SEMIANNUAL REPORT

IMPACT ON NEBRASKA AND THE GLOBAL FOOD INDUSTRY

JULY 1 – DECEMBER 31, 2013

Advancing the value-added food manufacturing industry by partnering on applied research and technical development from idea through ongoing market support.

FEBRUARY 2014
ROLANDO A. FLORES, PH.D.
PROFESSOR, HEAD AND DIRECTOR

UNIVERSITY OF NEBRASKA–LINCOLN
The Food Processing Center (The Center) is a multidisciplinary resource for the food industry with its units providing a combination of consulting, educational, technical, and business support services.

In the first half of fiscal year 2014, The Center assisted 135 clients for $324,648.38 in project revenue.

_Developments for the first half of FY 2014 included:_

- The Center worked on 203 projects for $324,648 in income.
- Better Process Control School was held for 57 in-person participants (15 from Nebraska) for a gross income of $29,700.
- The Extrusion Workshop was held for 17 in-person participants (7 from Nebraska) for a gross income of $13,100.
- Two National Food Entrepreneur Program (NFEP) seminars were held for 36 participants (21 from Nebraska) with a gross income of $7,750.
- The online Food Processing Management certificate program had 6 new registrants, 22 graduates with certificates, and $8,400 in new income.
- Student education: The Center faculty continued to advise a total of nine graduate students while The Center as a whole employed 35 undergraduate students. Fifteen undergraduate student workers were provided hands-on training in Dairy retail operations; five worked in product development and Center laboratories; 12 were employed in the dairy plant; two in the Pilot Plants; and one in NFEP. An additional undergraduate student worked with The Center on research projects under the UCARE program.
- The Center personnel produced one research publication that was accepted in this period.

The Center’s current organizational structure is available in Appendix B on page 17. In 2008, an Advisory Board was formed to assist The Center in its pursuits of excellence. The current members of the Advisory Board are listed in Appendix A on page 16.
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KEY TERMS:
FY 2014            Fiscal Year 2014            (July 1, 2013 to June 30, 2014)
FY 2013 II          Second half of Fiscal Year 2013 (Jan. 1, 2013 to June 30, 2013)
FY 2014 I           First half of Fiscal Year 2014 (July 1, 2013 to Dec. 31, 2013)
I. THE FOOD PROCESSING CENTER – OVERVIEW OF ACTIVITIES

From the period of July 1, 2007 to December 31, 2013, The Food Processing Center (The Center) completed 2,429 projects in assistance for 850 industry clients (250 of which were Nebraska-based companies) for a total worth of over $5.4 million. Chart 1 presents revenue totals in six-month increments for fiscal years 2009 to 2014 (FY I).

Larger than usual revenue is seen in the second half of fiscal year 2010 due to the completion of a large research and development project with the American Egg Board. The number of projects for the previous five fiscal years is displayed in Chart 2, which illustrates a steady increase in out-of-state projects.

The client base for The Center’s services has experienced a steady increase in the reference period. The increase in projects and clients indicates client loyalty to services of The Center, measured by the number of projects per client. Both in-state and out-of-state projects have increased, but this increase has been more pronounced among out-of-state clients (Chart 2).
A significant portion of The Food Processing Center’s operating budget is derived from revenue generated by industry projects. Currently, The Center receives a portion of its budget from the State of Nebraska. For fiscal year 2013, The Center is budgeted from the state $209,184 for Research and $340,663 for Extension for a total of $549,847. Percentages of budgeted state, industry, and grant funding for personnel (including benefits) for fiscal year 2013 are shown in Chart 4.

There is a significant change in the sources of funding in FY 2013 compared to the average in the previous five years (Charts 3 and 4). As can be seen from the charts, the proportion of state and grant funding has decreased in FY 2013, compared to the average funding from this source for the last five years. The difference was compensated by or reallocated to an increase in industry funding. The MEP (Manufacturing Extension Partnership) funding coming from NIST through the Nebraska Department of Economic Development ended September 2013. A new proposal was submitted from UNL with Center participation, and it was announced in January 2014 that funding was awarded.
II. UNIT OPERATIONS

Chart 5 shows the revenue by Center units for FY 2014 I (the first six months of the 2014 fiscal year) and an average of the previous 10 six-month periods. The standard deviation margins for the averages are shown. Revenue is higher (especially product development sensory innovation) in the current period for all units with the exception of the Pilot Plants.

The comparison of the revenue distributions between the last five fiscal years and the last six months in Charts 6 and 7 reveals a change in distribution. As a result of increased projects from the Applied Research and Engineering (ARE) unit, an increase can be seen in its proportional income and drops are seen in Pilot Plants, NFEP, Food Innovation and Entrepreneurship (FIE), and Lab Services.
Charts 8 and 9 depict the proportion of projects generated by The Center units for fiscal year 2013. The number of projects varies based on the nature of the work in each unit. Laboratory Services tends to have the greatest number of clients due to the variety of test samples that are submitted for analysis. Therefore, any direct comparison of the units comprising Charts 8 and 9 needs to take into consideration that the total number of clients reveals only a part of the overall picture regarding workload and revenue generation. While the Laboratory Services and PDSI units together completed over 60% of the projects, their contribution to the proceeds was 29% less than proportional, as seen in Chart 7.

Chart 8 shows the percentage of total projects of The Center over $1,000 (by unit) in FY2013 II, while Chart 11 shows percentage of projects under $1,000. This does not include grant income by the ARE unit, which is compiled separately (p. 8). The PDSI group had the most projects over $1,000 while the FIE group (now phased out) had the least (Chart 10). The Laboratory had the most projects under $1,000 as indicated in Chart 11. The Pilot Plants and PDSI generally work on larger or long-term projects that are contracted prior to the commencement of the work. Lab services has the most projects under $1,000. These projects are defined as samples that are submitted to the laboratory for analysis. No contracts are required and submissions can be made without prior notification.

Therefore, two types of industry projects are necessary: 1) low number, higher value (PDSI, Pilot Plants), and 2) high number, lower value (Laboratory). What are also needed are more collaborative projects between units that fulfill our concept as a one-stop service provider for the industry.
II.A. APPLIED RESEARCH AND ENGINEERING

The Applied Research and Engineering (ARE) unit focuses on applied food science research for the food industry.

ARE (Drs. Andréia Bianchini-Huebner, Jayne Stratton, and Wajira Ratnayake) utilizes and adapts the findings of original scientific research to meet specific industry needs. Current members of the ARE team have expertise in food safety, microbiology, mycotoxin control and detection, food chemistry, ingredient functionality, food processing, cereal processing, and shelf stability as related to molds and bacteria.

Establishing high-level collaborations requires establishing substantial credibility in both expertise and research capabilities. The ARE unit, therefore, is crucial for the future success of The Center and its intended plans for providing high-quality, advanced applied research to the food industry. The combined total of ARE grant and industry projects completed in the first half of FY 2014 was $226,474. An additional $77,068 was invoiced for technical services (laboratory) projects. Charts 8 and 10 show that despite the ARE working on 9% of The Center’s industry projects, it accounted for 26% of its industry income. Increased income and per-project value is anticipated as the unit increasingly carries out the high-level industry collaborations for which it was established.

In other work, the ARE unit received four industry-funded proposals and a fifth that was accepted in FY2013 II with work to be completed in FY2014 I (total amount $97,643). Those proposals with ongoing work are:

- Obis Biosciences, Kansas City, KS ($16,005). Characterizing the Release Profiles of Nisaplin from Different Size PLA Microspheres under Accelerated Conditions, Phase I. (Bianchini, Stratton)
- Orbis Biosciences, Kansas City, KS ($18,000). Characterizing the Release Profiles of Nisaplin from Different Size PLA Microspheres under Accelerated Conditions, Phase I option and Phase II. (Bianchini, Stratton)
- PepsiCo, ($30,655). Rapid Test Method Development for Corn Quality Analysis. (Ratnayake)
- PepsiCo, ($28,983). Ingredient Analysis, Corn Nixtamilization. (Ratnayake)

In FY 2014 I, several noteworthy impacts highlight the progress and success of the ARE unit in The Food Processing Center. In November, Dr. Bianchini-Huebner, Steve Weier, and Dr. Stratton attended the Process Expo in Chicago, IL to present talks on sanitation and acidified foods. Dr. Ratnayake attended the U.S. – China Food Ingredient Workshop and Convenience Foods Conference in Beijing, China in September.

Dr. Bianchini-Huebner, Steve Weier, and Dr. Rolando Flores attended the China - USA Joint Forum on Grain Science and Technology in Zhengzhou, China in November, 2013. The objective of this meeting in Zhengzhou, China was to foster further collaboration between UNL and Henan University of Technology. Dr. Bianchini-Huebner presented a talk on Food Safety Considerations for Cereal Based Products, while Steve Weier presented a talk on Extrusion. Dr. Flores also presented a talk on cereal food processing. Dr. Ratnayake, Dr. Bianchini-Huebner, and Dr. Flores attended the annual AACC meeting in Albuquerque, N.M. and participated at different levels.

Dr. Bianchini-Huebner traveled to Costa Rica to discuss with IICA (Inter-American Institute for Cooperation in Agriculture) the curriculum for a distance program that would offer online education to food safety auditors and inspectors in Central America and the Caribbean. Dr. Bianchini-Huebner also attended the Joint Annual Meeting 2013 of the American Dairy Science Association (ADSA) and the American Society of Animal Science (ASAS). The ARE group’s activities, research, and other information is available at the following website: http://are.unl.edu

Grant-Funded Research

A considerable portion of the funding for the ARE, and, therefore, The Food Processing Center, is derived
from grant-funded research. Dr. Wajira Ratnayake continued to work on two grants ($60,000 total) from the Nebraska Department of Agriculture. Another grant from the Nebraska Dry Bean Commission for $35,984 will keep supporting his applied research on dry-edible beans. Drs. Andreia Bianchini-Huebner and Jayne Stratton continue to work on a USDA grant investigating ochratoxin levels in U.S. products and commodities. Dr. Bianchini-Huebner retained ongoing support from the Midwest Dairy Association ($76,394). Table 1 lists grant-funded projects for ARE in FY 2014 I.

<table>
<thead>
<tr>
<th>Title</th>
<th>Funding Agency</th>
<th>Principal Investigator(s)</th>
<th>Start Date</th>
<th>End Date</th>
<th>Awarded Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving Dry-Edible Bean Utilization in the Food Industry: Developing New Ingredients and Products from Milled and Separated Fractions of Great Northern Beans</td>
<td>NE Dry Bean Commission</td>
<td>Wajira Ratnayake</td>
<td>7/1/2013</td>
<td>6/30/2014</td>
<td>$35,984</td>
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<tr>
<td>Tracking Heat-Resistant, Spore-Forming Bacteria in the Milk Chain: a Farm to Table Approach</td>
<td>Midwest Dairy Association</td>
<td>Andréia Bianchini-Huebner</td>
<td>3/1/2012</td>
<td>12/31/2013</td>
<td>$76,394</td>
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<tr>
<td>Improving Nebraska dry-edible bean utilization by the food industry through applied research on new product formulations-Noodle Machine</td>
<td>NE Dept. of Ag</td>
<td>Wajira Ratnayake</td>
<td>11/8/2012</td>
<td>9/29/2013</td>
<td>$50,394</td>
</tr>
<tr>
<td>Improving Nutritional Value of Convenient Foods using Nebraska Dry-Edible Beans to Exploit International Market Opportunities</td>
<td>NE Dept. of Ag</td>
<td>Wajira Ratnayake</td>
<td>9/30/2012</td>
<td>9/29/2015</td>
<td>$54,000</td>
</tr>
<tr>
<td>Utilization of fruit processing byproducts: Assessing the technical, safety, and commercial feasibility of new functional food ingredients from easily extractable compounds</td>
<td>Kimmel Foundation</td>
<td>Wajira Ratnayake, Jayne Stratton</td>
<td>1/1/2012</td>
<td>1/1/2014</td>
<td>$124,527</td>
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<tr>
<td>NRSI Microbial Field Forensics</td>
<td>NRSI StratCom</td>
<td>Andréia Bianchini-Huebner, Collaborator</td>
<td>5/6/2013</td>
<td>4/21/14</td>
<td>$2,000</td>
</tr>
</tbody>
</table>

**Total**  $353,299

As of this writing, USDA grants are currently under consideration as the requests for proposals have recently been issued.

**Teaching and Student Mentoring**

ARE has played a critical role in providing training and advising for Food Science and Technology graduate students and visiting scholars.

Students were particularly productive the first half of FY 2014 I. A total of nine graduate students (seven M.S., two Ph.D.) were enrolled in FY 2014 I and working toward degrees in the Food Science and Technology graduate program and mentored by ARE faculty. The names of seven ARE graduate students appear as authors/presenters on abstracts accepted by national
conferences in Summer 2013 (Institute of Food Technologists and American Dairy Science Association).

The undergraduate education experience has been greatly enhanced through workplace opportunities in The Center. The Center as a whole employed 35 undergraduate students. Fifteen undergraduate student workers were provided hands-on training in Dairy retail operations; five worked in product development and Center laboratories; 12 were employed in the dairy plant; two in the Pilot Plants; and one in NFEP. An additional undergraduate student worked with The Food Processing Center on research projects under the UCARE program. For its size, The Center is one of the largest employers of undergraduate students on campus.

Since 2008, 22 international students have been hosted as visiting scholars. The Center in FY 2014 I hosted 10 visiting food science scholars from The National Institute of Food Technology Entrepreneurship and Management (NIFTEM) in India. Steve Weier, Laurie Keeler, and Julie Reiling were directly involved in teaching the curriculum for this event. The Center partnered with FDST faculty to give the students a working experience in the areas of food microbiology, pilot plant operations, and product development/sensory innovation area. Dr. Stratton and Dr. Bianchini-Huebner directly supervise visiting undergraduate and graduate scholars who complete a research project in applied food microbiology during the time they are interns in The Center. One undergraduate scholar was from Brazil, and two were from Zamorano University in Honduras. One graduate scholar from Mexico is completing his M.S. research in the food microbiology laboratory.

**II.B. EDUCATIONAL WORKSHOPS, SHORT COURSES, AND DISTANCE LEARNING**

The Center sponsors educational workshops and short courses for food industry professionals to maintain and improve their skills. From July 1, 2007 to December 31, 2013, there were 1,316 participants in these workshops with 449 participants from Nebraska. In FY 2014 I, The Center offered two workshops to 74 participants for a gross income of $50,550. This was the Better Process Control School, directed by Dr. Stratton in October, which had 57 participants, 15 from Nebraska; the Extrusion workshop conducted in November with 17 participants, 7 from Nebraska; and the NFEP workshops with 36 attendees, 21 from Nebraska. The current event manager for The Center is Jill Gifford.

An educational service offered since January 2012 by The Center is the Food Processing Management (FPM) online certificate program, which is administered by Dr. Andréia Bianchini-Huebner. This practical distance education program covers a broad scope of key topics for food processing professionals seeking to advance their career, increase their productivity at work, and achieve superior performance in all areas of their business. The program includes topics in quality control and assurance, food safety, food processing, food product development, business growth strategies, and human resource management spread across three modules. The program is available at http://fpm.unl.edu. In FY 2014 I, there were six new registrations for the FPM program for a total of $8,400 in proceeds. To date, 22 students have completed the entire program.

**II.C. PILOT PLANTS**

The Center’s Pilot Plant staff (Thomas Dobesh, Jonathan Hnosko, and Steve Weier) assists companies and entrepreneurs with tasks such as equipment trials, testing functionality of new ingredients, production scale up, or developing the process for new products. The Center’s Pilot Plants have continued to work with a variety of industry clients from the U.S. The extrusion pilot plant continues to be the most utilized equipment within the plants, followed by the freeze-drying equipment. The Pilot Plants also continue to be a resource for the faculty and students within the Department of Food Science and Technology by assisting with class demonstrations and research projects. The Pilot Plants, as a whole, also have provided a working education for 12 student workers during FY 2014 I, a valuable opportunity for the students to reinforce and complement the concepts that are covered in their Food Science classes.

The Center’s dairy processing plant offers student
training and technical consulting work, and also produces cheese, ice cream and other products that supplement the unit’s income. Along with its educational and production capacities, the dairy plant has been steadily increasing the amount of technical assistance provided to industry. In fiscal year 2013, the dairy plant provided $23,124 in technical assistance, with $10,224 coming in FY 2014 I. In this period, the dairy plant produced 2,455 pounds of cheese and 8,100 gallons of ice cream. This represents a decrease in production of both ice cream and cheese from the previous six months, although historically there are slight annual increases in ice cream production while cheese numbers are generally stable from year to year.

Steven Weier also attended a meeting on Soy in Aquaculture in a trip funded by the United Soybean Board (Nebraska Soybean Board) and the U.S. Soybean Export Council in August, 2013 in Kapaa, Hawaii. Weier is general manager of the Pilot Plants and is progressing on his Ph.D. in Food Science and Technology.

II.D. PRODUCT DEVELOPMENT AND SENSORY INNOVATION

The Product Development and Sensory Innovation (PDSI) group (Bethany Jackson, Laurie Keeler and Julie Reiling) invoiced roughly $96,000 for FY 2014 I. This is a remarkable increase and attests to the confidence clients have in the PDSI services. Three main companies comprised the bulk of the work completed, one of which is investigating new and innovative ways to develop the concept of using insects as a protein source.

Laurie Keeler, Julie Reiling and Bethany Jackson traveled to the Institute of Food Technologists annual meeting in July to host The Center’s exhibitor booth and to attend meetings on the latest in food processing and food science technology and innovation.

In addition to technical assistance, PDSI serves as an educational resource for students in Food Science and Technology. PDSI employed four undergraduate student workers as well as international interns rotating through to gain valuable hands-on application experience.

• Bethany Jackson is progressing on a master’s degree and has completed distance classes through Michigan State to gain more training on regulations and food law. Bethany presented two class lectures, one for Dr. Gary Sullivan’s Animal Science Meat Class and one for Dr. Devin Rose’s Product Development Class. Both lectures were on labeling and nutrition facts panels for food products. Jackson also assists with all projects from The Center’s FEAP program that require product development.

• Julie Reiling has increased the number of sensory panels since taking over as manager. In FY 2014 I she conducted a total of 12 sensory panels. She also provides important training opportunities to student workers and will be recruiting new students for the College and the Department through the activities planned for FFA students. Reiling also completed more than 100 nutritional labels for clients, and assists with the labeling lectures for the Meats and Product Development classes.

• Laurie Keeler who has worked almost 25 years at The Food Processing Center, continues to expand her knowledge and experience by taking on unique projects for many new and returning clients. Some of the more successful and unique projects have been to assist with the processing of several varieties of insects for food ingredients, some unique pet food products, and several supplement projects. Many of Keeler’s projects also bring in income to the other units for services such as microbial testing, sensory panels, and pilot plant services. Keeler conducted a project with the Nebraska Grain Sorghum Board to assist the Food Science Club in baking 2,000 gluten-free cookies in one day for Husker Harvest Days.

II.E. RETAIL OPERATIONS INNOVATION

Kathy Vokoun serves as the manager of the Dairy Store while general oversight of the Dairy Store and the dairy team is provided by Steve Weier. The UNL Dairy Store falls under the organization of The Center, and is a “fast-casual” style restaurant and retail...
outlet within the Food Industry Complex. The Dairy Store achieved more than $163,000 in sales in FY 2014 I. The Dairy Store conducted five guided tours for 93 scheduled visitors during FY 2014 I.

II.F. NATIONAL FOOD ENTREPRENEUR ASSISTANCE PROGRAM™

Small Business Services (Jill Gifford, Bethany Jackson) as a separate group was phased out and folded into the National Food Entrepreneur Assistance Program™ (NFEP). The NFEP program is widely utilized by entrepreneurs throughout the country. It is the only program in the nation to provide comprehensive assistance to individuals wishing to develop a food manufacturing business. It begins with a one-day Recipe to Reality™ seminar (Phase I) that provides entrepreneurs with the key factors to be considered with a new food manufacturing business. After the seminar, participants may choose to enter Product to Profit™ (Phase II) where entrepreneurs receive comprehensive, individualized and confidential assistance for the development of their own business from food scientists and business consultants in The Center.

From July 1 to December 31, 2013, the Recipe to Reality™ seminar was conducted two times in Lincoln, Neb., for a total of 36 individuals. Twenty-one registrants were from Nebraska. The program averages 30 companies in Product to Profit™ at all times. Chart 12 displays the total number of clients The Center has assisted the past five fiscal years and the percentage of which were entrepreneurs in Phase II of NFEP.

For FY 2014 I, NFEP produced $43,210 in total revenue, $7,750 of which was earned for Recipe to Reality™, while $35,460 was received for Product to Profit™. These two programs provide key assistance to small entities wishing to enter the marketplace with new products.

![Chart 12: Proportion of Entrepreneurs Out of Total Clients](image)
It was announced in the UNL Chancellor’s State of the University address on September 17, 2013 that the Department of Food Science and Technology (FDST) and The Food Processing Center would be moving to Nebraska Innovation Campus upon completion of the Life Sciences Research Center in the location that was once home of the Nebraska state fairgrounds. Anticipated completion of this complex is summer 2015.

Ultimately, the plan is to have two million square feet of space with 500,000 square feet completed within five years. The uniquely designed buildings will be of quality construction that promotes positive energy, fosters interaction and stimulates ideas, collaboration, sustainability and innovation. FDST and the Center are excited to move to the next level in advancing core missions of teaching, research, and extension.
IV. PUBLICATIONS AND PRESENTATIONS

From July 1, 2013 to December 31, 2013, The Center personnel had one research publication accepted and provided 17 presentations and symposiums. A complete list of these publications and presentations is below.

Presentations

- Microbiological Quality of Winter Wheat Harvested in Different Regions of Nebraska, United States. (2013). L. Sabillon Galeas, A. Bianchini, J.E. Stratton, D. Rose, R.A. Flores. IFT Annual Meeting, Chicago, IL


IV. PUBLICATIONS AND PRESENTATIONS


**Awards**

*Dairy Research Institute Graduate Student Paper Presentation Contest in Dairy Foods Research*

Second Place: Maricarmen Estrada, University of Nebraska; Adviser: Dr. Andreia Bianchini-Huebner

**Publications Accepted**

### Advisory Board

<table>
<thead>
<tr>
<th>NAME</th>
<th>COMPANY/BUSINESS</th>
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<tbody>
<tr>
<td>FLORES, Rolando</td>
<td>The Food Processing Center, Director</td>
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<tr>
<td>BAIER, Richard</td>
<td>NE Chamber of Commerce &amp; Industry</td>
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<tr>
<td>GARBACZ, Stan</td>
<td>NE Agricultural Trade Representative</td>
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<tr>
<td>HISER, Greg</td>
<td>Nestle Purina</td>
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<td>MANINGAT, Ody, Board Chair</td>
<td>MGP Ingredients Inc.</td>
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<td>MESSINEO, Michael, Incoming Chair</td>
<td>Valentino’s Pizza</td>
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<td>MILLER, John</td>
<td>Oxbow Pet Products</td>
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<td>WILLIAMS, Rick</td>
<td>Oat Tech Inc.</td>
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Organizational Chart, February 2014

Rolando Flores, PhD
The Food Processing Center, Director
Department of Food Science and Technology, Head

Administrative Unit
Wanda Bowder
Connie Gebhardt
Justin Lewis

Business and Finance
Lauren Madsen
Business Center Staff

The Food Processing Center

Applied Research & Engineering
Jayne Stratton
Wajira Ratnayeke
Andréia Bianchini
Graduate Students

Pilot Plants, Dairy Store & Retail Services
Steve Weier
Jonathan Hnosko
Thomas Dobesh
Kathy Vokoun
Student Workers

Product Development & Sensory Innovation
Laurie Keeler
Julie Reiling
Bethany Jackson
Student Workers

Laboratory Services
Jayne Stratton
Robin Krokstom
Graduate Students
Student Workers

National Food Entrepreneur Program
Jill Gifford
Bethany Jackson
Student Workers

FPC Advisory Board
Richard Baier
Stan Garbacz
Greg Hiser
Clodualdo Maningat
Michael Messineo
John Miller
Sam Rao
Dan Rice
Gordon Smith
Kenny Soejoto
Rick Williams

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