

# Teaching Mass Spectrometry via Virtual Instrumentation Combined with Case Studies

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Recently developed technology has greatly expanded the utility of mass spectrometry as an essential analytical tool in many areas of science research, trace identification, and diagnostic work. For reasons that include the diverse nature of mass spectrometry instrumentation, and the perceived expertise needed, mass spectrometry is rarely taught to undergraduates, and even fewer students have an opportunity to experience the instrument hands-on. To provide more undergraduates with an introduction to mass spectrometry, we have married the anytime, anywhere capability of the internet, to case-based learning approaches, and create the Virtual Mass Spectrometry Laboratory. Cases include identification of an unknown liquid found in a Civil War-era medical kit, identification of an serum albumin extracted from a blood sample to identify the species, analysis of a hair sample to determine if cocaine is present, and determination of the polydispersity of different polymer samples. Currently, instruments include GC/MS, MALDI-TOF, and ESI-Ion Trap. For each case study, the user chooses and prepares a relevant sample, configures the virtual instrumental parameters, collects data, re-configure parameters or re-prepare the sample if initial choices were not sufficient, analyzes and manipulates the data, and prepares a report documenting an answer to the question posed in the case study. For each possible configuration of sample preparation and instrumental setting, archived real data is presented to the user; thus they can see data of any quality from poor to superb, and can experience artifacts and signal-to-noise problems. The General Anesthetic case study will be used to demonstrate the VMSL.