provide a facility for ranches in a 300-mile radius of Hugo. The plant would also produce approximately 200 jobs for Oklahomans.

Service

Service projects, continued

WILLIAM G. MCGLYNN, Ph.D.

Assistance Requested:

Evaluation of canned, shelf-stable food products for safety, proper processing procedures, and compliance with applicable state and federal regulations

Work Performed: In 2001, the Center served as Recognized Process Authority for 38 companies in Oklahoma and conducted Preserved Food Process Evaluations on more than 50 food products.

Economic Returns: The exact economic return of these projects is difficult to estimate. The potential return for a given company could be quite large, given that this program may prevent losses stemming from improperly processed products.



The FAPC completed many fresh, frozen and processed vegetable services.

Assistance Requested:

Evaluation of processed food formulation and generation of Nutrition Facts panels for the food product labels

Work Performed: The Center worked with 13 companies in Oklahoma and generated Nutrition Facts panel for the labels of more than 40 food products.

Economic Returns: Potential returns include increased sales due to more professional label appearance and enhanced consumer appeal.

Assistance Requested:

Participate in new product development/scale-up projects

Work Performed: The Center worked with six companies in Oklahoma specifically on creating new value-added food products and scaling the formulation up for commercial production. The total number of products formulated was eight.

Economic Returns: Potential returns for the companies assisted included increased sales of new/improved products.

Assistance Requested:

Provide technical information on frozen vegetable processing and assist in development of enlarged processing facility

Work Performed:

The Center worked with an Oklahoma state agency on a proposed frozen vegetable processing facility. We provided technical information on processing procedures,

processing aids, equipment and packaging for several frozen vegetable products.

Economic Returns: When fully operational, the facility has the potential to save the state money by more efficiently providing food products for agency use.

Assistance Requested:

Help conduct heat distribution testing on a newly designed retort for both water immersion and steam atmosphere thermal processing

Work Performed: The Center worked with an Oklahoma-based company to help evaluate a newly modified piece of thermal processing equipment. We traveled to their facility to provide specialized equipment for heat distribution tests. We subsequently analyzed the results and provided the company with a report that allowed them to refine their design and provide independent test results to prospective customers.

Economic Returns: The modified processing equipment may open up new markets around the world for this manufacturer beyond their traditional customers. Given that these systems sell for at least several hundred thousand dollars, the sale of even a handful of additional systems may add significantly to this company's bottom line.

Service projects, continued

Service

DAVID MOE

Assistance Requested: The client goal is to expand his market for Bermuda grass sprigs.

Work Performed: Initiate test protocol to determine if Bermuda grass sprigs harvested while dormant will retain viability if stored under controlled conditions. The results demonstrated that viability can be maintained at a near-constant level for at least four months when packaged and stored under certain conditions.

Economic Returns: Future action is under review by client.

Assistance Requested:

The client is looking for new markets for "food grade" calcium sulfate mined in Oklahoma. One potential end user is the processed meat industry.

Work performed:

Potential scenarios for

The FAPC not only assists with scale-up and product development, but also conducts pilot product processing for businesses wishing to do out-of-state test markets, such as the "Beef Jerky" processing.



David Moe and Renee Nelson gather Bermuda grass sprigs to determine viability levels when harvested while dormant.

"adding value" to processed meat systems were determined and tested.

Characteristics such as yield, color, flavor and shelf life were considered. However, product enhancement was not demonstrated with any of the scenarios tested. A report was issued to the client.

Economic Returns: Client will continue

to evaluate other food uses for calcium sulfate.

Assistance Requested: Client requested processing his existing "Beef Jerky" (State inspected) using the FAPC pilot plant (USDA inspected) in order to permit shipment outside Oklahoma for a test market.

Work performed: Provided facility, equipment and regulatory guidance for processing about 1,000 packages of "Beef Jerky."

Economic returns: Client decided not to pursue beyond the test market at this time.

Service Service projects, continued

JAKE NELSON

Assistance Requested: Use of the pilot plant abattoir

Work Performed: The objective was to test the efficacy of a novel approach to detecting fecal contamination on freshly slaughtered beef carcasses. This technology employed the use of a specific wavelength of light, of which when applied to the carcass, would cause the chlorophyll in plant matter (fecal contamination) to fluoresce. The project was funded by the client and performed in the abattoir within the FAPC. Executive summary of results are owned and maintained by the client.

Economic Returns: While the client maintains all data relative to the production and sales of this equipment, a recent press release indicates that this food safety technology will be installed "in-line" at a major beef processor as early as January 2003.

Assistance Requested: Pilot plant usage

Work Performed: The National Cattleman's Beef Association's research and development group requested the use of the meat processing facilities within the FAPC. Work performed is for the development of new beef item concepts, and NCBA personnel perform the work.

Economic Returns: No



A new detection method for fecal contamination of beef carcasses can detect chlorophyll in plant matter. The method uses a specific light wavelength which fluoresces chlorophyll found in plant matter.

economic returns have been realized for the beef industry by the FAPC.

Assistance Requested: Sensory analysis

Work Performed: This client requested the services of the Center's sensory area and a consumer panel. FAPC personnel cooked beef steaks

provided by the client, constructed a consumer panel and obtained and sent the data to the client. Results are confidential.

Economic Returns: No economic returns have been realized for the client by the FAPC.

Assistance Requested: Regulatory compliance

Work Performed: Jake Nelson and Jason Young, along with support from Siobhan Reilly and Halldor Sigfusson, gave this client assistance in meeting HACCP requirements as described. This client had received a letter of intended enforcement action by the USDA and feared for the future of his/her business. Problems developed from the manufacturing practices employed while producing beef jerky. To assist the client, Center personnel obtained samples for analysis, performed an audit of the plant, reported back to the client with data from his/her jerky and gave suggestions on changes that should be employed to the facility and their practices.

Economic Returns: The only economic testament is the fact the client is still in business, is meeting USDA regulations and has been able to expand the product line since meeting with the FAPC personnel.

PATRICIA RAYAS-DUARTE, Ph.D.

Assistance Requested: An existing Oklahoma company requested assistance in problem solving of a production batch that did not meet specifications. The client also was interested in finding alternative sources of state produced ingredients for their bake products.

Work Performed: The Center performed bake tests of different formulations and made recommendations on formulation changes for the problem batch.

Economic Returns: Overall reduction of ingredient costs is anticipated.

Assistance Requested: Two regional wheat and milling companies requested assistance on specialized analysis of wheat and/or flour blends for specific bake products.

Work Performed: The Center performed wheat, flour and baking evaluation according to each request.

Economic Returns: Not reported

Assistance Requested: One entrepreneur requested assistance in the processing of ingredients with specific advantages to be used on prototypes of snacks containing cereal and/or



The Center performed bake tests of different formulations for an existing Oklahoma company.

potato ingredients.

Work Performed: The Center assisted in processing schemes that enhanced the viscosity and functional properties of potato and cereal ingredients. Frozen snack prototypes were processed and shipped to potential clients.

Economic Returns: Not reported

Assistance Requested: One scientist from the USDA National Center for Agricultural Utilization, Peoria, Ill., requested assistance in the processing of Asian-type noodles containing oat fiber product.

Work Performed: The Center

assisted in processing and testing the quality of alkaline noodles made with hard red winter wheat and oat fiber.

Economic Returns:

Information will be used for pursuing commercial application of the oat fiber product.

Assistance Requested: An existing Oklahoma catering company requested assistance in the assessment of shelf life of savory wafers with potential sales to a major city in Texas through a regional distributor.

Work Performed: The Center performed shelf life studies of flavor and texture attributes. The Center also made suggestions to improve formulation of the wafer.

Economic Returns: Economic impact not assessed yet

Assistance Requested: An Oklahoma producer requested assistance in exploring the suitability of a sorghum hybrid grain, traditionally used as feed, for human consumption.

Work Performed: The Center produced a variety of snack products, and it was found suitable. This suggested that the grain has potential uses for human foods.

Economic Returns: Exploratory work with long-range economic impact

Service Service projects, continued

SIOBHAN REILLY, Ph.D.

Assistance Requested: Activities vary across disciplines (i.e., food safety, HACCP, microbiology, chemistry, product/process development, etc.). To date, 65 industry clients have been assisted by either research and/or technical support through her program. Solid relationships have been formed, such that most of these companies continue to be regular participants in her extension program. One of the most active programs is the Food Safety/Quality/HACCP Audit program that was developed. This has opened the door for many industry/Center activities that otherwise might not have been realized.

The companies listed, and others, have been assisted by the research and consulting capabilities of Reilly's laboratory:

Advanced Foods, Advanced Brands, Bama Pies, Chef's- Requested Foods, Coors Brewing Co., Cusacks Meat Co., Empak Foods, Hall Cattle Co., Hanson Cold Storage, J.K. Boersma Beverage Co., Kajlb Co. (Oklahoma Waffles L.L.C.), Kelly Foods (Bil-Jack Petfood), Knight Creek Farms, Lopez Foods, National Steak and Poultry, Ralps Packing Co., Seaboard Farms, Schwab and Co., Tulsa Beef and Provision, Tyson Foods, Unitherm Food

Systems, USA Bottling Inc. and Vaughan Foods.

The work with these companies is confidential, so specific examples must be omitted.

Work Performed:

General areas of industry assistance include (but are not limited to):

- 1) Identification of microorganisms (environmental/product oriented)
- 2) Detection of microbial contamination sources and hazards within food plants
- 3) Control of microbial growth in food products
- 4) Improvement of microbiological quality and safety of food products
- 5) Determination of appropriate methods/frequency for cleaning and sanitizing
- 6) Identification of methods/locations for environmental monitoring
- 7) Correct use of swabs, sponges, direct-contact plates, air sampling and bioluminescence to collect samples
- 8) Determination of needed microbial testing/sampling plans
- 9) Construction of

process flow diagrams for HACCP

- 10) HACCP plan development
- 11) Identification of CCPs and critical limits
- 12) Identification of corrective actions
- 13) Record keeping design
- 14) HACCP verification/validation
- 15) Product development
- 16) Determination of shelf stability
- 17) Improvement in shelf stability
- 18) Food safety/quality audits to identify microbial contamination sources and hazards within food plants and determine appropriate methods/frequency for cleaning and sanitizing impact



FAPC helped a company improve the quality of their pasta.

Service projects, continued

Service

DARREN SCOTT

Assistance Requested: Various Oklahoma processors and entrepreneurs requested help in developing nutritional labels for their products.

Work performed: Nutritional labels for jams, mustards, jellies, cookies, candies, chips, barbecue sauces, salsas and other foods were developed using a nutritional database. If the database was insufficient, the staff analytical chemist was consulted and proximate analysis was performed to provide additional data so the label could be completed. Clients were then able to meet

regulatory requirements for labeling, as well as meeting customer expectations.

Economic Returns: Not determined

Assistance Requested: Various Oklahoma processors and entrepreneurs requested help in reformulating and/or scaling up product formulations so that they could be manufactured on an industrial scale or produced in a particular fashion.

Work performed:

Products were developed, reformulated or scaled up using pilot scale equipment and sensory analysis to meet particular production or regulatory requirements. The products included jellies, barbecue sauces, mustards, salsas, pies and dessert toppings.

Economic Returns: Not determined



The FAPC helped Oklahoma processors and entrepreneurs develop nutritional labels for their products.



Products were developed, reformulated or scaled up using pilot scale equipment to meet specific requirements.

Service projects, continued

Service

HALLDOR SIGFUSSON, Ph.D.

Assistance Requested: Various Oklahoma-based clients requested assistance with process or product development and evaluation of product quality and stability.

Work Performed: Assisted with product development of pet food, process evaluation of meatballs and evaluation of shelf life and sensory attributes of fresh/frozen beef, pork and poultry.

The shelf life and sensory attributes of these steaks, as well as frozen beef, pork and poultry, can be tested. Changes can be made to product quality and stability at the conclusion of the tests.



Assistance Requested: Various Oklahoma-based clients requested assistance in meeting regulatory requirements for safe processing of meat/poultry products.

Work Performed: Visited several clients and performed quality audits of plants, in addition to providing technical assistance regarding processing and food

safety/HACCP assistance for various products, e.g. cured meats, sausages, jerky, emu, poultry, tamale and pizza toppings.



Safe processing requirements of meat and poultry products ensure quality end products.



Plant audits and food safety/HACCP assistance is provided for clients producing products such as tamales, pizza toppings, poultry, jerky, meats and sausages.

COREY STONE

Client: Ol' Santa Fe Tamale Company

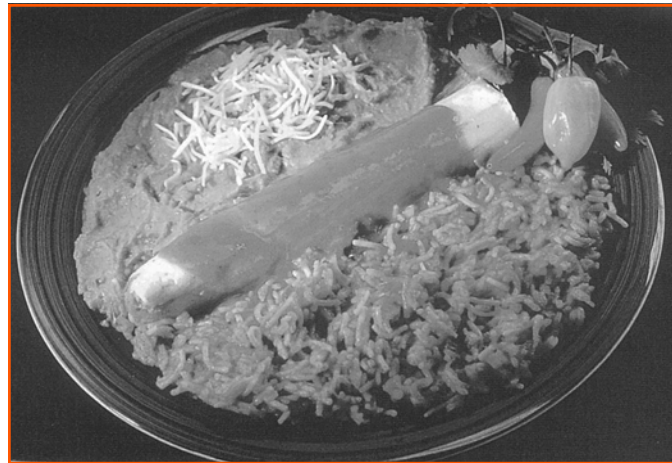
Assistance Requested: A Tulsa restaurant specializing in Santa Fe-style Mexican cuisine approached the Center looking for assistance in marketing their tamales to foodservice and institutional outlets.

Work Performed: The Center visited with Ol' Santa Fe on several occasions regarding the future of their business and their product line. The Center assisted with revisions of the current business plans, USDA regulations, equipment decisions and market evaluation. The Center evaluated the tamales and issued nutritional labels. The Center also advised on regulations regarding claims of health and nutrition with respect to the tamales.

Economic Returns: The client has already located a distributor and investors and is considering feasibility of building a facility in south Tulsa. At least two foodservice chains and one institutional entity have agreed to carry the product.

Client: Daddy Hinkle's

Assistance Requested: Daddy Hinkle's, an existing Oklahoma food company marketing spice rubs and marinades in Tulsa, Okla., requested assistance in locating equipment in an effort



Ol' Santa Fe Tamale Co. produces tamales, enchiladas and other Mexican food items. The Center assisted Ol' Santa Fe in creating nutritional labels and meeting USDA health regulations. The company sells to foodservice chains and institutions.

to take over production from their current copacker.

Work Performed: The Center provided information about necessary equipment and respective dealers, as well as other copacking options in their area.

Economic Returns: It is promising that Daddy Hinkle's will take over production and packaging of the bulk of their product line in the future.

Client: Ebiita Food Tech Consulting

Assistance Requested: Tony Bello of Ebiita Food Tech Consulting contacted the Center requesting assistance in relocating his starchy foods consulting business to Broken Arrow, Okla. from Plano, Texas.

Work Performed: The Center provided initial assistance for the new business plan, as well

as fee schedules for lab and pilot plant usage for work while the relocation takes place.

Economic Returns: Bello has already begun consulting for a large snack food producer and an unaffiliated university.

Client: Hyde-Away Farms

Assistance Requested: The two proprietors of this prospective new business attended the Center's entrepreneurial workshop. They planned to market various pickled vegetables.

Work Performed: The Center worked with the Patent and Trademark Depository at Oklahoma State University to complete a trademark search for the clients. The Center also provided a Letter of Process Authority and information on necessary equipment.

Economic Returns: Hyde-Away

Service Service projects, continued

Farms is currently having its products co-packed, while concentrating on market development. This project is still in the initial phases.

Client: Head Country Food Products

Assistance Requested: A prominent Oklahoma food business requested assistance in locating equipment and design of a new production system that could meet increased regional demand for its products, most notably barbecue sauce.

Work Performed: A Center food process engineer provided layouts and hands-on instruction for a steam-injection system, as well as possible alternatives to meet short-term demands. The Center also provided information on a piston filler for Head Country's current production line.

Economic Returns: Head

Country has been accepted into at least one additional warehouse of the nation's largest retail grocery chain and expects volume to increase by 85 percent of current capacity.

Client: Kay's Down Home/Kay's Old-Fashioned

Assistance Requested: A year 2000 participant of the Center's entrepreneurial workshop requested assistance in starting up her food business, focusing on potato salad.

Work Performed: The Center was very instrumental in forming a business plan, as well as coordinating marketing efforts for this product. Assistance included co-packer identification, trademark search initiation, advice on marketing materials, product formulation and scale-up, multiple pilot runs and market identification. An initial co-packer was unable to follow through with Kay's, and

alternatives were discussed.

Economic Returns: Kay's has requests from several retail grocery stores for products for their deli areas. The Center feels that Kay's must find a suitable distributor and co-packer and should then be able to move into this market.

Client: Kyoto Restaurant

Assistance Requested: A local Japanese restaurant requested assistance in marketing their house dressings and sauces.

Work Performed: The client provided recipes for pH testing and shelf life evaluation for a miso salad dressing, mustard sauce and ginger sauce. The Center also provided advice for bottling the sauces for retail sale. Most recently, discussion on possible additives and treatments to prevent spoilage and extend shelf life and shelf stability has taken place.

Economic Returns: Kyoto continues to grow in sales volume and is selling the products from its newly remodeled foodservice location in Stillwater, Okla.

Client: Landrun Seasonings

Assistance Requested: A small business marketing for a line of dry spice mixes contacted the Center for assistance, leading to a number of various independent projects.

Work Performed: The Center located a provider of liability



Head Country Food Products requested assistance in locating equipment and design of a new production system.

Service Service projects, continued

insurance for Landrun Seasonings. The original co-packer for the dry spice line was unable to meet Landrun's quality standards, and a suitable co-packer was located by the Center. Since then, Landrun also has come to an agreement with a large distributor, and its product line will be introduced to several retail stores in 2002.

Economic Returns: The forecast for sales of this product line are very favorable. Several retail store deli sections have agreed to carry the line, as has at least one out-of-state retail chain.

Client: Round Springs Bottled Water

Assistance Requested: An existing client of the Center continued a bottled water project.

Work Performed: The Center contacted a large Oklahoma-based convenience store chain about possibilities of Round Springs packing a private label bottled water specifically for the chain. The results of these initial discussions and relevant contact information were passed on to Round Springs.

Economic Returns: Round Springs is taking great care and caution to meet EPA standards for the bottling of spring water. While this has slowed the pace, it has allowed time for the client to set up multiple accounts in

the Grand Lake area for potential distribution. It is likely that once in operation, the greater portion of the facility's capacity will already be contracted.

Client: Oklahoma Pecan Growers

Assistance Requested: The Oklahoma Pecan Growers requested assistance in identifying ways to stabilize their market.

Work Performed: The Center worked with Oklahoma State University's Horticulture and Landscape Architecture Department and Oklahoma Cooperative Extension Service personnel to identify value-added opportunities for the pecan industry. Furthermore, the Center assisted industry participants by formulating an action plan based on objectives outlined by the association.

Economic Returns: Currently, the board of the association plans to meet and discuss further action. It is hopeful that a business concentrating on a line of value-added pecan

products will result from this effort, most likely in central or southern Oklahoma.

Client: Our Enterprises, LLC

Assistance Requested: An existing Oklahoma gourmet food business requested assistance in developing nutritional labels for a specific product line.

Work Performed: The Center provided the proper labeling requirements and nutritional facts for three salsa products.



The Oklahoma Pecan Growers Association worked in conjunction with the Horticulture and Landscape Architecture Department and the Oklahoma Cooperative Extension Service to develop a business line of value-added products in central or southern Oklahoma.

Service

Service projects, continued

Additionally, the Center advised on possible new outlets for existing product lines.

Economic Returns: Our Enterprises continues to grow and break into new markets. A greater than 50 percent increase in sales volume is expected over the next 12 months.

Client: Natural Farms

Assistance Requested: A custom meats shop and grocery requested assistance in identifying possible value-added meat products utilizing hard-to-sell cuts.

Work Performed: The Center offered a number of possible products that could be produced. The Center also suggested marketing techniques to move the existing products. The Center followed up with a video tape outlining the process for different cuts and possible resulting value-added products.

Economic Returns: Natural Farms continues to be a presence in the Tulsa market and is considering expansion to multiple locations in the greater Tulsa area.

Client: Taff Farm

Assistance Requested: A Sapulpa blackberry farm featuring a successful "U-pick" operation requested assistance with test-marketing a blackberry jelly.

Work Performed: The Center brought the client in for a pilot run. Samples of the product were evaluated for quality. The product made in that run was used to test-market the success of offering value-added blackberry products during the "U-pick."

Economic Returns: Taff Farm experienced its largest total volume since inception, due in some part to the presence of the jelly for sale.



Taff Farms, a "U-pick" blackberry farm in Sapulpa, Okla., used the Center to produce a blackberry jelly for sale on the farm. The Center produced a pilot run of the jelly to determine quality and palatability. The jelly resulted in an increase in sales for the farm.

Client: Salt Creek Cattle Company and Trading Post

Assistance Requested: Salt Creek Cattle Company and Trading Post, an existing Oklahoma agricultural business, requested assistance in expanding their business into a production and retail sale of custom-smoked meat products and barbecue sauce.

Work Performed: The Center provided assistance in starting a business plan, researching trademarks, scale up of barbecue sauce recipe and contact information for local health inspectors. Salt Creek returned to the Center to produce a pilot run of sauce for test-marketing purposes and

subsequently, identified a co-processor for retail production while a facility is built at Salt Creek's headquarters in Stroud, Okla.

Economic Returns: Salt Creek has since introduced a red pepper salsa which is currently its signature item in more than 10 stores. Salt Creek expects to have a facility completed in 2002, and has already begun opening new markets through various retail demonstration

Service projects, continued

Service

programs and trade shows.

Client: Timberline Ranch

Assistance Requested: One of the nation's largest elk ranches requested assistance in determining feasibility of operating a custom slaughter facility in north-central Oklahoma and general marketing of value-added elk products.

Work Performed: The Center met with Timberline to determine specific needs for researching feasibility of this venture. Discussions ranged from evaluation of current marketplace, potential for value-added elk products, and logistics of elk slaughter to specifics of a research project which could be conducted utilizing the Center's pilot facility. The project would concentrate on meat products, but a nutritional supplement produced from the velvet (soft horn) was also discussed.

Economic Returns: The industry has shown more promise in the light of recent published research on favorable health benefits of elk meat and horn.

Client: Stu's-Q BBQ Sauce

Assistance Requested: An existing Center client requested assistance in

growing sales volume.

Work Performed: The Center offered information regarding the retail demonstration program at Fire Lake Discount Foods in Shawnee, Okla. Also, the Center agricultural economist has been working with a large bulk retail products chain to introduce more Oklahoma companies and included Stu's-Q on the list of potential product lines.

Economic Returns: Stu's-Q has participated in the demonstration program, resulting in favorable sales

figures and is subsequently being stocked on that store's shelves. In the past year, Stu's-Q has doubled the number of retail outlets that carry the barbecue sauce product.

Client: Pep In The Mustard

Assistance Requested: A former entrepreneurial workshop participant and current Center client continued a project with the Center, focusing on development of her small food business.

Work Performed: The Center provided a variety of services, most notably business and market planning, formula scale-up, process evaluation, labeling advice and co-packer identification. An ingredients supplier in northeast Oklahoma was located and less expensive inputs were identified, resulting in much lower production costs. Several pilot runs followed to perfect the intricate production process before going to a co-packer.

Economic Returns: Pep In The Mustard has secured contracts with foodservice chains in Vermont and Florida and is currently negotiating with a retail chain in Florida representing more than 500 stores. The mustard is already in a local gourmet retail shop.



Stu's-Q BBQ Sauce, an existing Center client, has increased sales and doubled the number of stores carrying its product.

Service projects, continued

Service

CHUCK WILLOUGHBY

Client: 7-Eleven Stores of Oklahoma City

Assistance Requested: 7-Eleven Stores of Oklahoma City, a family-owned franchise operating more than 100 convenience stores in the greater Oklahoma City metropolitan area, requested assistance in start up of a donut bakery facility that would serve all its units.

Work Performed: 7-Eleven of Oklahoma City is expanding their business by manufacturing donut products that they will market and sell through their 100-plus convenience stores in the greater Oklahoma City metropolitan area. The Center assisted with review of plant design and layout. Further, the Center helped 7-Eleven by reviewing its logistics and distribution plan. Additional assistance is focused on product formulation, the identification of production equipment, referrals for flooring materials, referrals for sanitation program, a capacity analysis of delivery trucks, an evaluation of product merchandising units and a review of marketing and promotional materials.

Economic Returns: Production capacity is being determined. Employment in the new bakery is 13 full-time employees. Expansion into other product lines is expected.

7-Eleven Stores of Oklahoma City worked with the Center to produce acceptable plant production plans, logistics and distribution plans for donut production. The bakery site employs 13 full-time workers .



Client: August Moon Restaurant

Assistance Requested: August Moon Restaurant, a family owned Chinese restaurant in southwest Oklahoma City, requested assistance in bottling and marketing their sauces.

Work Performed: Client has attended Basic Training for Food Business Entrepreneurs. Client has been provided a list of potential co-packers and is considering that option as well as bottling in the restaurant kitchen.

Economic Returns: Client has not determined whether to pursue commercialization of sauce.

Client: Benningfield All Purpose Sauce

Assistance Requested: Client requested assistance regarding production and marketing of condiment targeted at diabetic

market.

Work Performed: Client has attended Basic Training for Food Business Entrepreneurs. Work activities include potential co-packer identification, product formulation assistance, nutrition facts information and process evaluation.

Economic Returns: Client is in the process of interviewing potential co-packers. Client will be participating in the Made In Oklahoma Program.

Client: Carla Bailey

Assistance Requested: Client requested assistance regarding production and marketing of salsa and pickled vegetables.

Work Performed: Client has attended Basic Training for Food Business Entrepreneurs, and currently markets fresh produce to various grocers. Client has been provided a list

of potential co-packers and has expressed that no other services are needed at this time.

Economic Returns: Client is marketing value-added products to current grocer/customer base.

Client: Ike's Chili House

Assistance Requested: Ike's Chili House, a popular restaurant in Tulsa, Okla., requested assistance in production and marketing their chili seasoning mix.

Work Performed: Client has attended Basic Training for Food Business Entrepreneurs. Client has been provided with a list of potential co-packers and has expressed that no other services are needed at this time.

Economic Returns: Client has not determined whether to pursue commercialization of seasoning mix.

Client: Gordon's Cow Tippin' Beef Jerky

Assistance Requested: Gordon's Cow Tippin' Beef Jerky, a family operated LLC in Guymon, Okla., requested assistance regarding production and marketing of beef jerky.

Work Performed: Client has attended Basic

Training for Food Business Entrepreneurs and HACCP Training. Work activities include review of label, nutrition facts information, review of HACCP plan and facility review. Client also has participated in retail demonstration opportunities coordinated by the Center.

Economic Returns: Client produces product under USDA inspection and markets products through retail grocers, convenience stores and special events in Oklahoma, Colorado and New Mexico. Expansion into other markets is expected.

Client: Green Country Smoke House

Assistance Requested: Larnell

Dennis, sole proprietor and doing business under the label Green Country Smoke House, requested assistance regarding production and marketing of beef jerky.

Work Performed: Client has attended Basic Training for Food Business Entrepreneurs. Work activities include potential co-packer identification and label review. Client is working with a USDA-inspected food manufacturer in McAlester, Okla., for production. Client has also participated in retail demonstration opportunities coordinated by the Center.

Economic Returns: Client markets products through retail grocers, convenience stores

and vending machines. Client is pursuing the fundraising market as well. Client participates in the Made In Oklahoma Program. Expansion into other product lines is expected.

Client: Hall Cattle Company

Assistance Requested: Ed Hall, a rancher from Mutual, Okla., requested assistance regarding production and marketing of

Green Country Smoke House received assistance from the Center to produce and market the brand's beef jerky. The jerky is now sold in convenience stores, retail grocery stores and vending machines.



Service projects, continued

Service

packaged pre-cooked beans.

Work Performed: Client has attended Basic Training for Food Business Entrepreneurs. Work activities include shelf life study, potential co-packer identification and retail demonstration opportunities. Client intends to market product as refrigerated/frozen through local retail grocers and convenience stores. Client is working with a USDA-inspected food manufacturer in Oklahoma City for production. Client will participate in the Made In Oklahoma Program.

Economic Returns: Client has made contact with local grocers and convenience stores, as well as a wholesaler in Woodward, Okla., who have expressed an interest in carrying his heat-and-eat product. His product already has good recognition in northwest Oklahoma, as it is prepared at many special events. Product will be available for market early 2002.

Client: Producers Cooperative Oil Mill

Assistance Requested: Producers Cooperative Oil Mill, a processor of cottonseed in Oklahoma City, requested assistance regarding production and marketing of cottonseed oil for retail and foodservice markets.

Work Performed: Client currently presses and extracts oil from cottonseed to be sent to various refineries in the United States to be further processed for retail and foodservice markets, as well as an ingredient for many snack food manufacturers. Because of the changing dynamics in the cottonseed oil market, fewer refineries are in existence, thus the client is considering further refining the oil for these markets and finding a co-packer to produce their products for them. Work activities include potential co-packer identification and oilseed research information.

Economic Returns: Client is in the process of interviewing potential co-packers. If the client decides to pursue this venture, the client will participate in the Made In Oklahoma Program.

Client: Udder Farms Assistance

Requested: Client requested assistance regarding production and marketing of laundry detergent that utilizes natural ingredients including goat's milk.

Work Performed: Client has attended Basic Training for Food Business Entrepreneurs. Work activities include plant and process flow design, equipment identification, potential co-packer identification, product formulation assistance, pilot plant usage and review of marketing materials.

Economic Returns: Client has been marketing product via the Web, direct to consumer and through a fundraising program. Currently pursuing international and military contracts. Plans to open a manufacturing plant in Payne County. Expansion into other markets are under consideration.



Udder Farms, an Oklahoma-based company, produces laundry detergent from goat's milk and other natural ingredients. The detergent sells via the World Wide Web.

Service projects, continued

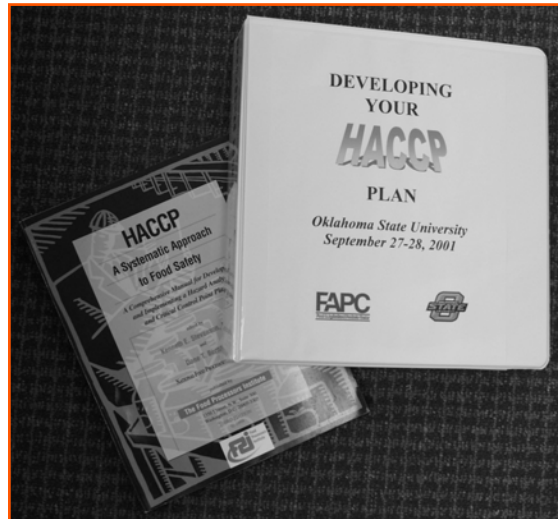
Service

JASON YOUNG

Assistance Requested: Seven clients have requested assistance with their HACCP and SSOP programs.

Work Performed: The plant requesting assistance was visited and a thorough evaluation of its HACCP plans and SSOP plans was reviewed. The HACCP Assistance Checklist was used as a standard check sheet to verify compliance to regulatory guidelines. The client's HACCP plan was reviewed line-by-line to look for and advise the clients of non-compliance or just to give the clients a heads up on what the regulatory agencies want to see in HACCP plans and SSOPs.

Results: At the end of the assistance/review, we had an exit meeting, and then a final report was sent back to the client, which included the HACCP Assistance Checklist and a summary of suggested comments and changes.



"HACCP: A Systematic Approach to Food Safety," and "Developing Your HACCP Plan" are tools used by the Center to assist food business entrepreneurs and companies.

The FAPC's Hazardous Analysis Critical Control Points reviews assist individuals in creating and updating plans designed to meet state and national regulations. The Center will provide help to new or old clients, offering specific comments and changes.



Outreach Projects

Outreach projects

The Oklahoma Food and Agricultural Products Research and Technology Center offers a variety of educational and service programs tailored to the needs of the food and agricultural products processing industry. Center faculty and staff provide outreach programs, such as workshops, seminars, professional public presentations, tours and educational displays to increase the awareness of the services of the Center. Some of the outreach projects include the Reaching Engineering and Architecture Career Heights program, Basic Training Workshop, Master Canners Workshop and HACCP Workshops.

"Our faculty and professional staff have been successful in delivering a broad array of workshops, conferences, roundtable discussions and symposia aimed at training and continuing education for the food industry in Oklahoma. Additionally, Center scientists and technologists perform industry in-plant audits, process reviews and product development support to assist in the improvement of process efficiency and product innovation."

J. Roy Escoubas, Director



Outreach projects

Outreach

DANIELLE D. BELLMER, Ph.D.

Title: REACH (Reaching Engineering and Architecture Career Heights) Program

Objective: Introduce a select group of high school girls from across the state of Oklahoma to the exciting career opportunities available in engineering, architecture and technology

Cooperating Agencies: Oklahoma State Regents for Higher Education, Phillips Petroleum Co., NASA, OSU College of Engineering, Architecture and Technology

Executive Summary: Bellmer served as one of two co-directors of the program and also as one of the biosystems module instructors. Thirty young women from across the state of Oklahoma spent two weeks on the OSU campus from June 2 to June 15. They experienced eight academic modules, a career guidance module, field trips, numerous social and team-building activities and carefully planned interactions with female faculty, staff, students and practicing engineers. Evaluations by participants indicate that the academy achieved its goal of increasing their awareness of engineering, architecture and technology. Overwhelmingly, participants rated the academy as a very positive experience.



These REACH Program participants conduct an experiment during their on-campus stay at OSU. Participants worked directly with female faculty, staff, students and practicing engineers.



During the REACH Program, 30 high school girls from across the state gained valuable information about career choices in engineering, architecture and technology. The girls participated in hands-on experiments, such as the one pictured above.

Outreach projects, continued

Outreach

RODNEY B. HOLCOMB

Title: Cooperatives

Cooperating

Objective: Discuss contemporary issues related to Oklahoma agricultural cooperatives and provide insight into successful new generation cooperative efforts nationwide

Cooperating Agencies:

Oklahoma Agricultural Experiment Station, Oklahoma Cooperative Extension Service, Oklahoma Agricultural Cooperatives Council, Oklahoma Department of Agriculture

Audience: Cooperative boards and managers, agricultural producers interested in cooperative development, rural development specialists

Number of Attendees: 84

Feedback: The event was considered a success. Future cooperatives conferences will be coordinated by the incoming Bill Fitzwater Endowed Chair for Cooperative Studies in the Department of Agricultural Economics. Assistance will be given to the chair in developing future workshops.

Title: Marketing Opportunities for Natural Beef

Objective: Provide Oklahoma cattlemen with information on the market potential of natural beef, primarily in the Southern Plains region



Rodney Holcomb provides a weekly segment on SUNUP discussing opportunities and economic growth in small Oklahoma communities.

Cooperating Agencies: Kerr Center for Sustainable Agriculture

Audience: Oklahoma ranchers, either currently producing or contemplating producing their cattle for marketing as "natural" beef (i.e. no growth hormones or antibiotics)

Number of Attendees: 52 in Tulsa; 21 in Wilburton; and 31 in Chickasha

Feedback: Participant responses indicated the program was a success. No plans have been made for future offerings.

Title: Healthy Communities

Objective: Provide a weekly segment on SUNUP discussing opportunities for and examples of economic growth in small Oklahoma communities

Cooperating Agencies:

Oklahoma Cooperative Extension Service (Mike Woods, Agricultural Economics; Glenn Muske, Human Environmental Sciences; and Charles Cox, 4-H)

Audience: Oklahoma rural community leaders and policymakers

Number of Attendees: N/A

Feedback: Since its trial run in July 2001, the "Healthy Communities" segment has become a standard component of every Friday's broadcast.

Title: Basic Training: A Guide to Starting Your Own Food Business

Objective: Jim Brooks, Corey Stone, Chuck Willoughby and Holcomb provide, on a monthly basis, the essential steps for developing a business plan for a new value-added, food-

Outreach projects, continued

Outreach

based business. Entrepreneurs interested in starting a food-based business in Oklahoma are encouraged to attend the one-day workshop.

Cooperating Agencies:

Oklahoma Department of Agriculture (Marketing Division, Weights and Measures Division); Oklahoma City/County Health Department; OSU Patent and Trademark Depository Library; and the College of Human Environmental Sciences

Audience: Food industry entrepreneurs and individuals/groups considering the mass production and marketing of a food item in Oklahoma

Number of Attendees: The workshop was held eight out of 12 months (the minimum registration is 10 for a workshop to be held), with an aggregate participation of 88 for the year.

Feedback: Each workshop elicits feedback and commentary from the participants. All feedback was extremely positive and suggestions made by some participants have been incorporated into the program format.



Chuck Willoughby (left) and Rodney Holcomb (center) visit with a Basic Training workshop participant. The monthly workshops provide valuable information for food-business entrepreneurs in Oklahoma.

Basic Training materials provide essential steps for developing a business plan for a new value-added food-based business.



Outreach projects, continued

Outreach

SIOBHAN REILLY, Ph.D.

Title: HACCP Workshops

Objective: Introductory and advanced courses in current HACCP issues, development of HACCP plans and employee training.

Audience: Industry representatives, managers, supervisors, line workers, OSU faculty and personnel and state and federal inspectors and officials.

Number of Attendees: Average 20 per session or table

Feedback: Extremely positive



The Center offers introductory and advanced courses on HACCP issues, including development of HACCP plans and employee training.

Title: Food Microbiology Workshop for Food Industry Professionals

Objective: To train food industry personnel in basic microbiology and sampling techniques.

Audience: Food industry professionals

Number of Attendees: 13

Feedback: Excellent reviews

Title: Master Canners Workshop: The Microbiology of Canned Foods (Coordinated by William McGlynn)

Objective: To provide current and would-be canners of high-acid foods with the basic tools and understanding needed to produce safe and high quality products. Areas covered include basic microbiology of canned foods, basic principles of thermal processing of canned foods, equipment selection, layout and operation for processing acidified and

high-acid foods, proper container handling and closure evaluation, principles of acidification and processing techniques for acidified and high acid foods, record keeping for regulatory compliance and quality assurance and basic sanitation for a canning operation.

Audience: Anyone producing canned high-acid or acidified foods for commercial retail sale including makers of jams and jellies, salsas, barbecue sauces, pickled vegetables and other similar products

Number of Attendees:

Approximately 25

Feedback: A survey was distributed after the one-day workshop. The feedback was uniformly positive. People felt the amount and nature of information provided was significant.



Outreach projects, continued

Outreach

CHUCK WILLOUGHBY

Title: Associated Wholesale Grocers Show

Objective: Promote the Center and provide market opportunities to clients

Audience: Retail Buyers

Number of Attendees:

Approximately 300

Feedback: Participating clients made good contacts leading to increased sales.

Title: Oklahoma Grocers Show

Objective: Promote the Center and provide market opportunities to clients

Audience: Retail Buyers

Number of Attendees:

Approximately 400

Feedback: Participating clients made good contacts leading to increased sales.

Title: Oklahoma CareerTech Conference and Expo

Objective: Promote the Center

Audience: Educators and Small Business Assistance Center personnel

Number of Attendees: 800

Feedback: Steady traffic at booth

Title: Fadler Foodservice Show

Objective: Promote the Center

Audience: Foodservice Buyers

Number of Attendees:

Approximately 300

Title: Hale-Halsell Show

Objective: Promote the Center



Center faculty and staff promote the FAPC at numerous conferences, industry trade shows and Oklahoma public schools. The presentations and booths increase awareness about the Center and the food industry.

Audience: Retail Buyers

Number of Attendees:

Approximately 500

Feedback: Steady booth traffic

Title: Presentation at West Central Oklahoma Alternative Agricultural Conference

Objective: Promote the Center

Cooperating Agencies:

Oklahoma Cooperative Extension Service

Audience: Agricultural Producers

Number of Attendees: 50

Feedback: Audience was attentive and asked good questions indicative of genuine interest in FAPC.

Title: Presentation at Buffalo High School Career Day

Objective: Promote the Center

Cooperating Agencies:

Oklahoma Cooperative

Extension Service

Audience: High School Students

Number of Attendees: 200

Feedback: Many students asked good questions indicative of genuine interest in the food industry.

Title: Presentation at Career Day at Richmond Elementary

Objective: Promote the Center

Audience: Fifth Grade Students

Number of Attendees: 50

Feedback: A few students asked good questions indicative of genuine interest in the food industry.

Title: Presentation at Mid-America Business Council

Objective: Promote the Center

Cooperating Agencies: Mid-

America CareerTech

Audience: Business & Community Leaders

Outreach

Outreach projects, continued

Number of Attendees: 53

Feedback: Audience was attentive and asked good questions indicative of genuine interest in FAPC.

Title: Tour for Dignitaries from Brazil

Objective: Promote the Center
Cooperating Agencies: DASNR International Programs

Audience: Foreign Dignitaries

Number of Attendees: 3

Feedback: Participants found FAPC interesting and asked questions of how to form such an entity in their home country.

Title: Tour for Dignitaries from Japan

Objective: Promote the Center
Cooperating Agencies: Tulsa Global Alliance, OSU-Tulsa

Audience: Foreign Dignitaries

Number of Attendees: 3

Feedback: Participants found FAPC interesting and asked many good questions.

Title: Tour for Mexico Study Group

Objective: Promote the Center
Cooperating Agencies: DASNR International Programs

Audience: Foreign Dignitaries

Number of Attendees: 23

Feedback: Participants found FAPC interesting and asked questions of how to form such an entity in their home country.

Title: Tour for Oklahoma Agricultural Leadership Council

Objective: Promote the Center
Cooperating Agencies:

Oklahoma Agricultural Leadership Council

Audience: Oklahoma Ag

Producers and Educators
Number of Attendees: 40-plus

Feedback: Participants found FAPC interesting and asked many good questions.

Title: Tour for Dignitaries from Syria

Objective: Promote the Center
Cooperating Agencies: Tulsa Global Alliance

Audience: Foreign Dignitaries

Number of Attendees: 3

Feedback: Participants found FAPC interesting and asked questions of how to form such an entity in their home country.

Title: Tour for Korean FDA Official

Objective: Promote the Center
Cooperating Agencies: Tulsa Global Alliance

Audience: Foreign Dignitaries

Number of Attendees: 3

Feedback: Participants found FAPC interesting and asked many good questions.

Title: Presentation on SUNUP Regarding Basic Training for Food Business Entrepreneurs

Objective: Promote the Center
Cooperating Agencies: OSU Agricultural Communications

Audience: OETA Viewership

Title: Presentation on SUNUP Regarding Work with Michael's Gourmet Products

Objective: Promote the Center
Cooperating Agencies: OSU Agricultural Communications

Audience: OETA Viewership



Chuck Willoughby, business and marketing specialist, (left) gives a tour of the Center. The Center, which offers promotional tours to groups and individuals, hosted foreign dignitaries from Brazil, Japan, Mexico, Syria and Korea.

Outreach projects, continued

Outreach

JASON YOUNG

Title: HACCP Roundtable (June, August, September, December)

Objective: A one-day forum designed for the discussion and dissemination of information on current HACCP and food safety issues to small and very small meat and poultry processors

Audience: Industry representatives, OSU faculty and personnel and federal and state officials.

Number of Attendees: Average 22 per Roundtable

Feedback: Extremely positive

Title: Basic HACCP Workshop

Objective: An introductory course for the development of HACCP plans, including plan writing, implementation, monitoring and verification, as well as employee training

Audience: Industry managers, supervisors and line workers

Number of Attendees: 21

Feedback: Extremely positive

Title: Advanced HACCP Workshop

Objective: This advanced workshop covers more specific areas of HACCP as they become prevalent in the industry.

Audience: Industry managers, supervisors, line workers, federal and state inspectors

Number of Attendees: 17

Feedback: Extremely positive



HACCP workshop attendees learn vital information regarding food safety issues for beginners through advanced-level meat and poultry business owners. The workshops allow participants to create HACCP plans and guidelines for employee training.



Meat and poultry business owners talk one-on-one with OSU and FAPC staff at HACCP workshops. The forums are also attended by state industry managers, supervisors, line workers and state and federal inspectors.

Industry Advisory Committee

Industry Advisory



Virgil Jurgensmeyer
J-M Farms

Don Ramsey
Blue & Gold Sausage

Dean Smith
SS Farms

Michael L. Wright
Hormel Foods

James L. Cochran
Pfizer Animal Health

Gary Crane
Ralph's Packing Co.

Rodger T. Kerr
Southwest Technology Center

David McLaughlin
Advance Food Company

Brett Burk
Elanco Animal Health

Linda Whitworth
Food with a Flare

Robert Bingham
Bil-Jac Foods

Charles Nichols
Davison & Sons Cattle Co.

Roger Ediger
Ediger & Ediger Farms

Mike Taffer
Mrs. Smith Foods

Gregg Ladd
Hiland Dairies

Faculty and Staff

OSU Value-Added Faculty and Staff

Staff and Faculty Located in the Food and Agricultural Products Center

Bellmer, Danielle
Bowser, Timothy
Brooks, Jim
Dunford, Nurhan
Gilliland, Stanley
Holcomb, Rodney
Johnson, Rachel
McGlynn, William
Muriana, Peter
Moe, David
Nelson, Jacob
Rayas-Duarte, Patricia
Reilly, Siobhan
Scott, Darren
Sigfusson, Dori
Stone, Corey
Willoughby, Chuck
Young, Jason

Agricultural Economics

Anderson, Kim
Henneberry, Shida
Lyford, Conrad
Peel, Derrell
Schatzer, Joe
Schreiner, Dean
Tilley, Dan
Ward, Clement
Woods, Mike

Agricultural Education

Kelsey, Kathleen

Animal Science

Berry, Joe
Brooks, Chance
Dewitt, Christina
Morgan, Brad
Ray, Fred

Biochemistry and Molecular Biology

Waller, George

Biosystems and Agricultural Engineering

Brusewitz, Gerald
Noyes, Ronald

Entomology

Bolin, Patricia
Bonjour, Edmond
Phillips, Thomas
Cuperus, Gerrit

Forestry

Hiziroglu, Salim

Home-Based and Micro Business Center—College HES

Muske, Glenn

Horticulture and Landscape

Architecture
Anderson, Jeff
Maness, Niels
McCraw, Dean

Nutritional Sciences

Hinds, Margaret
Stoecker, Barbara

Oklahoma State University—Oklahoma City Campus

Cruz-Rodz, Armando
Nielsen, Jerry

Plant and Soil Sciences

Carver, Brett

Psychology

Abramson, Charles

Wes Watkins Agricultural Research and Extension Center

Edelson, Jonathan
Shrefler, James

Veterinary College

Sangiah, Subbiah

DASNR Unit Leaders

Trapp, James
Leising, James
Hayes, Kevin
Wagner, Don
Essenberg, Margaret
Elliott, Ron
Wright, Russ
McKinley, Craig
Maronek, Dale
Stoecker, Barbara
Stiegler, James
Taylor, Merritt
George, Ronny
Warmann, Gerald
Bess, Claude
Smith, Steven

3 Guys Smokin'
A Wing and A Prayer
Advance Foods Co.
Alcide Corp.
Allied Custom Gypsum
American Brittle
American Native Beef
Cooperative
Auffill Farms
August Moon Inc.
B. L. Waybackers
Bachman, Susan
Backwoods Baskets Inc.
Balchem Corporation
Bama Foods
Barnes, C.D.
BAR-S Foods Co.
Beck's Waffles of Oklahoma -
formerly KAJLB Frozen Foods
Bedre Nut and Candy Co.
Belleville Salsa
Benningfield All Purpose Sauce
Bereshyt Ranch
Big Daddy's BBQ Sauce &
Spices
Big Giant Foods
Big Mama's Pastries Corp.
Bill's Kitchen and Catering
Billy Boy Bar-b-que
Blanton Junior
Bliss Industries Inc.
Brawdy Mushroom Farms
Bryan Finishes Inc.
Bush Brothers & Co.
Bulldog Beef Jerky
Caddo Country Industrial
Authority
Cajun Pickle People
Cargill
Carla Bailey
Chef's Requested
Cherokee Locker Plant
Chick and Millie's Blue Moon
Inc.
Christian Cheese

Circle-S Meat Market
City of Broken Bow
CJ NutraCon Inc.
Coco to Gogo
Constein's Farm
Cosmetic Specialty Labs
Country Bakery
Cusack Meats
Custinos Supreme Quality Food
Products
Daddy Hinkle's
Dancing Bear Ingredients
Dean Smith
Debra Peoples
Diane Byer
Dino's Salsa
Douglas Coop
Doyle Manufacturing Co.
DrSoy.com
Duty Packers
E.P.R.&D. Processing
Earth Elements
Echo
Eichorn, Brenda
El Sueno Enterprises
Elmers BBQ Restaurant
Elvia Hernandez
Emergeinteractive
Enchilada King, L.L.C. dba
Cocina De Mino
Energy Meter Systems
Eric Talley
Express Meat Company Inc.
Farm Fresh Food & Beverage
Co.
Farmers Cooperative
Association
Field's Pies
Frederick Chamber of
Commerce and Industry
Future Beef
Grandma Jo's Hot Coco
Gene Boiles
Glori's Italian Food
Gold Tree Herb Farm

Good Fun Foods
Grady County Ag
Enhancement, L.L.C.
Grandma Robbie's Original
Barbeque Sauce
Granna's Chili
Granny's Herbs
Great Plains Dough Products
Greenway Group
Griffin Foods
Grover Lane
Halal Project
Hale-Halsell Co.
Hall Cattle Co.
Harold Metcalf
Harrington, April
Head Country Food Products
Heartland Botanical Remedies
Heartland Mills
Hill Rudy
Horn of Plenty Produce
How Sweet It Is
Huckins, Lynn
Hyde-Away-Farms
Ike's Chili House
International Pantry
International Trading Co.
J. Lee Co.
J.C. Potter Sausage Co.
Jack's Potato House Inc. dba
Jamberry Farm
Janet's Eats & Sweets
Jimmy Dee's Oklahoma Sauce
Jim's Barbeque Sauce Co.
J-M Farms Inc.
J-M Foods
John Surmont
Johnston Enterprises Inc.
Jonathan Steaks
Jones Packing Co.
Kaiser Beverage Co.
Kastl Farms
Kay's Old Fashioned
Keepsake Candles
Keller Foods Inc.

Active Projects 2002, continued

Active

Kelly Foods
 Knight Creek Farms
 Kyoto Restaurant
 Landgraf Farms
 Landrun Seasonings
 Lex Gordon's Cow Tipping Beef Jerky
 Little Cabin Pecan Co.
 Little Eagle & Associates
 Livestock Nutrition Center
 Loeb's Specialty Foods
 Lost Creek Mushroom Farm
 Lyons Farms - All Angus.com
 Mabe Baby BBQ Sauce
 Malo Inc.
 Manila Foods
 Manildra Milling Co.
 Maple Leaf Farms
 Maria Rae's Inc.
 MariDee's Country Kitchen
 Maridry
 Martin Luther King Center
 Mary S. Lewis
 Mayfield Marinates & Sauces
 Miami Tribe
 Michael, Ben
 Michael's Gourmet Products
 Mid-Oklahoma Cooperative
 Mid-Continent Packaging
 Montgomery, Paul
 Moody, Paula
 Mountain Country Foods
 Mountain Mama's
 Mr. Tom Oly
 Mrs. Santa's Kitchen
 Muhanna Sweets (USA) Inc.
 My Dad's Salsa
 Mynor Ingredients
 Myron's Lil' Smoke House & Catering
 National Grain Sorghum Producers
 National Steak & Poultry

Natural Farms
 Nature's Choice, L.L.C.
 Nicolli's Italian-American Steakhouse
 Niday Dairy
 Nomadics Inc.
 Nonion, L.L.C.
 Nucare.com
 Nuttle, Marc
 O.K. Agriculture, L.L.C.
 Oklahoma Botanicals
 Oklahoma Boy Bar-b-que
 Oklahoma Cold Storage Inc.
 Oklahoma Department of Agriculture
 Oklahoma Department of Corrections
 Oklahoma Liquid Feed, L.L.C.
 Oklahoma Pecan Growers
 Oklahoma Wheat Commission
 OK-TX Watermelon Growers Association
 Old 300, L.L.C.
 Old Germany Restaurant
 Old Town Smokehouse
 Our Enterprises, L.L.C.
 Parkey, Bill
 Paul's Concessions
 Pep in the Mustard
 Pepper Creek Farms
 Pepper Jo's
 Perkins, Penny
 Pet Chauffeur & Nanny
 Pete's Place
 Phillips Plastic Division
 Pittman, Jim
 Pooch Paradise
 Prairie Gypsies Catering
 Pratt Foods
 Producers Cooperative Oil Mill
 Puckett, Sharon
 QFSE Inc. OK Restaurant Supply Co.

QuikWater, a division of Webco Inc.
 Ralph's Packing Co.
 Ranch Foods Direct, L.L.C.
 Randy Miller
 Rebecca Pound
 Redbud Gourmet
 Redland Industries
 Richardson Foods
 River Bend Café
 Rock Ridge Rabbitry
 Rocking D Honey Farm
 Rutkauskas, Otto
 S & J Enterprise
 S S Farms
 Salt Creek Cattle Co. and Trading Post
 Sapna, Raje
 Savadon, Grant
 Savage, Amanda
 SC and Dreams
 Schroeder, Donald
 Schwab Meat Co.
 Schwartz Meat Co.
 Scovil, Jim
 Selerakita.com
 Seminole Economic Development Council
 Shawnee Milling Co.
 Sheets Farms
 Shepherd, Bill
 Sisson Seed
 Sometimes It's Hotter
 Southern Protein Inc.
 Spencer Farms
 Springhill Farms
 Stan Clark Cos./Eskimo Joes
 Star Dairy
 Stars & Stripes Pizza
 State Fair Foods
 Stephen, Jeffrey
 Stratford's Little Jelly Factory
 Stu's-Q Bar-b-que

Active Projects 2002, continued

Active

Sunshine Solutions
Surmont, John
Sweis Brothers
Taff Farm
Tanenbaum/Stroud Project
The Outlaw Co.
Thomason, Mark
Thompson's Red River Jerky Co.
Tilman Producers Cooperative
Timberline Ranch
Tom's Barbeque
Totally Natural Foods
Tower Café
Trading Companies of
Americas Inc./Toucan Inc.

Trinity Hospice Foundation
Triple H Ranch
Tri-State Enterprises
Tulsa Department of Health
Tulsa Global Alliance
Tulsa Salsa
Udder Farms
Uncle Max's Famous Fudge
Unitherm Food Systems
USA Bottling
Valliant Vegetables
Value-Added Partners, L.L.C.
Value-Added Products Co-op
Value-Added Dairy Enterprise
Vaughan Foods Corp.

Vincent Farms
Waggin Tails Ranch
Walker Smoked Meats
Waltman Farm Foods
Wandering Viking
Wellness Works
Wheatland Foods
Wheatland Grain
Wholesome Foods
Wild Creek Ranch
Woodward Farms
Woody Candy Co.
Wright Enterprises
XTRAVAGANTZ Foods

Completed

Completed Projects 2002

A Wing and A Prayer
Advance Foods Co.
Aqua Farms
Backwoods Baskets Inc.
Bailey, Carla
Balchem Corporation
Bama Foods
Bar 19 Foods
BAR-S Foods Co.
Bedre Nut and Candy Company
Billy Boy Bar-b-que
Blazek, Nicki
Brawdy Mushroom Farms
Bryan Finishes Inc.
C.D. Barnes
Cargill
Chef's Requested
Cherokee Locker Plant
Christian Cheese
Circle-S Meat Market
CJ NutraCon Inc.

Coleman Natural Meats
Country Sunshine Specialties
Crabtree, James
Cusack Meats
Custinos Supreme Quality Food
Products
Daddy Hinkle's
Department of Correction Agri-
Service
DeWayne's Barbeque &
Catering Inc.
Douglas Co-op
Doyle Manufacturing Co.
Duty Packers
E.P.R.&D. Processing
Earth Elements
Ebiita Food Tech Consulting
El Sueno Enterprises
Elizabeth Faulkner
Elmers BBQ Restaurant
Emergeinteractive

Enchilada King, L.L.C dba
Cocina De Mino
Extreme Foods
Farm Fresh Food & Beverage
Co.
Farmers Cooperative
Association
Grandma Robbie's Original
Barbeque Sauce
Granna's Chili
Griffin Foods
Hale-Halsell Co.
Hall Cattle Co.
Head Country Food Products
Heartland Mills
Hernandez, Elvia
Howe Food Mart
Ike's Chili House
International Trading Co.
Jamberry Farm
Janet's Eats & Sweets

Completed

Completed Projects 2002, continued

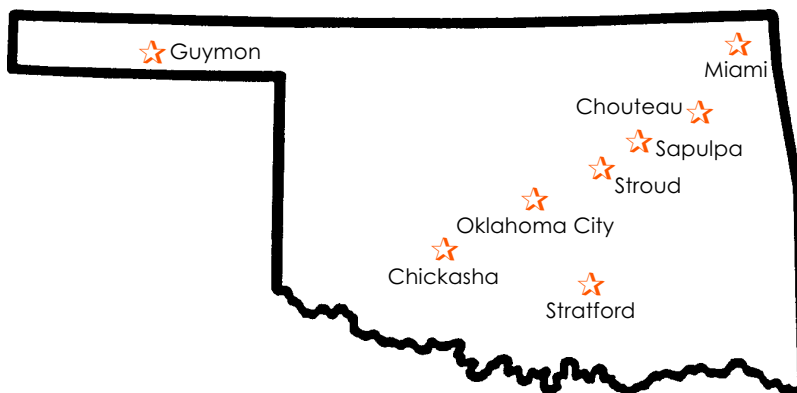
Jim's Barbeque Sauce Co.
 Knight Creek Farms
 Lex Gordon's Cow Tipping Beef Jerky
 Lingerfelter, John
 Loeb's Specialty Foods
 Lopez Foods Inc.
 Malo Inc.
 Manila Foods
 Maple Leaf Farms
 Maria Rae's Inc.
 MariDee's Country Kitchen
 Midwest Grain
 Mike Howell
 Mountain Mama's
 Muhanna Sweets (USA) Inc.
 My Dad's Salsa
 Myron's Lil' Smoke House & Catering
 National Steak & Poultry
 Nicoli's Italian-American Steakhouse
 O.K. Agriculture, L.L.C.
 Okfuskee Extensions Specialist
 Oklahoma Department of Corrections
 Oklahoma Liquid Feed, L.L.C.

Ol' Santa Fe Tamale Company
 Old Germany Restaurant
 Old Town Smokehouse
 Our Enterprises, L.L.C.
 Parkey, Bill
 Penington Locker
 Prairie Gypsies Catering
 Pratt Foods
 Ralph's Packing Co.
 Randy Miller
 Rebecca Pound
 Robertson's Hams
 Rocking D Honey Farm
 Salt Creek Cattle Co. and Trading Post
 Schwartz Meat Co.
 Selerakita.com
 Shawnee Milling Co.
 Sleeping Bear Creek Bottling
 Southern Protein Inc.
 Star Dairy
 Stars & Stripes Pizza
 State Fair Foods
 Stevison's Hams
 Stratford's Little Jelly Factory
 Susan Bachman
 Taff Farm

Tanenbaum/Stroud Project
 The Nut House
 The Outlaw Co.
 Thompson's Red River Jerky Co.
 Tommy Jack's
 Tom's Barbeque
 Trading Companies of Americas Inc./Toucan Inc.
 Trinity Hospice Foundation
 Tulsa Department of Health
 Tulsa Global Alliance
 Udder Farms
 Uncle Max's Famous Fudge
 Valliant Vegetables
 Value-Added Partners L.L.C.
 Value-Added Products Co-op
 Value-Added Dairy Enterprise
 VanPielt, Gary
 Vincent Giordano Corp.
 Wagner, Evelyn
 Wandering Viking
 Wellness Works
 Woodard, Darren
 Wright Enterprises
 XTRAVAGANTZ Foods

Start-Up

Start-Up Companies 2002



Salt Creek Cattle Co. and Trading Post–Stroud
 Stratford's Little Jelly Factory–Stratford
 Oklahoma Cold Storage Inc.–Oklahoma City
 Lex Gordon's Cow Tipping Beef Jerky–Guymon
 Hyde-Away-Farms–Chouteau
 Great Plains Dough Products–Chickasha
 Bryan Finishes Inc.–Sapulpa
 Miami Tribe–Miami

Food Research Initiative Projects

FRIP

Use of Microbubbles and Perfluorocarbons for Enhancement of Oxygen Transfer in Xanthan Gum Fermentation Systems
Danielle Bellmer, Ph.D.
Biosystems and Agricultural Engineering

Potential for Development of Value-Added Products from Peanuts
Margaret Hinds, Ph.D.
Nutritional Sciences

Manufacture of Three-Layer Particleboard from Eastern Red Cedar
Salim Hiziroglu, Ph.D.
Forestry

Predicting Beef Tenderness with Image Texture Analysis
Glenn Kranzler, Ph.D.
Biosystems and Agricultural Engineering

Bioconversion of Products Derived from Food Processing into Value-Added Commodities
Jerald Lalman, Ph.D.
Biosystems and Agricultural Engineering

A Case Study of Selected Economic Impacts of Services Provided by the Oklahoma Food and Agricultural Products Research Initiative Program (FRIP)
Conrad Lyford, Ph.D.
Agricultural Economics

Value-Added Food Extract Processing with Membranes
Niels Maness, Ph.D.
Horticulture and Landscape Architecture

Assessing the Economic Impacts of the Value-Added Products (VAP) Cooperative in Woods County and Northwestern Oklahoma
Rodney Holcomb, Ph.D.
Agricultural Economics

Evaluation of Methods for Physical Separation of Lycopene-Rich Fraction from Watermelon Puree
William McGlynn, Ph.D.
Horticulture and Landscape Architecture

Understanding Extensibility of Wheat Seed Proteins: One Step Up
Patricia Rayas, Ph.D.
Biochemistry and Molecular Biology

Oklahoma Hard Red Winter Wheat Segregated by Protein Level for Use in Frozen Products
Patricia Rayas, Ph.D.
Biochemistry and Molecular Biology

Controlled Partitioning of Exogenous Lipid-Soluble Antioxidants in (Value-Added) Meat Products Use of Novel Addition Method for Improvement of Oxidative Stability
Halldor Sigfusson, Ph.D.
Food and Agricultural Products Center

Using Extruded Cotton Gin Trash as a Feed Ration Ingredient for Stocker Cattle in Southwestern Oklahoma Montague
Tillman County Cooperative Extension Service

Biofuel from Hog Slaughter By-Products
Timothy Bowser, Ph.D.
Biosystems and Agricultural Engineering

Food Extension Initiative Projects

FEIP

Workshop on Biotechnology: The Science and the Issues in Food Safety
Patricia Bolin, Ph.D.
Entomology and Plant Pathology

Visual Merchandising Tools for Oklahoma Value-Added Entrepreneurs
Glenn Muske, Ph.D.
Oklahoma Cooperative Extension Service



Timothy Bowser, Ph.D., P.E., Assistant Professor | food engineering

Engineering

TIMOTHY J. BOWSER

Timothy Bowser began his college education in 1980 at Pennsylvania State University where he received B.S. and M.S. degrees in agricultural engineering, specializing in food processing. In 1986, he traveled to Fremont, Mich., where he worked as a process engineer for the Gerber Products Co. in research and development. Gerber then transferred him to its flagship plant in Fort Smith, Ark., where he served as a project engineer. Bowser moved on to earn his Ph.D. after receiving a National Needs Fellowship in Food Engineering in the Department of Agricultural Engineering at The University of Tennessee-Knoxville. In 1993, he joined Lockwood-Greene Engineers in Spartanburg, S.C., as

a consulting engineer in its food and pharmaceutical division. There, he worked on a variety of projects, including assisting with the development of the basic process design for Hunt Wesson's aseptic pudding plant in Waterloo, Iowa.

Bowser moved to Oklahoma State University in 1997, where he is an assistant professor in the Food and Agricultural Products Center and the Department of Biosystems and Agricultural Engineering with an extension and research appointment. His extension program centers on facility layout and design and process optimization. He leads workshops on oven and freezer operation and Clean in Place (CIP) technology. In addition, Bowser holds a U.S. Patent on size reduction and separation machinery, which he co-developed while at OSU. He also has contributed two

book chapters to the Encyclopedia of Agricultural and Food Engineering.

RESEARCH INTERESTS

Primary focus:

- 1) Food process optimization,
- 2) Steam-injection heating of food and agricultural products,
- 3) Food process waste recovery, and
- 4) Conversion of biomass and agricultural wastes into useful products.

SUPPORT PERSONNEL

A half-time research engineer, a half-time post-doctoral researcher, three graduate students and one undergraduate student employee currently support Bowser's program.

PRESENTATIONS

Bowser, T.J., D.D. Bellmer, B.G. Catani, M.M. Lelo, and R.L. Huhnke. 2001. Synthesis Gas Composition from a Fluidized Bed Gasifier as Affected by Biomass Feedstock Type and Characteristics. Oral presentation at the 2001 ASAE Annual

International Meeting, Sacramento, Calif.

Lewis, R.S., R.S. Tanner, T.J. Bowser, D.D. Bellmer, and R.L. Huhnke. 2001. Gasification/Bioconversion Process to Convert Biomass into Ethanol – a Holistic Approach. Oral presentation with abstract at the 23rd Symposium on Biotechnology for Fuels and Chemicals, Breckenridge, Colo.

Bowser, T.J., P.R. Weckler and R. Jayasekara. Process Design and Operation of a Steam-injection Heater for Viscous Food and Agricultural Products (poster). Research Symposium presented by the Oklahoma Food and Agricultural Products Research and Technology Center. Peter M. Muriana, Chair. April 2002.

Bowser, T.J. 2002. Processing/Handling of Agricultural Products. Topic in the Professional Engineer's exam review session at the 2002 ASAE Annual

International Meeting, Chicago, Ill.
Bowser, T.J., P.R. Weckler and R. Jayasekara. 2002. Design Parameters

for Operation of a Steam Injection Heater without Water Hammer when Processing Viscous Food Products. 2002 ASAE Annual

International Meeting, Chicago, Ill.
T.J. Bowser, J.S. Bowser. 2002. Temperature Profiling of Continuous Ovens

Used for Processing Food and Agricultural Products in Oklahoma. 2002 ASAE Annual International Meeting, Chicago, Ill.



DANIELLE D. BELLMER

A native of Michigan, Danielle Bellmer began her collegiate endeavors at Michigan State University where she received her B.S. degree in food engineering in 1992. She then traveled to Purdue University, where she was awarded the Ph.D. degree in food process engineering in 1996. Bellmer served on the faculty at Delaware Valley College in Doylestown, Pa. for one year before joining Oklahoma State University in June 1997.

She currently is an assistant professor in the Food and Agricultural Products

Danielle Bellmer, Ph.D., Assistant Professor | food engineering

Engineering

Center and the Department of Biosystems and Agricultural Engineering, where she has a teaching and research appointment.

RESEARCH INTERESTS

Bellmer's research program is most recently focused on issues related to food process and properties engineering, including biomass conversion, rheology and texture analysis and mass transfer in aerobic fermentation. In addition, Bellmer is involved in the development of new value-added products derived from Oklahoma commodities and is a co-inventor of PB Slices.

Primary focus: 1) Improvement of mass transfer in

aerobic fermentation systems, specifically xanthan gum fermentation systems, 2) Characterization of rheological properties of foods, 3) Development of new value-added products from Oklahoma commodities, and 4) Conversion of biomass and agricultural wastes into useful products.

PRESENTATIONS

D. Bellmer. 2002. A Case Study in Product Development: Peanut Butter Slices. Presentation at Future Food Summit, Jacksonville, Fla.

M. Lelo, T. Bowser, B. Cateni, D. Bellmer, R. Huhnke. 2001. Synthesis Gas Composition from a Fluidized Bed Gasifier as Affected by Biomass Feedstock

Type and Characteristics. Presentation at ASAE Annual Meeting, Sacramento, Cal. July 2001.

GRADUATE THESES SUPERVISION

Melissa Daniels Pearce. December 2001. Effects of Normal Force, Sample Relaxation and Testing Geometry on the Rheological Measurements of Semi-Solid Food Products. Doctor of Philosophy in Biosystems Engineering.

SUPPORT PERSONNEL

Bellmer is currently supported by a half-time research engineer, a half-time post-doctoral research associate, three graduate students and two undergraduate student employees.



STANLEY E. GILLILAND

Stanley Gilliland was awarded the Ph.D. degree in food science from North Carolina State University in 1966. He received B.S. and M.S. degrees in dairy manufacturing from Oklahoma State University in 1962 and 1963, respectively. He was on the faculty in the Department of Food Science at North Carolina State University until 1976. In the fall of 1976, he joined the faculty in the Department of Animal Science at Oklahoma State University as a dairy-food microbiologist. He currently holds the rank of Regents Professor and Sitlington Endowed Chair in food microbiology in that department and the Oklahoma Food and Agricultural Products Research and Technology Center. He also serves as the coordinator for the food science

graduate program at Oklahoma State University. He is a fellow in both the American Dairy Science Association (ADSA) and the American Academy of Microbiology. Because of his accomplishments in both research and teaching, he has received eight awards at the national level and seven at Oklahoma State University. The latter includes the Eminent Faculty Award from among all OSU faculty; the highest recognition given to a faculty member at the university.

SUPPORT PERSONNEL:

Gilliland currently is supported by one visiting scientist from Spain, one post doctoral research associate, one research specialist, eight graduate assistants and four undergraduate student employees.

RESEARCH INTERESTS:

Primary research areas: 1) Lactic acid bacteria used in dairy fermentations

and/or as probiotics including their production and stability; 2) function of species of *Lactobacillus* and *Bifidobacteria* as probiotics to control serum cholesterol, control intestinal pathogens and improve nutrient utilization by the host; 3) use of selected lactobacilli to control food borne pathogens and spoilage organisms in refrigerated foods; 4) improved detection methods for *Campylobacter*.

OTHER ACTIVITIES:

1) Worked with other Center microbiologists to develop and present a Food Microbiology Laboratory Workshop for industry. 2) Served as Interim Director of the Center.

PUBLICATIONS:

Journal Papers:

Lee, H.S., S.E. Gilliland, and S. Carter. 2001. Amyolytic Cultures of *Lactobacillus acidophilus*: Potential Probiotics to Improve Dietary Starch Utilization. J.

Food Sci. 66: 338-334.

Pigeon, R.M., E.P. Cuesta, and S.E. Gilliland. 2001. Binding of Free Bile Acids by Exocellular Polysaccharides of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus salivarius* subsp. *thermophilus*. J. Dairy Sci. (in press).

Senne, M.M.O. & S.E. Gilliland. 2002. Antagonistic Action of Cells of *Lactobacillus delbrueckii* ssp. *lactis* Toward Pathogenic Microorganisms in Fresh Meat Systems. Submitted to J. Food Protection.

Presentation at Professional Meetings:

Gilliland, S.E. 2001. Technological and Commercial Application of Lactic Acid Bacteria; Health and Nutritional Benefits in Dairy Products. Working paper presented at the FAO/WHO Expert Consultation on Probiotics. Cordoba, Argentina.

Graduate Theses

Supervised:
Joaquim Angelo
Oswaldo Saide.
December 2001.
Antioxidative and
Reducing Activities

of Species of
Lactobacilli and
Streptococci. Doctor
of Philosophy in Food
Science.
Erick J. Harp.

December 2001.
Influence of
Lactobacillus
delbrueckii ssp. *lactis*
on *Escherichia coli*
O157:H7, *Salmonella*
cholerasuis and

Listeria
monocytogenes on
Minimally Processed
Vegetables. Master
of Science in Food
Science.



Peter M. Muriana, Ph.D., Associate Professor | food microbiology

Microbiology

PETER M. MURIANA

Peter Muriana received an M.S. and Ph.D. in food science/biotechnology from North Carolina State University in 1986 and 1990, respectively. Prior to his post-graduate education at North Carolina State, Muriana was a research associate at the Nabisco Brands Corporate R&D facility in Wilton, Conn. After receiving his Ph.D., Muriana joined the faculty in the Department of Food Science at Purdue University (1990) and subsequently joined the Department of Animal Science at Oklahoma State

University (1997), where he currently holds the rank of associate professor.

RESEARCH INTERESTS

Muriana's research has focused on 1) inhibitory proteins (bacteriocins) as potential biopreservatives and molecular analysis of their genes, 2) egg pasteurization to eliminate *Salmonella*, 3) pasteurization of processed meat surfaces to eliminate *Listeria*, and 4) molecular detection and characterization of foodborne pathogens.

His research work with submersed-water post-package pasteurization has been adopted and implemented by several large processors, including Sara Lee and Cargill, to provide additional food safety

assurances for their ready-to-eat meat products and has worked with no less than eight nationwide companies regarding surface pasteurization of processed deli turkeys, hams and roasts. Muriana is a member of several professional associations. He has served as treasurer of the Indiana and Oklahoma sections of IFT, currently serves as member-at-large of the executive committee for the IFT Biotechnology Division and is chair of the Graduate Paper Competition for the IFT Food Microbiology Division (2001-2003). He also serves on the editorial board of Applied and Environmental Microbiology (2003-2006) and has served as an *ad hoc* reviewer for four scientific journals

related to food safety.

Primary research areas:

- 1) Surface pasteurization of processed meats to reduce *Listeria monocytogenes*, 2) thermal processing of egg and raw meat to determine pathogen lethality of heat treatments, 3) molecular detection and characterization of foodborne pathogens, and 4) applied and basic research on bacteriocins as potential biopreservatives.

SUPPORT PERSONNEL

Muriana's program is currently supported by one research technician, four graduate students and two undergraduate student employees.



SIOBHAN S. REILLY

Siobhan Reilly completed her bachelor of science degree in food science at the University of Florida. Upon completion of her degree, she was immediately offered a full-time position at Oklahoma State University and given the opportunity to attend graduate school. She began in the area of meat science (value-added processing) and progressed into food microbiology. From 1992 to 1997, Reilly worked full-time as the laboratory manager and research specialist in the Food Microbiology Laboratory in the Animal Science Department. During this time Reilly completed her master of science degree in food science with an emphasis on food microbiology.

In 1997, Reilly began working at the Center. Reilly's assignment is 60 percent research and 40 percent extension. Reilly utilized appropriated start-up funds to build her program and equip her new laboratory. Since then, through competitive grants and industry contracts, the program has grown significantly. In addition to working full-time for the FAPC, Reilly completed her doctor of philosophy in food science with emphasis in food microbiology.

Reilly's program employs on an average of five students per semester. Past students (undergraduate and graduate) have been trained in all areas of food safety and have moved into prominent roles in major companies in Oklahoma and the nation.

In fulfillment of her extension appointment at the FAPC, Reilly initiated the Food Safety and

Siobhan Reilly, Ph.D. | food microbiology

Microbiology

Quality Audit program currently in place. She has directed audits of major companies such as Advanced Foods, Chefs Requested Foods, Lopez Foods and Tyson's and has participated in the National Audit Program put forth by the National Pork Board. Reilly has encouraged the involvement of other FAPC personnel to help further promote this program, as well as the existing HACCP program in the Center.

PUBLICATIONS:

Reilly S.S., S.E. Gilliland. 1999. *Bifidobacterium longum* Survival During Frozen and Refrigerated Storage as Related to pH During Growth. J. Food Sci. Vol 64, No 4, pp. 714-718.

Reilly S.S., McPhillips A., and S.E. Gilliland. 2000. Improved Methods for Growth and Management of *Campylobacter jejuni* Cultures. Pork Quality and Safety. National Pork Producers Council. pp.143-147.

Reilly S.S., Gilliland S.E. 2002. The Morphological Changes Exhibited by *Campylobacter jejuni* and Their Influence on Methodology. [dphil thesis]. Stillwater OK.: Oklahoma State University. Available from: Oklahoma State University, Microfilms, Stillwater, OK.

Reilly S.S., S.E. Gilliland. 2002. Improved Techniques for Culturing *Campylobacter jejuni*. J. Food Sci. Submitted.

Reilly S.S., S.E. Gilliland. 2002. Influence of Gaseous Atmosphere on Morphology and Cellular Fatty Acid Composition of *Campylobacter jejuni*. J. Food Sci. Submitted.

Reilly S.S., Goad C., Scott D., Sigfusson H., and S.E. Gilliland. 2002. Use of Ozone as an Antimicrobial Agent on Food Products. Special emphasis: *Listeria* and ready-to-eat meat products. J. Food Prot. In Preparation.

Horticultural Processing



WILLIAM MCGLYNN

William McGlynn received a B.A. degree from the University of California–Davis in 1979, a M.S. degree in food science from the University of Arkansas in 1989, and a Ph.D. in food science from the University of Arkansas in 1997.

McGlynn came to work for the Food and Agricultural Products Center in May 1997 and is a faculty member in the Department of Horticulture and Landscape Architecture.

He is responsible for the extension and research activities of the Center as they relate to value-added processing of horticultural products. In this capacity, he provides technical assistance with fruit and vegetable processing for businesses of all sizes.

RESEARCH INTERESTS

McGlynn's research focuses on the application of new or existing processing technologies to enhance or retain content and functionality of inherent health-promoting compounds in processed horticultural products.

These studies include physical and chemical methods of extraction and concentration of antioxidant compounds in watermelon and sage.

He is also investigating the application of new processing technologies or techniques to improve the quality and safety of processed horticultural products. Minimizing microbial hazards and maximizing shelf life of minimally processed fruits and vegetables are targets.

SUPPORT PERSONNEL

McGlynn is supported by one research specialist, two graduate assistants and three undergraduate student employees.



JACOB NELSON

Jacob Nelson graduated with B.S. and M.S. degrees

from Oklahoma State University in animal science, with an emphasis in meats.

In June 1997, Nelson assumed his current position with the Food and Agricultural Products Center as meat pilot

plant manager.

He currently cooperates with other faculty and staff to meet the needs of pilot meat processing in the Center and in the state, assists with HACCP workshops

for very small and small processors and holds a teaching appointment with the Department of Animal Science to oversee laboratory needs for the meat science discipline teaching program.

Muscle Processing



Pilot Processing

David Moe | pilot processing

DAVID MOE

David Moe encompasses more than 30 years experience in the food industry, with a primary focus on “processed meat products and systems.”

Moe served as director of research and development for Wilson Foods. His responsibilities included new product

development, evaluation of new processing equipment, technical support to marketing, cost containment and quality systems for the full range of Wilson products.

Through the years, Moe developed numerous new products and processing systems, including tailored products and systems for industrial and foodservice markets, some of which have become benchmarks for the industry.

CURRENT INTERESTS

Currently, Moe is pilot plant manager for the Food and Agricultural Products Center. In its infancy, Moe coordinated the start up of the Center’s pilot processing facility.

His program focus has since shifted to work with Oklahoma entrepreneurs and the existing food processing industry to facilitate “adding value” to Oklahoma agricultural commodities through further processing. He also serves as a

resource for food safety, regulatory and other issues.

Moe has led “hands-on” processing sessions at the Oklahoma Beef Quality Summit, Pork 101 and for other groups.

RESEARCH FOCUS

- 1) Meat processing and systems,
- 2) Food product and process development,
- 3) Food process equipment,
- 4) Functional ingredients, and
- 5) Food safety



Food Science

Darren Scott | food science

DARREN SCOTT

Darren Scott is a food scientist at the Food and Agricultural Products Research and Technology Center. Scott joined the Center in January 2000.

He received both his bachelor and master degrees in food science at the University of Arkansas at Fayetteville. He also spent five years as a quality control supervisor in the fruit juice industry.

Scott uses his background and skills at the Food and Agricultural Products Center to assist Oklahoma entrepreneurs and processors in product development.

Rodney B. Holcomb, Ph.D., Associate Professor | **agribusiness economics**

Agribusiness Economics



RODNEY B. HOLCOMB

Rodney Holcomb earned his undergraduate (1991) and doctoral (1997) degrees in agricultural economics from Texas A&M University.

Holcomb currently serves as an associate professor in the Department of Agricultural Economics, holding a 70 percent extension and 30 percent research appointment in the Food and Agricultural Products Center.

The primary services he provides at the FAPC are industry analyses, market assessments and venture feasibility.

Holcomb serves as OSU's representative on the Oklahoma Agricultural Enhancement and Diversification Board and has served on the Lt. Governor's Small Business Commission. He is also a board member for the Food Distribution Research Society and serves as OSU's council representative for the Western Agricultural Economics Association.

Holcomb's programs have received renowned state and national awards, including the Oklahoma Cooperative

Extension Service, Oklahoma State University and Gov. Frank Keating. He has also received the USDA Plow Honor Award for Exceptional Service – the highest honor given by the U.S. Secretary of Agriculture.

Holcomb also serves as adviser for three student organizations, including the Aggie-X Club, Cowboys for Christ and the OSU Student Chapter of Ducks Unlimited.

RESEARCH INTERESTS

Holcomb's research interests lie in the areas of value-added manufacturing economics and market evaluations.

His goals are to identify economically

feasible alternatives and business structures for adding value to regional agricultural commodities, along with determining the impacts of these activities on local and state economies. He specializes in the economic modeling of processing businesses, consumer demand analysis and business organization.

SUPPORT PERSONNEL

Holcomb advised one graduate student and served on eight other graduate student advisory committees.

He also supervised two undergraduate student workers who were housed in the FAPC.

Cereal Chemistry



PATRICIA RAYAS-DUARTE

Patricia Rayas received her M.S. and Ph.D. degrees in food science and technology from the University of Nebraska-Lincoln. She holds a B.S. in chemistry from the University of Sonora, Mexico.

Formerly, Rayas worked with the Department of Cereal Science and Technology at North Dakota State University.

In July 1997, she joined the Department of Biochemistry and Molecular Biology and the Food and Agricultural Products Center. Here, Rayas

holds appointments in research and extension.

Her research focuses on specific hard red winter wheat proteins, generally associated with the functionality of the flour used in yeasted bread products.

Currently, she is studying the interactions of these proteins with carbohydrates and their effect on the rheological properties of gels.

Other research interests include the improvement of shelf life of frozen dough, the role of key proteins on the rheological properties of dough and the exploration of specialized ingredients made from sorghum grain.

The extension work performed by Rayas is related to the utilization of hard red and white winter

wheat. Every crop year, Rayas' team analyzes the end-user quality of Oklahoma wheat crop and prepares a crop survey report used by the milling industry.

Rayas has also participated in national and international seminars related to the wheat crop quality. Her extension activities also have included technical assistance provided to cereal-related industries in the state.

RESEARCH INTERESTS

Primary research areas include:

- 1) Extension of shelf life of frozen dough products;
- 2) Interaction of starch and glutenin proteins from wheat and their relationship to the rheological properties of dough;
- 3) Quantification of isoforms a low-molecular-weight

protein rich in cysteine and tryptophane amino acids and its relationship to kernel hardness;

- 4) Fractionation and identification of high-molecular-weight glutenin subunits from wheat endosperm;
- 5) Identification of membrane proteins from organelles of endosperm tissue of wheat at different grain fill stages during development; and
- 6) Production of new ingredients from sorghum grain.

SUPPORT PERSONNEL

Rayas' team includes one post-doctoral research associate, two research specialists, five graduate assistants and three seasonal student assistants during the wheat crop survey.

Oil and Oilseed Chemistry



NURHAN TURGUT DUNFORD

Nurhan Turgut Dunford received her B.S. in chemical engineering and M.S. in chemistry from Middle East Technical University and University of Ankara in Turkey, respectively. She was awarded M. Eng. and Ph.D. degrees in food process engineering from the University of Alberta, Canada. Dunford worked at Technical University of Warsaw, Poland, Chemical Engineering Department as a visiting scientist on a fellowship awarded by the United Nations, UNESCO section, for one year. In 1999, Dunford received the prestigious Government Invitation Fellowship awarded by the Department of

Health and Human Services of Japan. During this fellowship, she visited and presented lectures at the Kyushu and Kumamoto universities. Dunford's experience as an engineer and scientist encompasses more than 20 years, including positions in Turkey, Canada and the United States. She worked at the U.S. Department of Agriculture, Agricultural Research Service, National Centre for Agricultural Utilization Research (NCAUR) as a research chemist. During her tenure at the NCAUR, Dunford developed a supercritical fluid fractionation process for the enrichment of phytosterols in vegetable oils. Phytosterols possess blood cholesterol-lowering properties. A patent application for this process is in progress. During the winter of 2001, Dunford joined the faculty of the Department of Plant and Soil Sciences and the Food and

Agricultural Products Research and Technology Center at Oklahoma State University as an oil/oilseed chemist.

With a career including both research and extension, Dunford's research program focuses on the enhancement of the nutritional and economic value of oils and oilseeds through innovative processing. She has established research collaborations with national and foreign scientists and experts in Japan, Canada, Turkey and Mexico. Dunford is a registered professional engineer in Canada and active in professional organizations such as Institute of Food Technologists (IFT) and American Oil Chemists' Society (AOCS). Currently, she serves as a board member in the AOCS, Processing Division and represents the division at the AOCS Technical Program Committee. She also serves as a member of the Food Science Graduate Program

Coordination Committee at OSU.

SUPPORT PERSONNEL

Dunford currently is supported by one research specialist, two Ph.D. students and two undergraduate student employees.

RESEARCH INTERESTS

Primary research focus:

- 1) Development of environmentally benign processing techniques for oil/oilseed extraction, refining and fractionation;
- 2) Enhancement of lipid-based bioactive compounds in vegetable oils through processing;
- 3) Development of value-added products from agricultural by-products and waste streams;
- 4) Utilization of enzymes for oilseed processing and lipid modifications; and
- 5) Evaluation of effect of breeding and genetic modifications on the nutritional components of oil-bearing ag materials.



HALLDOR SIGFUSSON

Halldor Sigfusson was awarded the Ph.D. degree in food science from the University of Massachusetts-Amherst in 2000. He received a B.S. degree in food science from the University of Iceland in 1993. From 1998 to 1999 he worked as a research fellow at the University of Massachusetts and as a post-doctoral fellow at the Pennsylvania State University from 1999 to 2000. In March of 2001, he joined the Oklahoma Food and Agricultural Products Research and Technology Center at OSU as a value-added meat processing specialist. His responsibilities include basic and applied research (70 percent) and extension activities (30 percent). Since joining OSU, Sigfusson's research focuses on improving

the quality and stability of value-added meat, poultry and seafood/aquaculture products through the use of natural antioxidants, with a current interest in vitamin E. His extension program targets technical assistance to food processors and entrepreneurs of all sizes with developing new and improving existing value-added products. He also provides workshops in the area of food safety and HACCP and helps processors comply with USDA regulations. Sigfusson is a member of the Institute of Food Technologists, American Meat Science Association, American Chemical Society, American Oil Chemist's Society and Sigma Xi, the Scientific Research Society.

RESEARCH INTERESTS

The primary research areas are: 1) controlled delivery of natural antioxidants such as vitamin E and lycopene into membrane lipids of muscle foods to

improve quality and stability; 2) recovery and stabilization of functional proteins from muscle food by-products; and 3) structure-function relationship of ingredients/additives in food products.

SUPPORT PERSONNEL

Sigfusson is currently supported by one research specialist, two graduate assistants, one graduate student employee and four undergraduate student employees.

PUBLICATIONS

Sigfusson, H., Ziegler, G.R., and Coupland, J.N. 2001. Ultrasonic Prediction of Unsteady State Cooling of Food Products. *Transactions of the ASAE*, 44(5), 1235-1240.

Sigfusson, H., Decker, E.A., Morrissey, M., and McClements, D.J. 2001. Ultrasonic Characterization of North Pacific Albacore (*Thunnus alalunga*). *Journal of Aquatic Food Product Technology*, 10(3), 5-19.

Sigfusson, H., Decker, E.A., and McClements, D.J. 2001. Ultrasonic Characterization of Atlantic Mackerel (*Scomber scombrus*). *Food Research International*, 34(1), 15-23.

Sigfusson, H., and Hultin, H.O. 2001. Partitioning of d-Tocopherol in Aqueous Mixtures of Triacylglycerols and Isolated Membranes. Presented at the IFT Annual Meeting, New Orleans, La.

Sigfusson, H., Ziegler, G.R., and Coupland, J.N. 2001. Ultrasonic Monitoring of Unsteady State Cooling of Food Products. Presented at the IFT Annual Meeting, New Orleans, La.

Sigfusson, H., Ziegler, G.R., and Coupland, J.N. 2001. Effect of Shear on Kinetics of Serum Separation and Some Rheological Properties of Ketchup. Presented at the IFT Annual Meeting, New Orleans, La.

Business and Marketing

Chuck Willoughby | business and marketing



CHUCK WILLOUGHBY

Chuck Willoughby is a business planning and marketing associate at the Oklahoma Food and Agricultural Products Center.

Chuck's educational background includes a bachelor of science degree and

master of science degree both in agricultural economics from Oklahoma State University. After graduating from OSU in 1988, Willoughby worked in the field of agricultural economics through research contracts with the USDA and the Western Highway Institute.

Other professional endeavors in his career include sales and marketing and serving as a district executive with the Boy Scouts of America.

In 1995, Willoughby returned to OSU to work in the area of rural community development and in 1999 joined the team at FAPC.

At FAPC, Willoughby assists new food business entrepreneurs with business planning, market evaluation and resource identification. He works with large Oklahoma food manufacturers as well, assisting them to find the appropriate technical assistance to meet their needs. Willoughby also

serves as instructor at Basic Training for Food Business Entrepreneurs, a monthly workshop hosted by FAPC.

SUPPORT PERSONNEL

Willoughby is supported by one undergraduate student.

RESEARCH INTERESTS

- 1) Business Planning
- 2) Market Evaluation
- 3) Co-Packer Identification
- 4) Impact Analysis

Business and Marketing

Corey Stone | business and marketing



COREY STONE

Corey Stone is a business and marketing specialist at the Oklahoma Food and Agricultural Products Research and Technology Center at Oklahoma State University. Stone joined the Center in January of 2000 and has assisted clients in

various applications of agricultural products for retail and foodservice sales.

Previous to joining the Center, Stone earned a bachelor of science degree in statistics from Oklahoma State University and spent more than nine years in industry as a

foodservice manager, either directly supervising operations or as a special consultant in units in five states. Stone uses his foodservice experience to assist clients in marketing to foodservice or institutional outlets. Stone lives with his daughter in Stillwater.

Business and Marketing

Jim W. Brooks | business and marketing



JIM W. BROOKS

Upon attending the University of Central Oklahoma in Edmond, Okla., Jim

Brooks began his career in industrial sales and marketing, which subsequently lead him to serve as branch manager for Swift and Co. in Oklahoma City and Denver, Colo. Brooks was promoted to Swift Branded Products manager for the western region, headquartered in Dallas, Texas.

After many years of service and leadership with Swift and Company, he assumed responsibility as general sales manager for the Food Service Division of Scrivner Foods Inc. Following 11 years of management at Scrivner Foods, Brooks became co-owner and partner of Bake Rite Foods in Oklahoma City.

CURRENT INTERESTS

Joining the FAPC in January 1997, Brooks serves the Center as a business and marketing specialist, engaging his extensive business experience and skills to lead the business and marketing team to help Oklahoma businesses develop and expand. Brooks has exclusively worked in industrial consulting since that time.

Quality Management

Jason Young | quality management



JASON YOUNG

Jason Young is a quality management specialist at the Food and Agricultural Products Research and Technology Center.

Young joined the Center in May 2001, bringing 11 years of food industry experience in quality management. During those years, Young extensively developed food safety (HACCP), sanitation and quality systems programs.

Young received his bachelor of science degree in milling science from Kansas State University. He is an accredited lead instructor through the

International HACCP Alliance and a Certified Quality Auditor-HACCP through the American Society for Quality.

CURRENT INTERESTS

Young's program areas are quality systems, HACCP and food safety and sanitation. The demands by the USDA-FSIS on the small and very small meat and poultry establishments have kept Young busy on

regulatory HACCP assistance.

Young is part of the Food and Agricultural Products Research and Technology Center HACCP team and helps to coordinate and present HACCP workshops and food safety roundtables for the food industry.

SUPPORT PERSONNEL

Young is supported by one undergraduate student.

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