A18 Do You Really Know What Your Robot is Doing?: The Importance of Paying Attention to Liquid Handling Details

Mark Pietras, BA, John T. Bradshaw, PhD, and Keith J. Albert, PhD, Artel, 25 Bradley Drive, Westbrook, ME 04092*

After attending this presentation, attendees will understand that liquid handler performance, and behavior, can and will affect assay work. Uncovering liquid handler errors can help optimize and/or troubleshoot assay work.

This presentation will impact the forensics science community by exposing the importance of really understanding liquid handling devices, specifically, automated robots. As more forensic bench work turns to automation, it is extremely important that the automated volume transfer steps are known (verified) so the methods can be tweaked and optimized for the automated assays.

The introduction of automation into forensic science, biology, and chemistry labs has arguably led to significant advances in testing capabilities over the past 20+ years. Automation has certainly led to increased numbers of experiments, as compared to manual testing, particularly for pipetting operations. Because of this advantage, liquid handling robots have become commonplace even in small laboratories. However, in spite of all the advantages that a liquid handling robot brings to a laboratory, it also brings a different set of commonly overlooked challenges such as ensuring quality.

The focus of this presentation is to highlight the need of ensuring quality in important assays performed with automated liquid handlers. Nearly all assays performed within a laboratory are volume-dependent. In turn, all concentrations of biological and chemical components in these assays, as well as the associated dilution protocols, are volume-dependent. Because analyte concentration is volume-dependent, an assay's results might be falsely interpreted if liquid handler variability and inaccuracies are unknown or if the system(s) goes unchecked for a long period. If liquid handlers are properly employed (with the right methods/materials for the specific assay), and they are regularly assessed for performance, they can be powerful systems for lowering costs, increasing throughput and avoiding errors associated with manually-pipetted methods. It is imperative, therefore, to quantify the volumes transferred with an automated liquid handler, especially for the specific automated methods that are used to perform assays. Measuring and knowing the exact volumes transferred for specific and/or routine methods will inherently lead to confidence in the experiment. Knowing an assay's exact volume and component concentrations is critical to properly interpreting the results.

It may be argued that the largest challenge presented by using a liquid handling robot is the potentially incorrect assumption that the robot is doing what it is should be doing. The robot may in fact be doing exactly what the user told it to do, but is that really what the user wanted? One might say that the real question is, do you *really* know how your robot is behaving, and particularly, do you *really* know how your robot is performing for your assay work?

This presentation discusses real case studies of how liquid handlers were performing, or rather misperforming, for certain test procedures. Herein, examples of the importance of monitoring various commonly employed tasks will be presented which are likely considered mundane and often assumed to have little bearing on overall robot performance. Specific examples showing how liquid handler performance can be altered based on: (1) pre-wetting disposable pipette tips; (2) running identical methods on identical robots; (3) protocol differences between high volume and low volume dispenses; and (4) effect of volume transfer mode (reverse or waste mode vs. forward mode). The examples presented will help users to think more about the specific tasks they are asking their robots to perform, and hopefully uncover certain steps that, if observed and controlled, will result in optimized liquid handler performance to ensure the highest quality work possible.

Automated Liquid Handlers, Liquid Handler Behavior, Optimizing Liquid Delivery

 ** Presenting Author*