Imaging Mass Spectrometry Interest Group Workshop Report 2024

Location: Workshop held Wednesday, June 5th, 5:45pm-7:00pm in Ballroom AB (Level 3) at the ASMS Annual Conference in Anaheim, CA

Topic: Advances in High Spatial Resolution Imaging Mass Spectrometry

Moderators:
Boone Prentice – University of Florida; Florida, USA
*Ingela Lanekoff – Uppsala University; Uppsala, Sweden
**Note: Ingela filled in for Co-Organizer Andreas Römpp (University of Bayreuth, Bayreuth, Germany) who was unable to attend the conference due to illness*

Session Description and Goals: Many important biological processes occur within or between cells in spatially defined regions smaller than 10 μm (*i.e.*, roughly the average diameter of a mammalian cell). High spatial resolution imaging technologies are thus required in order to adequately resolve these small regions and structures. Molecular imaging data at this level of resolution offers the opportunity to directly measure changing concentrations of molecules in exceedingly small areas within cells. A growing number of creative instrumentation, sample preparation, and computational methods have been recently reported to enable high spatial resolution in mass spectrometry imaging (also termed imaging mass spectrometry). However, many challenges remain and suggest that additional efforts and tools are still required by the community. This workshop aims to discuss recent advances and challenges in high spatial resolution mass spectrometry imaging workflows. We also seek to highlight promising methods and paths forward that will continue to push the boundary of spatial resolution in mass spectrometry imaging.

Session Organization: The workshop session topic and inquiry for interested junior speakers was sent to world-wide research leaders in the field. A lineup of speakers was curated from the responses to highlight an array of the topics within the session description. In the final format seven junior researchers each gave a 5 minute targeted presentation on the topic to show the diversity of strategies for high spatial resolution imaging mass spectrometry instrumentation, methods, and software. The presentations were followed by a general discussion where the speakers served as a panel. The speakers were introduced by the moderators who also facilitated the discussion between the audience and the panel.

Speakers and Panelists:
- Furkan Bayram (MUSC, South Carolina, USA): Single cell sampling
- Brittney Gorman (PNNL, Washington, USA): SIMS and nanoSIMS
- Ally Esselman (Vanderbilt University, Tennessee, USA): Sample preparation
- Kasper Krestensen (Maastricht University, Maastricht, Netherlands): MALDI-IHC
- Jacob Samuel (University of Florida, Florida, USA): Expansion imaging
- Katja Wiedemann (University of Giessen, Giessen, Germany): SMALDI imaging
- Manxi Yang (Purdue University, Indiana, USA): nano-DESI imaging

Discussion: The speakers gave short, on-time, and informative presentations on the topic that together provided a nice overview for the following discussion. The talks were well-received and inspirational, as judged by the many and interesting questions during the panel discussion that easily filled the allotted workshop time. During the panel discussion, the audience showed high interest and contributed with many and diverse questions to the panel. The panel respondents were on-point and explanatory, demonstrating technical expertise in their research areas. Broadly, the range of new instrumentation, methods, and software approaches developed over the past ~5 years for high spatial resolution imaging mass spectrometry has significantly increased.

Several audience members and speakers also highlighted the importance of accurately defining spatial resolution (*i.e.*, pixel size). This provoked a nice discussion about ensuring robust means for measuring spatial resolution/pixel size, especially as new approaches define smaller limits for this figure of merit. Overall, the panel provided a good overview on this emerging topic and the audience was engaged and positive to the topic, material, and format.

Participants: Room attendance was estimated at ~125 attendees.