More efficient, sensitive estrogen detection developed

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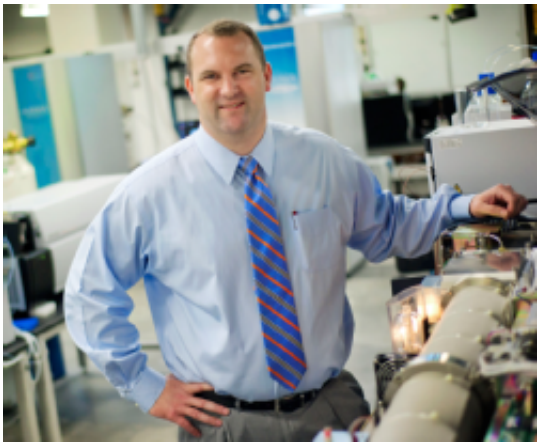

Kevin Schug, Shimadzu Distinguished Professor of Analytical Chemistry at UT Arlington. Credit: UT Arlington

Scientists at the Shimadzu Institute for Research Technologies and the Department of Chemistry and Biochemistry at The University of Texas at Arlington have collaborated to develop a new method for detecting trace amounts of estrogen in small samples that holds the potential to improve research into cancer and other diseases.

The hormone estrogen plays an important role in the human body and has been linked to everything from tumor growth to neuron loss during Alzheimer's disease. But detecting very small amounts of it in blood and other biological fluids can be difficult for health researchers, especially in the limited amounts available in laboratory experiments.

In response, a UT Arlington research team applied advanced mass spectrometry and chromatography instrumentation available at the Shimadzu Institute to develop a sensitive and efficient method for detecting trace amounts at less than 10 parts per trillion in a 100 microliter sample, said Kevin Schug, Shimadzu Distinguished Professor of Analytical Chemistry at UT Arlington. One part per trillion is the equivalent of a drop of water in 20 Olympic-size swimming pools.

"This new method pushes the detection limit for estrogens to a level that is applicable to research, human health, medicine, and environmental analysis. It is being instituted as a routine service for research means that all researchers now have the capability to more closely relate research model findings to human health and physiology," said Jose Barrera, director of the Shimadzu Institute and a co-author on the new paper published by the journal *Analytica Chimica Acta*. "This project represents the collaborative capability that the Shimadzu Institute possesses in helping augment groundbreaking research here at UT Arlington."

Jana Beinhauer, a visiting scientist from Palacký University in the Czech Republic who spent nine months working at UT Arlington, and Liangqiao Bian, of the Shimadzu Center for Advanced Analytical Chemistry, are lead authors on the new paper. In addition to Barrera and Schug, other co-authors are: Hui Fan, a recent Ph.D. graduate from the UT Arlington Department of Chemistry and Biochemistry; Marek Šebela, of Palacký University; and Maciej Kukula, of the Shimadzu Center for Advanced Analytical Chemistry.

Mass spectrometry and chromatography are ways to separate, identify, and quantify molecules in a complex mixture. The process involving liquid chromatography-electrospray ionization-tandem mass spectrometry relies on a vital step called "charge derivatization" or using a permanently charged reagent to selectively trap the estrogens and

isolate them from the lipids and proteins that could interfere with estrogen detection, Schug said.

"We are dealing with extremely small quantities and there are a lot of things out there that look like estrogen," he said. "You have to have this ability to separate out these individual components and detect them accurately."

Many current estrogen detection methods rely on the use of an antibody, a type of protein detection system. Those processes and others now being used by researchers are more time consuming, less reliable and require a larger sample than the 100 microliters used in the UT Arlington experiments, Schug said. The new UT Arlington method can be accomplished in less than 25 minutes, including sample preparation, he said.

"Estrogens perform important biological functions not only in sexual development and reproduction, but also in modulating many other processes impacting health and diseases in human and animals," Beinhauer said. "The metabolically active estrogens exert strong biological activities at very low circulating concentrations. Therefore this research is very important for finding sensitive, efficient, fast, automated and simple method how to determine the trace estrogens in serum."

More information: The new paper is titled "Bulk derivatization and cation exchange restricted access media-based trap-and-elute liquid chromatography-mass spectrometry method for determination of trace estrogens in serum." It is available here: www.sciencedirect.com/science/… ii/S0003267014013907