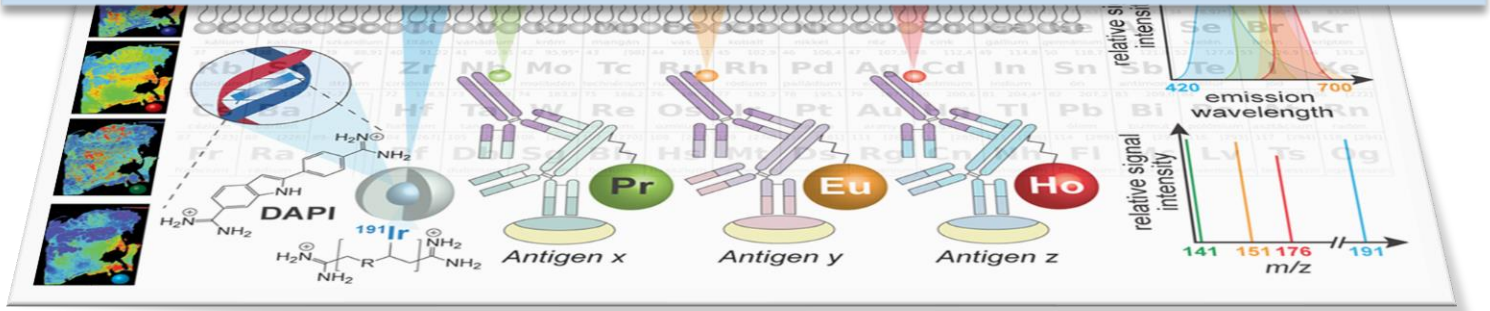
NSW CLINICAL MASS SPEC FORUM



Clinical and Forensic applications of ICP-MS

Date: 28 April 2022

Location:
Virtual event on Microsoft Teams *Massspec Forum Channel*

Meeting Chair:
Dr Paul Bonnitcha
Chemical Pathology at NSWHP and St Vincent's Hospital, Sydney

12:00-12:10 pm
Welcome

12:10-12:50 pm
Dr Jonathan Wanagat and Dr David Bishop: *Quantitative imaging of protein expression using immuno-mass spectrometry imaging*

12:50-1:20
Dr Ross Wenzel: *ICP-MS – Clinical Applications*

1:20-1:50
Miss Stephanie Burmuzoska: *Is the Arsenic in my Drinking Water Bad for Me?*

1:50-2:00
Interactive quiz.

|12:10-12:50pm| Quantitative imaging of protein expression using immuno-mass spectrometry imaging

Dr. Jonathan Wanagat is a UCLA physician-scientist who is board-certified in internal and geriatric medicine. He provides care for older veterans at the VA Greater Los Angeles Healthcare System and focuses his research on the causes of aging and treatments to slow or reverse aging. Dr. Wanagat earned his medical and doctorate degrees from the University of Wisconsin, where he also completed his medical residency. He then completed a fellowship in geriatric medicine at the University of Washington. He has received numerous prestigious awards, including the Paul B. Beeson Career Development Award in Aging from the American Federation for Aging Research and the National Institute on Aging, and the Paul F. Glenn Award from the American Aging Association

Dr David P. Bishop is a Senior Lecturer in Analytical Chemistry at the University of Technology Sydney, where his research focuses on the application of state-of-the-art technology to analytical challenges in a diverse range of disciplines with a particular emphasis on biological and environmental sciences. He recently completed an Australian Research Council's Discovery Early Career Researcher Award, where his Fellowship examined the translational utility of immunohistochemistry and chemical imaging in cell biology. He is a former Fullbright Scholar, spending part of 2016 at the University of California, Los Angeles (UCLA) Center for Duchenne Muscular Dystrophy (CDMD), developing new methods for visualizing disease biochemistry.

Abstract

Immuno-mass spectrometry imaging is an emerging technique for in situ protein quantification and localisation that is based on the combination of laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) in combination with metal-conjugated antibodies. High levels of quantitative multiplexed imaging of up to 40 targets in formalin--fixed, paraffin-embedded or frozen tissue sections is possible using standard immune-labeling protocols. The resulting multidimensional images provide single-cell resolution and quantification simultaneously across all targets and may include cell segmentation.

We deployed immuno-mass spectrometry imaging for the quantification and localisation

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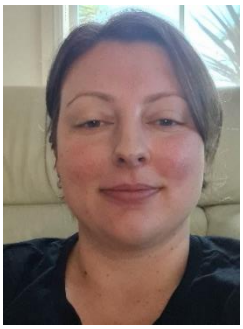
(cont'd) of dystrophin in muscle biopsies from healthy humans and patients with Duchenne muscular dystrophy. Duchenne muscular dystrophy (DMD) is a terminal childhood illness characterised by the absence dystrophin, a protein that confers stability during muscle contraction. An anti-dystrophin antibody was conjugated with isotopically-enriched gadolinium before histological application to frozen sections of human or mouse skeletal muscle. The sections were then imaged in two and three dimensions concurrently with matrix-matched standards using standard LA-ICP-MS imaging protocols. The method was validated to comply with the US FDA requirements.
Immuno-mass spectrometry imaging has a number of other promising applications in the clinical domains of oncology, cardiovascular disease and infectious disease, which we will briefly highlight, and provide future perspectives

|12:50 – 1:20pm |ICP-MS – Clinical Applications

Dr Ross Wenzel is employed as the senior scientist in charge of the trace elements laboratory at Royal North Shore Hospital in Sydney. He has more than 25 years of experience in trace element analysis and completed his masters by thesis in 2001 on arsenic speciation in urine by solvent extraction / graphite furnace atomic absorption spectrometry and capillary electrophoresis / ICP-MS. He recently completed his PhD thesis at UTS investigating cobalt regulation in race horses.

Abstract Inductively coupled plasma – mass spectrometry (ICP-MS) is a powerful analytical technique that can be used to determine trace element concentrations in clinical samples. It is capable of simultaneously measuring numerous elements in a range of sample matrices to detect instances of element deficiency or excess. Trace elements are defined as those elements present in human tissue at concentrations of µg/kg or less. Elements for which a specific deficiency syndrome exists are known as the essential trace elements and include iron, iodine, zinc, copper, selenium and manganese. Toxic trace elements typically include lead, mercury, arsenic, cadmium and manganese though several other elements can be considered toxic when present in sufficient quantities. I will describe the application of ICP-MS in the measurement of trace elements in clinical samples giving emphasis on how technological advances have improved the way we operate. Cases will be presented that highlight the advantages of this technique.

|1:20-1:50pm|"Is the Arsenic in my Drinking Water Bad for Me?"



Miss Stephanie Burmuzoska is a Senior Scientist in the Trace Inorganics Laboratory (TIL) at Forensic & Analytical Science Service. She received a BSc in Forensic Science, First Class Honours from University of Technology, Sydney (UTS) and has a strong interest in method development and validation in forensic and inorganic chemistry. Her team supports the NSW Ministry of Health Water Unit to provide safe drinking water to communities through the analysis of drinking water across NSW.

Abstract

The presence of arsenic in drinking water is a global concern. Arsenic levels in water supplies are commonly higher near mining and coal-fired power plant operations. Arsenic species in water can be present in one of two forms: organic which is generally considered to be non-toxic; and inorganic which is of significant concern and can be toxic.
During the recent NSW drought, our laboratory worked closely with public health units (PHUs) to determine arsenic levels in various water supplies and thus establish if levels were within the safe Australian Drinking Water Guideline levels. Initially, the established laboratory arsenic method did not have the ability to differentiate between organic and inorganic arsenic. Due to the community need, the laboratory developed and validated a method, now accredited, which combines Liquid Chromatograph (LC) with Inductively Coupled Plasma – Mass Spectrometry that allows the differentiation and quantitation of organic and inorganic arsenic species. This method and the service that the laboratory provides enables PHUs to ascertain if the presence of arsenic in a drinking water supply could have detrimental health impacts on the surrounding communities.