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Sam Nugen Receives International Life Science Institute Future Leader Award

Sam Nugen of the Department of Food Science was recently announced as the recipient of the International Life Science Institute North American Future Leader Award. The Future Leader Award is given annually to two early career nutritionists or food scientists that show exceptional promise in becoming future leaders in foods and health. The award provides research funding to new investigators to expand an existing project or to conduct exploratory research that might not receive funding from other sources. Sam was recognized for his work to develop low cost analytical methods for foods that are sensitive and rapid without the use of hazardous chemicals so they can be used for point-of-care. Sam's research is developing such methods by utilizing nanobiotechnology technologies to produce lab-on-a-chip biosensors to detect a variety of microorganisms and chemical toxins. An additional research area for Sam is the genetic engineering of bacteriophage for both the isolation and detection of microorganisms. This work is extremely novel as well as industrially practical in many fields. His work to use bacteriophages to isolate pathogens from complex matrices is generating a tremendous amount of interest from industrial partners as the isolation of bacteria is often more difficult than its detection. With Sam's award, we now have 4 ILSI-NA award winners in the Department including Yeonwha Park, Hang Xiao and Eric Decker.

Research News

Hang Xiao receives $1 M NASA grant

Maintaining the nutritional value of astronauts' food in space over long periods without refrigeration is a challenge, particularly for the essential vitamins. University of Massachusetts Amherst food scientists Hang Xiao and colleagues have received a three-year, $982,685 grant from NASA to investigate the degradation of essential vitamins over time in spaceflight foods, and develop strategies to minimize loss.

Xiao and UMass Amherst colleagues Micha Peleg, Eric Decker, D. Julian McClements, Lili He and Anna Liu, along with graduate students, will monitor the degradation mechanisms and kinetics in different types of foods given to astronauts during food processing and two years of storage. It's currently unknown how certain

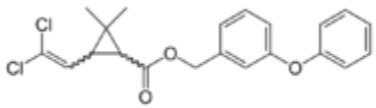
essential vitamins such as B1 (thiamine) and K in different foods respond to the conditions of spaceflight, Xiao points out.

“We’ll use the same foods that the flight crews receive at the International Space Station,” Xiao says. His team will determine the influence of the preparation and preservation conditions, the vitamins interactions with the food matrix, storage conditions and other factors on the degradation kinetics that is the rate of potency loss.

Food matrix refers to the food’s composition and structure, the food scientist explains. It differs dramatically as in spinach and beef, for example. “One may prove that certain matrices are more protective of the vitamins than the other, but we don’t know this yet,” Xiao notes.

A particularly innovative aspect of this project is that it should lead to a new mathematical modeling approach to simulate and predict the degradation kinetics of essential vitamins over a period up to five years, and also help develop guiding principles of how to stabilize vitamins in space to help NASA develop nutritious, shelf-stable foods for the health and wellness of spaceflight crews.

Yeonhwa Park Receives Two NIH Awards



Dr. Parks’ grants focus on the role of environmental toxins and health disorders. Summaries are given below:

Role of Permethrin in Development of Obesity and Type 2 Diabetes, PI: Y. Park, Co-PI: B. Braun and J. Clark

There has been a significant rise in the incidence of obesity and Type 2 diabetes in the last two decades and a growing body of epidemiological and laboratory evidence suggests a connection between environmental exposure to chemicals, including insecticides, with development of obesity and Type 2 diabetes. Among insecticides, organochlorine, organophosphorus, and pyrethroid insecticides have all been positively linked with weight gain and/or altered glucose homeostasis in various model systems. However, there is a paucity of investigation into the mechanism(s) by which these insecticides influence lipid and glucose metabolisms contributing to weight gain and development of type 2 diabetes. Among insecticides, this project will test the potential contribution of permethrin (a pyrethroid insecticide) to the development of obesity and type 2 diabetes. Pyrethroids comprised 23% of the world insecticide market by the mid 1990’s, and currently 13 pyrethroids in more than 3,500 registered formulations are widely used in the US to control insect pests in agriculture, animal protection and public health. Given the current epidemic of obesity and associated diseases and wide use of pyrethroids insecticides, there is critical need to determine the role of this insecticide in lipid and glucose metabolisms contributing to weight gain, development of type 2 diabetes, and related chronic disease conditions.

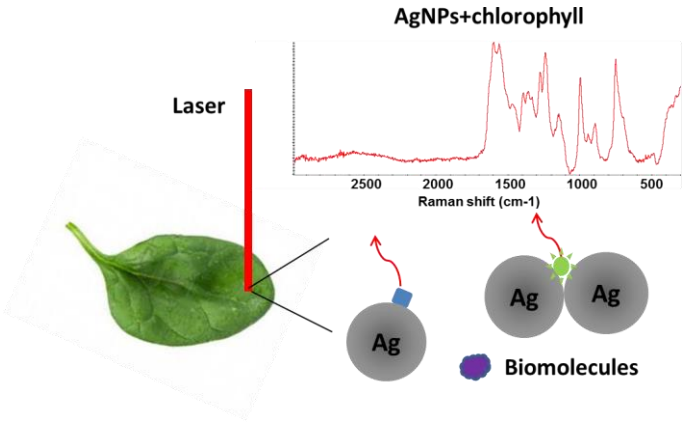
Role of Imidacloprid in Development of Obesity and Type 2 Diabetes, PI: Y. Park, Co-PI: B. Braun and J. Clark

There is limited information about the link between influences of neonicotinoid insecticides and incidence of obesity and Type 2 diabetes. Neonicotinoids are the newest and largest single insecticide class on the market currently, representing about 27% global insecticides used in 2010. Neonicotinoids are not only used for agricultural crop protection but also for controlling fleas and ticks for household pets, which implies significant exposure risk for humans. Thus the goal of the current project is to determine the role of imidacloprid (a neonicotinoid) in development of obesity and type 2 diabetes. Given the current unexplained rise in obesity and associated diseases, this project will help identify the potential contributing factors and may lead to the development of strategies for effective prevention and/or treatment of obesity and lessening its health impact in the future.

Amanda Kinchla Receives Funding to Utilize Mushrooms to Produce Low Fat Meat Products

The US has been battling the war against diet related health problems for many years. However, healthier low-fat and low-sodium products currently offered in the marketplace rarely deliver on taste and quality. If there are improved product offerings that do not compromise quality, consumers would be more motivated to improve their overall diet. Historically, mushrooms have demonstrated a wide variety of uses in culinary applications. This project will identify additional uses for mushrooms as a vehicle to improve consumer diets to enhance consumer health and wellness. The aim of this project is to develop a taco filling that will optimize the use of mushrooms by reducing the overall fat and/or sodium to provide a healthier alternative to the current 100% beef taco filling while still delivering all of the attributes of a traditional beef taco filling. The product will be developed in Amanda Kinchla's product development lab and acceptability will be tested in the UMass Dinning Commons in collaboration with Dining Services. This collaboration with dining services presents a unique opportunity to conduct sensory testing with large numbers of college students.

Lili He Receives 2 USDA Grants



Dr. Lili He has recently received two NIFA grants totaling ~ $1M. The first grant with Dr. Lynne McLandsborough as a co-PI is to *develop an innovative platform for detection of a mixture of pathogens, Salmonella enterica* and *Listeria monocytogenes*, in milk and ground beef. The platform is based on a technique called Surface enhanced Raman spectroscopy (SERS). It is a combination of Raman microscopic and nano-techniques. Raman microscopy can identify bacterial cells based on their biochemical signatures. The use of a nanosubstrate can enhance the Raman signals tremendously, reaching a single cell detection limit. The SERS platform is expected to be superior to the current detection methods, in terms of analytical time, sensitivity, and accuracy. The second grant, with Drs. Baoshan Xing, Sam Nugen, and Amanda Kinchla as co-PIs, is to investigate the *interactions between silver nanoparticles (AgNPs) and leafy vegetables* (i.e. spinach and lettuce). AgNPs have showed their potential toxicity to human health. AgNPs from pesticides and industrial materials can possibly contaminate fresh produce through surface contamination and root uptake. However, knowledge on the physical and molecular mechanisms of AgNPs contaminating fresh produce and their fates is currently limited. We will use SERS to investigate AgNPs attachment on and penetration into leaves via surface spray, and evaluate the impact of postharvest washing on surface attached AgNPs. We will also investigate AgNPs distribution in plant tissues and their fates via root-to-shoot exposure. The successful completion of this study will help us to have a better understanding on how AgNPs would possibly contaminate fresh produce. Understanding these processes will help us to evaluate the risk level of the AgNPs contamination in fresh produce and develop a better control strategy to prevent contamination. These two grants are important for maintaining the safety and sustainability of agriculture and food systems.

Julie Goddard Receives Grant to Replace Synthetic Antimicrobial Agents

Microbial food spoilage represents a significant economic and environmental issue: it is reported that 40% of food goes to waste, two thirds of which is due to spoilage. Natural, food grade antimicrobials can be used to prevent such waste, and synthetic metal chelators like EDTA are commonly added to foods to enhance their antimicrobial activity. However, consumers are increasingly demanding removal of such label-unfriendly synthetic additives from foods. Julie Goddard has recently been awarded a $499,977 grant from USDA NIFA on "*Preventing Spoilage of Packaged Foods by Non-Migratory Active Packaging*" in collaboration with Eric Decker and Lynne McLandborough. In this project we demonstrate that iron chelating active packaging can enhance the antimicrobial activity of antimicrobials with the ultimate goal of improving shelf life and reducing waste of packaged foods, while enabling removal of synthetic, label-unfriendly additives like EDTA.

Faculty News

Amanda Kinchla is collaborating with two food incubators, CropCircle Kitchen (Dorchester, MA) and the MA Food Processing Center (Greenfield, MA) to host a Product Development Short Course to support new food entrepreneur businesses. The goal is to make new processors aware early on about food science fundamentals to better prepare them for business success.

Eric Decker was named a Fellow of the Agricultural and Food Chemistry Division of the American Chemical Society. He also gave a plenary lecture at the International Society for Nutraceuticals and Functional Foods meeting in Istanbul.

Lili He's students gave several talks at the Eastern Analytical Chemistry Symposium. She is also receiving a new grant from the National Center of Food Protection and Defense on adapting surface enhanced ramen spectroscopy to utilization in the field.

Julie Goddard was a finalist for the student-nominated 2014 UMass Amherst Distinguished Teaching Award. Dana Wong, a Ph.D. candidate in Julie's lab, received a very prestigious Fellow Award from USDA NIFA. Maxine Roman, another Ph.D candidate led a group of graduate and undergraduate students in "Funtastic Food Science" as part of the campus-wide K-12 STEM outreach event, ScienceQuest.

Julian McClements is now the most **highly cited scientist in all of agriculture** as determined by Thomson Reuters. Julian was also named a Fellow of the Royal Society of Chemistry.

Sam Nugen has been working on new projects funded by the Center for Produce Safety and the Air Force Research Labs. These projects include a low-cost device for Salmonella detection and a wearable hydration sensor respectively. Grad Student Charmaine Koo will compete in the ACS Agricultural and Food Chemistry Division Graduate symposium in Denver. Sam Alcaine was awarded a competitive Fellowship from the USDA based on his work with phage-based diagnostics.

Yeonhwa Park gave presentations at the 6th Food Science Biotechnology and Safety Meeting in Monterrey, N.L. Mexico, and at the International Symposium and Annual Meeting for the Korean Society of Food Science and Nutrition.

Micha Peleg and **Mark Normand** recently submitted the 125th Interactive Wolfram Demonstration. For the complete list of already published Demonstrations see:
http://demonstrations.wolfram.com/search.html?query=normand
To run any and all the Demonstrations, and over 9800 others to date, download the (free) CDF Player by following instructions on the screen.

David Sela received a UMass-Industry grant to work with OceanSpray on the role of cranberry oligiosaccharides on the microbiome. His PhD student, Ezgi Ozcan, was awarded a travel grant and presented her research at the 2014 European Network for Gastrointestinal Health Research Conference at the Max-Rubner Institute in Germany. Undergrad Alex Russell received a Commonwealth Honors College Research Grant. David's research was also highlighted in the campus paper (see below).

Hang Xiao's group presented their research findings (5 oral presentations and 9 posters) during the Experimental Biology Meeting in San Diego, and 4 graduate students have received awards from research competitions. Dr. Xiao was also invited to give a keynote presentation on "Functional foods: developing vegetable products with health solutions" during the Australia Vegetable Convention in Cairns, Queensland, Australia.

Food scientist proposes way to improve health via breast milk

Posted by Cecilia Prado on Thursday, November 20, 2014 for the UMass Daily Collegian

A recent study conducted by a food scientist at the University of Massachusetts, David Sela, has provided evidence to suggest certain components in breast milk could be used as a tool to improve human health. Sela, in collaboration with a research team from the University of California, Davis, found components in human milk that could be used to manipulate the microbes living in the gastrointestinal tract, otherwise known as human microbiome.

Due to the National Institutes of Health Human Microbiome Project, a project designed to understand the impact of the microbiome in human health it is possible for scientists to understand how environmental factors affect microbial metabolism and the human genome. Previous research had attributed the misbalance between good and bad microbes within our microbiome composition to a variety of conditions, such as obesity, diabetes, asthma, allergies and potential mental illness. But pioneers in the field have begun to develop techniques that could potentially allow the colonization of beneficial bacteria and manipulate the human microbiome.

Sela is one of them.

According to his website, Sela is focusing his research on an organism named bifidobacteria. This bacterium has been found to prevent the colonization of pathogens in the gut, provide nutrients for the human host, train the immune system and digest nutrients that the host is unable to.

According to Sela, the colonization of the infant gut by bifidobacteria is essential for the health of the baby. "In cases when the early colonization of bifidobacteria is inhibited, the establishment of enteric pathogens in the gut happens at a much faster rate, such as the case of Necrotizing Enterocolitis," he said. Necrotizing Enterocolitis is a relatively common disease in premature infants in which pathogens colonize the baby's gut in the absence of beneficial bacteria.

Sela and his team conducted a series of genomic analyses with the purpose of understanding the mechanisms by which this organism interacts with the newborn, the mom and breast milk. His team found milk is composed of a variety of sugars named human milk oligosaccharides, or HMOs. Humans are not capable of digesting HMOs, which led his team to question its purpose and effect on the microbiome. According to Sela, the complete DNA sequence of bifidobacteria unveils an evolutionary adaptation of the species that allows them to utilize a larger range of HMOs than other strains.

He also believes there is strong evidence to suggest that milk from different mothers may promote the growth of different microbial populations. Sela proposed a technique involving the administration of "HMO cocktails" to infants that cannot receive traditional breast-feeding. This could potentially improve their immune system, neural development and gastrointestinal health in the future.

This new-age prebiotic has the potential to be more effective than regular probiotics or prebiotics, which sometimes don't contain the strains mentioned, or the microbes die before they can really create an effect. Sela believes this is a great step toward understanding the way in which milk shapes the microbiome of a nursing infant. "We used to think of the gut as a black box," Sela said. "Now we know that what's inside, plays a crucial role in human metabolism."

Up Coming Short Courses

Food Emulsion Short Course: May 19-20th, 2015

- This workshop will present the basic principles, concepts and techniques of emulsion science, and show how this information can help to understand, predict and control the properties of real food products and ingredients.
- ***Register now!*** **Early bird rates available until April 3rd.**
  - SRA Registration fee $800
  - Professional Registration fee $900
- Use the link or QR code below for registration and additional information, http://www.umasshotel.com/groups-meetings/registration/
- For additional questions email: amanda.kinchla@foodsci.umass.edu