J-WAFS at MIT creates two technologies that extract drinking water and crop fertilizer from air using the sun

Jeddah, Saudi Arabia – May 31, 2017
New research into harvesting water from air and technology that enhances crop production are among several projects being supported by the Abdul Latif Jameel World Water and Food Security Lab (J-WAFS) at the Massachusetts Institute of Technology (MIT).

Co-founded in 2014 by Community Jameel and MIT, J-WAFS is an initiative to coordinate and promote research related to water and food safety and security that will have a positive impact on communities in a rapidly changing world with expanding population.

Seven new projects are being supported by J-WAFS this year, and two notable initiatives include:

- **Harvesting water from air:** Developing technology that can be used to extract clean, fresh water from the air at any range of humidity using a specialized porous material.
- **Enhancing crop production:** Creating a solar-powered device to convert atmospheric nitrogen, water, and sunlight into ammonia, which can be added to soil to promote plant growth.

Fady Mohammed Jameel, President of Community Jameel International, said: “Community Jameel firmly believes that MIT-led research can deliver real solutions to help communities transform themselves. With Community Jameel’s partnership, MIT is providing an opportunity to tackle some of the most pressing issues related to food and water safety and security in the Middle East and around the world.”

John Lienhard, the Abdul Latif Jameel Professor of Water and Food at MIT, said: “We must continue to advance innovations and creative ideas for delivering safe and secure food and clean and renewable water supplies. Through the innovative technologies and collaborations we are supporting with these new research projects, J-WAFS is working to secure the future of our communities, the sustainability of our cities, and the prosperity of our economies in the face of rising population, greater urbanization, and changing climate.”

In the Middle East and North Africa (MENA) – the world’s driest region - more than half of the region’s population live under conditions of ‘water stress’, where demand outstrips supply, according to the World Bank.

Since 2015, J-WAFS has supported a number of research projects to improve food and water safety and security. In one previous project, environmental modeling is used to understand mercury contamination in rice, which is an emerging pathway to mercury exposure for people living in areas contaminated by coal-fired electricity and other industrial activities. Another project resulted in designs for constructed wetlands that can reduce stormwater runoff and improve the ecological function of water systems in urban centers.

For more information about Community Jameel and J-WAFS visit www.cjameel.org and jwafs.mit.edu

J-WAFS Abdul Latif Jameel World Water and Food Security Lab

Community Jameel

Notes to Editors

J-WAFs research can be found here: jwafs.mit.edu/research/projects/current#seedgrant

Several of the projects that received support this include:

Enhancing crop production with an eye toward sustainability
Enhancing crop production while supporting environmentally sustainable farming practices in developing countries was a theme of several funded projects this year. Two projects are addressing challenges around nitrogen fertilizer. Nitrogen is required for agricultural productivity, and most nitrogen fertilizer is manufactured using fossil fuels, which has a large carbon footprint. In Africa and other parts of the world, nitrogen fertilizer is not accessible to most farmers due to poor infrastructure for distribution, limiting the crop yields they can achieve. However, in North America and elsewhere, excess fertilizer runoff from farms contributes to water pollution. Karthish Manthiram, Warren K. Lewis Career Development Professor in the Department of Chemical Engineering, will develop a solar-powered electrochemical device that can convert nitrogen from air, water, and sunlight into ammonia to be added to soil to promote plant growth. Christopher Voigt, professor of biological engineering, is pursuing an entirely different path, with the objective of engineering cereal grains that can "fix" atmospheric nitrogen the way that legumes do. Once realized, these grains could become self-fertilizing high-yield producers in varied regions across the globe and dramatically reduce the damage to soil health, water supply, and local ecosystems often associated with the use of chemical fertilizer.

Enhancing methods for culturing microalgae for food and fuel
Another funded project could significantly contribute to our ability to expand a promising future source of protein and oil, and reduce the energy use associated with its production. Mathias Kolle, assistant professor of mechanical engineering, aims to create a new class of multifunctional micro- and nanostructural optical fibers that can more efficiently and effectively transport light and carbon dioxide throughout industrial microalgae cultures. Microalgae are effective generators of protein-rich biomass that could, if produced on an industrial scale, supplement human nutrition, provide animal feedstock, and serve as biofuel. However current production methods aren't economically viable for this scale. Kolle's microfibers could transform large-scale industrial microalgae production, making microalgae-produced protein and fuel an economically viable, sustainable, and energy efficient option in the future.

Harvesting water from air
Securing clean drinking water in environments that are water-scarce or polluted is a challenge in many regions of the world. Additionally, agriculture and industrial uses deplete – and contaminate – global supply of freshwater which increases the demand for alternative means of water gathering. Mircea Dinca, associate professor of chemistry, and Evelyn Wang, Gail E. Kendall Associate Professor in the Department of Mechanical Engineering, are teaming up to develop a new technology that can be used to harvest water in even the most arid regions of the globe. They will create a passive solar device that can extract clean, fresh water from the air at any range of humidity, using a metal-organic framework (MOF), a specialized porous material. J-WAFS seed funding will support the development of MOFs that can be used for providing water to remote areas, with greatly reduced infrastructure costs.

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Community Jameel

About Community Jameel

Community Jameel is a social enterprise organization that operates a wide range of initiatives to promote a positive society and economic sustainability. From individual, community and Arab life as a whole, in Saudi Arabia and beyond, Community Jameel promotes Arab arts and culture in the Middle East and around the world, works against unemployment, enables research for poverty alleviation and food and water security, and provides education and training opportunities. Community Jameel was formally established in 2003 to continue the Jameel family's tradition of supporting the community, a tradition started in the 1930s by the late Abdul Latif Jameel, founder of the Abdul Latif Jameel business, who throughout his life helped tens of thousands of disadvantaged people improve their lives across a variety of fields, including healthcare and education.