

Analytical Chemistry Seminar

Tuesday, February 13, 2024
3:30 p.m. ~ WTHR 320

"New-Generation Automated Ambient Mass Spectrometry Platform for High-Throughput Experimentation in Early Drug Discovery"



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Abstract:

The early drug discovery workflow relies heavily on high-throughput experimentation, both in terms of organic synthesis as well as complex biosample analysis. The identification of new biological targets through large-scale biospecimen studies, the generation of large sets of drug candidates and their rapid bioactivity screening, as well as the in vitro and cell-based confirmation of hits and subsequent lead optimization, all rely on high-throughput strategies which are typically spread out across diverse technologies in specialized facilities. The efficiency of this workflow could then benefit from the consolidation of these activities in a single closed-loop platform. Here, we describe the design, development, and implementation of a new-generation automated system that achieves such consolidation by combining robotics and desorption electrospray ionization (DESI) mass spectrometry (MS) for the acceleration of the drug discovery pipeline.

This second generation high-throughput DESI-MS system was developed by a combination of custom and commercial robotics, software, and analytical instrumentation, based on the design of the earlier Purdue-DARPA Make It system. A Hamilton Vantage 2.0 fluid handler was integrated with a Waters Xevo G2-XS mass spectrometer equipped with a prototype AutoDESI source. The system is also equipped with an entry/exit device which extends the sample capacity to ca. 100,000 samples per run, with an overall throughput that can be flexibly customized up to 3 Hz. Experiments proceed by automated preparation or manipulation of reactions, bioassays, or biological samples, followed by the generation of high-density arrays (6,144 samples/array) which are automatically transported and analyzed in a fully traceable workflow.

The new high-throughput DESI-MS technology will be transferred to the US National Center for Advancing Translational Sciences (NCATS) this July, and will be integrated as a new physical module within the ASPIRE infrastructure, where it is anticipated it will consolidate the early drug discovery workflow and advance NCATS mission towards addressing long-standing challenges in translational research so that new treatments reach people faster.

Bio:

Nicolás is a postdoctoral research associate in Prof. R. Graham Cooks group, where he also earned his Ph.D. in 2023. He received B.Sc. degrees in chemistry and industrial engineering from Universidad de los Andes, Colombia. His research has focused on the development of ambient mass spectrometry technologies for high throughput bioanalysis. His work has resulted in several honors including the Charles H. Viol Memorial Fellowship, the Eastman Summer Fellowship in Analytical Chemistry, the ACS Division of Analytical Chemistry Graduate Fellowship, the Tomas B. Hirschfeld Scholar Award, and the Journal of Mass Spectrometry postgraduate award.