2010-2011

ANNUAL REPORT

Joint Institute for Food Safety and Applied Nutrition

The University of Maryland

February 2012

ANNUAL REPORT

Mission

JIFSAN advances sound strategies that improve public health, food safety, and applied nutrition using risk analysis principles through cooperative research, education, and outreach programs.

Vision

To be internationally recognized as a premier source of scientific information and education programs on food safety and applied nutrition that enables the development of sound public health policy and reduces the incidences of food-related illness.

Joint Institute for Food Safety and Applied Nutrition (JIFSAN)

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From the Director

As we are celebrating the 15th anniversary of JIFSAN's establishment, JIFSAN continues to strive and move beyond its initial goals. In the past year (August 2010- July 2011), several broad-based initiatives in international trainings and partnerships have provided momentum to the transformation of JIFSAN. JIFSAN and the Waters Corporation signed an agreement to establish a laboratory-based training facility, the International Food Safety Training Laboratory (IFSTL). This program complements JIFSAN's extensive international training programs, and will deliver hands-on training to foreign and domestic scientists in the application of state of the art fit-for-purpose methods for monitoring compliance with food safety standards.

JIFSAN is developing sustainable partnerships for training within the global food safety community under the umbrella of Global Collaborating Food Safety Training Centers. Based on the success of the Bangladesh Partnership, this provides a vehicle and framework to sustain in-country regional training and capacity building thereby leveraging JIFSAN and FDA training resources. Discussion on Mexico Center on Advanced Good Agricultural Practice Training was initiated. Additional partnerships will be established for such centers.

We have also strengthened research collaborations in microbial food safety and applied nutrition, and offered again an excellent undergraduate internship program that provides unique opportunities for UM students. Food safety risk analysis program was significantly enhanced with a 3-year USDA grant that focused on facilitating information exchange and developing user-friendly risk analysis tools, and a residency fellowship program designed to improve learning outcomes of participants in risk analysis summer integrated courses.

Success requires hard work and strong partnerships with the government, industry and other academic institutions. I heartily commend and thank the JIFSAN staff, and colleagues at FDA, JIFSAN Advisory Council and other partner organizations that have helped bring this year's success.

Jianghong Meng, DVM, PhD

Director

Conducting applied as well as cutting-edging research in food safety and applied nutrition.

The Joint Institute for Food Safety and Applied Nutrition (JIFSAN) research program assists in the generation of new knowledge supporting the development of a strong scientific base to address ongoing and increasingly complex public health issues. The program includes not only traditional laboratory and field research, but also educational, behavioral and social research. JIFSAN worked closely with FDA scientists to identify research needs and to bring together researchers at UM, FDA and other institutions to conduct the collaborative research. (Appendix B). During this reporting period, projects funded through JIFSAN's internal research program and internship program have generated 14 publications (13 research articles and 1 book chapter) in major food safety, applied nutrition, and other public health journals (Appendix C). JIFSAN continued building a strong research program with a direct impact on the public health. Research progress of several projects is highlighted below:

Microbial Food Safety Research:

JIFSAN conducted collaborative research on microbial food safety that focuses on the development of methods for identification and subtyping of bacterial pathogens, particularly *Salmonella* and Shiga toxin producing *E. coli* (STEC). Nanocsensors were developed for detecting *E. coli* O157:H7 using a label-free, accurate and reliable platform. Transistor chips for the biosensors could be potentially reused. New technologies including whole genome sequencing and bioplex were used to establish and pinpoint a potential reservoir of infestation for STEC and *Salmonella* on fresh produce. The work should facilitate a more detailed source tracking of feral STEC and *Salmonella* strains isolated from numerous distinct ecological niches in conjunction with foodborne outbreaks. Information gained from understanding the evolutionary relatedness of these foodborne pathogens is key to unraveling the molecular epidemiological pathways that lead to food contamination by dangerous STEC and *Salmonella*.

Produce Safety Research:

A legume plant model, *Medicago truncatula* (a close relative to cultivated alfalfa) was developed by Dr. Jean-Michel Ane of the University of Wisconsin, for studying symbiotic plant-microbe interactions. It is an ideal system for studying interactions with *E. coli* O157:H7 and *Salmonella enterica*. The model system enabled us to confirm the internal colonization of plant tissues by these pathogens. Several genes were identified that differentially regulated in *M. truncatula* during the infection, which provided valuable insight into the plant genes involved in the recognition mechanism. These genetic markers will help in rapid and efficient detection of crop contamination with the pathogens grown under field conditions.

Plant-associated microflora have been shown to either promote or inhibit the establishment of foodborne pathogens on the plant surfaces (phyllosphere). Dr. Chris Walsh at the University of Maryland characterized the bacterial communities on the tomato fruit surface and the water sources (ground and surface) commonly used in commercial vegetable production to determine if the bacterial diversity of the surface was impacted when different water sources were used for direct crop application. The two water sources tested had a significantly different bacterial composition, yet the season long use of these two water sources did not have a significant impact on the bacterial composition of the tomato fruit surface. This study represents the first in-

depth characterization of phyllosphere bacterial communities on the tomato fruit grown in Maryland.

Applied Nutrition Research:

Dr. Nadine Sahyoun (UM) and Dr. Wen Yen Juan (FDA/CFSAN) began the process of developing a risk assessment framework for folate by conducting critical literature review to determine the key events and control points in the metabolic pathway of the nutrient. This involves examining folate metabolism from consumption, to absorption, uptake by cells and metabolism by target tissue. They will identify methods to develop risk assessment models.

Dr. Lucy Yu (UM) and Dr. Thomas J. Flynn (FDA/CVM) developed in vitro hepatotoxicity assay(s) using human (HepG2/C3A) and rat (MH1C1) hepatoma cells to rapidly evaluate potential liver toxicity of dietary supplement materials. The data suggest that this in vitro model may be useful for identifying hepatotoxic phenolics and botanical preparations rich in phenolics.

Extramural research projects:

An Online Integrated Food Safety Risk Analysis Resource for National and International Information Exchange (WWW.FoodRisk.org): JIFSAN received a 3-year grant from USDA in 2009 to develop an online integrated food safety risk analysis resource to improve global food safety by facilitating the exchange of information and user-friendly tools. In partnership with the National Institute for Public Health and Environment (RIVM) in the Netherlands and the National Food Institute in Denmark, JIFSAN has developed an online integrated catalogue on risk assessment (ICRA). ICRA's risk assessor interface was completed and was transferred from RIVM to JIFSAN in June 2011. ICRA has currently two food-commodity combinations (Salmonella in pork meat and Campylobacter in poultry meat) and its users interface is being developed by JIFSAN IT. JIFSAN has also collaborated with the National Agricultural Library (NAL/USDA) and researchers from the School of Information Studies at the University of Maryland to update the NAL thesaurus with risk analysis terms so it could be adopted by FoodRisk.org. FoodRisk.org indexation and searches are now linked to the NAL thesaurus and are much more robust and efficient.

INRA-MET@RISK: JIFSAN collaborated with the French National Institute for Agricultural Research (INRA); University of California, San Diego, and the US FDA's Center for Food Safety and Applied Nutrition on a joint research project to analyze the way that food safety risk assessments treat various forms of uncertainty. This four year project was funded by a French agency and officially started March 2010. The initial collaborative effort resulted in the development of terminology to describe the way risk assessors express uncertainty in risk assessment documents from the United States and Europe. The project involves testing a computer based tool developed by INRA and UC San Diego using a variety of food safety risk assessments to determine how each addresses the different forms of uncertainty (such as data uncertainty and model uncertainty) in the risk models, how these uncertainties are presented in the descriptive technical reports and executive summaries, and whether there are consistent differences between different types of risk assessments (for example, risk ranking assessments and product pathway assessments). This project will further develop a tool that will systematically evaluate risk assessments and other food safety documents.

Towards Sustainable International Food Safety Trainings through Partnership:

Training programs constitute a significant component of the JIFSAN mission. International training programs are conducted with co-sponsors in the host country. Partnerships with host countries, with industry, and with government agencies have been a key to our success with acquiring resources for expanding JIFSAN's activities. Programs conducted from August, 2010 to August, 2011 are listed in Appendix D.

The Aquatic and Aquaculture Food Safety Center (AAFSC) in Bangladesh:

The Center was initiated in November 2009 by the Bangladesh Shrimp and Fish Foundation (BSFF), the local partner organization of JIFSAN, the Bangladesh government, JIFSAN, FDA and US Embassy in Bangladesh. JIFSAN and FDA trainers offered a standard JIFSAN GAqP program at that time. During the training program BSFF and the GAqP team selected a group of individuals who would become the cadre or AAFSC resident trainers. In March 2010 a formal MOU between UM and BSFF was signed establishing the AAFSC. In September 2010 nine resident trainers that were selected traveled to the US and participated in an intense two-week internship at the JIFSAN training facilities in College Park, the aquaculture research facilities at FDA's Center for Veterinary Medicine, and aquaculture research facilities at the University of Maryland Center for Environmental Science. A GAqP program was offered at AAFSC in December 2010 in collaboration with AAFSC. The AASC interns/trainers will provide the majority of the program with the JIFSAN trainers acting largely as advisors. The AAFSC has been widely supported in Bangladesh.

Based on the success of the Bangladesh Partnership, JIFSAN is developing additional sustainable partnerships for training within the global food safety community under the umbrella of Global Collaborating Food Safety Training Centers. This provides a vehicle and framework to sustain in-country regional training and capacity building thereby leveraging JIFSAN and FDA training resources. These Centers will be established through partnerships within the sponsoring country's; utilize existing resources within host country to reach all members of the applicable market sector including the competent authorities and industry; and develop a cadre of in-country trainers, thereby increasing the capacity to conduct on-going extension-like training. In order to reach these goals and maintain currency, JIFSAN and FDA will also provide continuing consulting expertise, guidance and updating to trainers as needed.

The Advanced Good Agricultural Practice (GAP) Training Center in Mexico:

A draft proposal was prepared in the spring of 2011 to establish a Mexico GAP Training Center in collaboration with Senasica, industry groups and academia. The proposal was reviewed by appropriate parties including CFSAN and forwarded to Senasica, which has recently provided a positive response to the proposal. The next annual report will include a progress statement.

APEC Partnership Training Institute Network (PTIN):

JIFSAN continued its active participation in the Asia-Pacific Economic Cooperation (APEC) Food Safety Cooperation Forum (FSCF) started in 2009. Collaborating with (Michigan State University (lead) and Ohio State University, JIFSAN received a grant targeting APEC region from USDA on "Development and Evaluation of Standardized, Competency-Based Food Safety Education and Training Programs for the Food Industry."

The newly established laboratory training program (IFSTL; see below) already started training activities as part of the laboratory capacity building, and is listed as a potential venue for the APEC region.

International Food Safety Training Laboratory (IFSTL):

The IFSTL project developed at high speed in the 2010-2011 year; plans were designed for the space in the Patapsco Building in the fall of 2010 and demolition/renovation took place in the Winter, Spring and Summer 2010- 2011. A Laboratory Manager, Dr. Janie Dubois, was hired and joined JIFSAN in April 2011. The IFSTL construction was approaching functional completion by the end of FY 2010-2011 and the Grand Opening was scheduled for September 15th 2011. The following two courses were offered in FY 2010-2011:

Microscopic Identification of Botanicals took place in March 2010 in the training room in the JIFSAN office. Twelve students attended the weeklong course. The instructors were FDA and FDA-retired experts who presented a series of lectures on optical theory, understanding optical microscopes, the necessity and composition of a monograph, and on the microscopic features of natural and extraneous contaminants of botanical materials. Each participant was given access to a compound microscope and was instructed on the preparation of slides and development of a monograph.

Methods of Pesticide Residue Analysis was sponsored by FDA for CAFTA-DR countries. Twelve students from Chile, Costa Rica, Guatemala Dominican Republic and Honduras participated in the week long training. Instructors including subject experts from FDA/CFSAN and ORA, USDA and EPA delivered lectures on pesticide residue detection in fresh fruits and produce from many perspectives: the regulation and compliance in the region were reviewed, followed by technology transfer considerations and hands-on exercise on analytical methods.

Expanding global capacity building in risk analysis:

JIFSAN's Food Safety Risk Analysis Professional Development Training Program offers a summer integrated program, online distance learning, and fellowships. The 2011 SIP program was held in June 2011. Thirty-nine attendees represented U.S., Saudi Arabia, Nigeria, Hong Kong, Chile, United Arab Emirates, Colombia, Canada, Korea, Uruguay and China. Ines Martinez Bernie from Uruguay was awarded the JIFSAN 2011 Fellowship in Risk Analysis providing free registration for the full three-week program.

For the first time, JIFSAN also offered a Residency Fellowship that requires students who come to the risk analysis training to identify a clearly defined research project that they can focus on after taking the course work. They may work with a mentor(s) at JIFSAN/FDA for up to six months to complete their research projects. Dr. Jianghui Zhu from China, supported by ILSI China, completed this program in 2011 and his research project was on "Cross-Contamination in Food Preparation in China: A Mechanistic Model Applied to *Salmonella*-Broiler Chicken Combination."

JIFSAN's FoodRisk.org facilitates information exchange and developing user-friendly risk analysis tools. The site was transferred from outside hosting to JIFSAN's private servers. The development and implementation of a thesaurus that will greatly improve the "search-ability" of the FoodRisk.org database was completed. The FoodRisk.org Database Search feature has

been rebuilt using the NAL thesaurus. The new search application implements the NAL thesaurus structure to allow for translation of search terms into thesaurus keywords. JIFSAN created an online version of the What We Eat in America - Food Commodity Intake Database, 2003-2006, found at http://fcid.foodrisk.org/. WWEIA-FCID 2003-06 was developed by U.S. EPA's Office of Pesticide Programs to improve the utility of the WWEIA food consumption survey for dietary exposure assessment. The current online version allows for users to query the recipes used in the database.

Providing educational resources to help train a skilled workforce in food safety and applied nutrition:

JIFSAN offers opportunities for both students and professionals through undergraduate research internship and graduate assistantship as well as postdoctoral fellow programs. The JIFSAN education programs have provided domestic and international participants tools and techniques to assure that food products are wholesome and safe for consumption. The JIFSAN Internship program is a unique undergraduate research program designed to provide UM undergraduate students with an opportunity to collaborate with FDA scientists on specific research projects related to CFSAN's mission. The JIFSAN Internship Program continues to attract high caliber undergraduate students who are eager to have an opportunity to work with FDA researchers in a "hands on" environment. During the 2010-2011 budget periods, 27 students participated in the program (Appendix E).

Appendix A – JIFSAN Staff

Administration
Jianghong Meng, DVM, Ph.D. Director
Vernora (Nora) Petty, Assistant to the Director
Mary Grimley, Financial Officer
Pamela Biery, Business Services Specialists

International Training Program
Paul Mazzocchi, Ph.D., Associate Director
James Rushing, Ph.D., Manager, International Training Programs
Judy Cooper, Coordinator, International Training Programs
George Evancho, Senior Fellow

Risk Analysis Program
Clare Narrod, Ph.D., Manager, Risk Analysis Program
Samantha Watters, Program Management Specialist

International Food Safety Training Laboratory (IFSTL)
Janie Dubois, Ph.D., Laboratory Manager
Marie Ahlgren-Stephanosront, Program Management Specialist
Derick Lucas, Ph.D., Chemist

IT Program
Kyle McKillop, Coordinator
Timothy Shaffer, IT Support Assistant
Paul Guevara, IT Support Assistant

Internship Program
Kaci Thompson, Ph.D., Director of Undergraduate Research &Internship Programs, College of Chemical and Life Sciences, UM

Appendix B - Research

Cooperative Projects:

Novel molecular typing methods for analyzing Shiga toxin producing *E. coli* (STEC) and *Salmonella* PI: Jianghong Meng, UM, Collaborator: Eric Brown, FDA/CFSAN

Risk communication projects PI: Monique Turner; Xiaoli Nan, UM, Collaborator, FDA/CFSAN

(1) Food Defense Research Initiative: Evaluation of the ALERT (Assure, Look, Employees, Reports, Threat) campaign; (2) Survey on consumers' emotional and cognitive reactions to food recalls; and (3) Be Food Safe

Development and Validation of Isotope Methods for Distinguishing Between Naturally Occurring and Synthetic Phthalates in Food: PI: Steve Ono, UM, Collaborator, FDA/CFSAN

Internal Competitive Research Program Projects:

2008-2010 projects

Evaluating Public Health Impacts and Cost-Effectiveness of Implementing GAPs in the Tomato Farm Environment. PI: Amy Sapkota, UM, Collaborators: Sammy Joseph, UM, Andrew Estrin and Cristina F. McLaughlin, FDA/CFSAN

Developing Phyllosphere Metrics in GAPs to Reduce the Risks of Salmonellosis in Fresh-Market Tomatoes and Other Vegetable Crops. PI: Chris Walsh, UM, Collaborator: Eric Brown, FDA/CFSAN

Plant Responses to the Colonization by Escherichia coli O157:H7 and Salmonella. PI: Jean-Michel Ane, University of Wisconsin, Collaborators: Charles Kasper, University of Wisconsin, Eric Brown, FDA/CFSAN

2009-2011 projects

Development and Validation of Nanosensors for Detecting and Subtyping Foodborne Pathogens. PI: Drs Romel D. Gomez and Wenxia Song (UM) and Drs. Eric Brown and Thomas Hammack (FDA/CFSAN)

Development of a Risk Assessment Framework for Folate Metabolism and the Identification of Applicable Risk Assessment Models.PI: Dr. Nadine Sahyoun (UM) and Dr. Wen Yen Juan (FDA/CFSAN)

Development and Validation of In Vitro Hepatotoxicity Assay(s) for Dietary Supplemental Materials. PI: Dr. Lucy Yu (UM) and Dr. Thomas J. Flynn (FDA/CVM).

Extramural research projects

An Online Integrated Food Safety Risk Analysis Resource for National and International Information Exchange – Funded by USDA. PI: Dr. Juliana Ruzante (JIFSAN, UM) and Dr. Jianghong Meng (JIFSAN, UM)

INRA-MET@RISK

Appendix C - Publications

Research Articles:

1) Xia, X, J. Meng, P.F. McDermott, S. Ayers, K. Blickenstaff, T. Tran, J. Abbott, J. Zheng, and S. Zhao. 2010. Presence and Characterization of Shiga Toxin-Producing *Escherichia coli* and Other Potentially Diarrheagenic *Escherichia coli* in Retail Meats. Appl. Environ. Microbil. 76: 1709–1717.

2) Lubran, M.B., R. Pouillot, S. Bohm, E.M. Calvey, J. Meng, and S. Dennis. 2010. Observational Study of Food Safety Practices in Retail Deli Departments. J Food Prot 73:1849-1857.

3) Zheng, J., C. Keys, S. Zhao, R. Ahmed, J. Meng, and E. W. Brown. 2011. Simultaneous Analysis of Multiple Enzymes Sharply Increases the Accuracy of PFGE in Assigning Genetic Relationships among Homogeneous *Salmonella* Strains. J. Clin. Microbiol. 49:85-94.

4) Yan, X., Y. Peng, J. Meng, J. Ruzante, P. M. Fratamico, L. Huang, V. Juneja, And D. S. Needleman. 2011. From Ontology Selection And Semantic Web To An Integrated Information System For Food-Borne Diseases And Food Safety. Adv Exp Med Biol. 696:741-50.

5) Lienau, E. K., E. Strain, C. Wang, J. Zheng, A. R. Ottesen, C. E. Keys, T. S. Hammack, S. M. Musser, E. W. Brown, M. W. Allard, G. Cao, J. Meng, And R. Stones. 2011. Identification Of A Salmonellosis Outbreak By Means Of Molecular Sequencing. N Engl J Med. 364:981-2.

6) Xia, X., J. Meng, S. Zhao, S. Bodeis-Jones, S. A. Gaines, S. L. Ayers, And P. F. Mcdermott. 2011. Identification And Antimicrobial Resistance Of Extraintestinal Pathogenic *Escherichia coli* From Retail Meats. J Food Prot. 74:38-44.

7) Xia, X., P. F. McDermott, S. Zhao and J. Meng. 2011. *Escherichia coli* from retail meats carry genes associate with uropathogenic *E. coli*, but are weakly invasive in human bladder cell culture. J. Appl. Microbiol. 110: 1166-1176.

8) Zheng, J, F. Tian, S. Cui, J. Song, S. Zhao, E. Brown, and J. Meng. 2011 Differential gene expression by ramA in ciprofloxacin-resistant Salmonella Typhimurium. PLoS ONE 6(7): e22161. doi:10.1371/journal.pone.0022161

9) Wang, X., S. Zhao, H. Hobblto, T. Tran, K. Blickenstaff, and J. Meng. 2011. Antimicrobial resistance and molecular subtyping of *Campylobacter jejuni* and *Campylobacter coli* isolated from retail meats. J Food Prot. 74:616-621

10) Telias, A, White JR, Pahl DM, Ottesen AR, Walsh CS. 2011. Bacterial community diversity and variation in spray water sources and the tomato fruit surface. BMC Microbiol. 2011 Apr 21;11:81

11) Xie, Z., Zhao, Y., Chen, P., Jing, P., Yue, J., **Yu, L.** 2011. Chromatographic fingerprint analysis, and rutin and quercetin compositions in the leaf and whole-plant samples of

diploid and tetraploid Gynostemma pentaphyllum. *Journal of Agricultural and Food Chemistry*. 59: 3042-3049

12) Huang, H., Cheng, Z., Shi, H., Xin, W., Wang, T.Y., **Yu, L**. 2011. Isolation and characterization of two flavonoids, engeletin and astilbin, from the leaves of Engelhardia roxburghiana, and their potential anti-inflammatory properties. *Journal of Agricultural and Food Chemistry*. 59: 4562-4569

13) Liu, Y., Flynn T.J., Ferguson, M., Hoagland, E.M., **Yu, L.** 2011. Effects of dietary phenolics and botanical extracts on hepatotoxicity-related endpoints in human and rat hepatoma cells and statistical models for prediction of hepatotoxicity. *Food and Chemical Toxicology*. 49: 1820-1827.

Book Chapters:

1) Yan, X., Y. Peng, J. Meng, J. Ruzante, P. M. Fratamico, L. Huang, V. Juneja, D. S. Needleman. 2010. From Ontology Selection and Semantic Web to an Integrated Information System for Food-Borne Diseases and Food Safety, In: Software Tools and Algorithms for Biological Systems, Springer.

Appendix D - International Trainings

Good Agricultural Practices (GAP):

September 27-October 1, 2010, Guadalajara, Mexico, in collaboration with Senasica and the University of Guadalajara for 45 participants, 25 of whom were managers from the private sector.

October 18-22, 2010, Turrialba, Costa Rica. This was a regional program with 57 participants. The following countries were represented: Belize (2); El Salvador (2); Guatemala (2); Honduras (2); Mexico (3); Nicaragua (2); Panamá (2), and; Dominican Republic (2).

December 13-17, 2010, Ensenada, Mexico: 60 participants.

Good Aquacultural Practices (GAqP):

September 13-24, 2010: Phase II training program in College Park, and Cambridge Maryland with **9** participants traveling from Bangladesh.

December 5-9, 2010, Phase III training program in Cox's Bazar, Bangladesh.

May16-20, 2011, Xiamen, China.

Commercially Sterile Packaged Foods (CSPF) Training Programs:

September 13-17, 2010: Qingdao, China

March 14-18, 2011: Hanzhou, China.

Appendix E – Undergraduate Internship/Graduate Assistantship FY 2011

Undergraduate Internships

			Fall 2010 - Summer 2011	
	Last Name	**First Name**	**Project**	**Collaborator**
1	McElroy	Kevin	Detection of Unpasteurized Milk in Cheese and other Dairy Products	George Ziobro
2	Sadowski	Jennifer	Cloning and characterization of virulence factors from foodborne pathogens like Vibrio specides and *E. Sakazakii*	V. Sathyamoorthy
3	Hepp	Susan	Characterization of the Lac+Phenotype in Salmonella Tennessee Isolates Associated with the Peanut Butter Outbreak of 2007	Eric Brown
4	Dickey	Erin	Evaluation of the BAM Salmonella Culture Method for the recovery of Salmonella from green leafy produce.	Thomas Hammack
5	Islam	Emrul	Characterization of Housekeeping Genes in *Salmonella enterica* for their phylogenetic accuracy and SNP discovery	Rebecca Bell
6	Lee	Hannah	Determine the bacterial load of food borne pathogens carried by flies	Monica Pava-Ripoll
7	Vanegas	Camilo	Study of shellfish toxicity off the coast of New England	Stacey Etheridge

			Summer 2010 - Spring 2011	
	Last Name	**First Name**	**Project**	**Collaborator**
8	Lee	Chloe	Cloning, Expression, Purification and Characterization of Virulence Factors from Foodborne Pathogens	V. Sathyamoorthy
9	Mehta	Akshita	Assessment of differential cytokine expression in mouse peritoneal macrophages following exposure to Shiga Toxin 2.	Lisa Plemons
10	Simpson	Alexandra	Study of the survival growth characteristics of *Listeria monosytogenes* associated with gastroenteritis and invasive listeriosis.	Atin Datta
11	Gudger	Erin	Coordination/Analysis of data for a foodborne illness outbreak surveillance database	Babgaleh Timbo
12	Maniwang	Emerson	Use of Nucleic Acid Based Diagnostics for the Detection of Food Allergens	Eric Garber
13	Esquivel	Rianne	Single Laboratory Validation of New Chromogenic Agars for Salmonellae	Socrates Trujillo

14	Blazar	Jeffery	Characterization of Salmonella enterica subsp. enterica serovar Saintpaul isolates Associated with the Outbreak of 2008.	Marc Allard
15	Tangri	Vidur	Bioinformatic annotation of detection and food outbreaks literature related to *C. botulinum* in foods.	Shashi Sharma
16	Yu	Tianxi	Emulsifier Effect in Packaging Additive Migration to Food	William Limm
17	Babu	Taarika	Cloning and Characterization of Virulence Factors from Foodborne pathogens like *Vibrio* Species and *Enterobacter sakazakii*	Stephanie Defibaugh-Chavez
18	Lee	Nathaniel	Multiresidue Analysis of Pesticides and Other Chemical Contaminants in Foods	Jon Wong
19	Manuel	Rameena	Development of structure-searchable toxicology databases derived from FDA in-house toxicity data	Kirk Arvidson
20	Yanson	Collen	Food Safety Risk Analysis: Quantitative Risk Assessments	Sherri Dennis
21	Joo	Jane	*Cyclospora cayetanensi*s and *Cryptosporidium parvum*: Methods Development	Joan Shields
22	Patel	Ronak	To identify allergenic proteins of the major food allergens and to determine their digestibility and IgE immunoreactivity.	Ondulla Foye-Jackson
23	Kuo	Jenifer	Establish methodology for assessing inflammatory cytokine expression (RNA and protein), for future projects involving infectious and inflammatory models of foodborne pathogens	Mohammad Alam
24	Tahsin	Tashnia	Development of structure-searchable toxicology databases derived from FDA in-house toxicity data	Diana Doell
25	Rueter	Kevin	Study of shellfish toxicity off the coast of New England	Stcey Etheridge

Fall 2009 - Summer 2010

	Last Name	**First Name**	**Project**	**Collaborator**
26	Noronha	Jasimine	Research on Product Safety	Joy Johanson
27	Odusami	Oluwakemi	Genome Wide RNAi Screens in C. elegans to discover Host Response Genes.	Hediye Hese Cinar

Graduate Assistantship

	Last Name	First Name	Project	Collaborator
1	Li	Jinxi	Development of Methods for the Characterization of Protein Allergens	John Callahan (CFSAN) / Catherine Fenselau (UM)
2	Cao	Guojie	Whole Genome Sequencing of Salmonella Newport	Marc Allard (CFSAN) / J. Meng (UM)

Appendix F – Symposia/Conferences

The Omics of Eating Behaviors Workshop, held December 9, 2010 in Greenbelt, Maryland. It is known that biological processes play a significant role in the foods that people choose to eat. Biological processes can be broadly defined and encompass genetic make-up to physiological factors. Mechanisms responsible for individual differences in dietary response are not well understood. Research has begun to focus on nutrient-gene interactions. Environmental factors play a significant role in making dietary choices. Environment encompasses more than commonly associated factors such as chemical toxins, pesticide exposure, smoking, etc., but also includes dietary habits. Genomic, proteomic, metabalomic, and bioinformatic techniques are beginning to facilitate the study of gene-nutrient interactions at the cell, individual and population level. All of these encompass the term "nutrigenomics". This workshop focused on the genetic underpinnings related to food choice.

2011 Annual Advisory Council Symposium, Mitigating Consequences of an Outbreak/Adverse Event, held April 27-28, 2011 in Greenbelt, Maryland. Outbreaks and adverse events occur with alarming frequency resulting in a lack of, or decline in, confidence in the safety of foods. Preventing such events and restoring consumer confidence is the goal of the entire food industry. Having the right tools and knowledge gives you an advantage when facing the challenges of an outbreak/adverse event, and knowing how to communicate with consumers could help you remain competitive. This symposium provided an overview of lessons learned from past events, covered the use of risk analysis tools to focus resources on preventing future occurrences, and helped to understand how the consumer interprets and reacts to information. This symposium was also part of the 15th Year Celebration for JIFSAN.

CODEX Training Workshop for African Countries, held May 14-26, 2011 in Maryland. USDA agencies are continuing a comprehensive program to encourage members of the Codex Alimentarius Coordinating Committee for Africa (CCAfrica) to participate more fully in the international food safety standards setting bodies and to adopt Codex and other internationally recognized standards related to agricultural trade. Establishing functional national Codex offices will promote adherence to international standards and participation in the specialized Codex committees. This training workshop complimented ongoing work in CCAfrica to implement a strategic plan to strengthen and enhance the participation and effectiveness of CCAfrica within Codex and the Codex Africa Region.

12th Fera/JIFSAN Symposium, Dealing with uncertainty in Risk-Based Decision Making and Response, held June 25-17, 2011, in Maryland USA. The focus of this symposium dealt with uncertainty in risk-based decision making and response. The symposium provided an overview of the sources and characterization of uncertainty, and consideration when making food safety decisions and communication. Invited speakers were drawn from regulatory agencies, public interest groups, universities and research institutions in Europe and North America. Sessions included discussions on sources of uncertainty, tools for characterizing uncertainty, and new methods and models for reducing uncertainty during data collection.