

**Research Participation Program
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
Office of Applied Research and Safety Assessment
Laurel, Maryland**

Project FDA-CFSAN 2010-0002

Several projects are available in the Office of Applied Research and Safety Assessment, Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration, in Laurel, Maryland.

**Identification of Vitamin A Signaling Disrupters
FDA-CFSAN 2010-0002 A**

This project directly supports the Food and Drug Administration (FDA) Center for Food Safety and Applied Nutrition (CFSAN) mission to insure the safety of the food supply by developing high-throughput, *in vitro* methods for identifying food additives and supplements that have the potential to adversely affect normal cellular function in animals. The vitamin A signaling pathway (VASP) is one of the most important signaling pathways in mammals. Vitamin A, through its active metabolite RA, controls the expression of more than 500 genes which are essential for normal embryonic development and cellular function in adult tissues and organs. The participant will join ongoing molecular and cellular studies aimed at developing high throughput screening assays for detecting agents that can interfere with the VASP. Emphasis will be on identifying agents that can disrupt the normal VASP and thus are capable of interfering with normal cell function. The participant have the opportunity to: (1) identify chemicals that can interfere with the ability of vitamin A to regulate various vitamin A-responsive genes in cultured mouse stem cells; (2) review the literature and other information available on this topic area; and (3) prepare scientific reports, manuscripts, and make presentations to a variety of groups including international scientific meetings. Activities may include: (1) analyze chemical-induced changes in gene expression using various molecular methods including endpoint and real-time RT-PCR and microarray analysis; (2) support stem cell cultures maintenance; (3) discuss the progress of the project with the supervisor; (4) keep up with the literature in this rapidly changing scientific area; and (5) assist in performing scientific analyses of complex results from experiments using Quality Assurance guidelines developed by Dockets Management Branch (DMB).

Qualifications:

The applicant must have obtained, within the last five years, a doctoral degree in cellular and molecular biology or related field and be a U.S. Citizen or a legal permanent resident. Postdoctoral experience is not necessary. Excellent writing and oral communication skills are required. Experience in culture of eukaryotic cells is highly desirable.

**New Microarray Methods for Outbreak and Surveillance Analyses of Enteric Pathogens
FDA-CFSAN 2010-0002 B**

The Office of Applied Research and Safety Assessment developed a comprehensive DNA microarray in 2007 containing virtually every available whole genome sequence from common foodborne enteric pathogens (FDS-SEEC array). This array contains 85 genomes of *Salmonella*, *Shigella*, *Escherichia coli*, and *Vibrio cholera* with an integrated probe set to interrogate plasmid, mobile genetic element, antibiotic resistance gene, and intergenic sequence content on a single chip in high-

density format. In addition, sequence tiling of core conserved genes from *E. coli* and *Salmonella* provides a platform for single nucleotide polymorphism (SNP) discovery. It has been successfully employed to analyze foodborne and clinical bacterial isolates from 2008 and 2009 outbreaks as well as historical culture collections. The predecessor to this design, also developed by the Center for Food Safety and Applied Nutrition (CFSAN) scientists, is now commercially available and works on a large collection of diverse *E. coli* and *Shigella* strains from many different outbreaks. Therefore, this research program has a vested interest in custom array technology with the desire to apply newly developed pan-genomic toolsets with innovative approaches.

This project will generate new applications for the FDA-SEEC array with regards to food safety. The original array design contains some 83k probe sets that extrapolate into over 2 million individual hybridization signals. From one aspect, a streamlined version containing particularly discriminating genetic features identified in the whole genome data analyses to date will represent a cost-effective and practical tool for field scientists. It may provide rapid detection, identification, and unique source- or outbreak-specific genetic information and would represent the first applied example of such technology in FDA – with an unparalleled informative capacity for food safety. From another perspective, the array design has been tested only with single pathogen isolates but may become more informative in metagenome probing of microbial communities either from clinical or field sources. Hence, can the array discriminate closely related strains (pathogens and nonpathogens alike) when probing complex community DNA and, more importantly, can it be used in surveillance directly from farm or food sample lots? Probing with a nonculture first approach would significantly change the landscape of field lab research by speeding delivery of presumptive positive pathogen calls with a high degree of accuracy. Finally, and from yet another perspective, using the array as an expression tool may provide particularly discriminating details into virulence capacity and other gene expression-based differences important in colonizing particular reservoirs. In aggregate, the new microarray methods can also supply other downstream tracking methodologies such as real-time and multiplex-PCR and improve multi-locus sequence typing sets or the necessary SNP data for IBIS and BIOPLEX technologies.

The participant will gain in-depth knowledge of microarray principles and/or analysis with the aid of the mentor. The participant will prepare and handle bacterial DNA and RNA with the added complexity of extracting it from different and potentially problematic matrices; as a result, some dedication to assist in the development of new or improved extraction procedures may be required.

Qualifications:

The applicant must have obtained, within the last five years, a doctoral degree in microbiology and/or cellular and molecular biology or related field and be a U.S. Citizen or a legal permanent resident. Postdoctoral experience is not necessary.

Development of Metagenomic Microarray for Gastrointestinal Tract Commensal Microbial Community

FDA-CFSAN 2010-0002 C

This project will deliver a high density microarray with probes to interrogate the "pan-genome" of the lower gastrointestinal tract commensal microbiota. This will provide a useful tool with the capacity to monitor the metabolic and bacterial flux upon challenge, for instance, with pathogen outbreak strains. In addition, this array could have wide applicability towards vulnerable populations (immunocompromised), antibiotic resistance gene reservoirs, exposure to "live microbial ingredients", and perhaps even the effects of food ingredients and additives. Furthermore, it

supports this Center's mission by investigating potential food risks with new and innovative approaches. By all current estimates, our gut communities are undoubtedly complex and involve a consortium of over 500 microbial species. This consortium contributes unique metabolic capacities of otherwise indigestible compounds, produces secondary (and in some cases potentially toxic) metabolites, facilitates absorption of dietary lipids, fats and fat-soluble vitamins, yet provides a biological barrier to transient pathogens. Thus, it is positively associated with the overall health and well-being of the human host considering its perturbation may result in an increased susceptibility to infection. In aggregate, the consortium can be treated as a biological organ adapted to the anaerobic niche of our gut lumen. Metagenomics is the study of the genetic complement of microbial communities in a culture-independent fashion. This is important especially since the vast majority of microbes in ecological habitats (such as the gastrointestinal tract) are most likely uncultivable because of the inability to define growth requirements that can be reproduced in the laboratory. The deliverable goal of the project will empower us with the ability to measure this complex community as a biological and perhaps toxicological endpoint.

The participant will assist with the overall concept and design of the array using available sequenced bacterial strains of gut origin (available on NCBI and other genome repositories) and gut community metagenomes of human and/or 3 probes of these genes (and other gut-associated sequenced genomes) will be generated, arrayed, and tested initially for quality and reproducibility using a rodent model with fecal sampling. These gene sets will enable identification of species diversity and as well as metabolic pathway clustering. Further whole genomes of other gut strains (for example from NCBI) will also be arrayed. Subsequent development of challenge protocol(s) for pathogens or ingestible drugs or food-associated compounds will ensue as time permits.

The participant will assist in handling complex bacterial community analyses, metagenomics as applied to gut commensals, knowledge and utility of phylogenetic approaches, COGs and KEGG classifications and associated databases. Therefore, the participant will participate in technology development in these areas with applied use in broad areas of food safety of ingredients and additives, dietary supplements, and live microbial consumption (intentional or otherwise). The potential also exists for assessment of interspecies gene transfer and capture (as related to antibiotic resistance) and improving current metagenome coverage in the rodent model.

Qualifications:

The applicant must have obtained, within the last five years, a doctoral degree in cellular and molecular biology or microbiology or related field and be a U.S. Citizen or a legal permanent resident. Postdoctoral experience is not necessary. Excellent writing and oral communication skills are required.

Analysis of Outbreak Strains of *Salmonella enterica* using Optical Mapping and Partial 454 Sequencing

FDA-CFSAN 2010-0002 D

Optical mapping, which is methodology to scan and assess the architecture of complete bacterial genomes, has proven useful for comparative genomics as well as for epidemiology and microbial forensics. In the case of molecular analysis of the foodborne pathogen and *Escherichia coli* 0157:H7, the chromosomal organization of each of 11 *E. coli* 0157:H7 isolates has been examined in FDA laboratories by BamHI optical mapping. A BamHI optical map for a typical 5-5.5 Mbp *E. coli* 0157:H7 chromosome presented 500-700 ordered restriction fragments, with the number and arrangements of fragments varying with the isolate. As restriction digestion is carried out on

genomic DNA affixed to a glass substratum, the molecular size of contiguous *Bam*HI fragments is determined and precisely mapped along the chromosome. In contrast, pulsed field gel electrophoresis (PFGE), used commonly in molecular epidemiology studies, produces typically 50 genomic restriction fragments ordered only by fragment size within the gel, not by map position on the genome. Because of its greater resolution and specificity for strain identification, optical mapping holds promise use in molecular epidemiology needed for outbreak investigations. Complex events, including inversions, deletions, and insertions occurring within an individual chromosome, can be tracked with optical mapping. The optical maps can serve as a unique DNA "bar code" identifier for a particular microbe, not only at the species or subspecies level but also at the individual strain or isolate level.

In order to complement and extend the results from optical mapping of chromosomes, 454 partial genome sequencing has been used for characterization of *E. coli* O157:H7 outbreak strains, specifically to provide detail of the chromosomal markers identified by optical mapping. The two-stage approach was used to analyze isolates from the 2006 spinach-associated outbreak. The optical maps demonstrated thirteen chromosomal markers that distinguished the spinach isolate from a number of other optically mapped *E. coli* O157:H7 strains. 454 partial genomic sequences were used to characterize each of the thirteen chromosomal markers. The results of three (3) of these analyses provided resolution of *E. coli* O157:H7 outbreak strains that far exceeded PFGE mapping.

The recent *Salmonella* outbreaks attributed to contaminated peppers (and/or tomatoes) and to peanut butter paste serve notice of the need for more rapid and sensitive technologies to detect and identify food contaminants. The Fellow will apply optical mapping and partial 454 sequencing approaches, proven effective in the case of *E. coli* O157:H7, to investigate the molecular architecture of *Salmonella* outbreak strains.

The participant will: (1) aid to investigate the application of optical mapping and partial 454 sequencing as a means to characterize *Salmonella* spp. linked to foodborne outbreaks, to identify genetic markers useful for *Salmonella* identification, and to devise rapid methods for use of these technologies in a rapid response to outbreaks caused by *Salmonella* contamination of foods; and (2) support management in reviewing the literature and other information available on *Salmonella* spp. isolation and identification procedures.

With respect to the scientific activities, the participant will: (1) use aseptic microbiological techniques for bacterial culture of *Salmonella* spp. and preparation of cells for optical mapping of chromosomes and preparation of templates for 454 sequencing; (2) assist in performance of several analyses involved in the optical mapping procedure; (3) participate in performing the bioinformatics analyses required for processing the results of optical mapping and 454 sequencing procedures; (4) discuss with supervisor the progress of the project; (5) assist in reviewing and evaluating relevant data for determination of candidate *Salmonella* strains for analysis; and (6) use Quality Assurance guidelines developed by DMB in performance of scientific analyses.

Qualifications:

The applicant must have obtained, within the last five years, a doctoral degree in cellular and molecular biology or related field and be a U.S. Citizen or a legal permanent resident. Postdoctoral experience is not necessary. Excellent writing and oral communication skills are required.

Validating the Predictive Performance of *C. elegans* as an Alternative Model in Toxicity Testing

FDA-CFSAN 2010-0002 E

The Developmental/Reproductive Toxicology Branch located in the Division of Toxicology (DT) establishes and conducts cohesive mission-relevant research in toxicology and molecular biology that will ensure the safety of the U.S. food supply. In fulfilling this mission, the DRTIB/DT: (1) provides Center and Agency leadership in the areas of *in vitro* and *in vivo* developmental/reproductive toxicology; (2) recommends, develops, coordinates and conducts research on the toxic effects of substances for which the Center has regulatory responsibilities, and may investigate mechanisms of the underlying toxicological reactions; (3) develops and/or validates various *in vitro/in vivo* systems that may serve as adjuncts to, or replacements for, animal models, and conducts research on the application of *in vitro* test systems, or batteries of *in vitro* tests, to assess the toxic effects of substances for which the Center has regulatory responsibilities; (4) conducts toxicological studies on various classes of substances for which the Center has regulatory responsibility to provide data for guideline development and for evaluation of petitions and proposals and for the review of current tolerances and applications; and (5) develops long-term research plans, and as appropriate leverages with other organizations including other center and agency components.

DRTIB/DT provides laboratory capabilities including: (1) the Center's laboratory facilities involved with the development and validation of alternative methods for screening food-related chemicals for toxicity; (2) the Center's animal testing facilities when *in vivo* studies are necessary to answer specific questions about food-related chemicals (e.g., fluoride) and chemical toxicants (e.g., mycotoxins, phytoestrogens, androstenedione, and sodium arsenite) and pharmacokinetics of food-related chemicals; and (3) complex Parametric Analyzer and Sorter equipped with reflex sampler and Worm Tracker in early stages of development.

The participant will assist the Developmental/Reproductive Team in evaluating the predictive performances of *C. elegans* to serve as an alternative animal model in toxicity testing. The participant will: (1) assist in evaluating various endpoints of growth and development (e.g. fecundity, generational period, numbers of offspring, survivability etc) in *C. elegans* exposed to selected compounds of known toxicity under various culture conditions (axenic liquid culture, standard agar culture or multi well culture formats) using COPAS technology to develop short-term high-throughput screening assays; (2) participate in developing approaches to identify both gene expression patterns and individual genes as candidates for development as biomarkers of exposure; (3) assist in evaluating characteristics of *C. elegans* locomotion (e.g., crawling and/or swimming) as an endpoint of toxicity; and (4) assist in performing all laboratory experiments in compliance with Quality Assurance guidelines developed by DT and CFSAN.

The participant will assist in using genetic and cell biology approaches to investigate the mechanism of uptake and transport of the toxins in *C. elegans* and will assist in using chemical genomics approaches to identify the cellular pathways affected by these toxins. Excellent writing and oral communication skills are required as the participant will be required to record accurately experimental findings and assist in the preparation of manuscripts or providing written summaries of experimental finding. The participant will be trained in the use of the Complex Parametric Analyzer and Sorter and Worm Tracker. The training involves an understanding of the FDA's regulatory mission and its role in ensuring the safety of the nation's food supply.

Qualifications:

The applicant must have obtained, within the last five years, a doctoral degree in molecular biology, biochemistry, or cell biology and must be a U.S. Citizen or a legal permanent resident.. Experience with *C. elegans* genetics and using *C. elegans* as a model organism is desirable. Programming skills (Matlab) and a familiarity with bioinformatics is a plus. Postdoctoral experience is not necessary. Excellent writing and oral communication skills are required.

**Development and Application of Biomarkers and Analytical Analysis for Safety Assessment of Components of Dietary Supplements, Whole Foods, Direct and Indirect Food Additives
FDA-CFSAN 2010-0002 F**

The participant will join a multidisciplinary team and assist in evaluating the effects of xenobiotics (primarily chemical, some microbial), species, gender and inflammation on organ toxicity (primarily liver), reproduction and development.

The participant will have the opportunity to (1) assist in providing analytical support for a multidisciplinary team using high pressure chromatography (HPLC), gas chromatography (GC), basic spectrophotometry (nanodrop), flow cytometry (GUAVA system), mass spectrometry, plate readers (visible, fluorescence, luminescence), ELISAs and EIAs, as needed; (2) assist in methods development and in the analysis of proteins and lipids from foods, tissues and cells, analytes blood and tissues samples may include albumin, bilirubin, various lipids (fatty acids), liver enzymes, C-reactive protein, various cytokines and hormones; (3) assist in maintaining tissue cultures including medium preparation, maintenance of cells in culture and biochemical endpoint assays used to evaluate cytotoxicity, inflammation and apoptosis; (4) assist in the collection, processing and analysis of tissues from laboratory rodents as needed; and (5) assist in performing laboratory experiments in compliance with quality assurance and safety guidelines developed by DT and CFSAN.

The participant will be trained in the design and conduct of toxicological studies using cells and worms in culture or tissues obtained from laboratory rodents and in the evaluation of toxicological data relevant to the project. The participant will gain an understanding of how such data, when coupled with a review of the scientific literature can be used to design experiments that will be used in the hazard assessment of food-related chemicals. The training involves an understanding of the FDA's regulatory mission and its role in ensuring the safety of the nation's food supply. The participant will be trained in the conduct of each of the specific analyses by the senior scientists and will be schooled in the relevance of the research to the FDA's regulatory mission and role in maintaining the safety of the nation's food supply.

Qualifications:

The applicant must have obtained, within the last five years, a doctoral degree in chemistry, biology, biochemistry, toxicology and/or other appropriate biological sciences and be a U.S. Citizen or legal permanent resident. No postdoctoral experience is necessary but a minimum of two years in analytical chemistry, biochemistry, and cell culture is highly desirable.

**Application of the Neuroimmunoendocrine Model to Evaluate the Role of Systemic Inflammation Induced by Biological Agents in Systemic Toxicity
FDA-CFSAN 2010-0002 G**

The Neurotoxicology & In Vitro Toxicology Branch (NIVTB) in the Division of Toxicology establishes and conducts a cohesive mission-relevant research program in the areas of toxicology,

nutritional science, and molecular biology. This research is focused on the primary mission to ensure the safety of the U.S. food supply. OARSA scientists recommend, plan and conduct research to determine the safety and health hazards of foods, nutritional supplements, food and color additives, chemical contaminants, cosmetic ingredients and natural toxicants.

For many reasons, diet is known to play an important role in the development and control of the inflammatory response in humans. Diet may influence inflammation by its potential contaminants or by the level of its nutrients. There is also growing evidence that the development of inflammatory conditions are common in Americans and that these contribute to a variety of adverse health effects including many that cause the greatest incidence of death. These inflammation episodes, both acute and chronic, may be produced by environmental factors such as dietary pathogens and their toxins including lipopolysaccharide or LPS. Toxic contaminants like deoxynivalenol, therapeutic chemicals like colchicine, and nutrients like Vitamin D have been shown to have an important modulating influence on the inflammatory response, but a complete understanding of their interactions and the dietary levels of Vitamin D that may help to protect Americans from some adverse effects of inflammation are uncertain. Considerable evidence suggests that a large number of apparently healthy individuals in North America and around the world suffer from vitamin D insufficiency, despite the fact that both Canada and the U.S. fortify a limited number of foods with a low and possibly inadequate level. A large number of studies have linked newly defined notions of adequate vitamin D intake and overall Vitamin D status to reductions in cancer, and reduced risk from infections, autoimmune disorders, metabolic bone disease, and adverse cardiovascular conditions. A common factor in all of these disorders is inflammation.

The participant will be involved in studies to determine how various levels of deoxynivalenol, colchicine, and dietary Vitamin D may influence the effects of inflammation and as a result, help determine if current recommendations for safe levels are appropriate. The participant will be trained in all aspects of toxicological research associated with these studies.

The participant, under the supervision of a mentor, will assist with studies designed to investigate the effects that an acute inflammatory challenge will have on the toxicity of selected compounds such as deoxynivalenol, colchicine, and Vitamin D that are of interest to the FDA. These studies are in progress and the live animal segment of the current experiment will continue through 2009 and into early 2010, generating a significant number of samples for analyses. All these analyses are germane to CFSAN's mission of ensuring the safety of the food supply. He/she will conduct specific analyses to determine both health benefits and health risks. He/she will interact professionally with a variety of other members of the research team.

The participant will receive training and participate as a scientific professional in all aspects of the research study under the supervision of the mentor. The participant will: (1) assist in maintaining study records, laboratory equipment, and supplies used in analyses, assists in providing over-sight and guidance to technical staff participating in research activities, and comply with all quality assurance guidelines developed by the Division of Toxicology and CFSAN; (2) assist in the processing and storage of plasma and other tissues that are periodically harvested from the ongoing projects; and (3) assist in the conduct of analyzing tissue samples for analytes that are indicative of both health benefits and risks, using a variety of analytic techniques expected of a scientist at this level. These include techniques such as spectrophotometry, centrifugation, chromatography, ELISA, and RIA. The participant will be trained to conduct a variety of analyses including protein, Vitamin

D, glucose, enzyme activities from various tissues, C-reactive protein, leptin, adiponectin, and various cytokines.

The participant will assist with animal studies utilizing laboratory rats to produce observational and analytical results with accepted methods for data generation, data summary, and presentation. This includes basic and applied work in analytical chemistry, inorganic chemistry, and organic chemistry as is related to animal and human concerns. The participant will also assist in data analysis and the preparation of final reports including written summaries of results and conclusions.

Qualifications:

The applicant must have obtained, within the last five years, a B.A. /B.S. or a M.A. /M.S. degree in biochemistry, biology, chemistry, or nutritional science and be a U.S. Citizen or a legal permanent resident.

An appropriate candidate for this position at the bachelor level would have, at a minimum, an undergraduate degree in chemistry with biological or biochemical training or an undergraduate degree in biochemistry or nutritional science with a strong chemistry background. An appropriate candidate at the M.S. level would have either a master's degree in chemistry with strong biological or biochemical training or a master's degree in biochemistry or nutritional science with a strong chemistry background. Two full years of related progressively higher level graduate education leading to a master's degree is equivalent to completion of the degree.

**Skin Penetration and Characterization of Nanoparticles
FDA-CFSAN 2010-0002 H**

The Dermal Absorption/Metabolism Team (DAMT) is a key component of the Developmental/Reproductive Toxicology Branch located in the Division of Toxicology (DT) and establishes and conducts cohesive mission-relevant research in dermal toxicology whose objective is to ensure the safety of the U.S. cosmetic supply.

The DAMT mission is to identify potentially hazardous chemicals in cosmetics and color additives. The Team recommends, develops, coordinates and conducts research on the toxic effects of substances for which the Center has regulatory responsibilities and may investigate mechanisms of the underlying toxicological effects. The research involves the selection and development of skin models most applicable to the particular research need. Biochemical methodology for studying metabolic and toxicological endpoints will be developed and applied when required. Physical and biochemical analysis will be performed by applying analytical methodology such as high pressure liquid chromatography (HPLC), thin-layer chromatography (TLC), liquid scintillation counting (LCS), and other methods as needed. Unconventional or novel methodologies will be developed to separate and quantitate parent compound and metabolites as needed. As cutaneous metabolic pathways are still relatively unknown, the Team may be required to predict and identify metabolites and synthesize standards for structure verification if unavailable from commercial, public or private sources.

The DMAT is responsible for conducting exploratory, fundamental and applied research which evaluates the potentially hazardous effects of a wide spectrum of cosmetic and color additives. The team's research primarily focuses on the toxicological study of skin absorption and metabolism to determine absorption of chemicals from cosmetics and colors so that a relevant cosmetic exposure

assessment may be determined. This research may involve the development of new methodologies/techniques since not widely acceptable procedures currently exist. The Dermal Metabolism/Absorption Team seeks solutions to a diverse group of problems.

The DMAT attempts to develop new methods, techniques, and theoretical explanations to improve predictability of test results. The team develops and/or validates various *in vitro/in vivo* systems that may serve as adjuncts to, or replacements for, animal models, and conducts research on the application of *in vitro* test systems, or batteries of *in vitro* tests, to assess the toxic effects of substances for which the Center has regulatory responsibilities. Newer and more diverse methodology maybe developed to include molecular biology and *in vitro* techniques as well as other approaches deemed appropriate by the scientific community as investigational tools.

DMAT studies are frequently conducted under the Good Laboratory Practice regulations, and the Team is responsible for ensuring that their work complies with all applicable guidelines and regulations of the Center (i.e., Good Laboratory Practice regulation, Institutional Animal Care and Use guidelines, and applicable Safety guidelines).

Members of the DAMT may serve as the Agency's technical authority in the field of dermal toxicity. The DAMT conducts toxicological studies on various classes of substances for which the Center has regulatory responsibility to provide data for guideline development and for evaluation of petitions and proposals and for the review of current tolerances and applications. The DAMT contributes to laboratory resources that include: (1) in the area of the development and validation of alternative methods for screening food-related chemicals for toxicity; and (2) the center's animal testing facilities when *in vivo* studies are necessary.

The participant will join a team evaluating the ability of nanomaterial's to penetrate the skin. With respect to specific scientific activities, the participant will: (1) be instructed in the basic principles of the science of skin absorption through literature review and discussions with members of the DAMT; (2) assist in the conduct of *in vitro* absorption studies through literature review and laboratory instruction by members of the DAMT; (3) be instructed on the major chemistry factors that are examined in the characterization of nanoparticles such as particle size, surface charge, agglomeration, etc.; (4) be taught how to determine what factors might be particularly important in the skin absorption of nanoparticles; and (5) assist in conducting experiments using available equipment to characterize nanoparticles that are also being studied for their skin absorption capability, as a member of a team.

Qualifications:

The applicant must have obtained, within the last five years, a doctoral degree in a related field and be a U.S. Citizen or legal permanent resident.

Notice for All Appointments:

Appointments are for one year and may be renewed upon recommendation of FDA, based on project needs and priorities and are subject to availability of funds. The participant will receive a monthly stipend depending on educational level and work experiences. The participant must show proof of medical insurance. The appointment is full time at FDA in Laurel, Maryland. Participants do not become employees of FDA or the program administrator and there are no fringe benefits paid.

The Research Participation for FDA is administered by the Oak Ridge Institute for Science and Education. To be considered, send a current resume and cover letter to Debbie Alcorn via email at Debbie.Alcorn@ornl.gov or via fax at (865) 241-5219. Please reference project FDA-CFSAN 2010-0002 A, B, C, D, E, F, G, or H.