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CHARACTERIZATION OF DISEASE IN PRECLINICAL CANCER RESEARCH USING DESORPTION ELECTROSPRAY IONIZATION MASS SPECTROMETRY (DESI-MS)

Alessandra Tata[1] and **Arash Zarrine-Afsar**[2]
[1]University of Toronto, Canada
[2]University of Health Network, Canada

There is a clinical need for new technologies that would enable rapid cancer diagnosis based on molecular signatures. New developments in ambient ionization mass spectrometry suggest that this technique will soon become a routine medical tool for cancer diagnosis. In particular, desorption electrospray ionization mass spectrometry (DESI-MS) is very successful because it does not require extensive tissue preparation; the data collection and analysis can be done within a few seconds. Generally, tissue smears are used in rapid intraoperative pathology workflows coupled quick staining methods to characterize cancer tissues. The author evaluated the combination of rapid DESI-MS detection with rapid tissue smear preparation for cancer detection. Principal component analysis (PCA) was performed to evaluate the concordance between DESI-MS profiles of breast cancer from tissue slices and smears prepared on various surfaces. During tumour resection, margin assessment is of extremely importance. This is usually done by H&E staining. To this aim, we demonstrated the utility of combined polarimetry and DESI-MS for accelerated identification of tumor boundaries. Polarimetry images are made available considerably faster than H&E images proposed for guiding DESI-MS. Therefore, a multi-modality combination of polarimetry and DESI-MS appears capable of accelerating the acquisition of MS data. Finally, patients affected by stroma-rich tumours exhibit a poor prognosis and a higher chance of relapse. As such, there is a need for a technology platform that allows rapid determination of the tumour stroma ratio. To this aim, we provided a proof of principle demonstration that DESI-MS can be used to determine tumour stroma ratios. This proof of principle demonstration is encouraging and must be further validated using human samples and a larger sample base. At maturity, DESI-MS thus may become a molecular pathology tool providing an alternative rapid cancer assessment without the need for time consuming staining and microscopy methods, potentially further conserving human resources.

BIOGRAPHY

Alessandra Tata received her master degree in Pharmacy (2006) and PhD in Pharmaceutical Sciences from University of Rome "Sapienza" in 2010. During her PhD studies, she did her internship as visiting scholar at Purdue University joining Dr. R.G. Cook's group in 2008. She has been a post-doctoral fellow at ThoMSon Mass Spectrometry Laboratory at the State University of Campinas, Brazil during 2011-2014 where she applied the MALDI-MS technique to develop methods for the rapid and sensitive detection of lipid profiles in oocytes, embryos, uterus and semen utilized in the *in vitro* fertilization. In 2014 she joined Prof. Demian Ifa's Lab at York University, Canada to apply DESI-MS techniques to the study of microbial networking and then moved to University of Health Network, Canada to develop methods for the rapid detection and characterization of tumor margins by ambient mass spectrometry with Prof. Arash Zarrine Afsar. She has just left research to start up her own company in Italy.

alessandratata1@gmail.com