UMassAmherst | Food Science

Department Head's Note

Our faculty, staff, and students have spent the last year adjusting to changing circumstances. After working at reduced laboratory capacity for 15 months, on June 2, UMass returned to normal research levels without a requirement for face masks or social distancing for vaccinated researchers. Our department taught only four in-person courses the last two semesters, but in the fall, we will be back to 100 percent in-person courses on the UMass Amherst campus. This fall semester, I am looking forward to seeing students on campus, human interactions while teaching, and having Chenoweth Laboratory again hum with student researchers' activity.

A big thank you goes out to Professor Eric Decker for his leadership and vision for the Food Science Department over the past 11 years. On September 1, 2020, Prof. Decker stepped down from his position as Department Head. He is still an active faculty member and is devoting time to his research program. Under his leadership, our department hired seven of our current faculty members, and our overall research funding grew substantially.

During Prof. Decker's tenure, the UMass Food Science faculty had twice the awards per faculty member, citations per faculty, and publication per faculty than our peer food science institutions. He provided leadership to the Strategic Research Alliance, and working with the Food Science Advisory Board, Prof. Decker established endowments to support faculty salaries, research, graduate student fellowships, and teaching activities. Much of the current success of the department is due to his work and dedicated leadership. We appreciate all he's done for us.

I have big shoes to fill, but I am ready for the challenge. I encourage all alumni to stay in touch with the Food Science Department at UMass. We greatly appreciate your support and commitment to our program.

Lynne McLandsborough
Department Head and Professor

From the UMass Food Science Advisory Board

The UMass Food Science Advisory Board was established in 1989 with the following goals:

- Advocate for the department, both on and off-campus
- Increase connection, engagement, and support of alumni
- Raise funds for strategic initiatives
- Provide external and industry perspectives to the department

Focusing on these goals, the board, with alumni support, has made key contributions to the department, such as establishing the Graduate Student Scholarship Fund, the Fergus Clydesdale Center for Health and Wellness, and the Strategic Research Alliance.

Alumni engagement is critical to the Advisory Board's success in assisting the department to continue to be the #1 Food Science Department. Increasing our connection to fellow alumni is an area of current focus. Utilizing social media is one way we are trying to do this. If you are not already a member of our LinkedIn Group, please go to LinkedIn, search for the "UMass Food Science Alumni and Students" group, and join. This will help keep you informed about the department and Advisory Board news.

The Advisory Board extends congratulations to the 2021 Food Science graduates and welcomes them to our alumni family. Being a UMass Food Science graduate not only means that you have received a great Food Science education, but also that you are a member of a large and engaged group of alumni.

Partnership to Develop Sustainable Food Products

The University of Massachusetts Amherst is among nine institutions chosen to collaborate with Big Idea Ventures to help develop and commercialize new, sustainable food products and agricultural innovation that will fuel economic development in rural communities, the New York City–based venture capital firm announced Tuesday.

In January, Big Idea Ventures launched the Generation Food Rural Partners (GFRP) fund, a $125 million target fund that aims to accelerate the commercialization of groundbreaking, university-developed intellectual property involving "the new food space." North Carolina State was the initial collaborator.

In addition to UMass Amherst, the other new collaborators are: Louisiana State University, Oregon State University, Penn State University, Purdue University, Tufts University, University of Hawaii, University of Illinois at Urbana-Champaign, and Worcester Polytechnic Institute.

"We're honored to welcome these universities to the GFRP consortium," says Tom Mastrobuoni, chief investment officer for Big Idea Ventures. "The research being conducted at each of these institutions spans our three areas of focus: food, protein, and agriculture innovation. Our team is excited to start building new companies based on technology being developed by some of the world's best and brightest."

Big Idea Ventures will open "venture centers" to work with the universities to identify and evaluate new developments with the strongest commercialization potential, and the fund will then invest in new companies formed around the groundbreaking research. These new companies will be headquartered in rural communities near the collaborating universities.

"We believe GFRP will drive additional research and encourage entrepreneurs to establish their companies near our venture centers in rural America," Mastrobuoni says. "Food traditionally comes from rural communities and this is one way to help those communities grow economically."

The GFRP collaboration will speed new discoveries to the marketplace by supporting research and funding start-up companies. "

#1 Again Among U.S. Universities

UMass Amherst's Food Science department maintained its #1 ranking in the U.S. and jumped to #7 in the world, according to the 2020 Global Ranking of Academic Subjects, part of the annual Academic Ranking of World Universities, published by ShanghaiRanking Consultancy.

Top-ranked in the U.S. for the past two years, the food science department rose two positions globally in the latest list, up from ninth in the 2018 and 2019 rankings. The next two highest-ranked U.S. food science programs in 2020 were at Cornell University, 16th globally, and the University of California, Davis, 19th.

"This impressive achievement was even more remarkable considering that the department at UMass has only 12 faculty members, compared to three- to 10-fold more for the departments ranked above them," says David Julian McClements, Distinguished Professor of Food Science and one of three UMass Amherst food scientists named among the world's most highly cited researchers. The other two are Eric Decker, professor and former department head, and Hang Xiao, professor and Clydesdale Scholar of Food Science.

The department, which has the oldest academic food science program in the country, also features other internationally recognized faculty members and has been successful in attracting innovative students and postdoctoral researchers who have made pioneering contributions to the field.

The department is a global leader in research on nutraceuticals, functional foods, food nanotechnology, food safety, the gut microbiome, and healthy lipids, and is starting new programs on sensory science, genomics, plant-based foods, alternative proteins, and sustainability.

ShanghaiRanking uses transparent methodology and third-party data to determine the rankings. Indicators include measures of research quality and the highest academic recognitions, as well as the extent of international collaboration.

Eric Decker Wins Top Food Science Awards

Eric Decker, Professor of Food Science, has recently received the two top awards in his field: the American Oil Chemists' Society's (AOCS) Supelco/Nicholas Pelick Research Award and the Institute of Food Technologist's (IFT) Lifetime Achievement Award in Honor of Nicolas Appert.

A pioneering researcher whose work focuses on lipid chemistry and foods, Decker says these latest honors mark the pinnacle of his career.

"These awards are a very exciting recognition of all the tremendous work done by my postdocs, students, and research collaborations. Their work has helped decrease food waste, make foods safer, and protect important shortfall nutrients such as antioxidants and omega-3 fatty acids," says Decker, who served as 2019-20 president of the AOCS. The century-old group strives to advance the science and technology of oils, fats, proteins, surfactants, and related materials. Decker also chairs the AOCS Foundation.

"Winners represent the very best and brightest minds in research areas of prime concern to the AOCS," according to a statement from the organization.

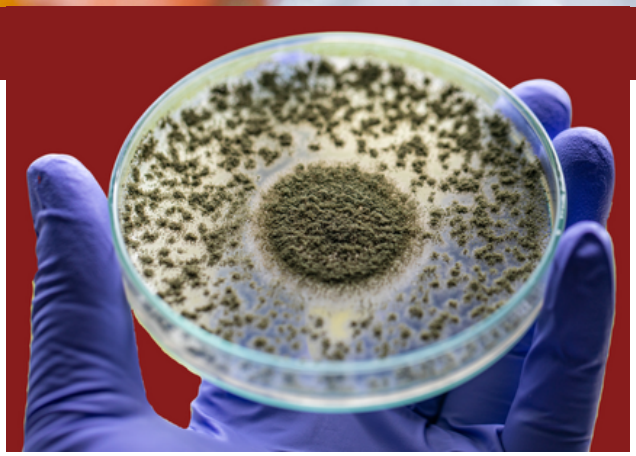
The IFT's Nicolas Appert award, named after the French inventor known as the "father of canning," recognizes "consistent lifetime contributions to food science and technology."

Decker's research aims to characterize mechanisms of lipid oxidation, antioxidant protection of foods, and the health implications of bioactive lipids. These efforts focus on improving nutrition by incorporating more stable, unsaturated fatty acids into foods while preventing oxidative rancidity that causes food waste.

Decker, a Most Highly Cited Scientist in Agriculture with more than 440 publications, has served on committees of the FDA, Institute of Medicine, Institute of Food Technology, USDA, and American Heart Association. He was one of 13 appointed members of the National

Academies of Sciences (NAS) Committee to Review the Dietary Reference Intakes (DRIs) for sodium and potassium, an 18-month process that culminated in new recommendations in 2019.

John Gibbons Receives NSF CAREER Grant for Fungi Research



Humans of 10,000 to 13,000 years ago figured out how to domesticate molds and other fungi to preserve food, make it tastier, and to make wine.

How this happened is "the big question," says John Gibbons, food science, who this month begins the search for Fungal Domestication Syndrome, supported by a five-year, $729,900 National Science Foundation Faculty Early Career Development (CAREER) grant. "Almost everything we know about domestication stems from plant and animal models," Gibbons says. "But fungi have very different underlying population biology and ecology." His studies will advance knowledge of the effects of fungi domestication and related genomic and evolutionary processes.

Much domestication likely involved "happy accidents," he points out, so even though microbially preserved food might taste very different than fresh, the guiding principle was, "if it didn't kill you and it was preserved, that was helpful," he adds. "As long as you can get your food to last longer that's the key."

His new grant emphasizes both research and education, so Gibbons plans a "citizen science" component that will invite the public to send samples of homemade or commercial fermented foods to his lab — a kind of "Meet Your Microbe" drive, he says. Students in his genomics lab will isolate and identify microorganisms from these to gain practical experience in microbiology, molecular biology, genomics, and bioinformatics.

The genetic detective work will focus on a mold called Aspergillus oryzae, used to make soy sauce, sake, miso, and other traditional Asian fermented foods and drinks. Domestication refers to the genetic modification of a plant or animal, usually through breeding, to select for traits that are beneficial to humans, he explains.

Gibbons adds, "It is evolution on steroids; it involves really strong selection and it crams changes into 10,000 years instead of the hundreds of thousands or millions it might normally take."

With the coming of agriculture, he points out, more people enjoyed a surplus of food for the first time, and they found that the best way to preserve things for long periods is through microbial preservation. Cheese, made by treating milk with bacteria, is a prime example and dates back 10,000 years, he notes. "Right around that same time there is archaeological chemistry evidence that people, probably using the organism that I'll be studying, made rice wine in China."

Aspergillus oryzae is one of the official "national microbes of Japan," Gibbons notes. "It's really deep in their culture, and people have shown reverence and respect for it for centuries." The project will involve sequencing the genomes of hundreds of the wild progenitor fungi (A. flavus) and hundreds of the tame (A. oryzae) samples in a multilayered approach to identify the genomic regions targeted by artificial selection — "to pinpoint regions that show the footprints of domestication."

Other experiments will follow to study different traits, including toxicity and secondary metabolite production. The researchers will measure growth rate, inhibitory effects on community food microbes, volatile compound profiles, and gene expression profiles of A. oryzae and A. flavus strains under diverse conditions.

MOTIF FOODWORKS PARTNERS WITH UMASS

Motif FoodWorks, the animal-free ingredient innovation company, and food scientists at the University of Massachusetts Amherst will collaborate in a research partnership to optimize the process of characterizing functional properties of food proteins.

This research on the solubility, stability, color, and other properties of protein is critical to the production of successful plant-based products, says Motif, whose mission is to make plant-based food better tasting and more nutritious with animal-free ingredients and food science expertise.

Stefan Baier, head of food science at Boston-based Motif, will lead the two-year initiative with top food scientists from UMass Amherst — Professor Eric Decker, Distinguished Professor David Julian McClements, and Professor Hang Xiao, Clydesdale Scholar of Food Science — who will share their innovative research in lipid oxidation, protein functionality, structural design, natural product, chemistry, bioavailability, and metabolism.

"It's exciting to see our research being used to improve and expedite the processes behind some of the most exciting trends in the food industry," Decker says. "Our partnership with Motif will have a real-world impact on the ability of their food scientists to innovate and bring new, viable proteins to the market."

As companies across the food and beverage industries are looking to expand the scope and sophistication of the plant-based products they offer consumers, the processes behind these products need to evolve to ensure continued innovation and growth in the market.

Baier explains, "When it comes to protein functionality, there are certain physical and chemical attributes that are critical to the ultimate success of a plant-based product – things like solubility, or how the protein will emulsify. These characteristics become key pieces in the roadmap to ultimately formulating a protein that will perform the way you need it to."

The majority of the functionality tests still used by food scientists are based on processes that were developed in the 1950s and rely on significant sample sizes – 50 to 100 grams – to determine whether a particular sample demonstrates desired properties. Together, UMass and Motif will work to characterize key properties of food-grade proteins at lower protein concentrations, as well as develop miniaturized versions of these test methods so that small amounts of proteins can be rapidly analyzed.

"Being able to identify these properties at smaller concentrations will help us identify promising leads earlier in the process," Baier says. Developing tasty, plant-based, protein-packed food is not a simple task but a multistep operation.

"We are trying to solve very complex problems for our customers – helping them to create plant-based foods that meet consumer expectations – and that work begins at the formulation level," says Mike Leonard, Motif's chief technology officer. "Our partnership with UMass will help make a critical part of Motif's process more efficient, optimizing our ability to identify and scale promising protein leads and ultimately enabling us to provide better ingredients to our customers, faster."

Predoctoral Fellowship

Food science PhD candidate Cassandra Suther has received a prestigious predoctoral fellowship of $180,000 from the U.S. Department of Agriculture's National Institute of Food and Agriculture (USDA-NIFA) to study the effect of norovirus on the development and severity of food allergies.

Suther was doing an experiment, focusing on a well plate containing multiple small cavities, when she received the news about her fellowship over email. "I was so excited I dropped my 96-well plate in the sink," she recalls. "Luckily, it was fine. It is such an honor to receive the award and I look forward to conducting the research."

Suther is set to complete her doctorate next year and plans to continue allergy research at UMass Amherst. "After that, I want to work in a government laboratory and pursue academic editing," she says.

Affecting about 10 percent of the U.S. population, food allergies are

increasing at an alarming rate. One of the theories on a contributing factor is the "hygiene hypothesis," which suggests that limiting exposure to microorganisms in childhood may increase allergic diseases.

What if contracting a common foodborne and environmental virus, norovirus, might actually present an advantage when it comes to food allergies? Although norovirus can cause severe diarrhea and vomiting, there may be some evidence to suggest some benefit from infection.

"Food allergies are thought to be heavily linked to the dysbiosis, or reduced diversity, of the gut microbiome and its immune effects," Suther says. "Based upon some data that previously has been reported, we suspect that infection with norovirus may actually have the potential to reduce the likelihood of someone developing food allergies."

Suther is a PhD candidate in the lab of Matthew Moore, assistant professor of food science who studies food and environmental viruses. Suther also will collaborate closely with Dr. Yanjiao Zhou, a medical doctor and computational biologist at the University of Connecticut Health Center, for the project. Zhou was one of the lead analysts in the Human Microbiome Project, a National Institutes of Health initiative.

"Cassie is an extremely promising young scientist, and it is a privilege to get to work with her," Moore says. "This award was very well-deserved and definitely not the last she will be receiving. It will be really exciting to see both this project and her career evolve."

"Viral interactions in the field of allergies is an underdeveloped topic," Suther says. "This research could change our understanding of the role of eukaryotic enteric viruses in the development, or lack thereof, of a number of diseases outside of the gastrointestinal tract."

NIFA's Agriculture and Food Research Initiative, under which Suther received the fellowship, focuses on developing the next generation of research, education, and extension professionals in the food and agricultural sciences.

Student Awards

PhD students Minji Kim and Christina Wormald both won the International Association for Food Protection Travel Scholarships, which are the top graduate scholarships from IAFP.

Christina Wormald came in first at the 2021 IFT Extension, Education and Outreach Division's 12 Minute Oral Presentation Competition.

The UMass StickoDips team, William Wolfe, Kanan Kobata, Hung (Harry) Pham, Ruya Ji, and Brian Zang, won first place for the 2021 IFT USDA Smart Snacks for Kids competition.

Hualu Zhou (PhD student) won first place in the oral competition in the IFT Nutrition division with their presentation, "Fortification of Plant-Based Milk With Calcium may Reduce Vitamin D Bioaccessibility: An In Vitro Digestion Study."

Jianan Zhang (PhD student) was awarded the 2021 Founder's Scholarship from the Honor Society of Phi Kappa Phi.

Katie Hilty (rising Senior) was accepted in the LeeSIP program to perform summer research with Alissa Nolden.

Introducing Our Newest Faculty Member

Lutz Grossmann is a food scientist who graduated with a PhD from the University of Hohenheim in Germany. His research focuses on facilitating a sustainable food system transition by designing holistic approaches to increase the consumption of plant- and microbial protein–rich foods. He is especially interested in combining downstream processing technology with the molecular, physicochemical, and nutritional properties of novel protein sources to improve liquid and solid plant-based food structures.

His work has four main clusters:

- Unleashing the potential of novel protein-rich raw materials for foods, such as from microbial and fungi sources. For example, he works with microalgae proteins and he will expand this work also to other single-cell organisms.
- Establishing downstream processing approaches for novel raw materials. Specifically, obtaining functional proteins by physical processing and to understand how the downstream processing affects the protein functionality.
- Understanding the techno-functional behavior of proteins based on molecular and physicochemical properties to obtain material-science blueprints that help to design food processes that yield desired functionality and structures.
- Understanding structuring processes, such as extrusion processing, to produce more functional fibrous structures at lower temperatures that resemble that of meat more closely, also in terms of functionality.

By combining these clusters, his research will help to improve the functionality, structure, and nutritional profile of protein-rich foods with plant and microbial ingredients.

Faculty News

Alissa Nolden received an Early Career R21 Grant award from NIH-NIDCD, titled Plasticity of Sweet Taste: Importance of Diet and Receptor Expression in Taste Buds.

Amanda Kinchla, MS, hosted a virtual symposium at IFT this summer to share and discuss integrated research-extension work that helps to provide food safety education and technical support to small processors. Additionally, she shared her research related to plant-based proteins at IFT and the Emerging Meat Alternative Conference in November. Much of her efforts at the start of 2021 are focused on a USDA-funded project titled, “Improving Access and Motivation for Small and Medium Processors in the Northeast to Be in Compliance With FSMA’s Preventive Controls Rule.” This is an interdisciplinary project collaborating with Jill Ann Fitzsimmons from the UMass Resource Economics department.

Gudong Zhang is Vice Chair (2020-21) and Chair-elect (2022) of the Sub-Division of Diet & Gut Microbiome, Division of Agricultural and Food Chemistry (AGFD), American Chemical Society.

John Gibbons received a National Science Foundation CAREER grant to study the evolutionary genomics of the sake, soy sauce, and miso fermenting mold Aspergillus oryzae. Gibbons gave an invited lecture at KojiCon on the history and science of koji molds.

Julian McClements won the 2021 Alton E. Baley award from AOCS recognizing outstanding research contributions and exceptional service in the field of fats, oils, lipids, and related disciplines. The award was sponsored by Archer Daniels Midland (ADM). McClements received three grants (one USDA, and two from the Good Food Institute) to work on development of plant-based meat. In addition, he appeared on a number of podcasts, including Shirtloads of Science out of Australia related to his book Future Foods.

Lili He received a ~$500,000 UDSA grant to study the impact of adjuvants on pesticide persistence on fresh produce. She has established a Raman, IR, and XRF Core Facility that has multiple advanced instruments that can do molecular and elemental analysis and imaging. The center provides training, analytical services, and technical support for academics and the industry. For more information, please refer to https://www.umass.edu/ials/raman-ir-xrf-spectroscopy.

Matthew Moore (co-PI) and collaborator Yanjiao Zhou (PI) of UConn Health were awarded a ~$500,000 grant from USDA NIFA's Food and Human Health program for their proposed project "Functional Modulation of the Microbiome-Gut-Brain Axis by Walnut Consumption." The work will explore the effects of walnut consumption on the whole microbiome and its cross-organ implications on the brain. Moore was appointed Vice Chair of the Editorial Management Committee of *Journal of Food Protection* as well as chair of the Developing Food Safety Professionals group for the International Association for Food Protection. Matt also was appointed as Guest Associate Editor for a special issue in *Frontiers in Sustainable Food Systems,* titled "Using Genomics to Inform Food Safety Inspection Systems."

Lynne McLandsborough stepped into the role of Food Science Department Head.

Micha Peleg gave an online, short (10 hours) post-graduate food rheology course at the University of Torino (Italy).

Please visit us at:

https://www.foodsci.umass.edu

https://www.facebook.com/UMassAmherst

There are opportunities to participate in research within the UMass Food Science Department. Dr. Nolden is the PI of the UMass Sensory Research Team and has ongoing projects in the areas of plant-based foods, food behavior, and talking with individuals who have experienced taste loss from COVID and chemotherapy. If you are interested in learning more about these projects and interested in participating in online surveys, check out our page at **https://www.foodsci.umass.edu/research/participate-research-studies.** You can also follow new studies and latest research updates on Twitter @SensoryFoodSci.