Analytical Chemistry Cumulative Exam:
MALDI-MS Imaging of Intact Biological Samples

Prof. Luke Hanley, 1 May 2015

Exam is based on the following article that was provided ~1 week in advance of exam date:
M.M. Gessel, J.L. Norris, R.M. Caprioli, J. Proteom. 107 (2014) 71.

Assume for this exam:

- MALDI-IMS = MALDI-MSI = MALDI-MS imaging
- Only mass analyzers to be considered are linear-TOF, reflectron-TOF, or TOF/TOF
- Microprobe mode
- Samples are analyzed intact: i.e., as a slice of mammalian tissue or a bacterial biofilm

1. (10%) Describe the experimental workflow for MALDI-MS imaging, including how microprobe mode works.
2. (15%) Describe the typical spatial resolution of MALDI-MS imaging, two experimental limits to spatial resolution, and two strategies to increase it.
3. (10%) Describe two methods of matrix application and provide one advantage & one disadvantage of each method.
4. (5%) What is the role of mammalian tissue washing in MALDI-MS imaging?
5. (18%) Describe the two different strategies in protein analysis by MALDI-MS imaging and provide one advantage & one disadvantage of each method.
6. (12%) How is tandem MS done in a TOF/TOF instrument? This should include an experimental description of the ion analyzer components of the TOF/TOF.
7. (20%) Describe three effects that limit quantification in MALDI-MS imaging and the primary quantification strategy to overcome these limitations.
8. (10%) How is depth profiling done in MALDI-MS imaging?