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Editorial

The Impact of Automation on Immunoanalysis Testing

William E. Acree Jr*

Department of Chemistry, University of North Texas, Denton, TX 76203-5070, USA

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Over the last few decades, the immunoanalysis field has seen significant advancements in automation, which has greatly improved the precision, accuracy, and efficiency of immunoassay testing.[1] Automation in immunoassay testing involves the utilizing various technologies, including robotic systems, assay platforms, and data management software.[2] This editorial article aims to summarize the impact of automation on immunoassay testing and its advantages in different analytical settings.

One of the main benefits of automation in immunoassay testing is its ability to reduce human error and improve precision for the specific method used.[3] Unlike manual testing, automated systems can perform repetitive tasks in a controlled and consistent manner, minimizing variability, improving uniformity and increasing reproducibility. Furthermore, automation eliminates the need for manual pipetting, which not only saves time but also reduces the contamination risk. It also allows for higher throughput and increased sample size, which is particularly useful in high-throughput analytical settings such as clinical laboratories. Automation in immunoassay testing has significantly improved clinical laboratory operations. For example, automated immunoassay systems such as Abbott Architect, Roche Cobas, and Siemens Centaur are widely used in clinical laboratories for the detection of biomarkers associated with various diseases.[4] These systems can perform high-throughput testing on a large number of samples, reducing turnaround time and increasing test accuracy. Furthermore, automated systems can diagnosis small analyte concentrations, providing clinicians with a more comprehensive assessment of a patient's medical condition.

Another important aspect of automation in immunoassay testing is its enhanced specificity and sensitivity. Automated systems can detect extremely small concentrations of analytes with high accuracy, which is critical for biomarkers detection and diseases diagnosis. Automation can also perform multiplex immunoassay testing, which enables both simultaneous detection and quantification of multiple analytes contained in a single sample, thus providing more comprehensive information regarding a patient's medical condition and often eliminating the need to perform additional tests.[5] For example, Luminex Corporation's xMAP technology is used for high-speed, miniaturized multiplex immunoassay testing, which enables the detection of up to 100 target analytes concurrently.[6] This technology has facilitated research in areas such as drug discovery, vaccine development, cancer biomarker discovery, early disease diagnosis and advances in cell and gene therapies.

Automation in immunoassay testing has also led to the development of new assay scaffolds, such as microfluidics, which allows for miniaturization and portability of testing devices.[7] Microfluidic-based systems use small volumes of samples and reagents, reducing the testing cost and increasing the analysis speed. These systems are particularly helpful in point-of-care testing, where both rapid (real-time) and accurate diagnosis are critical.

Finally, automation in immunoassay testing has also improved the data management and analysis aspect of the process. Automated data management software can collect and analyze large amounts of data in a short time, allowing for more efficient processing and reporting of results.[8] These systems can also track and manage information about reagents, calibration, and instrument maintenance, thus ensuring the accuracy and reproducibility of testing. For example, Thermo Fisher's Biomarker Research Services utilizes automated data management and analysis software to gather and analyze large numbers of clinical data.[9] Automated data analysis systems provide comprehensive insights into biomarkers and disease conditions, enabling the identification of novel biomarker targets and improving the development of personalized medicine, considering the individual's unique physiology and medical condition.

In conclusion, the impact of automation on immunoassay testing has been significant, and its benefits have revolutionized the way that sample testing is performed in different analytical settings. Automation

***Corresponding Author:** William E. Acree Jr, Email: bill.acree@unt.edu

has improved the accuracy, precision, and efficiency of immunoassay testing, leading to more comprehensive and reliable diagnostic results. As technology continues to advance, it is expected that the role of automation in immunoassay testing will continue to grow, improving patient outcomes and advancing medical research.

Competing Interests
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