DEPARTMENT OF
EPIDEMIOLOGY
GEISEL SCHOOL OF MEDICINE
AT DARTMOUTH

Center for
Molecular
Epidemiology
at Dartmouth

February 4, 2015

Dr. Maria Jamela Revilleza
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Re: NIGMS Science Advance New Publication / Scientific News; Center for Molecular Epidemiology (P20GM104416)

Dear Dr. Revilleza,

We are writing to inform you that the research reported in the following publications was supported in part by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM104416 (PI, Margaret Karagas):

> Jackson BP, Punshon T. Recent Advances in the Measurement of Arsenic, Cadmium, and Mercury in Rice and Other Foods. Current Environmental Health Reports. 2015 Jan [Online]

Project Title: Center for Molecular Epidemiology at Dartmouth, Project 4: "Assessing Maternal-Fetal Exposure Pathways Using Bio-Imaging" (Project Leader: Dr. Tracy Punshon)

Institution and State: Dartmouth College, New Hampshire

PI Name: Dr. Margaret R. Karagas (Center PI/Director)

Background:
Trace element analysis of foods is of increasing importance because of raised consumer awareness and the need to evaluate and establish regulatory guidelines for toxic trace metals and metalloids. This paper reviews recent advances in the analysis of trace elements in food, including challenges, state-of-the-art methods, and use of spatially resolved techniques for localizing the distribution of arsenic and mercury within rice grains. Total elemental analysis of foods is relatively well-established, but the push for ever lower detection limits requires that methods be robust from potential matrix interferences, which can be particularly severe for food. Inductively coupled plasma mass spectrometry (ICP-MS) is the method of choice, allowing for multi-element and highly sensitive analyses. For arsenic, speciation analysis is necessary because the inorganic forms are more likely to be subject to regulatory limits. Chromatographic techniques coupled to ICP-MS are most often used for arsenic speciation, and a range of methods now exist for a variety of different arsenic species in different food matrices. Speciation and spatial analysis of foods, especially rice, can also be achieved with synchrotron techniques. Sensitive analytical techniques and methodological advances provide robust methods for the assessment of several metals in animal- and plant-based foods, particularly for arsenic, cadmium, and mercury in rice and arsenic speciation in foodstuffs.

Advance:
This paper is a review of the recent developments in techniques used for the accurate determination of potentially toxic trace element analysis of foods, with particular attention to arsenic. The paper

summarizes important examples of arsenic speciation in a variety of foods, and discusses common interferences and artifacts that affect quantitative data obtained from the complex and variable matrix of food. The article serves as a guide for those seeking to better understand the information these techniques provide.

How NIGMS Grant Enabled Advance: Funds from the NIGMS Grant partially funded the study co-author Dr. Tracy Punshon.

Public Health Impact Statement:
In response to raised consumer awareness and possible future regulatory guidelines for arsenic concentrations in food, this article reviews relevant aspects of quantitative metal analysis techniques commonly used to measure the concentration and species of arsenic in food, ranging from sample preparation and volume averaged analysis examples of arsenic analysis of foods, which is currently the most sensitive and accurate technique for determining the concentration of arsenic in foods, to spatially resolved methods which show metal distribution.

NIH Director's theme(s) relevance*:
This paper advances the understanding with the latest information on accurate measurement of arsenic in foods, which is relevant for assessing dietary exposure.

Grant Support:
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Publication Citation and Link (if applicable):
http://link.springer.com/article/10.1007%2Fs40572-014-0035-7

Key Words:
Arsenic, Cadmium, Mercury, Food, Speciation, Analytical methods

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Please let me know if you would like any additional information.

Sincerely,

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Cc: Dr. Yanping Liu (liuyanp@mail.nih.gov)