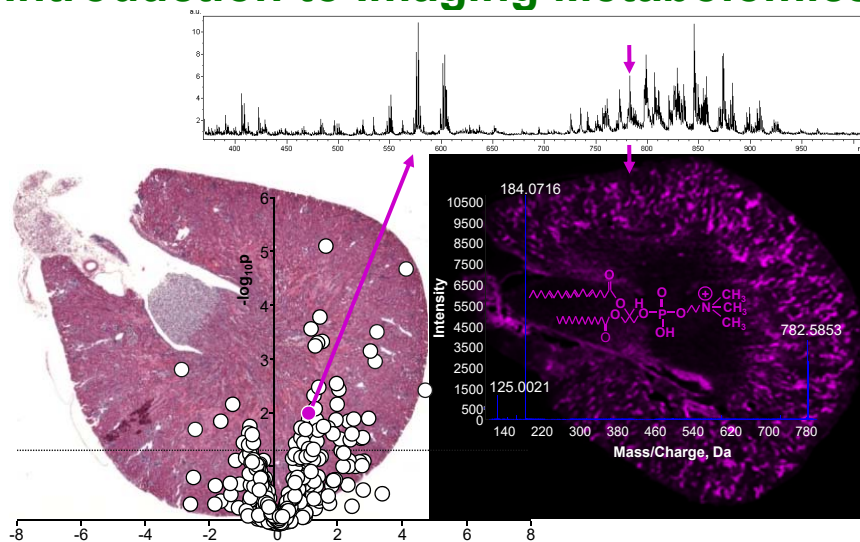


Introduction to Imaging Metabolomics.



7-20-2017

Janusz Kabarowski, Dept. Microbiology, UAB.

Matrix-Assisted Laser Desorption/Ionization (MALDI):

Matrix molecules absorb laser light, enter an excited state, and collide with sample molecules, facilitating charge transfer to create ions.

Conventional MALDI plate

autoflex speed
MALDI-TOF instrument

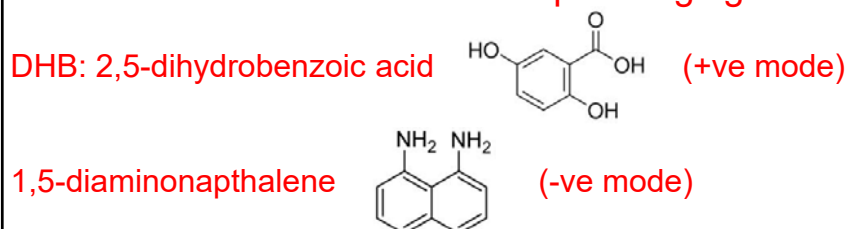
Laser Beam
Analyte Ion
Matrix Ion
Analyte/Matrix Mixture
To Mass Analyzer

Mass Spectrometric Imaging for biomedical tissue analysis
Kamila Chughtai and Ron M.A. Heeren
Chem Rev. Vol.110(5): pp3237–3277, 2010.

Vacuum sublimation is used to apply an even microscopically thin uniform layer of matrix compound onto tissue section without the need for solvents.

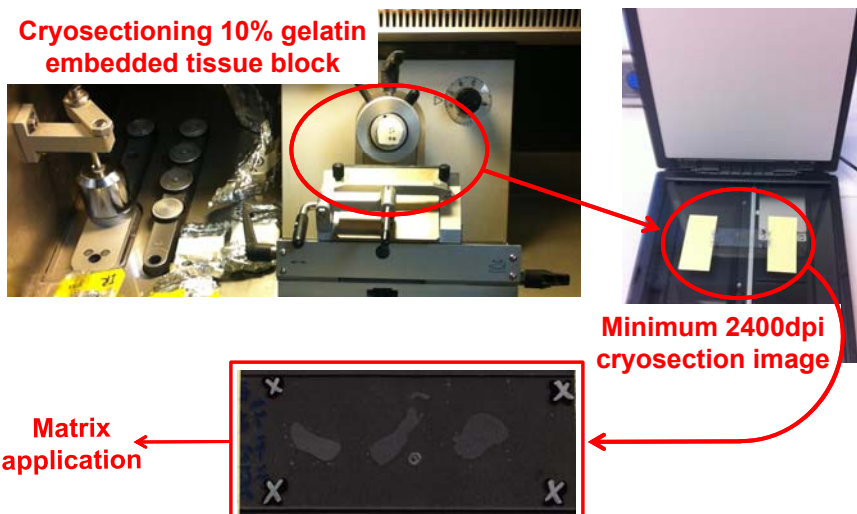
Sublimation: *the transition of a substance from solid to gas phase without an intermediate liquid phase.*

MALDI matrices for lipid imaging:

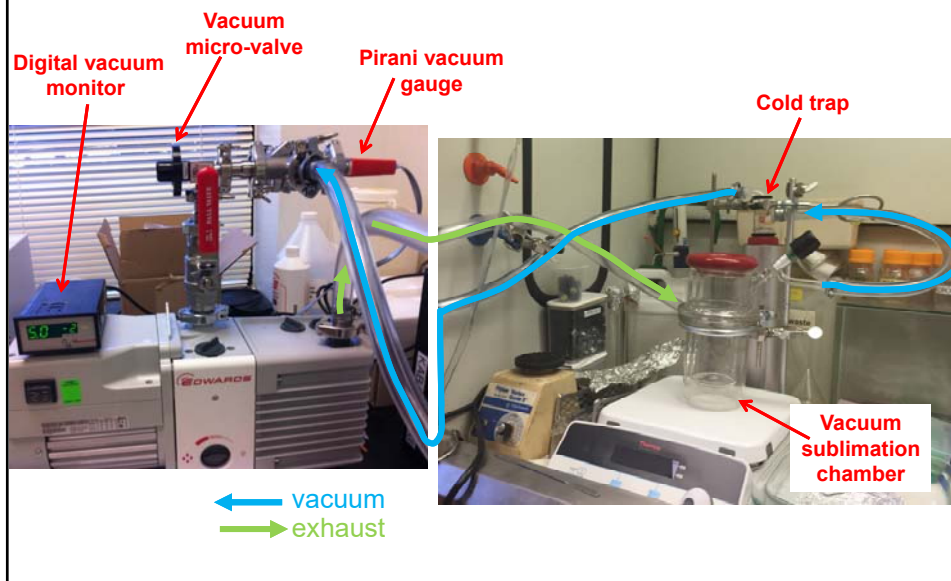


Cryosectioning onto Indium Tin Oxide (ITO) coated glass slides and scanning digital image of slide for “teaching” FlexControl software on MALDI-TOF.

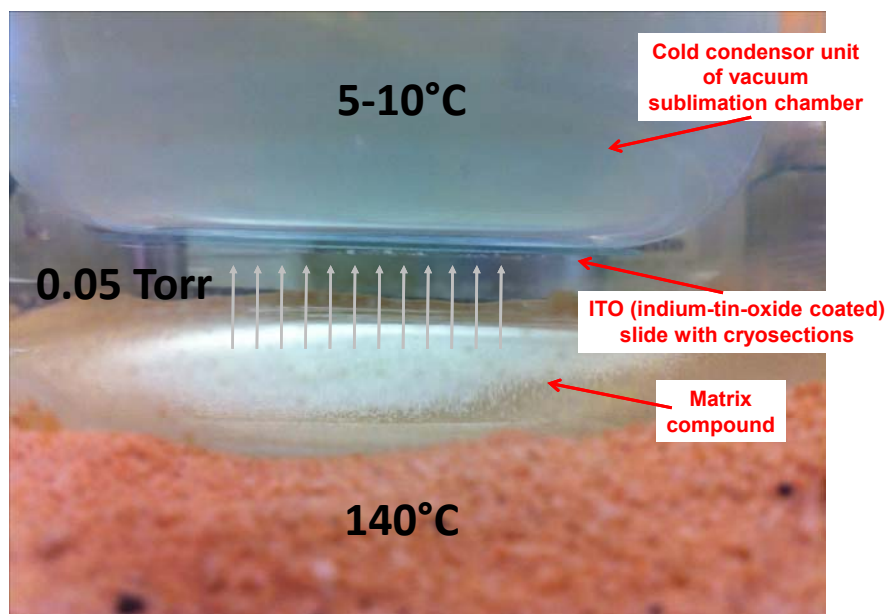
Cryosectioning 10% gelatin embedded tissue block



Vacuum sublimation apparatus for matrix application in MALDI Imaging.



Matrix deposition by vacuum sublimation.



Slides with matrix applied by vacuum sublimation.

Deposition of the matrix compound is at the molecular level because gaseous molecules recrystallize at the relatively cold surface of the tissue section attached to the cold condenser.

The uniformity of matrix deposition onto the slide attached to the cold condenser surface reflects the random Brownian motion of the released gaseous matrix molecules.



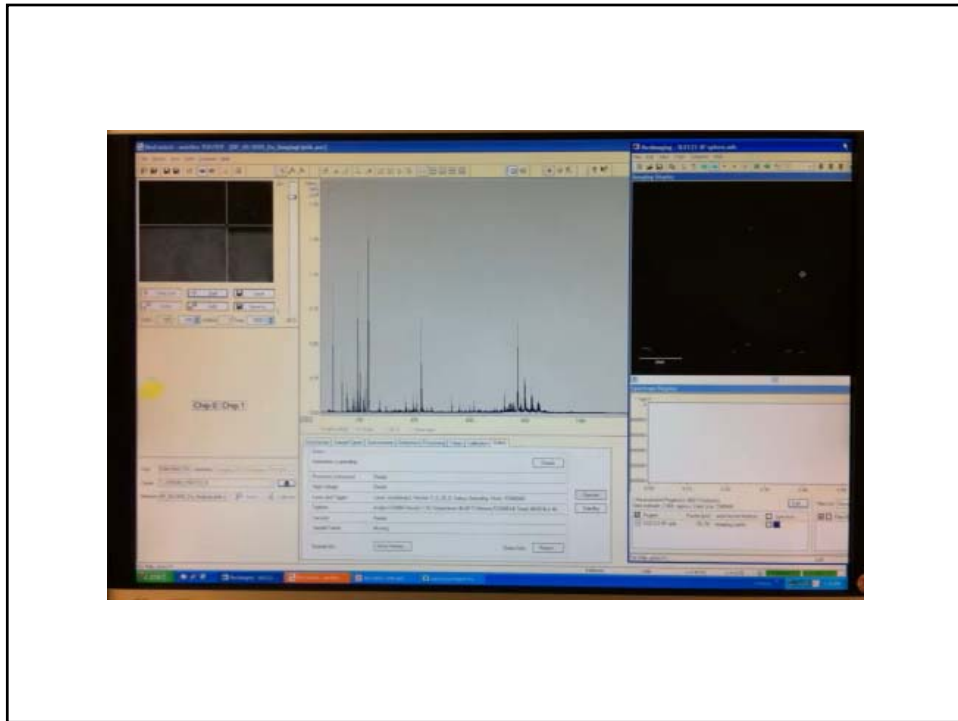
Adapted MALDI plate holds slides for MALDI-IMS.

Conventional MALDI plate

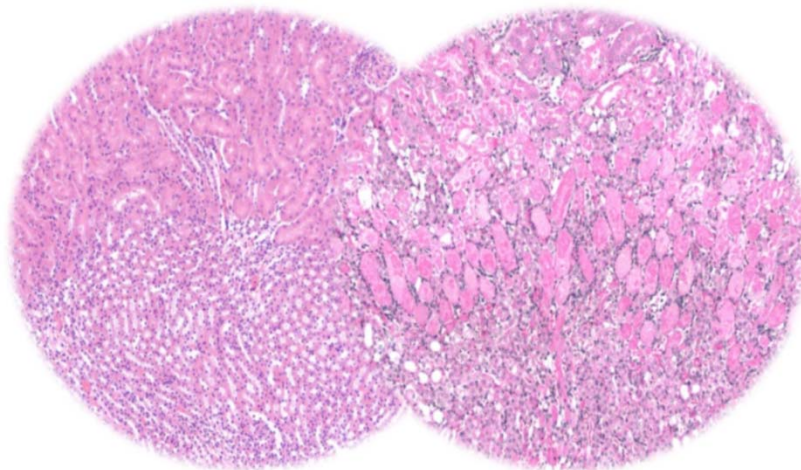


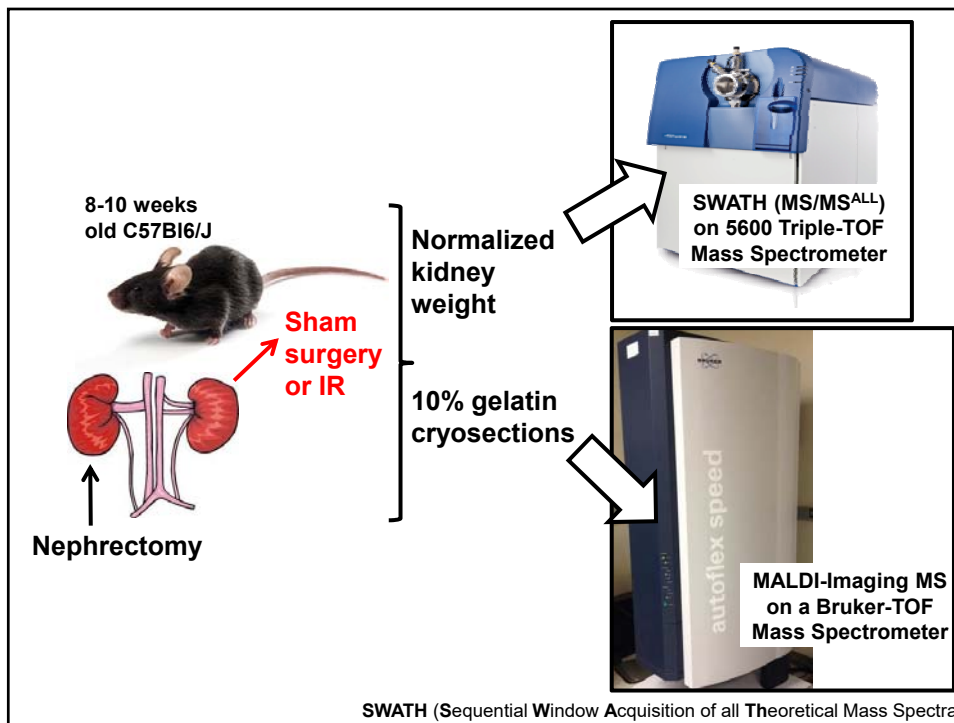
MALDI plate for cryosections



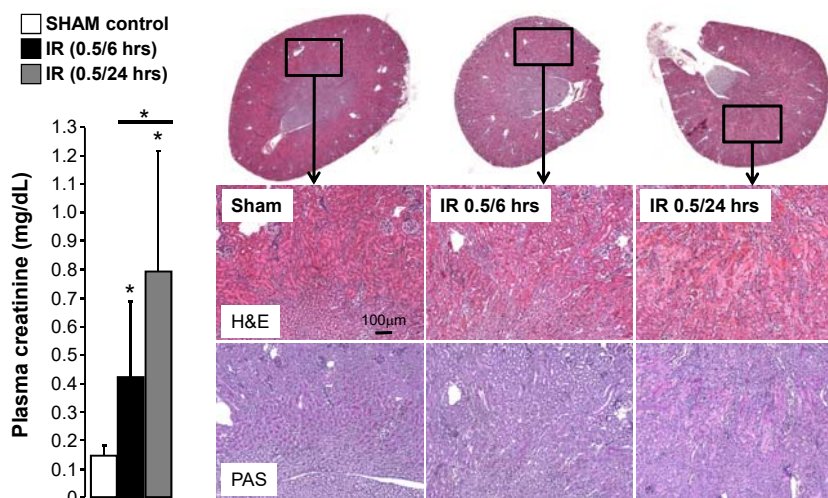


Quantitative and Spatial Analysis of Lipids Involved in Acute Kidney Injury.

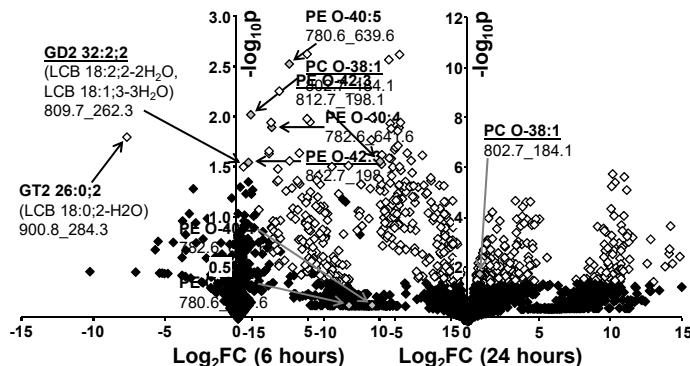




Plasma creatinine and kidney histology in mice subjected to ischemia/reperfusion (IR) related kidney injury at early and late time-points.

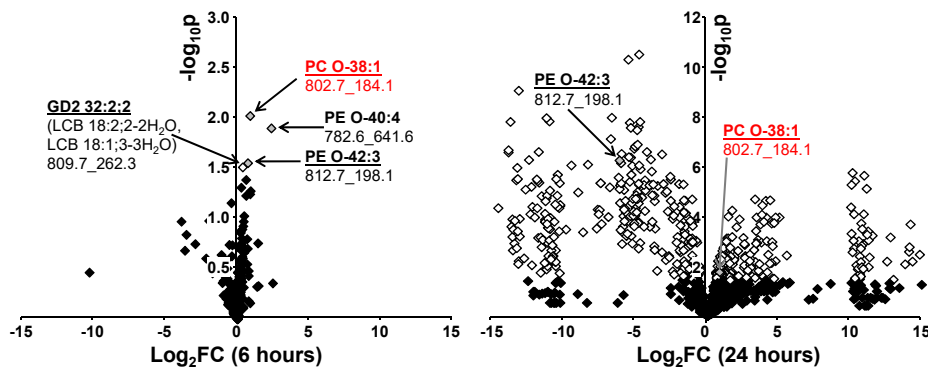


SWATH-MS on renal lipids following ischemia/reperfusion (IR)-related kidney injury

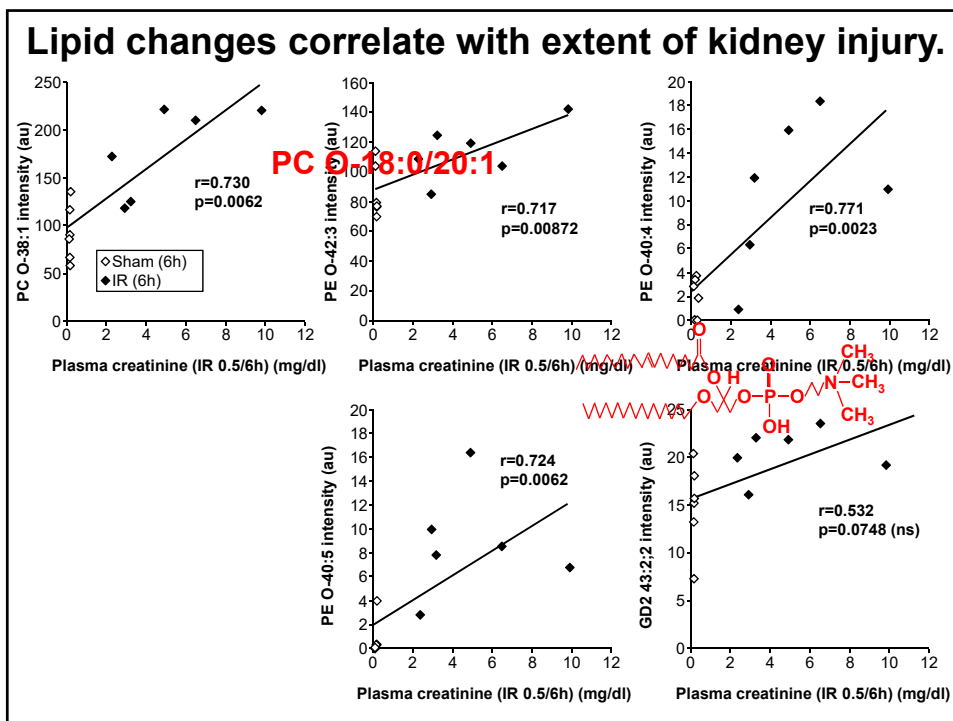
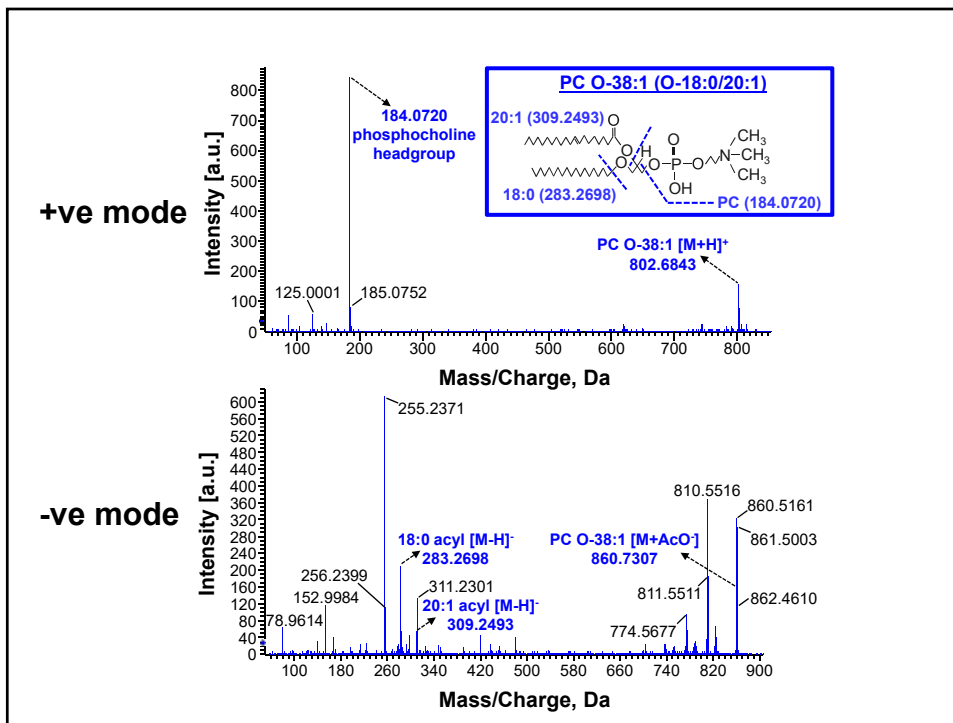


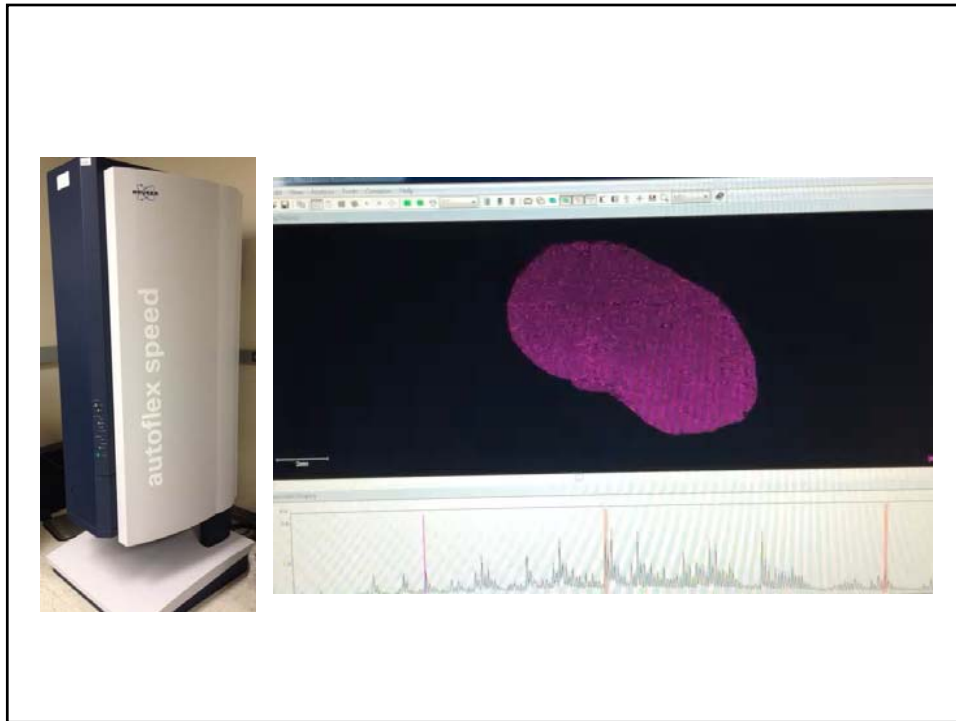
Early lipid changes in acute kidney injury using SWATH lipidomics coupled with MALDI tissue imaging. Rao S*, Walters KB*, Wilson L, Chen B, Bolisetty S, Graves D, Barnes S, Agarwal A, Kabarowski JH. Am J Physiol Renal Physiol, 310(10):F1136-47, 2016.

SWATH-MS on renal lipids following ischemia/reperfusion (IR)-related kidney injury

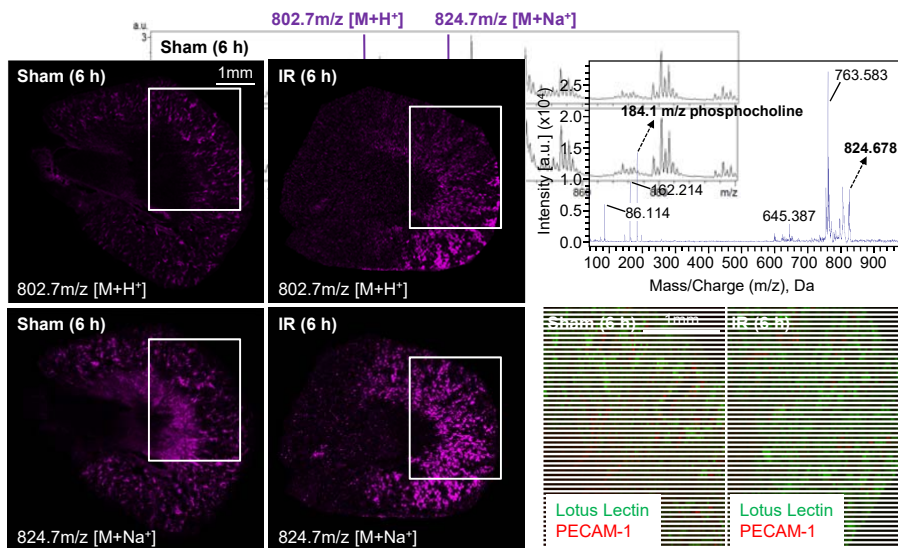


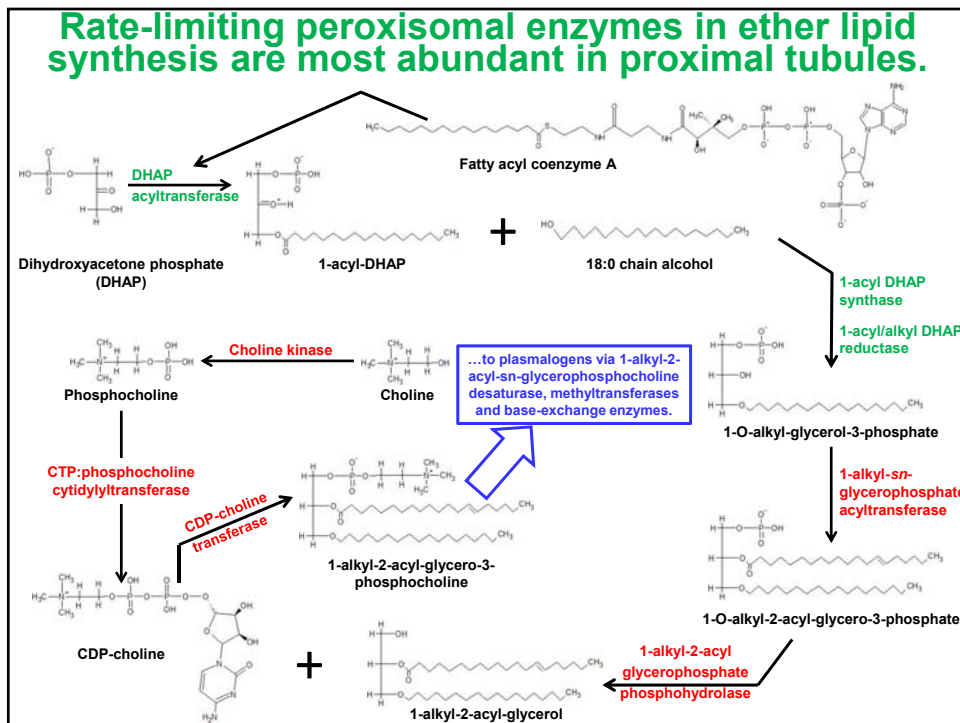
Intensity >10





PC O-18:0/20:1 imaging in sham and IR kidneys.





Other projects using SWATH lipidomics and MALDI-IMS.

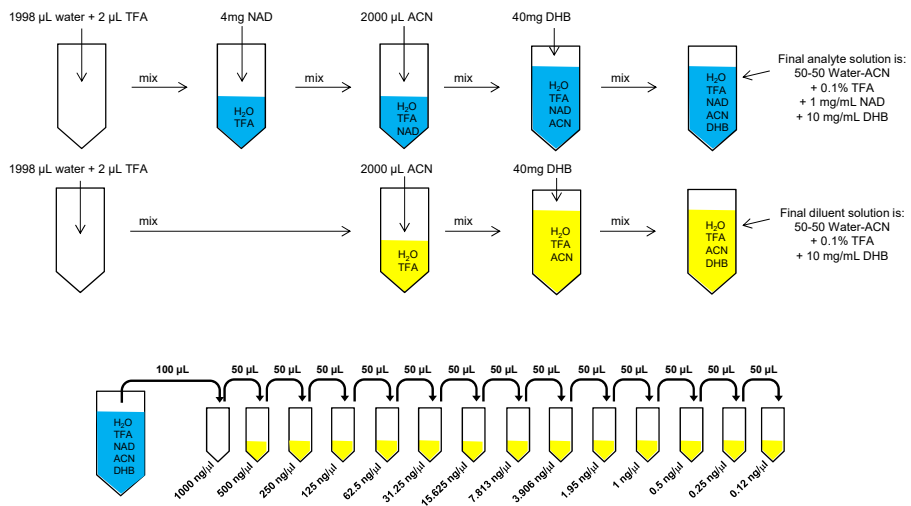
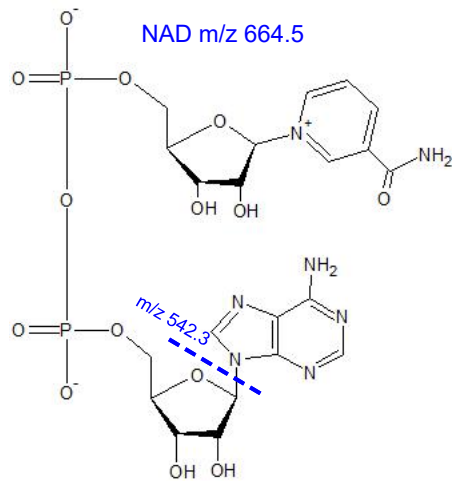
New therapeutic lipoprotein mimetic peptides (NIH) (Drs. Roger White and Anantharamaiah, UAB).

Eye lens lipid changes associated with aging (Dr. Steve Barnes, UAB).

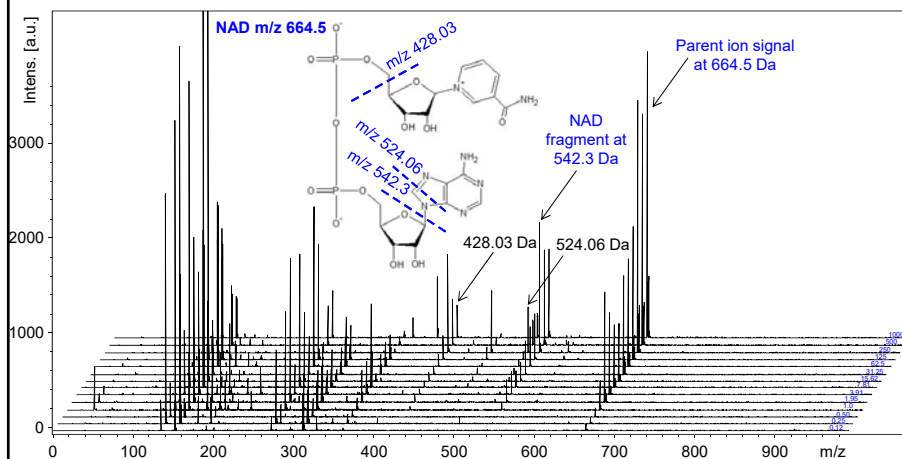
Cosmic radiation effects on vascular inflammation and atherosclerosis risk (NASA).

NAD metabolites in kidney injury and inflammation (Drs. Samir Parikh and Anders Berg, Harvard).

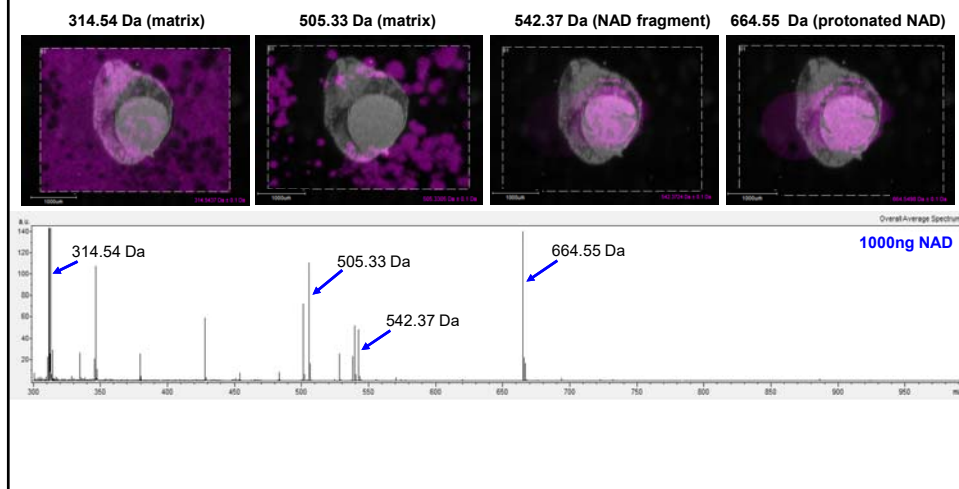
Method development for targeted metabolite imaging projects.

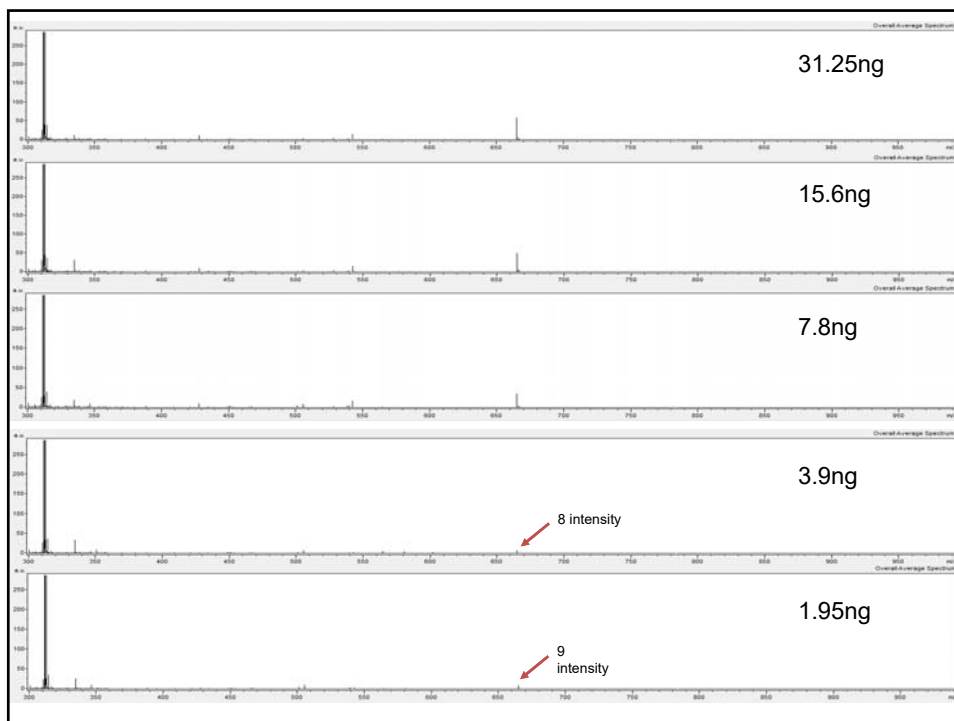
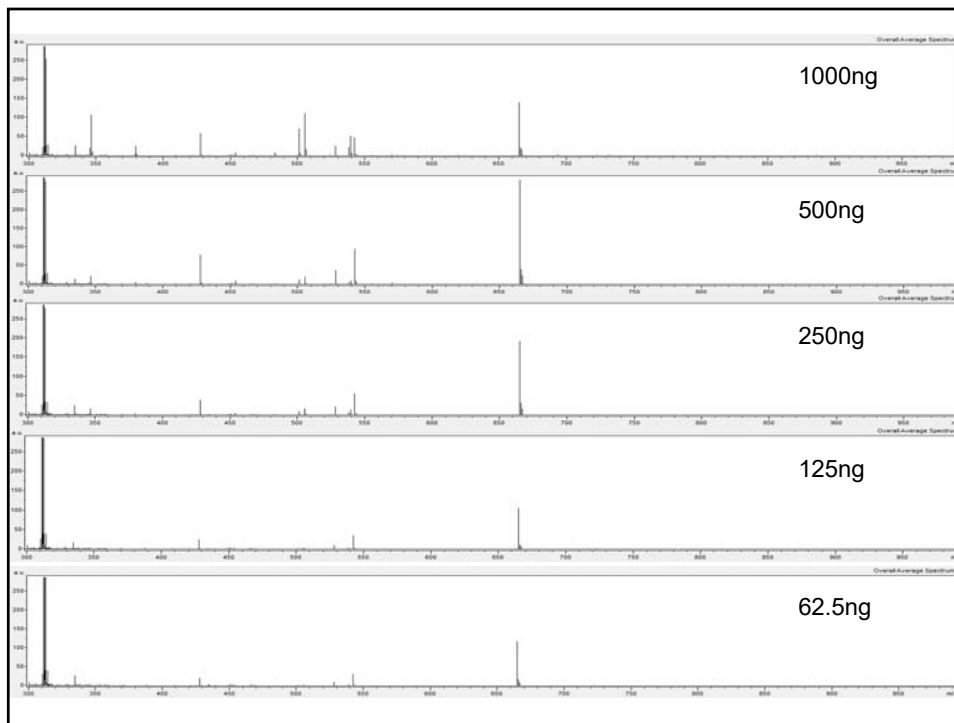


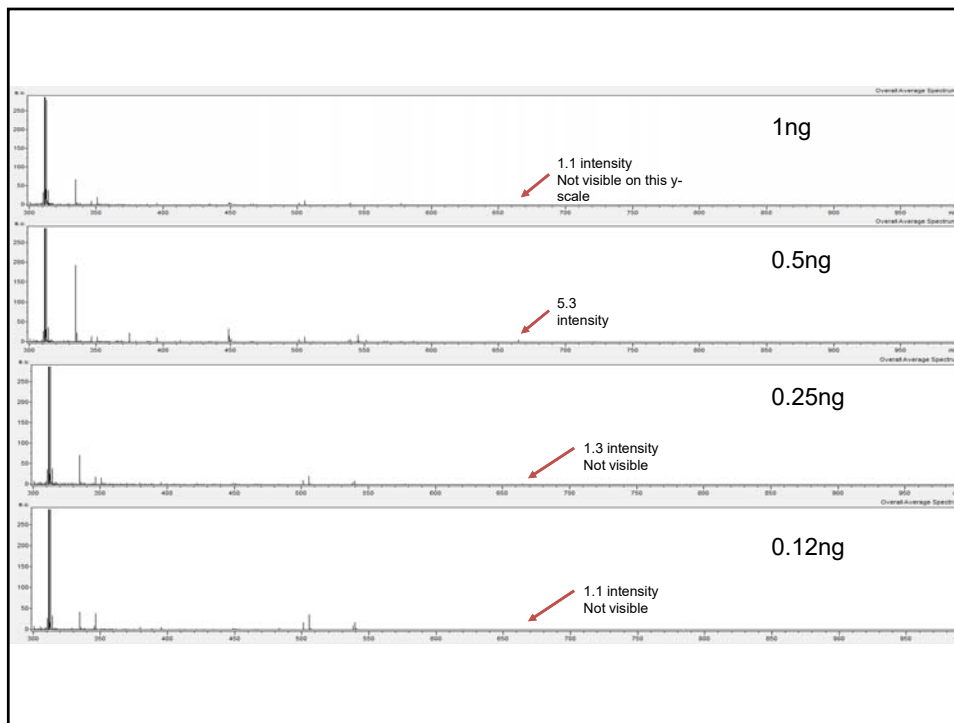
Conventional MALDI-MS using a well plate with spotted standards of NAD + matrix solution



MALDI-IMS using NAD standard spots and vacuum-sublimated matrix to simulate tissue imaging method and data collection







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