J-WAFS and MIT News

Krithika Ramchander Wins First Place in MIT Mechanical Engineering de Florez Competition

Mechanical engineering PhD student Krithika Ramchander won first place for graduate science in the 2017 MIT Mechanical Engineering de Florez Competition. Ramchander's award was for "Development of low cost water filters using plant xylem," a J-WAFS Solutions project on which she has been working with PIs Rohit Karnik, associate professor in the Department of Mechanical Engineering and Amy Smith, founding director of MIT's D-Lab and senior lecturer in the Department of Mechanical Engineering.

Read more about the J-WAFS Solutions project

Water Solutions-based Projects Take Home Awards at MIT’s 100K Entrepreneurship Competition

Two startups focused on water solutions took home cash prizes from MIT's annual $100K Entrepreneurship Competition this May. The $100K Competition, now in its 28th year, has helped to launch more than 160 companies founded by student entrepreneurs at MIT. The $5000 Audience Choice award went to change:W ATER Labs, a team of MIT researchers and others making toilets that can condense waste into smaller bulk for easier transport in areas where people live without indoor plumbing. PipeGuard, an MIT team developing a sensor that can be sent through water pipes to detect leaks, won a $10,000 Booz Allen Hamilton data prize.

Read more

Safi Organics Among the Top 20 Global Food Leaders

Safi Organics, the second place winner of the 2016 Rabobank-MIT Food and Agribusiness Innovation Prize, received yet another accolade last month. The founder and CEO Samuel Rigu of Kirinyaga, Kenya, was named one of the "20 Food Leaders Under 40" by FoodTank, a nonprofit based in New Orleans, that promotes environmentally, socially, and economically sustainable ways of alleviating hunger, obesity, and poverty around the globe through education and advocacy. Safi Organics provides affordable carbon negative organic fertilizer, made from locally-sourced crop residual, to small scale farmers in Kenya.

Read more
How to find foodborne pathogens? Light them up.

What is the FDA-recommended process for detecting disease-causing bacteria in food? Send a sample to a lab and wait. Suspect food products are shipped; tests are done by trained chemists and microbiologists; paperwork is compiled and completed. This method takes time, and leaves many companies in the food production supply chain in the dark for long periods, during which they either delay shipping their product, or risk a recall if contaminants are found. If a faster test were accessible to them, they could detect pathogens earlier and with greater efficiency.

Researchers at MIT intend to illuminate a path forward. Jongyoon Han and Timothy Lu, both professors in the Departments of Electrical Engineering and Computer Science and Biological Engineering, are applying microfluidics – a multidisciplinary research approach that looks at the behavior, control, and manipulation of fluids on a sub-millimeter scale – to find a solution. J-WAFS seed funding is fueling their development of a method for food contamination detection that, if successful, could improve the speed and efficiency of the food testing process and make it accessible to workers beyond the specialists who perform pathogen testing in lab settings.

The microfluidic process that Han and Lu are developing takes place in four steps. First, they separate the bacterial cells from the food sample. Second, they concentrate the bacterial cells together. Third, they “infect” these cells with bacteriophages (viruses that infect and replicate within a bacterium). Han and Lu have engineered these bacteriophages to target particular pathogens and produce a substance that luminesces. The team calls this infection process “phage loading.” After phage loading, they measure the light produced by the infected bacteria to determine the level of pathogen contamination in the food sample.

The team is currently exploring strategies for cell separation and bacterial concentration. Their approach involves using centrifugal force to separate cells in a variety of food samples; they’ve also tested a method involving selective cell binding to isolate and sort them. To create the bacterial concentration, Han and Lu’s team have created a microfluidic process that involves continuously transferring the sorted, negatively-charged bacterial cells into a specially-engineered microscale chamber. There, an electrical field pulls them toward a specific device outlet and they are concentrated in a chamber on the other side. Concentrating the bacteria is an important step; it helps bacteriophages to more easily find the target bacteria. As a result, the light produced is stronger and more easily measured.

Once they have achieved an optimal concentration of bacteria, the team applies the “phage loading” process to – literally – light the bacteria up. This process exploits an enzyme called luciferase that is expressed by the bacteriophage they have engineered. Luciferase produces biomolecules in cells, and these phages express a highly active form of it in living bacterial cells. So, once triggered by the phage-loading process, the cells light up. While this process can take some time, depending on the organism that is being tested, it still only ranges from tens of minutes to several hours. When the bacterial concentration is illuminated, the team uses a luminometer – a simple device used to test low light levels – to read the level of light given off by the samples.

Presently, Han and Lu have tested this process on three common liquid food samples: milk, meat drippings, and vegetable wash water. They chose these as the focus of their initial work because of the diverse challenges that they pose. For example, to accurately test vegetable wash for pathogens, you need a large volume of fluid for processing. The samples of meat and milk on the other hand have a significant number of background molecules and cells that need to be removed in order to concentrate the bacteria effectively for phage-loading. In all of these cases they have engineered bacteriophages to specifically recognize and target salmonella and listeria, though they plan on branching out to other pathogens later.
Ultimately, each food product will need a specific technology to facilitate processing. Han thinks of it this way: "processing technologies for ice cream may be different from that of vegetable wash. What we are trying to do is to develop a fundamental set of tools to enable future detection in a variety of media." The ultimate goal is to hone this technology so that it can be deployed to users across the food supply chain: producers, manufacturers, and retail outlets. A technology such as this will make the food testing process much faster and easier to implement, enabling earlier detection of contaminants in our food supply and better prevention of disease outbreaks.

Upcoming J-WAFS and Other MIT Events

J-WAFS Director John Lienhard to Present at EAT Foundation’s Stockholm Food Forum

John Lienhard, Abdul Latif Jameel Professor of Water and Food at MIT and director of J-WAFS is presenting at the EAT Foundation’s Stockholm Food Forum on June 12th. This convening gathers specialists from a wide range of disciplines to discuss progress on transforming the food system to solve the interconnected challenges of climate, sustainable development, and health. Interested viewers can view a live feed of the proceedings at the EAT Foundation’s website. To catch Prof. Lienhard’s talk, tune in at 12:50 PM CET (Central European Time) on Monday, June 12th. The Stockholm Food Forum runs through June 13th.

Hosted by: EAT Foundation
When: June 12 - 13th, 2017
Where: Stockholm, Sweden
More info and live feed access

MIT Beyond Food Bootcamp

Apply to the MIT Beyond Food Bootcamp, a 5-day event in Taiwan focused on innovation and entrepreneurship in food, sustainability, and health. Applicants will learn and practice innovation and entrepreneurship strategies and gain access to Taiwanese and MIT innovation ecosystems. The cost is US$6000 and the application deadline is July 1, 2017. Contact bootcamp@mit.edu with questions.

Hosted by: MIT Global Entrepreneurship Bootcamps
When: September 10 - 15th, 2017
Where: Taiwan
More info and registration

MIT Short Course on Innovation and Technology in Agriculture and the Environment

Register for an interdisciplinary, team-taught short course on innovation and technology in agriculture and the environment through MIT’s Professional Education program. This five-day course will meet from June 19 - 23rd, 2017 and is suited to people in professional management positions, government administrators (US or overseas), and people in academia. It will focus on three areas in agricultural innovation: 1) nano/micro/global aspects of environmental impacts; 2) the application of advanced technologies in agriculture, and 3) the use of data and modeling in the field. The course is directed by Markus Buehler, professor and department head of the MIT Department of Civil and Environmental Engineering, and involves 13 professors and instructors, among them J-WAFS-affiliated faculty Chandra Madramootoo, Dennis McLaughlin, Martin Polz, Ruben Juanes, and Michael Strano.

Hosted by: MIT Professional Education
When: June 19 - 23rd, 2017, 8:30 AM - 5 PM daily
Where: MIT; registration required
More info and registration

Boston-area Water and Food Events

NEWIN Water Pitch Night: Nitrogen and Coastal Water Quality

Join the New England Water Innovation Network (NEWIN) for an evening of talks focused on nitrogen and coastal water quality. This monthly event brings water innovators together to network and share ideas. Four New England water IT and sensor
technology innovators will pitch their solutions.

**When:** June 15th, 5:30 - 8 PM  
**Where:** Massachusetts Clean Energy Center, 63 Franklin Street, Boston  
[More info and registration](#)

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## Funding and Other Opportunities

### Water Data Challenge Research Grant Competition

The Government of Australia and other partners, including the World Bank, are launching the [Water Data Challenge](#). This research grant competition seeks breakthroughs in enabling low-income farmers to access timely water data to support resilience and improved water management. Applications are accepted on a rolling basis for planning grants of $10,000 USD, and winners will be announced in July 2017. First round winners will be eligible for early-stage awards up to $250,000 USD and ready-to-scale awards up to $1 million USD.

### Young Earth Solutions (YES) Research Grant Competition

The 2017 Barilla Center for Food & Nutrition's 2017 [YES! Young Earth Solutions] Research Grant Competition seeks groundbreaking research ideas that have a high impact potential for the sustainability of food systems. Emerging experts are encouraged to submit studies that are innovative, have a promise of significant impact, and can meet global research needs. Project submissions can be related to new or ongoing research. [Proposals must be submitted online through the BCFN website](#) by June 28, 2017, 11:59 pm CET. Winners receive a €20,000 research grant for a one-year investigation.