

## U.S. DEPARTMENT OF AGRICULTURE PRE-HARVEST FOOD SAFETY ACTIVITIES AND INITIATIVES

To best ensure food safety and protect public health, a farm-to-table approach is required—one in which effective mitigations and controls are designed and employed throughout the food production continuum, including on the farm, in the processing plant and the retail outlet, and at the point of preparation and consumption. For this reason, collectively agencies of the U.S. Department of Agriculture are working with industry partners to ensure that hazards are identified and controlled throughout various stages of food production. The focus of today's meeting is on pre-harvest pathogen control strategies for reducing prevalence of Shiga toxin-producing *Escherichia coli* and of *Salmonella* in and on cattle. Below is a summary of select pre-harvest-related activities, both accomplished and underway, at four agencies within U.S.D.A.

### *The Food Safety and Inspection Service*

In pursuit of its mission of ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged, FSIS has been actively engaged in pre-harvest food safety activities. Examples include:

- In September 2003, FSIS convened a public meeting to discuss pre-harvest food safety and *Escherichia coli* O157:H7, with the goals of (i) determining whether interventions available to producers can form the basis for best management practices to reduce the load of *E. coli* O157:H7 in livestock before slaughter, (ii) identifying promising interventions and determining what steps need to be taken to make the interventions available at the livestock production level, and (iii) identifying which research gaps should be the focus of the research community, including government, academia, and industry.<sup>1</sup> After the public meeting, the industry took the initiative in publishing a guidance document, "*E. coli* O157 Solutions: The Pre-harvest Commitment."<sup>2</sup>
- In May 2010, FSIS issued informational guidance to beef slaughter establishments on pre-harvest management controls for reducing *E. coli* O157:H7 shedding in beef cattle. The guidance described several pre-harvest interventions and management practices that are the subject of research and the state of the findings about these practices. It also recommended that slaughter establishments receive their cattle from beef producers that implement one or more documented pre-harvest management practices to reduce fecal shedding, and it encouraged pre-harvest interventions as the first control steps in an integrated beef products safety system.<sup>3</sup>

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<sup>1</sup> See <http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/03-031N.htm>

<sup>2</sup> See <http://www.aamp.com/documents/BestPracticesE.coliO157H7Solutions.pdf>

<sup>3</sup> See [http://www.fsis.usda.gov/PDF/Reducing\\_Ecoli\\_Shedding\\_In\\_Cattle\\_0510.pdf](http://www.fsis.usda.gov/PDF/Reducing_Ecoli_Shedding_In_Cattle_0510.pdf)

- In September 2010, FSIS solicited input from the National Advisory Committee on Meat and Poultry Inspection (NACMPI) on pre-harvest Hazard Analysis and Critical Control Point (HACCP) controls for *Salmonella* Enteritidis, *Escherichia coli* O157:H7, antimicrobial-resistant pathogens, and chemical residues. The information gleaned from NACMPI will be used by FSIS and its public health partner agencies in developing guidance for reducing the prevalence of these pathogens in regulated products.
- In September 2011, FSIS solicited additional input from NACMPI on developing effective policies and collaborative steps to promote public health, specifically on the pre-harvest topic of *Salmonella*-specific controls around food safety hazards that can occur *before entry* into the official establishment. The committee recommended, among other things, that FSIS should hold public meetings with stakeholders including the Animal and Plant Health Inspection Service (APHIS), Agricultural Research Service (ARS), and Food and Drug Administration (FDA) and develop pre-harvest best practices and compliance guidelines for livestock and poultry producers. FSIS should also incorporate the information about the effectiveness of the interventions they have investigated. Further, FSIS should determine whether it can take a leadership role in tracking new technologies for pre-harvest (interventions) that are currently moving through the regulatory process and on a quarterly basis report their movement and what FSIS is doing with other agencies to move them forward.

### ***The Animal and Plant Health Inspection Service***

APHIS Veterinary Services (VS) has been involved in activities related to pre-harvest food safety for many years. Recent pre-harvest food safety activities include:

- Since the 1990s, VS has collected data on farms across the United States to characterize the prevalence and, in some cases, antimicrobial resistance profiles of potential food safety pathogens. Initially, VS focused on more well-known foodborne pathogens such as *Escherichia coli* O157, *Salmonella*, and *Campylobacter*. We have expanded this effort to include the prevalence and antimicrobial resistance of emerging pathogens as well as commensal organisms.
- In addition, VS produces information annually on the quality of U.S. milk and gathers information on producer participation in quality assurance programs.
- VS administers the National Poultry Improvement Plan (NPIP), which contains provisions specific to *Salmonella* Enteritidis.

- The National Veterinary Services Laboratories (NVSL) routinely perform *Salmonella* typing for poultry and livestock species.
- To assist the FDA, NVSL initiated a program in 2010 to rapidly confirm isolates as positive or negative for *Salmonella* Enteritidis.
- VS regulates veterinary biologics, including licensing. VS recently conditionally approved a vaccine for cattle to reduce the occurrence of *E. coli* O157:H7, and vaccines targeted against *Salmonella* are also available.

### ***The Agricultural Research Service***

The ARS Food Safety National Program NP108 falls under Goal 4 of the Agency Strategic Plan: Enhance Protection and Safety of the Nation’s Agriculture and Food Supply. The Program’s mission is to provide to stakeholders, partners and customers through basic, applied, and developmental research the means to ensure that the food supply is safe, and that food and feed meet foreign and domestic regulatory requirements. The vision of the program is to increase public health through the development of technologies which protect food from pathogens, toxins, and chemical contaminants during production, processing, and preparation thus increasing the safety of the food supply. NP108 sees food safety as a continuum (from farm to fork); therefore, there is no strict demarcation within the program of pre/post harvest research.

Pre-harvest activities fall under several parts of the NP108 2011-2015 Strategic Action Plan:<sup>4</sup>

- 1.A Population Systems: This area identifies and characterizes the movement, structure, and dynamics of populations throughout food production, processing and storage; hence the entire safety continuum. Major components of emphasis and interaction include epidemiology, ecology, host-pathogen relationships.
- 1.B. Systems Biology: The concept of systems biology involves a unique integrative approach to understand the basic genetic components of pathogens, their expression, and directly relate this information to the microorganism’s biology.
- 1.C. Technologies for the Detection and Characterization of Contaminants: Challenges arise from either uncontrolled microbes entering through raw materials, contamination during processing, or from undesired chemical contaminants including chemical residues, and bacterial, fungal and plant toxins. [Sensitive and specific] detection technologies are

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<sup>4</sup> The 2011—2015 plan is available at <http://www.ars.usda.gov/SP2UserFiles/Program/108/2011-2015ActionPlanforweb.pdf>, with a list of appropriated funded projects under the plan at: [http://www.ars.usda.gov/research/programs/programs.htm?projectlist=true&NP\\_CODE=108](http://www.ars.usda.gov/research/programs/programs.htm?projectlist=true&NP_CODE=108)

required at the earliest possible stage in the food chain, thus avoiding/preventing the need for processing interventions, or possible recall.

- 1.D. Intervention and Control Strategies: To ensure safe food and protect public health, intervention and control strategies must be identified, implemented, and then measured as to their impact on the reduction and control of food-borne pathogens or other zoonotic organisms, and chemical contaminants. This approach incorporates strategies in both pre- and post-harvest systems as the science dictates, to produce a complementary and efficient approach for food safety.

In the 2011-2015 NP108 Program cycle, the following are examples of areas of concern to be addressed: Detection and control of foodborne parasites; Epidemiology of pathogens in dairy farms; Pathogen transport in irrigation waters; Manure management systems; Characterization of foodborne pathogens on animal and plant systems; Prevention/characterization of persistent colonization by pathogens in food animals; Virulence, antibiotic resistance and host responses; Impact of stress on foodborne pathogen colonization; Animal intestinal microbiomes; Microbial interactions and management approaches to reduce pathogens; Interventions to reduce pathogens in animals, including shell eggs, and produce production; Epidemiology, ecology, monitoring, and molecular genetics of antimicrobial resistance in pathogenic and commensal bacteria from food animals.

### ***The National Institute of Food and Agriculture***

NIFA is USDA's extramural funding agency, making competitive grants available to partners and stakeholders that help reduce the incidence of foodborne illness through research, education and extension (outreach). NIFA recognizes pre-harvest food safety as an essential component of any sustainable and integrated food safety system. Funded grants have focused on improving on-farm measures for increasing the safety of food of animal origin. More importantly, funded grants have helped guide the establishment of programs for reduction, prevention, control, and surveillance of risks (including public health risks) in farm animal production. For a comprehensive summary of NIFA-funded grants related to pre-harvest food safety from 2005 through 2010, please see the list below.

## NATIONAL INSTITUTE OF FOOD AND AGRICULTURE FOOD SAFETY PRE-HARVEST GRANTS

Title	Location	PI	Year	Amount
<b>COMPETITIVE GRANTS</b>				
THE SURVIVAL OF BACTERIAL AND VIRAL PATHOGENS IN MANURE AND BIOSOLIDS IN THE SOUTHEASTERN UNITED STATES	USDA-ARS, GENETICS AND PRECISION AGRICULTURE UNIT	Brooks, J. P.	2010	\$92,950
PREPARING UNDERREPRESENTED SCHOLARS FOR CHALLENGES IN POULTRY FOOD SAFETY--A RESEARCH, INTERNSHIP, AND LEADERSHIP DEVELOPMENT M.S. PROGRAM	TEXAS A&M UNIV	Caldwell, D. J.	2010	\$120,000
CHARACTERIZATION OF GENES INVOLVED IN THE PRODUCTION OF PILI BY CAMPYLOBACTER JEJUNI	UNIVERSITY OF ARIZONA	Cooper, M. A.	2010	\$124,033
REGULATION OF THE CTS TYPE II SECRETION SYSTEM AND ITS ROLE IN GENETIC VARIATION OF CAMPYLOBACTER JEJUNI	UNIVERSITY OF MICHIGAN	Ellermeier, J. R.	2010	\$125,000
C-DI-GMP SIGNALING IN E. COLI O157:H7 BIOFILM FORMATION AND COLONIZATION OF THE GASTROINTESTINAL TRACT OF BEEF CATTLE	UNIVERSITY OF WYOMING	Zhu, M.	2010	\$149,946
GRADUATE TRAINING OF VETERINARIANS IN ANIMAL INFECTIOUS DISEASES AND EPIDEMIOLOGY	MICHIGAN STATE UNIV	Sordillo, L. M.	2010	\$156,000
INTEGRATING NATIONAL RESOURCE INFORMATION AND FOOD SYSTEM SIGNALS TO IDENTIFY NOVEL METHODS FOR CONTROL OF MICROBIAL CONTAMINATION IN SPINACH	TEXAS A&M UNIV	Ivanek, R.	2010	\$299,874
REDUCING SALMONELLA ENTERITIDIS AND CAMPYLOBACTER JEJUNI IN CHICKENS BY DIETARY SUPPLEMENTATION OF PLANT-DERIVED ANTIMICROBIAL MOLECULES	UNIV OF CONNECTICUT	Venkitanarayanan, K.	2010	\$366,107
IMPROVING OYSTER QUALITY BY ENHANCING NATURAL IMMUNITY	NORTH CAROLINA STATE UNIV	Noga, E. J.	2010	\$398,874
REVEALING THE MECHANISMS OF COMPETITIVE EXCLUSION OF ENTEROPATHOGENS FROM THE INTESTINAL MICROBIAL COMMUNITY	UNIVERSITY OF GEORGIA	Lee, M. D.	2010	\$399,154
QUANTIFICATION OF THE RELATIONSHIP BETWEEN DISTILLER'S GRAINS CO-PRODUCTS AND ESCHERICHIA COLI O157:H7 LOAD IN REAL-WORLD, COMMERCIAL FEEDLOTS	WEST TEXAS A&M UNIVERSITY	Loneragan, G. H.	2010	\$399,437

EFFECTS OF DIETARY ENERGY SOURCE ON COLONIC MICROBIAL ECOLOGY OF CATTLE	OHIO STATE UNIVERSITY	LeJeune, J.	2010	\$399,790
DEFINING SALMONELLA GENES IMPORTANT FOR COLONIZATION AND PERSISTENCE IN POULTRY	TEXAS A&M UNIVERSITY	Andrews-Polymenis, H.	2010	\$399,954
DIFFERENTIAL EPIDEMIOLOGY AND ECOLOGY OF CLINICAL AND BOVINE-BIASED GENOTYPES OF ESCHERICHIA COLI O157:H7	WASHINGTON STATE UNIVERSITY	Besser, T. E.	2010	\$1,000,000
REDUCTION OF ESCHERICHIA COLI O157:H7 ON SMALL-SCALE COW/CALF OPERATIONS USING BEST MANAGEMENT PRACTICES	SOUTHERN UNIV	Jaroni, D.	2010	\$1,077,639
THE ROLE OF PONDS IN REDUCING THE THREAT OF PATHOGEN CONTAMINATION FROM LIVESTOCK IN AGRICULTURAL WATERSHEDS	J. PHIL CAMPBELL, SR. NATURAL RESOURCE CONSERVATION CENTER	Jenkins, M. B.	2009	\$25,450
MINOR USE ANIMAL DRUG PROGRAM NORTH CENTRAL REGION	IOWA STATE UNIVERSITY	Griffith, R. W.	2009	\$73,493
FUNGAL GENOMICS AND BIOSECURITY	NORTH CAROLINA STATE UNIV	Payne, G. A.	2009	\$209,765
A NEW NANOBASED REAL TIME AFLATOXIN DETECTOR PHASE II	SENSOR DEVELOPMENT CORPORATION	Mansfield, R.N.	2009	\$349,915
BATH/ORAL LIVE RECOMBINANT EDWARDSIELLA VACCINE FOR THE AQUACULTURE INDUSTRY	BIODESIGN: CENTER FOR INFECTIOUS DISEASES AND VACCINOLOGY	Curtiss, R.	2009	\$372,000
MODELING PERSISTENCE OF NON-O157 SHIGA TOXIN-PRODUCING ESCHERICHIA COLI IN BEEF SLAUGHTER AND VALIDATION OF INTERVENTIONS USED IN PROCESSING	UNIV OF WISCONSIN	Ingham, B.	2009	\$600,000
QUANTIFYING MICROBIAL RISKS DURING GROWTH OF PRODUCE	COLORADO STATE UNIVERSITY	Goodridge, L. D.	2009	\$1,084,429
GLOBALIZATION OF AGRICULTURE: TRAINING THE NEXT GENERATIONS OF U.S. INTERNATIONAL SCHOLARS	MICHIGAN STATE UNIV	Yokoyama, M. T.	2008	\$15,000
ACQUISITION OF RT-PCR EQUIPMENT FOR QUANTIFICATION OF ENVIRONMENTAL PATHOGENS	DREXEL UNIVERSITY	Olson, M. S.	2008	\$24,457
SCREENING OF MECHANISTICALLY INDEPENDENT MULTIPLE ANTIMICROBIAL TREATMENTS FOR EFFECTIVE DECONTAMINATION OF SALMONELLA ON POULTRY	UNIVERSITY OF ARKANSAS	Milillo, S. R.	2008	\$115,320
LIVE RECOMBINANT SALMONELLA VACCINATION WITH NOVEL UNIVERSAL ANTIGEN PRESENTATION AND IMMUNE POTENTIATION	UNIVERSITY OF ARKANSAS	Hargis, B. M.	2008	\$383,593
IMPACTS OF IRRIGATION WATER QUALITY ON THE PERSISTENCE AND TRANSMISSION OF E. COLI O157:H7 FROM SOIL TO PLANTS	U.S. SALINITY LABORATORY, Riverside, CA	Ibekwe, A. M.	2008	\$394,761
OPTIMIZING THE USE OF SODIUM CHLORATE TO CONTROL SALMONELLA IN SWINE	UNIV OF WISCONSIN	Bahnsen, P.	2008	\$398,665
A NEW OPEN READING FRAME IN THE POTYVIRIDAE GENOME	IOWA STATE UNIVERSITY	Miller, W. A.	2008	\$399,620

UNRAVELING VIBRIO PARAHAEMOLYTICUS PATHOGENESIS BY USING A FUNCTIONAL GENOMICS APPROACH	UNIVERSITY OF DELAWARE	Boyd, E. F.	2008	\$399,784
DISSEMINATION OF CEPHALOSPORIN RESISTANCE GENES	WASHINGTON STATE UNIVERSITY	Sischo, W. M.	2008	\$425,434
COMPARATIVE FUNCTIONAL GENOMICS OF PLANT PATHOGENIC FUSARIUM SPECIES	USDA ARS Cereal Disease Laboratory, St. Paul, Minnesota	Kistler, H. C.	2008	\$771,000
KNOWLEDGE EXTRACTION AND ANNOTATION IN A GRID BASED BIOINFORMATICS ENVIRONMENT	UNIVERSITY OF DELAWARE	Schmidt, C.	2008	\$1,000,000
GORDON RESEARCH CONFERENCE ON MYCOTOXINS AND PHYCOTOXINS	GORDON RESEARCH CONFERENCES, Rhode Island	Voss, K. A.	2007	\$10,000
MYCOBACTERIUM AVIUM PARATUBERCULOSIS: INCIDENTAL HUMAN PATHOGEN OR PUBLIC HEALTH THREAT?	AMERICAN SOCIETY FOR MICROBIOLOGY, Washington, DC	Nacy, C. A.	2007	\$15,000
A NEW LITTER DISINFECTANT FOR POULTRY PATHOGEN CONTROL	LYNNTECH, INC, Texas	Denvir, A.	2007	\$80,000
A TOOL TO CHARACTERIZE FUNGAL RECEPTORS OF PLANT SIGNALS THAT AFFECT MYCOTOXIN PRODUCTION DURING ASPERGILLUS/SEED INTERACTIONS	WESTERN WASHINGTON UNIVERSITY	Brodhagen, M. L.	2007	\$100,000
DYNAMICS OF CAMPYLOBACTER COLONIZATION IN POULTRY	OHIO STATE UNIVERSITY	Rajashekara, G.	2007	\$235,851
DEVELOPMENT AND CHARACTERIZATION OF SALMONELLA MUTANTS FOR USE AS LIVE VACCINE	TUSKEGEE UNIVERSITY	FADL, A. A.	2007	\$283,465
ELUCIDATE CELLULAR AND MOLECULAR MECHANISMS OF GENETIC CONTROL OF CAMPYLOBACTER COLONIZATION IN CHICKENS USING WHOLE GENOME ARRAY	TEXAS A&M UNIV	Zhou, H.	2007	\$288,076
PATHOGEN TESTING METRICS FOR GAPS IN DELMARVA LEAFY GREENS/FRESH PRODUCE AND POULTRY LITTER COMPOST	UNIV OF MARYLAND EASTERN SHORE	Marsh, L. E.	2007	\$299,821
MANAGEMENT PRACTICES FOR SALMONELLA REDUCTION ON BROILER BREEDER FARMS	UNIVERSITY OF GEORGIA	Berghaus, R. D.	2007	\$304,157
LISTERIA MONOCYTOGENES RESPONSE TO PHAGOCYTOSIS: A COMPARATIVE FUNCTIONAL GENOMICS APPROACH	MISSISSIPPI STATE UNIV	Lawrence, M.	2007	\$358,071
ATTACHMENT, UPTAKE, DISSEMINATION AND INACTIVATION OF FOODBORNE ENTERIC CALICIVIRUSES IN VEGETABLES	OHIO STATE UNIVERSITY	Saif, L. J.	2007	\$394,000
EMERGENCE AND FITNESS MECHANISMS OF FLUOROQUINOLONE RESISTANT CAMPYLOBACTER IN POULTRY	IOWA STATE UNIVERSITY	Zhang, Q.	2007	\$398,773

FOOD SAFETY VACCINE OF ECONOMIC BENEFIT TO POULTRY PRODUCERS TO PREVENT SALMONELLA AND APEC INFECTIONS AND FOODBORNE TRANSMISSION TO HUMANS	ARIZONA STATE UNIVERSITY	Curtiss, R.	2007	\$399,938
SELF-AMPLIFYING NANOBIOSENSOR FOR DIRECT DETECTION OF PRIONS IN BLOOD	INNOVATIVE BIOTECHNOLOGIES INTERNATIONAL, INC.	Montagna, R. A.	2007	\$500,000
PRE-HARVEST CRITICAL CONTROL POINTS IN FEED YARDS TO PREVENT CROSS-CONTAMINATION OF PATHOGENS ONTO CATTLE AND OTHER ENVIRONMENTAL AREAS	TEXAS TECH UNIV	Brashears, M. M.	2007	\$597,652
BIOCIDE AND HEAVY METAL INTERVENTION IN SWINE PRODUCTION AND ASSOCIATION WITH MULTI-DRUG RESISTANT SALMONELLA	OHIO STATE UNIVERSITY - VET MED	Gebreyes, W. A.	2007	\$810,949
POTENTIAL PUBLIC HEALTH AND FOOD SAFETY IMPACTS ASSOCIATED WITH USE OF ANTIBIOTIC GROWTH PROMOTERS	UNIV OF MINNESOTA	Isaacson, R.	2007	\$940,000
THERMAL RISK FOR SALMONELLA IN SWINE	MICHIGAN STATE UNIV	Funk, J. A.	2007	\$940,722
INTERNATIONAL SYMPOSIUM ON THE EPIDEMIOLOGY AND CONTROL OF FOODBORNE PATHOGENS IN PORK	IOWA STATE UNIVERSITY	McKean, J.	2006	\$15,000
SOURCE, DIVERSITY AND RESISTANCE OF FOODBORNE PATHOGENS IN SWINE AND PORK	OHIO STATE UNIVERSITY	Gebreyes, W. A.	2006	\$25,064
ELIMINATION OF PATHOGENS FROM LIVESTOCK USING A COMBINATION OF YUCCA SAPONINS AND SODIUM CHLORATE	SARTEC CORPORATION, Anoka MN	Yan, B.	2006	\$80,000
FOOD ANIMAL RESIDUE AVOIDANCE DATABANK	UNIVERSITY OF FLORIDA	Webb, A. I.	2006	\$153,204
FOOD ANIMAL RESIDUE AVOIDANCE DATABANK	UNIV OF CALIFORNIA	Tell, L. A.	2006	\$268,108
CONTROL OF SALMONELLA IN INFECTED CHICKENS BY COMBINING APPLICATION OF BACTERIOPHAGES, COMPETITIVE EXCLUSION, AND MATERNAL IMMUNITY	AUBURN UNIVERSITY	Price, S.	2006	\$298,271
FUNGAL GENOMICS AND BIOSECURITY	NORTH CAROLINA STATE UNIV	Payne, G. A.	2006	\$300,372
THERMAL-STABLE MARKER PROTEINS FOR DETECTION OF BOVINE CENTRAL NERVE SYSTEM TISSUES AND BLOOD IN FEEDSTUFFS	FLORIDA STATE UNIVERSITY	Hsieh, Y. P.	2006	\$324,012
EVALUATION OF OZONE AS AN ANTIMYCOTOXIN AND MICROBIOCIDAL TREATMENT FOR WHEAT AND BARLEY	NORTH DAKOTA STATE UNIV	Wolf-Hall, C.	2006	\$335,000
FOOD ANIMAL RESIDUE AVOIDANCE DATABANK - NORTH CAROLINA COMPONENT	NORTH CAROLINA STATE UNIV	Riviere, J. E.	2006	\$344,710
GENETIC ANALYSIS OF CHICKEN COLONIZATION BY CAMPYLOBACTER JEJUNI	UNIVERSITY OF MICHIGAN	DiRita, V. J.	2006	\$355,288
A BIOENERGETIC APPROACH FOR CONTROL OF LISTERIA MONOCYTOGENES	RUTGERS UNIVERSITY	Montville, T. J.	2006	\$374,715

COMPARATIVE GENOMICS, TRANSCRIPTOMICS, AND PROTEOMICS OF PATHOGENIC AND NON-PATHOGENIC ISOLATES OF CAMPYLOBACTER JEJUNI	WASHINGTON STATE UNIVERSITY	Konkel, M. E.	2006	\$375,000
GENOME SEQUENCING OF STREPTOCOCCUS INIAE, AN EMERGING PATHOGEN OF AQUACULTURE	BAYLOR COLLEGE OF MEDICINE	Highlander, S. K.	2006	\$388,000
EFFICACY OF GRASSLAND BUFFERS FOR REDUCING SALMONELLA, CRYPTOSPORIDIUM PARVUM, AND ROTAVIRUS IN RANGELAND RUNOFF	UNIV OF CALIFORNIA, DAVIS	Atwill, E. R.	2006	\$398,716
INVESTIGATION OF THE CAMPYLOBACTER JEJUNI CADF PROTEIN AS AN AGENT FOR REDUCING CAMPYLOBACTER CARRIAGE IN CHICKENS	WASHINGTON STATE UNIVERSITY	Konkel, M. E.	2006	\$399,714
SURVIVAL KINETICS OF CRYPTOSPORIDIUM OOCYSTS IN SWINE FACILITY WASTES OF THE SOUTHERN PIEDMONT AND COASTAL PLAIN WATERSHEDS	CORNELL UNIVERSITY	Bowman, D. D.	2006	\$399,983
REDUCING THE COLONIZATION OF SALMONELLA ENTERITIDIS AND CAMPYLOBACTER JEJUNI IN CHICKENS WITH CAPRYLIC ACID	UNIV OF CONNECTICUT	Venkitanarayanan, K. S.	2006	\$430,871
SURVIVAL AND COOKING INACTIVATION OF ESCHERICHIA COLI O157:H7 IN NONINTACT BEEF PRODUCTS	COLORADO STATE UNIVERSITY	Sofos, J. N.	2006	\$487,326
GENE NETWORKS CONTROLLING DEVELOPMENT, PATHOGENICITY AND SECONDARY METABOLISM IN ASPERGILLUS	NORTH CAROLINA STATE UNIV	Payne, G. A.	2006	\$700,000
THE ROLE OF EUROPEAN STARLINGS IN THE EPIDEMIOLOGY OF E. COLI O157 OF DAIRY CATTLE	OHIO STATE UNIVERSITY	LeJeune, J.	2006	\$1,146,635
ECOLOGY AND EPIDEMIOLOGY OF ESCHERICHIA COLI O157:H7 IN FRESH PRODUCE PRODUCTION REGIONS OF SALINAS, CALIFORNIA	USDA, ARS, Pacific West Area, Albany, CA	Mandrell, R. E.	2006	\$1,177,000
DEVELOPMENT OF A SIMPLE, QUANTITATIVE KIT TO TEST VEGETABLES AND FRUITS FOR EVIDENCE OF FECAL CONTAMINATION	SCIENTIFIC METHODS, INC, GRANGER, IN	Hsu, F. C.	2005	\$79,917
MICROBIAL ECOLOGY OF FOOD-BORNE PATHOGENS- ROLE OF PROTOZOA IN A PATHOGEN SURVIVAL AND MAINTENANCE IN THE ENVIRONMENT	TENNESSEE TECHNOLOGICAL UNIVERSITY	Berk, S. G.	2005	\$100,000
PREPARING VETERINARY STUDENTS FOR LEADERSHIP IN CONTEMPORARY FOOD ANIMAL AGRICULTURE	TEXAS A&M RESEARCH FOUNDATION	Posey, R. D.	2005	\$116,205
DETERMINING SOURCES AND PATHWAYS OF PARALYTIC SHELLFISH POISONING TOXINS FOR FOOD SAFETY USING A NOVEL RECEPTOR-BASED BIOSENSOR	UNIVERSITY OF WASHINGTON	Jiang, S.	2005	\$120,000
PH.D. NATIONAL NEED FELLOWSHIPS IN FOOD SAFETY AND TOXICOLOGY AT THE UNIVERSITY OF NEBRASKA	UNIVERSITY OF NEBRASKA	Hutkins, R.	2005	\$138,000
NATURAL TRANSFORMATION OF CAMPYLOBACTER JEJUNI IN CHICKENS; IMPACT ON FOOD SAFETY	MICHIGAN STATE UNIV	Linz, J. E.	2005	\$228,111

FUNGAL GENOMICS AND BIOSECURITY	NORTH CAROLINA STATE UNIV	Payne, G. A.	2005	\$234,275
RESPIRATORY CHAIN OF CAMPYLOBACTER JEJUNI	NORTH CAROLINA STATE UNIV	Olson, J. W.	2005	\$250,000
ANTIMICROBIAL DELIVERY SYSTEMS TO IMPROVE FOOD SAFETY	UNIV OF MASSACHUSETTS	Weiss, J.	2005	\$255,401
FUNCTIONAL CONSEQUENCES OF GENOME EVOLUTION IN LISTERIA MONOCYTOGENES	UNIVERSITY OF NEBRASKA	Benson, A. K.	2005	\$261,515
DEVELOPMENT OF LIVE ATTENUATED BACTERIAL VACCINES TO PREVENT CARRIAGE OF SHIGA TOXIN-PRODUCING E. COLI IN CATTLE	UNIVERSITY OF MARYLAND	Zhu, C.	2005	\$275,000
E. COLI O15:H7 AND CATTLE:GENETIC CHARACTERIZATION OF THE HOST-BACTERIA INTERACTION	UNIV OF IDAHO	Bohach, C. H.	2005	\$298,933
PHAGE DISPLAYED RECOMBINANT ANTIBODIES FOR CHARACTERIZATION AND DETECTION OF CAMPYLOBACTER IN FOODS	TENNESSEE STATE UNIVERSITY	Chen, F. C.	2005	\$299,892
FOOD QUALITY PROGRAM SPECIAL GRANT PROPOSAL FY2005	UNIVERSITY OF ALASKA	Smiley, S. T.	2005	\$318,540
IDENTIFICATION AND CHARACTERIZATION OF VIRULENCE ATTENUATED L. MONOCYTOGENES WITH UNIQUE MUTATIONS IN INTERNALIN A	CORNELL UNIVERSITY	Wiedmann, M.	2005	\$340,000
EVOLUTION OF AFLATOXIGENICITY IN ASPERGILLUS	NORTH CAROLINA STATE UNIV	Carbone, I.	2005	\$347,395
COMPLIANCE AND TRAINING FOR SPECIFIED RISK MATERIAL REMOVAL IN BEEF MEAT PRODUCTS	COLORADO STATE UNIVERSITY	Salman, M. D.	2005	\$354,303
REDUCTION OF PRE-HARVEST SALMONELLA ENTERICA SUBSPECIES ENTERICA SEROVAR ENTERITIDIS IN POULTRY	UNIV OF MINNESOTA	Nagaraja, K.	2005	\$377,916
MEDIATORS OF SALMONELLA INFECTION AND CARRIAGE IN PIGS	NORTH CAROLINA STATE UNIV	Altier, C.	2005	\$422,245
THE MOLECULAR EPIDEMIOLOGY OF CLOSTRIDIUM PERFRINGENS TYPE A FOOD POISONING	UNIV OF PITTSBURGH	McClane, B. A.	2005	\$446,212
INCIDENCE AND ECOLOGY OF MACROLIDE-RESISTANT CAMPYLOBACTER IN CHICKENS AND TURKEYS	IOWA STATE UNIVERSITY	zhang, Q.	2005	\$599,999
DISSEMINATION OF CEPHALOSPORIN RESISTANCE GENES	UNIV OF CALIFORNIA (VET-MED)	Sischo, W. M.	2005	\$980,000
<b>TOTAL FUNDS EXPENDED FOR COMPETITIVE GRANTS</b>				<b>\$35,128,767</b>
<b>NON-COMPETITIVE GRANTS</b>				
ANIMAL SCIENCE FOOD SAFETY CONSORTIUM: ARKANSAS, KANSAS AND IOWA	IOWA STATE UNIVERSITY	Dickson, J. S.	2010	\$215,917

DEVELOPMENT OF A NOVEL MULTILOCUS SEQUENCE TYPING (MLST) SUBTYPING STRATEGY FOR TRACKING THE FARM TO FORK TRANSMISSION OF ESCHERICHIA COLI O157:H7	PENNSYLVANIA STATE UNIVERSITY	Dudley, E. G.	2010	\$397,256
ECOLOGY OF E. COLI O157:H7 IN BEEF COW-CALF OPERATIONS FROM RANCH TO FEEDLOT	KANSAS STATE UNIV	Nagaraja, T. G.	2010	\$465,334
ECOLOGY OF ESCHERICHIA COIL O157:H7 IN BEEF COW-CALF OPERATIONS FROM RANCH TO FEEDLOT	KANSAS STATE UNIV	Nagaraja, T. G.	2009	\$132,385
SEAFOOD SAFETY, MA	UNIV OF MASSACHUSETTS	Levin, R.	2008	\$290,761
UNDERSTANDING AND PREVENTING THE SURVIVAL AND TRANSMISSION OF ZOONOTIC PATHOGENS IN THE DAIRY SYSTEM	PENNSYLVANIA STATE UNIVERSITY	Dudley, E. G.	2008	\$547,259
THE IMPACT OF DIETARY DISTILLERS' GRAINS ON ESCHERICHIA COLI O157:H7 IN CATTLE , AND INTERVENTIONS TO REDUCE THE POTENTIAL FOOD SAFETY IMPACT	KANSAS STATE UNIV	Nagaraja, T.	2008	\$939,222
ECOLOGY OF ESCHERICHIA COLI O157:H7 IN BEEF COW-CALF OPERATIONS FROM RANCH TO FEEDLOT	KANSAS STATE UNIV	Nagaraja, T.	2006	\$186,962
ENHANCEMENT FOR THE SAFETY OF PORK PRODUCTS	IOWA STATE UNIVERSITY	Dickson, J. S.	2005	\$311,642
FOOD SAFETY: FARM TO TABLE	OKLAHOMA STATE UNIVERSITY	Gilliland, S. E.	2005	\$514,849
<b>TOTAL FUNDS EXPENDED FOR NON-COMPETITIVE GRANTS</b>				<b>\$4,001,587</b>
<b>FORMULA FUND GRANTS (HATCH, EVANS ALLEN AND ANIMAL HEALTH)</b>				
USE OF BIOGENIC IMMUNOMODULATORS TO ENHANCE EARLY INTESTINAL DEVELOPMENT AND MUCOSAL IMMUNITY TO ENTERIC PATHOGENS IN BROILER CHICKENS	AUBURN UNIVERSITY	Fasina, Y. O.	2009	*
THE VIRULENCE PLASMIDS OF CLOSTRIDIUM PERFRINGENS	UNIV OF CALIFORNIA, DAVIS	Uzal, F.	2009	*
BULK MILK MONITORING ON NY DAIRY FARMS	CORNELL UNIVERSITY	Schukken, Y.	2009	*
ELECTRONIC VETERINARY PRESCRIPTION EVRX PILOT STUDY FOR A TOOL DEMONSTRATING JUDICIOUS ANTIBIOTIC USE	IOWA STATE UNIVERSITY	Hurd, H. S.	2009	*
DEVELOPMENT OF RAPID METHODS FOR DETECTION AND ENUMERATION OF VIBRIO VULNIFICUS, VIBRIO PARAHAEMOLYTICUS AND ENTERIC VIRUSES IN SEAFOOD AND HARVESTING AREAS.	LOUISIANA STATE UNIVERSITY	Janes, M. E.	2009	*
COMPARATIVE EPIDEMIOLOGY OF ANTIMICROBIAL RESISTANCE IN ANIMALS, HUMANS, AND THEIR ENVIRONMENTS	MICHIGAN STATE UNIV	Kaneene, J. B.	2009	*
EFFICACY OF FOOD SAFETY BEST PRACTICES AND MANAGEMENT SYSTEMS TO CONTROL HAZARDS IN FOOD	MICHIGAN STATE UNIV	Bourquin, L. D.	2009	*

PROMOTING PROPERTIES OF MUSHROOM-FORMING FUNGI IN POULTRY	NORTH CAROLINA A&T STATE UNIV	Willis, W. L.	2009	*
USE OF PEPTIDE-BASED TOOLS FOR ANTIBACTERIAL DRUG DISCOVERY AND DELIVERY	NORTH CAROLINA STATE UNIV	Hamilton, P. T.	2009	*
MECHANISMS UNDERLYING DIETARY IMPACTS OF ESCHERICHIA COLI O157 SHEDDING IN CATTLE	OHIO STATE UNIVERSITY	LeJeune, J.	2009	*
THE HEALTHFULNESS OF SEAFOOD FOR SENSITIVE POPULATIONS	PURDUE UNIVERSITY	Santerre, C. R.	2009	*
FISH, FISHING, AND RISK TO ECO-RECEPTORS AND HUMANS IN COASTAL NEW JERSEY	RUTGERS UNIVERSITY	Burger, J.	2009	*
BIOLOGY OF AFLATOXIGENIC FUNGI AND BIOCONTROL OF AFLATOXINS IN ORCHARDS OF NUT CROPS IN CALIFORNIA	UNIV OF CALIFORNIA	Michailides, T.	2009	*
DEVELOPMENT OF NOVEL VACCINES FOR ESCHERICHIA COLI O157:H7 TO INHIBIT COLONIZATION OF CATTLE RESERVOIR HOSTS	UNIV OF IDAHO	Minnich, S. A.	2009	*
BACTERIOLOGY RESEARCH	UNIV OF WISCONSIN	Kaspar, C.	2009	*
CHARACTERIZATION OF THE SYNERGISTIC INTERACTION BETWEEN SALMONELLA ENTERICA AND ZANTHOMONAS VESICATORIA IN THE TOMATO PHYLLOSPHERE	UNIV OF WISCONSIN	Barak-Cunningham, J.	2009	*
IDENTIFICATION OF GENES RESPONSIBLE FOR ADHESION OF AVIAN PATHOGENIC E.COLI 01:K1:H7 TO INTESTINAL SURFACES IN CHICKENS	UNIV OF WISCONSIN	Berres, M.	2009	*
MYCOTOXINS: BIOSECURITY AND FOOD SAFETY (NC129)	UNIV OF WISCONSIN	Keller, N.	2009	*
INTERACTIONS OF PATHOGENIC ESCHERICHIA COLI WITH HOST INTESTINAL EPITHELIAL CELLS	UNIVERSITY OF ARIZONA	Viswanathan, V. K.	2009	*
PHARMACEUTICALS IN SURFACE WATERS AND THEIR POTENTIAL FOR TRANSFER INTO IRRIGATED AGRICULTURAL CROPS	UNIVERSITY OF ARIZONA	Sanchez, C. A.	2009	*
INVESTIGATION OF ANIMAL RESPONSE TO PROBIOTICS	UNIVERSITY OF ARKANSAS	Bottje, W. G.	2009	*
INACTIVATION OF FOODBORNE PATHOGENS WITH NON-THERMAL PLASMA PROCESSING AND NATURAL ANTIMICROBIALS AND GENETIC MECHANISMS UNDERLYING MICROBIAL INACTIVATION OR ADAPTATION	UNIVERSITY OF GEORGIA	Critzer, F. J.	2009	*
CHARACTERIZATION OF A NOVEL CONTACT-DEPENDENT INHIBITORY MECHANISM IN CALF ADAPTED ESCHERICHIA COLI	WASHINGTON STATE UNIVERSITY	Sawant, A. A.	2009	*

TRANSCRIPTIONAL SIGNATURES OF SALMONELLA ENTERITIDIS ISOLATES WITH VARYING ABILITY TO CONTAMINATE INTACT EGGS	WASHINGTON STATE UNIVERSITY	Shah, D. H.	2009	*
INVESTIGATION OF FOOD ANIMAL DISEASE PROBLEMS IN THE STATE OF WASHINGTON	WASHINGTON STATE UNIVERSITY	Fox, L. K.	2009	*
THE RISK OF ESCHERICHIA COLI AND CAMPYLOBACTER SPP. IN NEW YORK CITY WATERSHED	CORNELL UNIVERSITY	Mohammed, H. O.	2008	*
MANAGING CHESTNUT AND CHRISTMAS TREE DISEASES IN MICHIGAN	MICHIGAN STATE UNIV	Fulbright, D.	2008	*
DETERMINING THE DYNAMIC INTERACTIONS BETWEEN PATHOGENS AND CHICKENS FOR THE DEVELOPMENT OF MANAGEMENT STRATEGIES TO REDUCE PATHOGENS ON THE FARM: PRE-HARVEST FOOD SAFETY	MISSISSIPPI STATE UNIV	Kiess, A. S.	2008	*
DEVELOPMENT OF GENOMICS & MOLECULAR BIOLOGY-BASED METHODS FOR TRACKING AND CONTROLLING FOODBORNE MICROORGANISMS IN FOODS & THE ENVIRONMENT	PENNSYLVANIA STATE UNIVERSITY	Dudley, E. G.	2008	*
SCENT DETECTION DOGS: AN UNUSED TOOL FOR FOOD SAFETY	UNIV OF CALIFORNIA, DAVIS	Atwill, E. R.	2008	*
WATER SYSTEMS MONITORING AND MODELING IN ARID REGIONS	UNIVERSITY OF ARIZONA	Waller, P. M.	2008	*
THE EFFECTS OF TEMPERATURE, SALINITY AND PESTICIDES ON OYSTER HEMOCYTE ACTIVITIES	UNIVERSITY OF FLORIDA	Rodrick, G. E.	2008	*
IN VIVO RESPONSE TO FUNGAL INFECTION	UNIVERSITY OF MAINE	Wheeler, R. T.	2008	*
ALTERATIONS IN PHOSPHORYLATED FETUIN-A, A NOVEL REGULATOR OF INSULIN ACTION, IN INSULIN RESISTANCE AND METABOLIC SYNDROME: EFFECTS OF LIFESTYLE MO	AUBURN UNIVERSITY	Mathews, S. T.	2007	*
IMPROVING POULTRY MEAT QUALITY AND SAFETY	AUBURN UNIVERSITY	McKee, S. R.	2007	*
IMMUNE FUNCTIONS MEDIATING IMMUNITY OR SUSCEPTIBILITY TO CHRONIC SALMONELLOSIS IN DAIRY CATTLE	CORNELL UNIVERSITY	Wagner, B.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	CORNELL UNIVERSITY	Schukken, Y. H.	2007	*
BIOLOGICAL EXPOSURE ASSESSMENT& RISK	IOWA STATE UNIVERSITY	Roth, J. A.	2007	*
QUORUM SENSING MECHANISIMS IN CAMPYLOBACTER	IOWA STATE UNIVERSITY	Plummer, P.	2007	*
ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	KANSAS STATE UNIV	Robertson, D.	2007	*

FLIES IMPACTING LIVESTOCK, POULTRY AND FOOD SAFETY	KANSAS STATE UNIV	Broce, A.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	KANSAS STATE UNIV	Schultz, B.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	LOUISIANA STATE UNIVERSITY	Owens, W. E.	2007	*
ADVANCED TECHNOLOGY APPLICATIONS TO EASTERN HARDWOOD UTILIZATION	MICHIGAN STATE UNIV	Han, K. H.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	MICHIGAN STATE UNIV	Erskine, R. J.	2007	*
IDENTIFYING POTENTIAL ALFATOXIN GENE REGULATORS IN MAIZE AND ASPERGILLUS TO INCREASE RESISTANCE IN MAIZE	MISSISSIPPI STATE UNIV	Brown, A.	2007	*
ENHANCING THE COMPETITIVENESS AND VALUE OF US BEEF	MONTANA STATE UNIVERSITY	Kott, R. W.	2007	*
BIOLOGY AND MANAGEMENT OF IRIS YELLOW SPOT VIRUS (IYSV) AND THRIPS IN ONIONS	NEW MEXICO STATE UNIV	Cramer, C.	2007	*
ELUCIDATION AND CONTROL OF EMERGING DISEASES AND PRODUCTION PROBLEMS IN AN EVOLVING PORK INDUSTRY	NORTH CAROLINA STATE UNIV	Almond, G.	2007	*
GENOMIC FEATURES, MARKERS AND ADAPTATIONS OF MAJOR LISTERIA EPIDEMIC CLONES AND OF CAMPYLOBACTER FROM FOOD ANIMALS	NORTH CAROLINA STATE UNIV	Kathariou, S.	2007	*
CURRENT AND SPORADIC DISEASE PROBLEMS IN POULTRY	OHIO STATE UNIVERSITY	Saif, Y. M.	2007	*
ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	OHIO STATE UNIVERSITY	Saif, L. J.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	OHIO STATE UNIVERSITY	Hogan, J. S.	2007	*
FORECASTING, EPIDEMIOLOGY, AND MANAGEMENT OF PLANT DISEASES	PENNSYLVANIA STATE UNIVERSITY	Moorman, G. W.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	PENNSYLVANIA STATE UNIVERSITY	Jayarao, B. M.	2007	*
NC1041: ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	SOUTH DAKOTA STATE UNIVERSITY	Francis, D. H.	2007	*
STRATEGIES TO IMPROVE AVIAN HEALTH	TEXAS A&M UNIV	Farnell, M. B.	2007	*
WATERBORNE PATHOGENS IN AGRICULTURAL WATERSHEDS	UNIV OF CALIFORNIA (VET-MED)	Atwill, E. R.	2007	*

THE INCORPORATION OF DRUG TESTING METHODOLOGY DATA INTO THE FOOD ANIMAL RESIDUE AVOIDANCE DATABANK (FARAD)	UNIV OF CALIFORNIA (VET-MED)	Tell, L.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UNIV OF CONNECTICUT	Andrew, S.	2007	*
GENETIC CHARACTERIZATION OF E.COLI	UNIV OF IDAHO	Bohach, C. H.	2007	*
THE TRANSCRIPTOME AND TRANSCRIPTIONAL REGULATORY NETWORK OF THE ASPERGILLUS NIDULANS SEXUAL CYCLE	UNIV OF IDAHO	Miller, B. L.	2007	*
ENTERIC DISEASES OF SWINE AN CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	UNIV OF MINNESOTA	Gebhart, C.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UNIV OF MINNESOTA	Godden, S.	2007	*
MODULATION OF INTESTINAL MICROBIAL COMMUNITY STRUCTURE AND FUNCTIONING BY MYCOBACTERIUM AVIUM SUBSPECIES PARATUBERCULOSIS INFECTION	UNIV OF MINNESOTA	Sreevatsan, S.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UNIV OF WISCONSIN	Ruegg, P.	2007	*
REGULATION OF SPORULATION AND TOXIN PRODUCTION IN ASPERILLUS	UNIV OF WISCONSIN	Yu, J.	2007	*
ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	UNIVERSITY OF ARIZONA	Joens, L. A.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UNIVERSITY OF GEORGIA	Nickerson, S. C.	2007	*
ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	UNIVERSITY OF ILLINOIS	Kuhlenschmidt, M. S.	2007	*
IMPROVING THE SAFETY OF PORK: PRELIMINARY STEPS TO REDUCE CONTAMINATION OF PIG FARMS WITH TOXOPLASMA, A COMMON PARASITE TRANSMITTED FRO	UNIVERSITY OF ILLINOIS	McAllister, M.	2007	*
ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	UNIVERSITY OF KENTUCKY	Newman, M. C.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UNIVERSITY OF MISSOURI	Middleton, J. R.	2007	*
NC-1041, ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	UNIVERSITY OF NEBRASKA	Moxley, R. A.	2007	*
DBI-PLANT GENOME RESEARCH PROJECT	UNIVERSITY OF NEVADA	Schlauch, K.	2007	*
FLIES IMPACTING LIVESTOCK, POULTRY AND FOOD SAFETY	UNIVERSITY OF TENNESSEE	Jones, C. J.	2007	*

MOLECULAR MECHANISMS OF PATHOGENESIS AND ANTIBIOTIC RESISTANCE IN CAMPYLOBACTER JEJUNI	UNIVERSITY OF TENNESSEE	Lin, J.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UNIVERSITY OF VERMONT	Kerr, D. E.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UTAH STATE UNIVERSITY	Wilson, D. J.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	VIRGINIA POLYTECHNIC INSTITUTE	Petersson-Wolfe, C. S.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	VIRGINIA POLYTECHNIC INSTITUTE	Petersson-Wolfe, C. S.	2007	*
REGULATION OF IMMUNE AND COAGULATORY RESPONSES BY STAPHYLOCOCCUS AUREUS	VIRGINIA POLYTECHNIC INSTITUTE	Mullarky, I. K.	2007	*
ENTERIC DISEASES OF SWINE AND CATTLE: PREVENTION, CONTROL AND FOOD SAFETY	WASHINGTON STATE UNIVERSITY	Besser, T. E.	2007	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	WASHINGTON STATE UNIVERSITY	Fox, L. K.	2007	*
PREHARVEST MANAGEMENT METHODS TO REDUCE BACTERIAL LOADS ON GOAT SKIN AND CARCASS SURFACES	FORT VALLEY STATE UNIVERSITY	Kannan, G.	2006	*
CLOSTRIDIAL ENTERITIDES IN PIG	IOWA STATE UNIVERSITY	Ramirez, A.	2006	*
PHYSIOLOGY AND GENETICS OF FUSARIUM SPP.	KANSAS STATE UNIV	Leslie, J.	2006	*
INVESTIGATING MAIZE-ASPERGILLUS FLAVUS INTERACTION FOR ENHANCEMENT OF RESISTANCE TO AFLATOXIN CONTAMINATION	LOUISIANA STATE UNIVERSITY	Chen, Z.	2006	*
STRATEGIES FOR IMPROVING INTESTINAL INTEGRITY TO ENHANCE FOOD SAFETY AND HEALTH IN POULTRY	NORTH CAROLINA A&T STATE UNIV	Willis, W. L.	2006	*
ANALYSIS OF IN-PLANT FACTORS AND GENOTYPING OF ANTIMICROBIAL RESISTANCE AMONG FOUR ORGANISMS ISOLATED FROM SWINE PROCESSING PLANTS	OHIO STATE UNIVERSITY - VET MED	Gebreyes, W.	2006	*
QUANTIFICATION OF ENTEROTOXIN-MEDIATED ENHANCEMENT OF BACTERIAL ADHERENCE TO INTESTINAL EPITHELIAL CELLS	SOUTH DAKOTA STATE UNIVERSITY	Hardwidge, P. R.	2006	*
THE POULTRY FOOD SYSTEM: A FARM TO TABLE MODEL	TEXAS A&M UNIV	Sanchez, M.	2006	*
MICROBIAL ECOLOGY OF SHIGA-TOXIGENIC ESCHERICHIA COLI IN A CATTLE HERD IN CALIFORNIA	UNIV OF CALIFORNIA (VET-MED)	Hoar, B. R.	2006	*

NON ANTIBIOTIC TREATMENTS TO REDUCE FOOD BORNE PATHOGENS IN POULTRY	UNIVERSITY OF ARKANSAS	Donoghue, D. J.	2006	*
THE POULTRY FOOD SYSTEM: A FARM TO TABLE MODEL	UNIVERSITY OF FLORIDA	Williams, S. K.	2006	*
EXPORT OF PROTEIN IN ESCHERICHIA COLI	UNIVERSITY OF MISSOURI	Randall, L.	2006	*
REGULATION OF ESCHERICHIA COLI SHIGA-LIKE TOXINS AND THEIR IMPACT ON HOST CELL APOPTOSIS	UNIVERSITY OF NEW HAMPSHIRE	Rodgers, F. G.	2006	*
ADAPTATION OF L. MONO BIOFILMS ON POULTRY AND PROCESSING SURFACES TO STRESS AND ITS RELATIONSHIP TO VIRULENCE.	ALABAMA A & M UNIVERSITY	Williams, L. L.	2005	*
ENHANCING FOOD SAFETY THROUGH CONTROL OF FOOD-BORNE DISEASE AGENTS	AUBURN UNIVERSITY	Oyarzabal, O. A.	2005	*
LEAD AND OTHER HEAVY METALS IN COMMUNITY GARDEN SOILS	CONNECTICUT AGRICULTURAL EXPERIMENT STATION	Stilwell, D. E.	2005	*
DEVELOPMENT OF AN ATTENUATED VACCINE AGAINST BOVINE SALMONELLOSIS	CORNELL UNIVERSITY	Chang, Y. F.	2005	*
FACTORS AFFECTING THE RISK OF E. COLI O157:H7 BECOMING ENDEMIC IN SWINE	IOWA STATE UNIVERSITY	Cornick, N. A.	2005	*
MECHANISMS OF ANTIBIOTIC EFFLUX IN CAMPYLOBACTER	IOWA STATE UNIVERSITY	Zhang, Q.	2005	*
MYCOTOXINS: BIOSECURITY AND FOOD SAFETY	IOWA STATE UNIVERSITY	Murphy, P. A.	2005	*
POSSIBLE EMERGENCE OF A PLASMID-MEDIATED RESERVOIR OF RESISTANCE GENES AMONG THE ESCHERICHIA COLI OF POULTRY	IOWA STATE UNIVERSITY	Nolan, L. K.	2005	*
SURFACE PROTEINS OF LISTERIA MONOCYTOGENES: ROLE IN BACTERIAL VIRULENCE	MISSISSIPPI STATE UNIV	Wang, C.	2005	*
MYCOTOXINS: BIOSECURITY AND FOOD SAFETY	NORTH DAKOTA STATE UNIV	Wolf-Hall, C.	2005	*
REGULATION OF VIRULENCE FACTORS BY PROTEINS OF THE FLAGELLAR SYSTEM IN ENTERIC BACTERIA	NORTH DAKOTA STATE UNIV	Pruess, B. M.	2005	*
SWINE PRODUCTION, SALMONELLA AND THE SALMONELLA INFECTION CYCLE	PURDUE UNIVERSITY	Ragland, D.	2005	*
MYCOTOXINS: BIOSECURITY AND FOOD SAFETY	TEXAS A&M UNIV	Shim, W.	2005	*
MYCOTOXINS: BIOSECURITY AND FOOD SAFETY (NC129)	UNIV OF HAWAII	Cho, Y.	2005	*
MYCOTOXINS: BIOSECURITY AND FOOD SAFETY	UNIV OF WISCONSIN	Keller, N.	2005	*

CAMKII AND TRAFFICKING OF FOODBORNE TOXINS IN DIGESTIVE EPITHELIA	UNIV OF WISCONSIN	Groblewski, G.	2005	*
REGULATION OF MYCOTOXIN BIOSYNTHESIS	UNIV OF WISCONSIN	Keller, N.	2005	*
BIOMARKERS FOR AQUATIC BIOTOXIN EXPOSURE IN FISH AND SHELLFISH REARED IN AQUACULTURE IN FLORIDA.	UNIVERSITY OF FLORIDA	SHEPPARD, B. J.	2005	*
MYCOTOXINS: BIOSECURITY AND FOOD SAFETY	UNIVERSITY OF ILLINOIS	Haschek, W. M.	2005	*
GENETIC BASIS OF RESISTANCE TO FOOD-BORNE BACTERIAL PATHOGENS	UNIVERSITY OF NEBRASKA	Duhamel, G. E.	2005	*
MASTITIS RESISTANCE TO ENHANCE DAIRY FOOD SAFETY	UNIVERSITY OF VERMONT	Kerr, D. E.	2005	*
<b>TOTAL FORMULA FUNDS</b>				<b>\$ 26,205,000</b>