



2026 TRENDS

Laboratory Informatics

TREND 1

The Evolution from LIMS to Smart LIMS

TREND 2

Robots and Cobots Pave the Way for Lights Out Labs

TREND 3

Interoperability Standards

TREND 4

Cybersecurity: An Operational Strategy

As technologies evolve, the transformation of laboratory operations continues to be driven by Laboratory Informatics. The usage of Artificial Intelligence (AI) and Machine Learning (ML) remains at the forefront of optimizing processes. Organizations are relying on real-time predictions and automation to improve quality and compliance, reduce human error, and increase efficiency.

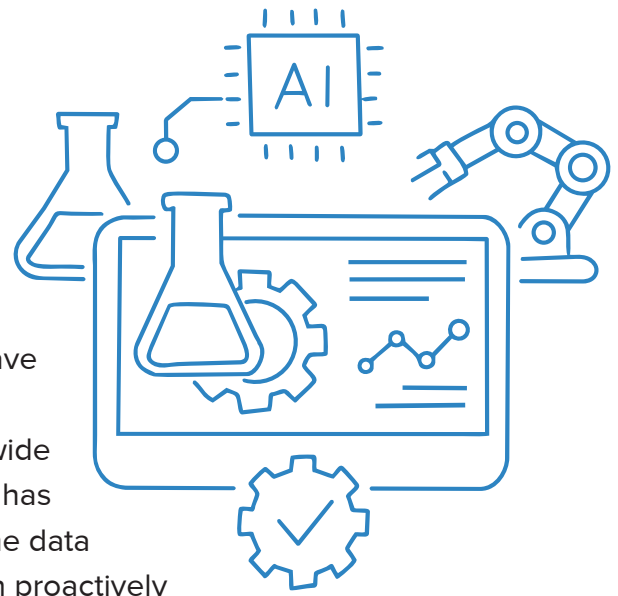
In this report we will focus on 2026 Laboratory Informatics trends for the coming year, specifically looking at Smart LIMS, Lights Out Labs, Interoperability, and secure data.



TREND 1

The Evolution from LIMS to Smart LIMS

Laboratory Information Management Systems (LIMS) have been a cornerstone of laboratory operations for decades. Laboratories have relied on these systems for sample tracking, data output, product quality, and regulatory compliance. A Smart LIMS incorporates a wide use of Artificial Intelligence (AI) and Machine Learning (ML), which has become critical to laboratories for predictive [analytics](#) and real-time data interpretation, enhancing operational performance. [Agentic AI](#) can proactively respond to deviations, failures, and inconsistencies, saving valuable time and money for an organization.



A Smart LIMS that involves Agentic AI can allow a LIMS to modify its workflow based on patterns of results across large datasets, optimizing laboratory functions. Automating [instrument](#) communication bidirectionally with a Smart LIMS can [predict instrument maintenance](#), preventing costly downtime and potential delays to market. The real-time data analysis that can predict failures and assess impacts before they happen ensures the product is of the highest quality without constant human monitoring.



TREND 2

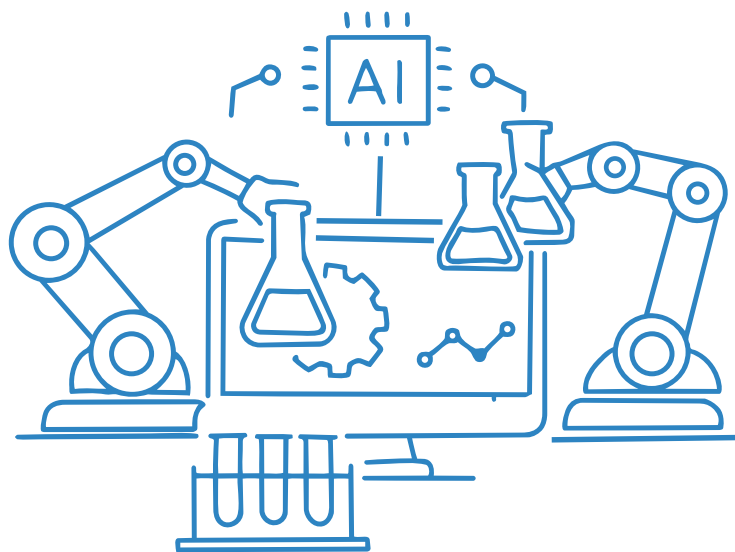
Robots and Cobots Pave the Way for Lights Out Labs

In laboratory informatics, the [use of automation](#) for laboratory functions are growing rapidly. There are many benefits to automation – reduction of human error, increased efficiency of operations, and integrations for seamless communication across instruments and systems.

[Automation](#) has been used in science since 1875, slowly progressing until the 1950s when the first standalone automated analyzer and automatic titrators in a laboratory were used. Soon after, in 1961, [Robotics](#) were introduced to manufacturing and are used in laboratories today to transfer materials and samples to another location or to provide liquid handling with precision.

Cobots are being introduced as human assistants, making the laboratory safer and more efficient. These [cobots](#) can safely handle hazardous chemicals, automate workflows that are often lengthy to set up, and aid in routine tasks such as sample preparation. When integrated with a laboratory informatics platform, there is full traceability of each action.

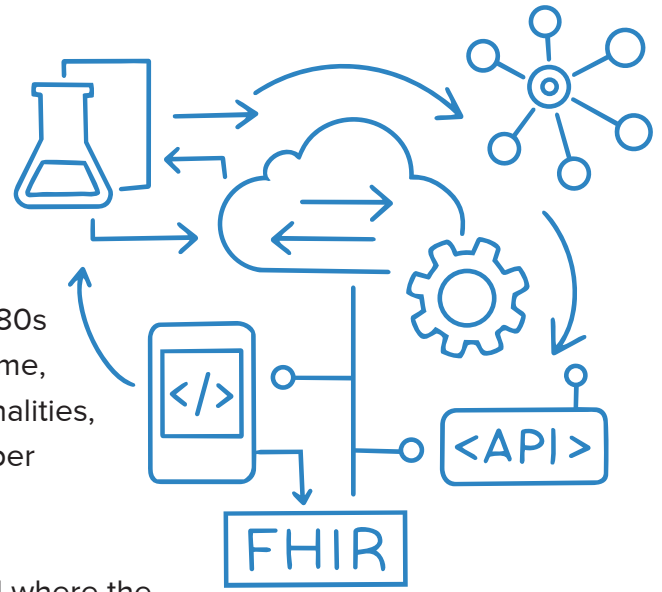
In 2026, laboratories are trending towards an End-to-End (E2E) or Lights-Out Lab to operate unattended by humans, using robots and cobots to continue processing. The advantages of implementing advanced automation technologies are handling higher throughput with around-the-clock operations, increased consistent repeatability, and reduced risk of injury to laboratory personnel – all while maintaining regulatory compliance.



TREND 3

Interoperability Standards

Laboratory informatics evolved from its first inception in the 1980s when early stand-alone LIMS platforms were first used. Over time, this slowly became increasingly digitalized with added functionalities, such as [Electronic Laboratory Notebooks \(ELN's\)](#) replacing paper notebooks.



Today, we are in the era of [Lab 4.0](#) – a fast-paced digital world where the laboratory is utilizing AI, cloud computing, automation, and the Internet of Things (IoT) – connecting systems for seamless data exchange.

Laboratory informatics are adopting standards of interoperability like [FHIR](#) (Fast Healthcare Interoperability Resources) for seamless communication across systems. LIMS solutions are using RESTful APIs (Application Programming Interfaces) utilizing either JSON or XML formatting to allow flexible data exchange, moving away from custom integrations and interfacing. These APIs can be used for connecting to instruments for data capture, other systems such as an ERP (Enterprise Resource Planning), or externally to a customer portal.

Vendors are now making interoperability easier by creating Out-Of-The-Box (OOB) connection tools, reducing the need for system customizations. Organizations are standardizing integrations by utilizing middleware to transform data formatting before sending it to a LIMS. Using middleware allows for one solution instead of multiple different integrations, streamlining operations, and system maintenance.



TREND 4

Cybersecurity: An Operational Strategy

With laboratory technologies utilizing more [cloud-hosted](#) platforms, integrating AI and ML, and capturing sensitive data, organizations need robust cybersecurity strategies. AI tools are being used to reveal system vulnerabilities leading to data poisoning and proprietary information being exposed. It's imperative that organizations ensure their data is inaccessible to those outside of the lab to protect them from financial costs and regulatory or legal penalties.

To safeguard laboratory data from security risks, while ensuring data integrity, regulatory compliance, and the protection of sensitive information, organizations should:

1. Implement Role Based Access Controls (RBAC) limiting functions a user can perform
2. Ensure a dual login process such as Multi-Factor Authentication (MFA) or Virtual Private Network (VPN) for added security
3. Implement audit trails across the entire laboratory informatics platform to have comprehensive, end-to-end tracking of the sample lifecycle
4. Design security measures in alignment with regulations of governing bodies, such as the [US Food and Drug Administration \(FDA\) 21 CFR Part 11](#)
5. Employ encryption algorithms such as [Advanced Encryption Standard](#) (AES)
6. Utilize Transport Layer Security (TLS) protocols when data needs to be moved to prevent interception



Looking Ahead

The laboratory informatics trends of 2026 highlight the increased use of AI and ML in both positive and negative ways, Smart LIMS concepts, the opportunities of a Lights-Out laboratory, enhanced interoperability, and increased security measures. The benefits from these trends are vast as they allow for increases in compliance and data integrity while operating more efficiently, but they should be implemented judiciously to ensure potential risks are mitigated.

ABOUT CLARKSTON CONSULTING

Businesses across the life sciences industry partner with Clarkston Consulting to enhance strategic decision-making, improve operational efficiencies, implement new technologies, and promote business growth and market diversification. Leveraging deep functional and industry expertise, our people discover, design, and deliver solutions that fit your business, your goals, and your future. At Clarkston, your purpose is our purpose.

For more information about how we can help your company, [please contact us](#).

