Abdul Latif Jameel World Water and Food Security Lab

Population growth, climate change, urbanization, and development pose unprecedented challenges to the world's diverse needs for water and food. The Abdul Latif Jameel World Water and Food Security Lab (J-WAFS) was established in the fall of 2014 as an Institute-wide effort to bring MIT's unique strengths to bear on these problems.

Background

An MIT faculty group organized by Associate Provost Philip Khoury began discussing MIT's water research portfolio in 2009–2010, as highlighted in the Summer 2010 issue of *MIT Spectrum* and at the May 2010 *Rethinking Water* workshop at MIT. This discussion continued within the framework of the Environmental Research Council during 2010–2011. In 2012, Professors John H. Lienhard V and Maria T. Zuber prepared a report to the provost on solutions-oriented environmental research at MIT that highlighted water and food as areas of significant interest and activity among MIT research groups. During late 2013, Professor Lienhard discussed these ideas with an MIT alumnus, Mr. Mohammed Abdul Latif Jameel '78. Mr. Jameel was inspired by the objective of bringing MIT research to bear on the world's critical challenges in water and food, and he gave a major endowment to create the Abdul Latif Jameel World Water and Food Security Lab, or JWAFS. The lab is named for Mr. Jameel's father. Concurrent with the gift to form the lab, Mr. Jameel also endowed the Abdul Latif Jameel Professorship in Water and Food.

The new lab, JWAFS, began operations on September 1, 2014. J-WAFS is an interdepartmental laboratory reporting to the vice president for research and committed to working broadly with the departments and schools of MIT. In typical MIT parlance, the word "lab" refers to a vehicle for cross-school research activities as opposed to a physical laboratory space.

Goals, Objectives, and Priorities

J-WAFS was created to coordinate and promote water and food research at MIT, emphasizing the deployment of effective technologies, programs, and policies that will have a measurable and international impact as humankind adapts to a rapidly expanding and evolving population on a changing planet.

In support of this mission, JWAFS spearheads the efforts of MIT's faculty, labs, and centers to work towards solutions for water and food security that are energy-efficient and environmentally benign. JWAFS provides grants and support to MIT researchers in order to promote the development and commercialization of the next generation of technologies that can be broadly applied to food safety, urban water supply, agriculture and irrigation, watershed protection, and water purification and reuse. JWAFS' goals also emphasize collaborating with domestic and international partners in order to address issues that arise in specific regional contexts. Finally, JWAFS supports graduate student-driven water and food research and business communities on campus through fellowships, conference sponsorship, and other mentoring and assistance.

As of the end of June 2015, JWAFS' priorities include furthering our research initiatives, fundraising and industry engagement, the development of regional partnerships, and continued student support. We will launch our 2015 seed grants on September 1, 2015, and then initiate the 2016 round of seed funding. Concurrently, we will coordinate with the Deshpande Center for Technological Innovation on the selection and launch of the 2015 JWAFS Solutions grants and initiation of the 2016 round of J-WAFS Solutions funding.

Fundraising for JWAFS will continue in collaboration with MIT Resource Development as part of the upcoming Capital Campaign. We will also work with the MIT Industrial Liaison Program (ILP) to develop and launch the JWAFS Consortium in the spring of 2016. A major conference on MIT water and food research, co-sponsored with ILP, will coincide with the formal launch of the Consortium.

Development of new funded international or regional partnerships will continue throughout AY2016. Regional engagement will support the collaboration of MIT faculty and students with local experts in order to address particular issues and problems in parts of the world facing serious water and food challenges.

JWAFS will also continue to support student engagement and campus activities around water and food, including the initiation and awarding of one or more graduate student fellowships.

Highlights and Accomplishments

Engagement, Visibility, and Fundraising

- J-WAFS secured a $4.85M grant to initiate J-WAFS Solutions, which over a five-year period will fund approximately 15 two-year projects to commercialize MIT water and food technologies.
- J-WAFS secured a $1M gift to endow an MIT graduate student fellowship in water research.
- J-WAFS Director John Lienhard presented at various high-profile conferences and presidential events, and engaged with numerous potential corporate and philanthropic sponsors, including at the EmTech Technology Review Conference in September 2014, the World Economic Forum in January 2015, ILP conferences in November 2014 and May 2015, and a roundtable hosted by the Center for Debate on Public Policy in Brazil in May 2015.
- J-WAFS developed its graphic identity and logos and launched its website.

Supporting MIT Research

- Through a competitive process initiated by a call for proposals, J-WAFS awarded $1.8 million in seed grants of $100,000 per year, overhead free, to nine two-year projects involving Principal Investigators (PIs) from 11 MIT departments and all five schools.

- J-WAFS issued a call for proposals for J-WAFS Solutions grants, focusing on commercialization of MIT water and food technologies.

Other Water- and Food-related Activities

- J-WAFS convened and sponsored an international, non-partisan Eastern Nile Working Group at MIT (November 13–14, 2014) to address technical and policy issues related to the construction of the Grand Ethiopian Renaissance Dam, and in February 2015 delivered a summary report with recommendations to high officials in Egypt, Ethiopia, and Sudan.
- J-WAFS sponsored the MIT Water Summit (December 11–12, 2014), organized by the student MIT Water Club.
- J-WAFS sponsored the MIT Sustainability Summit (April 24–25, 2015), organized by the student-run Sustainability@MIT club.
- J-WAFS Director John Lienhard served as a judge for the new Water Innovation Prize presented by the student MIT Water Club and the Headwaters Innovation Prize presented by the New England Water Innovation Network.
- JWAFS Executive Director Renee Robins served as a judge for the water and sanitation category of the MIT IDEAS Global Challenge presented by the MIT Public Service Center.

Research Support

J-WAFS is dedicated to working Institute-wide to improve the productivity, accessibility, and sustainability of the world's water and food systems. JWAFS coordinates the efforts of MIT's faculty, labs, and centers to work towards solutions for water and food security that are environmentally benign and energy-efficient. J-WAFS supports technology innovation and basic research activities by motivating, accelerating, and coordinating research in water and food being conducted at MIT, in particular by stimulating interdisciplinary research.

Research funded by J-WAFS draws on a number of disciplines that span all five schools at the Institute. We promote innovative and translational research projects that can effect meaningful, perhaps even measurable, changes on the world at large, as well as regionally appropriate solutions, whether for fast-growing megacities or for the rural developing world. During 2014–2015, JWAFS launched two new funding programs for MIT researchers.

J-WAFS Seed Grants

JWAFS uses a substantial part of its endowment return to fund research seed grants at MIT, supporting innovative new work that will improve water and food security. JWAFS' first round of seed funding was announced in January 2015 through a call for proposals sent to faculty and senior and principal researchers at MIT.

J-WAFS is particularly interested in catalyzing new partnerships across MIT departments. As part of the call for proposals process, a "research speed-dating" event was held in January 2015. Approximately two dozen MIT PIs gave short presentations on their research interests in water and food, introducing faculty across numerous different disciplines. At least one new multidisciplinary collaboration resulted from this event, and more may follow.

Thirty-four proposals were received in response to the call. The proposals were reviewed by MIT reviewers for technical merit, innovation, and the relevance and importance of the research to significant water and food issues, and final selections were made through a panel review. Strong preference was given to proposals with the potential to measurably affect the world outside academia.

Nine projects encompassing innovative research in food safety and science; water supply, purification, and testing; environmental science and engineering; and development were selected for two-year seed grants of $100,000 per year, overhead free. The successful proposals represented PIs from 11 MIT departments across all five schools. Grant recipients included both junior and senior MIT faculty members.

The funded projects, which will begin September 1, 2015, are:

Advancing Water and Food Sustainability through Improved Understanding of Uncertainties in Climate Change and Climate Variability
PIs: Susan Solomon, Department of Earth, Atmospheric, and Planetary Sciences and Department of Chemistry; and Kenneth Strzepek, MIT Joint Program on the Science and Policy of Global Change

A Bioassay-Based Approach to Food Safety in China
PIs: Anthony Sinskey, Department of Biology; Stacy Springs, Center for Biomedical Innovation; and Vishal Vaidya, Harvard Medical School

A Data-Driven Approach to Managing Food Security in Global Supply Chains
PIs: Retsef Levi, Tauhid Zaman, and Yanchnong Zheng, MIT Sloan School of Management

Electrochemically-Modulated Separation Processes for the Treatment of Contaminated Water Sources
PIs: Alan Hatton, Department of Chemical Engineering

Enabling Distributed Water Quality Management by Dry Sample Preservation and Centralized Analysis
PIs: Rohit Karnik and John Hart, Department of Mechanical Engineering; and Chintan Vaishnav, MIT Sloan School of Management

Engineered Nitrogen Fixation: Expression in Plant Organelles
PI: Christopher Voigt, Department of Biological Engineering

Leverage Points: Opportunities for Increasing Food Production in Developing Countries
PIs: Dennis McLaughlin, Department of Civil and Environmental Engineering; and Erica James, Department of Humanities - Anthropology

Quantifying Mercury Contamination of Rice and its Impact on Food Security in China
PIs: Noelle Selin, Institute for Data, Systems, and Society and Department of Earth, Atmospheric and Planetary Sciences; and Valerie Karplus, MIT Sloan School of Management

Strategies for Urban Stormwater Wetlands Los Angeles and Houston
PIs: Alan Berger, Department of Urban Studies and Planning, and Heidi Nepf, Department of Civil and Environmental Engineering

J-WAFS Solutions Grants

The J-WAFS Solutions program's mission is to move water and food technologies from labs at MIT into the commercial world, where they will improve the productivity, accessibility, and sustainability of the world's water and food systems. JWAFS Solutions aims to help MIT faculty and students commercialize breakthrough technologies and inventions by transforming promising ideas at MIT into innovative products and cutting-edge spinout companies.

The JWAFS Solutions program is funded through a research contract with Abdul Latif Jameel Community Initiatives and administered through a partnership with the MIT Deshpande Center for Technological Innovation. The program will award grants of $150,000 per year to approximately 15 projects over five years, starting in September 2015. The program is structured to allow additional sponsors to join the program.

Initial activity in the winter and spring of 2015 entailed finalizing the terms of the program with the sponsor and issuing the call for proposals. The program was launched in April 2015 with an official signing ceremony. Shortly thereafter, the J-WAFS and the Deshpande Center issued the call for proposals. As of June 30, 2015, three pre-proposals have been selected to move on to the full proposal round for review. Final award decisions will be made in July 2015.

Student Support, Events, and Conferences

Grand Ethiopian Renaissance Dam Workshop

The Grand Ethiopian Renaissance Dam (GERD)—now under construction across the Blue Nile River in Ethiopia—will be the largest hydroelectric dam in Africa, and one of the 12 largest in the world. But controversy has surrounded the project ever since it was announced in 2011—especially concerning its possible effects on Sudan and Egypt, downstream nations that rely heavily on the waters of the Nile for agriculture, industry, and drinking water. To help address the ongoing dispute, JWAFS convened a small, invitation-only workshop of international experts, held November 13–14, 2014. Participants addressed the technical issues involved in the construction and operation of the dam, in hopes of providing an independent and impartial evaluation to aid in decision-making.

The workshop, led by J-WAFS Director John Lienhard and Dr. Kenneth Strzepek '75, SM '77, PhD '80 from the MIT Joint Program on the Science and Policy of Global Change, brought together an invited, non-partisan panel representing expertise on hydrology, water resource management, climate variability, and economics. The aims of this workshop were to: (1) assess the possible and probable impacts of GERD on downstream water flows, both during reservoir filling and after; (2) recommend processes for filling the reservoir that will have minimal negative impact on downstream users; (3) make a regional assessment of the benefits of the dam to development; and (4) identify which of the surrounding concerns are not likely outcomes of the dam.

The broad conclusions of the expert panel were that the entire region stands to gain from improved management of hydrological variability, buffered exposure to the impacts of future climate change, the promise of access to abundant hydroelectric power once the requisite transmission infrastructure has been built, and the international stability that mutually beneficial cooperation and economic trade can bring— particularly as relates to food and other agricultural commodities. With a combined population of over 220 million people in the three countries, the opportunity provided by a sound management approach is significant. Five specific recommendations for action by the three concerned governments (Egypt, Sudan, and Ethiopia) are laid out in detail in the report of the workshop.

The report of the expert panel was shared with the governments of the affected countries in early February 2015. During March 2015, Professor Lienhard, accompanied by Dr. Strzepek and two non-MIT report authors, met personally with officials in Egypt; Dr. Strzepek went on to meet officials in Ethiopia. A news release in mid-April made the full report available to the public, along with formal comments from Egypt and Ethiopia.

2014 MIT Water Summit

The MIT Water Club is a student group and a leading network for water research and innovation at MIT. The Water Club was originally sponsored by the former Environmental Systems Initiative, and is now primarily sponsored by JWAFS. The Water Club organizes a major annual summit as well as the MIT Water Innovation Prize.

The MIT Water Summit gathers students and faculty from MIT and the greater Boston area along with leaders from the water industry, other industries that rely on water, the venture capital community, and government to explore current problems and potential solutions to challenges in water. The third annual Water Summit was held December 11–12, 2014, with panels focusing on Water and Our Food Security, Water and Our Cities, and Water and Our Industries. JWAFS was the major sponsor of the student-led event. Invited speakers came from diverse companies and other sectors, including PepsiCo, Poseidon Water, the World Bank, GE Water and Process Systems, Sandia National Lab, Monsanto, and Boston-area water start-ups and venture investment firms. Nearly 250 participants attended the event, including students and faculty, business leaders, technologists, and investors.

World Economic Forum, Davos

J-WAFS organized an *IdeasLab* for the January 2015 World Economic Forum in Davos, Switzerland. JWAFS Director John Lienhard, along with MIT Professors Karen Gleason (Chemical Engineering), Alan Berger (Architecture), and Collette Heald (Civil and Environmental Engineering) led a discussion about challenges around water and food security, including expansion of our water supply through recycling, the impact of climate change and ozone pollution on food productivity, holistic design of cities for improved sustainability, and advanced sensors for monitoring the safety of food. MIT President Rafael Reif hosted an associated dinner event, with a Q&A session addressing the four panelists facilitated by *New York Times* journalist and author Thomas Friedman.

2015 MIT Sustainability Summit

J-WAFS was the major sponsor of the 2015 Sustainability Summit. The summit is another high-profile student-led MIT initiative, organized by the Sustainability@MIT club, with advising by the Sustainability Initiative at the MIT Sloan School. Its objective is to connect MIT's students and alumni with executives, business managers, and experts across a variety of disciplines and geographies. The 7th annual summit, held in April 2015, addressed Food, Farming, and the Future, and also included the MIT Food and Agriculture Club.

The 2015 Summit's focus was on understanding—and offering solutions to—the complex problems facing local and global agriculture systems. The summit addressed food and farming challenges through the lens of the "Circular Economy," a systems-thinking approach that demonstrates that a flourishing, sustainable world is built on intentionally cycling resources between production and consumption: from farm to table and back again.

J-WAFS Director John Lienhard delivered the Summit's opening remarks on MIT's food and agriculture activities and moderated a panel on the application of big data to food supply chain and food safety challenges.

Finances and Funding

Primary funding for J-WAFS comes from its core endowment, which supports J-WAFS personnel, the J-WAFS seed grants, and some activities by student professional groups at MIT, such as the MIT Water Club.

In the spring of 2015, J-WAFS signed a $4.85M sponsored research agreement with Abdul Latif Jameel Community Initiatives to create the JWAFS Solutions program previously described.

Also in the spring of 2015, JWAFS secured a $1M pledge to endow a graduate fellowship. The named Fellowship Fund for Water Solutions will be formally announced in AY16. It will support an MIT graduate student pursuing research in the broad area of water supply.

J-WAFS has also received gifts from several other donors. Fund-raising for international partnerships, the JWAFS Industrial Consortium, graduate fellowships, and other programs is ongoing.

Personnel Information

J-WAFS personnel are as follows:

Professor John H. Lienhard V, from the Department of Mechanical Engineering, was appointed as the founding director of J-WAFS and as the Abdul Latif Jameel Professor of Water and Food, effective July 1, 2014. In this role, his appointment moved to the Office of the Vice President for Research.

Renee J. Robins '83 was appointed executive director for JWAFS in December 2014. She returned to MIT from a position at Harvard University, having previously worked for several programs at MIT from 1998 to 2011.

Brian Pierson was appointed as the administrative and fiscal officer for J-WAFS in November 2014. Previously, Brian worked at MIT for four years, serving as a staff accountant in MIT's central accounting department and as a fiscal officer within the Department of Mechanical Engineering.

Administrative Initiatives

MIT has provided J-WAFS with office space in Kendall Square (One Broadway, MIT E70, 12th floor), in an area shared with other MIT international programs and initiatives. This new location includes offices and a dedicated conference room, and it is expected to serve as JWAFS' offices through at least mid-2017.

Various communication efforts were competed this fiscal year. JWAFS' logo design and related document templates were completed early in 2015. The J-WAFS website was launched in June of 2015, timed to go live with the publication of the summer issue of *MIT Spectrum*, which focused on water and food research at MIT.

As described in the Research section above, JWAFS has partnered with the MIT Deshpande Center for Technological Innovation in order to implement the JWAFS Solutions program. Funding for the program flows through JWAFS to PIs, with an allocation for administrative costs going to the Deshpande Center, which implements the call for proposals and review process, and which manages the engagement of mentors and business advisors.

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Abdul Latif Jameel Professor of Water and Food

Renee J. Robins
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