# Electrochemical paper to detect lethal pathogens

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A research project gaining momentum at the University of Alberta has the potential to change the world's view on how harmful bacteria in food and water are detected.

Frédérique Deiss, a postdoctoral fellow specializing in electrochemistry, is currently in the early stages of developing a project which aims to create low-cost, portable electrochemical paper-based devices to detect deadly pathogens such as E. coli in milk.

Deiss was awarded a $112,000 grant from Grand Challenges Canada – Rising Stars in Global Health, and is working towards having a functional prototype that can be tested by local farmers and the scientific community around Nairobi, Kenya in about a year's time.

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> FRÉDÉRIQUE DEISS
> POSTDOCTORAL FELLOW, UNIVERSITY OF ALBERTA

"We are developing the very first prototype with non-pathogenic bacteria of E. coli because that is what we have and use in our lab," she said. "The local farmers and our collaborator in Kenya — the International Livestock Research Institute — are very interested in the detection of bacteria in milk."

This inexpensively produced, portable device aims to simplify a lengthy testing process where samples from dairy farms have to be collected and transported to labs for testing, a process that could be challenging in areas with limited infrastructure and lab capacities, Deiss said.

**PAPER PROTOTYPE** Paper-based devices could help detect E. coli in water or food. RICHARD CATANGAY-LIEW

The device would also continuously monitor bacteria development in areas that have an established infrastructure, as well as give an all-in-one bacteria testing and measurement tool to those in more rural areas.

Two Harry Ainlay High School students are assisting Deiss in making the devices, and the team plans to make a product that can be created globally using easily accessible materials.

"I do not want to create a system where we make them in North America and then ship them somewhere else to be used," Deiss said, "This would make a lot of problems with transport and how to store them."

The disposal of bio-waste is another interesting element, Deiss said, as she noted the devices could be burned after a month's use or after bacterial contamination.

Deiss said the simplicity of the project is what made her one of 61 grant recipients out of around 750 applications to Grant Challenges Canada, which is funded by the Government of Canada. She also noted the straightforwardness of the model made her think it was "too simple to work" when she first started developing it.

Her idea to make the electrochemical device, which can be constructed with regular packaging tape and specialized paper, resulted from the combination of knowledge gained from her PhD program in France, her first postdoctoral appointment in Harvard University and her current experience at the U of A.

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"The idea was to put together what I knew about electrochemistry on paper, which I learned in Harvard, and combine it with the culturing of bacteria in paper that I learned here at the U of A," she said.

"It is always easier to build on what you already know in order to move faster."

In the midst of developing the prototype, Deiss is already setting ground for the next stage of her project as she searches for additional funding to carry the project forth past this initial phase.

Deiss said the interest in the project has given her an exponential boost in confidence as a young researcher, which is something she hopes encourages others.

"I would advise young researchers to be bold, push further and don't hesitate."

# Prof secures highest recognition for an engineering educator

**Shandi Shiach**
OPINION EDITOR • SHANDILLIAHOSEN

A University of Alberta visionary has won the Medal for Distinction in Engineering Education from Engineers Canada.

Acting Associate Dean, Suzanne Kresta, a professor of chemical engineering and editor of the *Handbook of Industrial Mixing*: Science and Practice, is an agitator — a play on her specialization as a "mixer," coined by an industrial chemical plant manager. She's also a self-dubbed renegade educator, having tussled with administration as an undergraduate at the University of New Brunswick, earning herself a teaching gig there before her first degree.

"She takes a transformative approach to teaching her courses, focusing on the students and their needs," Darrell Fisher, chairperson of the Engineers Canada Awards Committee, said by email.

The committee noted that many students listed Kresta's courses among the top five most important of their program.

"Dr. Kresta's goal is to transform her students from guided learners to self-directed teams of life-long learners and practicing professional engineers," Fisher said. "She is actively involved in women in engineering groups and activities."

The 2011 census found that women were less likely than men to choose programs in engineering, regardless of their high school math ability. Universities in Alberta and Canada have grown their engineering programs in the past decade to try and meet demand for qualified professionals in engineering-related fields. Kresta is particularly passionate about improving classroom outcomes for her colleagues as well as learners, innovating the act of teaching itself.

"It's fun to help people win," she said.

Kresta envisions a future where educators will be matched to courses and students in informed ways that create the most beneficial links between material and people. For example, some excel in one-on-one or small group mentorship situations, or curriculum lecturing, or engaging and inspiring discussion, and so on.

Kresta has adopted and distributed data collection methods that help teachers see gaps, learn what their strengths are and leverage learning styles of their students. She's encouraged professors and professional instructors to work backward, identifying learning goals, creating evaluation blueprints, teaching then testing if it's working, and solving problems.

"Engineering is just about the coolest thing you can possibly do with your life," Kresta said. She has two daughters who are also in engineering.

Teaching came as a natural extension to her as an engineering academic. Kresta comes from a family of people who have found ways of sharing their expertise in life and their professional spheres, including an aunt who wrote a better form of braille when she found it lacking for learning-disabled blind students.

Engineering, in particular, helps people in every facet of society, said Kresta. Engineers save lives by providing clean drinking water, design and test roller coasters and games, make clean energy possible through innovations in electricity and many other areas.

**PRIZED PROFESSOR** Suzanne Kresta has earned the highest distinction in the country as an engineering educator. SUPPLIED

"And that's what a lot of our students are like," she said. "(It's like) 'A problem? I get to solve a problem? Yay!'"

Philip Mulder of the Association of Professional Engineers and Geoscientists of Alberta (APEGA) said by email that his organization is "particularly pleased that Dr. Kresta has received further well-deserved recognition — this time at the national level by Engineers Canada."

Kresta has been honoured in many ways throughout and before her 22 years at the University of Alberta, including a national award for research at a relatively young age, and with a 2013 Excellence in Education Award from APEGA.

"Dr. Kresta is known to fellow members of APEGA," said Mulder, "as a passionate and caring educator who inspires undergraduate engineering students to excel."