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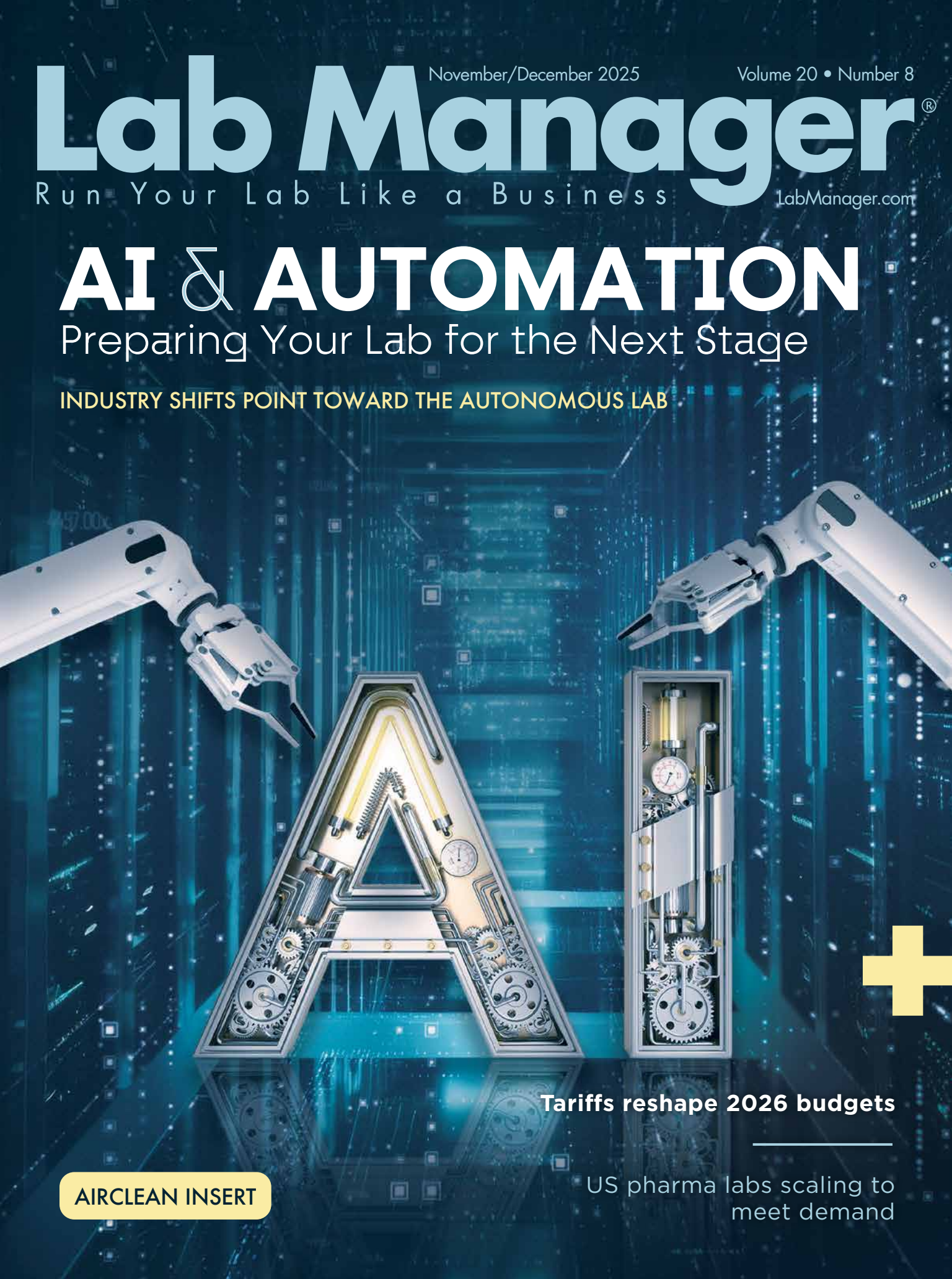

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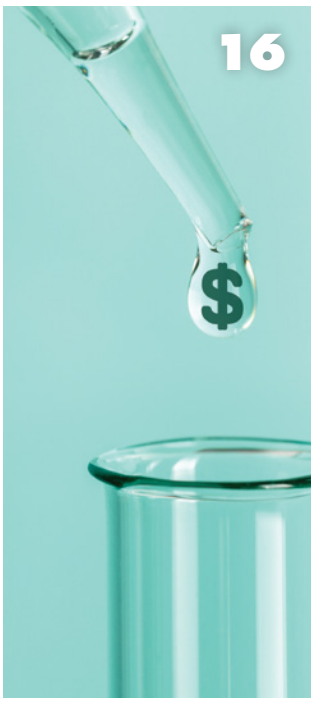

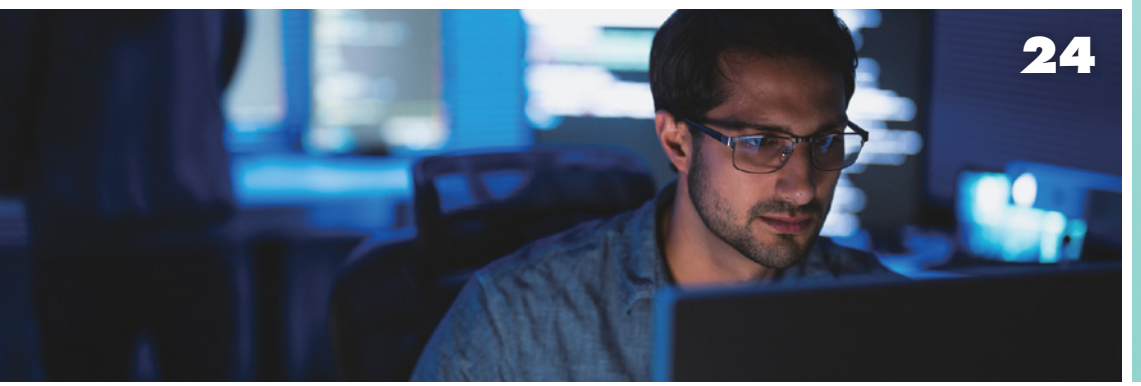

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lab priorities for 2026

As we wrap up the year, it's clear that many of the pressures labs are feeling now will carry into 2026. The articles in this issue highlight how technology, economics, and shifting industry priorities are redefining how lab managers plan, invest, and lead.

Economic forces sit near the center of that story. Rising tariffs, higher borrowing costs, and shifting supply chains are already influencing equipment quotes, consumables, and contract terms. Our analysis of tariff-driven budget changes outlines how labs can respond with more flexible procurement strategies, diversified suppliers, and smarter lease-versus-buy decisions to stay resilient.

This issue also looks at the technologies and operational challenges gaining momentum across sectors. Our cover story examines how AI and automation are moving from conceptual to operational, with agentic AI, autonomous mobile robots, and open connectivity standards beginning to shape more integrated workflows.

We also explore the growing emphasis on cybersecurity, the practical realities facing clinical labs, advancements in chromatography, and the renewed push toward domestic pharmaceutical manufacturing—and what that shift means for labs navigating capacity expansion, modernization, and workforce demands.

As you look to 2026, what challenges sit at the top of your list? Which trends feel most urgent in your lab? We'd love to hear from you.

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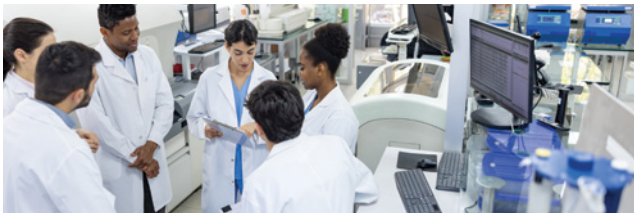
MANAGER MINUTE

Three Keys to Getting Good Purchase Ideas from Staff

by Scott D. Hanton, PhD

Labs are staffed by very experienced scientists and have multiple needs that often exceed their budgets. Lab managers can get the information they need to make effective purchase decisions by getting constructive feedback from staff about their needs and priorities. The people who work most closely with the existing equipment will be aware of its limitations and challenges. They will also have insight into the needs for new specifications and how often the benefits of new capabilities would be used to deliver on stakeholder needs. Here are three tips to get better input from staff informing lab purchasing decisions:



#1 – Needs versus wants

Most labs have more needs than they have budget to buy new equipment. Help staff better differentiate between needs, capabilities that solve problems, and wants, which are capabilities that solve inconveniences. The more the entire lab aligns with the highest-priority needs, the better everyone aligns on how funds for new equipment will be spent. It also helps to build a three-year capital plan that shows people the lab's priorities and the near-term plan to address capability needs.

#2 – Listen to everyone

Everyone working in the lab is generating experience and expertise around the activities they complete. All this learning and knowledge is helpful and useful to lab managers when making purchasing decisions. Using all that information helps lab managers make better, faster decisions. It's not just the most senior or most educated staff in the lab who have useful information. Ignoring more junior team members leaves the lab vulnerable to the biases of a small group and increases the likelihood of groupthink during complex capability decisions.

#3 – Input options

Listening to everyone in the lab can be difficult. Some people may not feel safe sharing their ideas or openly disagreeing with senior lab leaders. Lab managers can offer multiple options for staff to share their thoughts on equipment purchases, ensuring everyone has a voice. Some examples to consider include:

- Small team meetings
- Individual one-on-one meetings
- Walking through the lab to talk to people individually at the bench
- Suggestion box
- Anonymous surveys
- Staff-only meetings (without senior lab leaders)

Each of these tools may enable staff members to feel sufficiently safe to share their ideas. A lack of open sharing in a lab may indicate a lack of emotional and psychological safety. Improving safety in the lab will encourage more people to share more ideas.

Openly seeking broad input on the priorities for significant lab purchases helps create a more emotionally and psychologically safe team environment, surface important ideas and observations, and align the team around the biggest capability priorities for the lab to invest in. Getting broad input will help lab managers make better decisions faster.

Thanks for reading. I hope you can use this information. I am very interested in hearing from you. If you have feedback or comments on this set of tips, or suggestions for future Manager Minutes, I'd love to hear from you. Please reach out to me at ***shanton@labmanager.com****. I'm looking forward to our conversations. Thanks.*

TRENDS IN

AI & AUTOMATION

Preparing Your Lab for the Next Stage

INDUSTRY SHIFTS POINT TOWARD THE AUTONOMOUS LAB

by Holden Galusha

AI and automation are no longer concepts for the future—they're becoming daily tools in the lab. For managers, the question isn't whether to adopt them, but how to prepare for the next phase: integrating intelligent systems that can learn, act, and adapt alongside your team.

Complementary trends in lab automation and AI—including agentic AI, autonomous mobile robots, and more—are together pointing to how these systems will manifest: a future where closed-loop, autonomous labs may accelerate experimentation and allow scientists to iterate on their research faster than ever before.

TRENDS AND ADVANCEMENTS IN LABORATORY AI

Following FAIR (findable, accessible, interoperable, reusable) data principles is important to achieve fewer bottlenecks and more useful analyses in the lab. But FAIR can also serve as the foundation for allowing the lab to innovate in other ways: namely, using artificial intelligence (AI).

De-siloed data for AI model training

Following FAIR data principles naturally leads to de-siloing the data: pulling records from LIMS, ELN, QMS, instruments, standardizing all the data, and consolidating it in a single data lake or data warehouse. De-siloing gives managers a complete view of lab operations and becomes even more powerful when AI models can learn from that unified data.

General-purpose AI models quickly hit the ceiling of their capabilities when trying to use them in a specialized context like lab work. "For AI to be genuinely useful in a research environment, it must reflect the realities of the lab," says Rob Brown, head of the scientific office at Sapio Sciences. "That means working with domain-specific models that are trained on scientific data and designed to operate within the scientific context." For lab managers, this shift means investing in data readiness—ensuring clean, consistent datasets before evaluating AI tools. Lab managers should start by applying models to a single workflow, such as instrument maintenance forecasting, before attempting full-scale rollouts. In clinical and pharma labs, especially, evaluating whether AI-generated insights meet validation requirements is critical.

Agentic AI

Have you ever used ChatGPT, Google Gemini, or similar chatbots? These bots are reactive AI models, responding only when prompted by the user. Agentic AI is touted as the proactive evolution of this tech:

"Agentic AI is a class of artificial intelligence that can follow instructions, understand intent, and carry out tasks within a specific scientific or operational context," Brown says. "Unlike earlier forms of AI that simply respond to queries or generate suggestions, agentic AI is designed to help users take meaningful action towards a goal." Brown notes that, in a lab environment, these capabilities manifest by interpreting prompts given by the user, retrieving relevant data, applying scientific models to that data, and summarizing results—all without requiring the scientist to manually coordinate systems or pull data.

More autonomous experimentation accelerates science and stretches limited budgets further. When harnessed properly, agentic AI can be an efficiency multiplier with tangible benefits for both research and business. Yet successful implementation requires clarity about which tasks AI agents may automate versus those requiring human sign-off. Lab managers should frame AI as an augmentation tool, not a job replacement, to maintain staff morale and engagement.

One real-world showcase of agentic AI comes from Cedars-Sinai. In a paper published in *Bioinformatics*, Jason Moore, PhD, chair of the Department of Computational Biomedicine, worked with his lab to create an agentic AI model that referenced "knowledge graphs" of biomedical data to answer various questions posed by the researchers.[1] Moore stated that their agentic AI model provided answers with 80 to 90 percent accuracy, as opposed to the 50 percent accuracy that ChatGPT achieved.

TRENDS AND ADVANCEMENTS IN LABORATORY AUTOMATION

While AI excels in analysis and decision-making, it cannot execute physical tasks on its own. That's where automation comes in. By connecting instruments through open standards and relieving staff of repetitive manual tasks with mobile robots, automation ensures that the intelligence provided by AI translates into faster, more reliable experimentation.

Open equipment communication protocols

Proprietary communication protocols still limit automation progress, forcing labs to buy equipment from a single vendor to achieve compatibility. There is little to no cross-vendor interoperability, with each vendor forming their own walled garden of equipment. Consequently, it becomes difficult for labs to implement more advanced automated workflows unless all their equipment is from the same vendor (and are all new enough to support the communication protocols at all). Few labs are outfitted this way.

Slowly but surely, however, the tides are changing. Open-source connectivity standards like SiLA 2, as well as standardized data formats like the Allotrope Framework, are "gradually improving plug-and-play integration and data portability," says Meghav Verma, VP of automation at Axle Informatics. "We're not there yet, but vendor support and open-source control layers . . . have meaningfully lowered the integration efforts for mixed vendor cells." While adoption of these standards remains uneven across different types of devices, progress is being made.

As open interfaces mature, lab managers can make purchasing decisions based on performance and budget, not vendor lock-in. They should prioritize vendor interoperability in purchasing decisions, involve IT early for data infrastructure planning, and budget for middleware or integration layers between different platforms.

Autonomous mobile robots

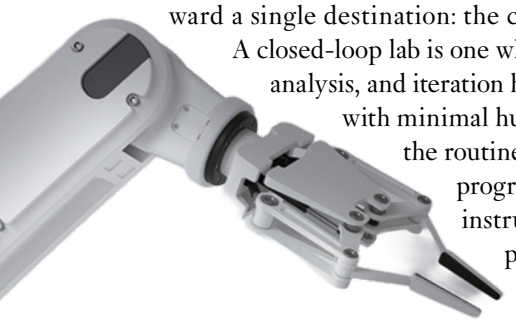
Even when instruments connect digitally, physical sample movement still slows workflows. Whenever a batch of samples is prepped or an analysis is complete, scientists must step away from what they're currently doing and move the samples to the next asset in the workflow. While moving samples is a quick task, doing so dozens of times per day can add up. Another emerging trend in lab automation—autonomous mobile robots (AMRs)—may be able to streamline sample transfers.

"AMRs are moving plates, consumables, and samples between instruments and rooms—closing the gap between otherwise well-automated islands," says Verma. Clinical labs have led the adoption of AMRs, but research labs are following their lead.

AMRs and open communication protocols can work in concert to maximize lab automation, negating the need to manually move both physical samples and digital data between assets. Automating these tasks saves time and reduces human error, helping ensure experimental integrity.

For enterprising lab managers looking to incorporate AMRs in their lab, they must factor in recurring maintenance costs, training, and other secondary costs into the ROI assessment. Additionally, identifying the bottlenecks where AMRs would offer maximum payoff from the start, and adapting workflows and safety guidelines would minimize safety risk.

CLOSED-LOOP LABS: THE CONVERGENCE OF AI AND AUTOMATION TRENDS



The four trends outlined above collectively point toward a single destination: the closed-loop laboratory. A closed-loop lab is one where experimentation, analysis, and iteration happen seamlessly, with minimal human intervention in the routine tasks that slow down progress. Data flows across instruments, software, and processes; AI models generate insights and recommend actions; and automation carries out tasks. Everything is overseen by human experts, but they are left free to pursue the aspects of research that require a uniquely human touch.

Such a paradigm shift may be closer than you think. As Garrett Peterson, chief strategy officer at Yahara Software, says: "While the idea of fully automated, closed-loop laboratories can sound like a radical shift, the underlying principle has been around in lab informatics for some time. At its core, it's about integrating data and workflows across LIMS, QMS, ERP, instruments, and human-driven steps so that experimentation, analysis, and iteration can happen much more fluidly. Done well, this enables 'hyper-acceleration' of discovery through rapid, top-to-bottom process iteration."

In fact, there are already existing examples. Lawrence Berkeley National Laboratory announced the A-Lab in April 2023, describing it as a closed-loop, automated materials discovery lab powered by robots and AI.[2] The A-Lab can process up to 100 times as many samples as a human can and pare down paths for further investigation with AI. Gerbrand Ceder, PhD, principal investigator for the A-Lab, said that it's intended to "iterate rapidly, the way scientists operate" while leaving scientists free to spend more time designing experiments.

Similarly, Oak Ridge National Laboratory's INTERSECT project (Interconnected Science Ecosystem Initiative) uses open architecture to align hardware and software, bringing together agentic AI, AMRs, and robotic systems to enable autonomous laboratories. INTERSECT labs are already running at ORNL, accelerating advances in materials science and chemistry.

The A-Lab and INTERSECT prove what's possible—but for most labs, the next step is simpler: unifying data, testing targeted AI use cases, and building automation one workflow at a time.

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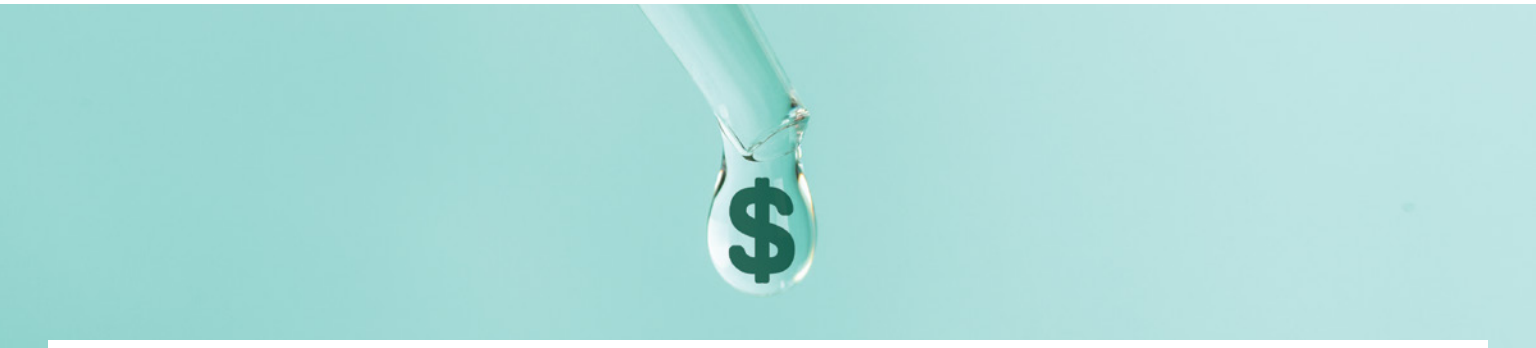

Rising Tariffs Reshape Laboratory Budgets for 2026

TARIFFS AND INFLATION ARE DRIVING LABS TO RETHINK PURCHASING, PARTNERSHIPS, AND FINANCIAL PLANNING IN THE YEAR AHEAD **by Michelle Gaulin**

Laboratories are heading into 2026 with steady demand but tighter financial margins. The broader economy has cooled from its post-pandemic rebound, and analysts expect sluggish US growth next year as tariffs, inflation, and higher borrowing costs continue to shape purchasing behavior.

According to the Organisation for Economic Co-operation and Development's (OECD) September 2025 Economic Outlook, US growth is projected to slow from 2.8 percent in 2024 to 1.8 percent in 2025 and 1.5 percent in 2026, reflecting lessening investment and the ongoing impact of higher trade barriers.[1] The International Monetary Fund reports a similar trend, noting that growth is weaker and inflation is higher than expected due to tariff-related costs and persistent supply chain strain.[2]

For lab managers, these broad shifts may manifest in familiar ways: equipment quotes that expire more quickly, higher consumable costs, and extended lead times. Even as scientific activity remains strong, the cost of keeping labs supplied and compliant is rising—making 2026 a year when financial agility and smart sourcing will matter more than ever.

Tariff shifts ripple through the supply chain

In June 2025, the White House doubled Section 232 tariffs on steel and aluminum to 50 percent, citing domestic manufacturing priorities.[3] The US Trade Representative also expanded tariffs on Chinese imports, adding duties on electronics, plastics, and other materials that labs depend on.[4]

According to recent analyses from Yale University's Budget Lab, overall tariff levels in 2025 climbed sharply—rising more than sevenfold between February and midyear.[5] It's one of the fastest increases the Budget Lab has recorded since tracking began. That spike is already feeding into higher import prices and slower investment in equipment and materials.

For laboratories, this means many of the materials that keep research facilities running—such as steel casework, aluminum framing, glassware, personal protective equipment (PPE), and electronics—now cost more or take longer to arrive. Even routine purchases may come with new surcharges or shorter quote windows as suppliers adjust to changing import costs.

Procurement specialists across various industries are also updating their contracts to include price-adjustment clauses that allow vendors to revise pricing if tariffs shift during the contract.[6] Lab managers may begin to see these terms appear in equipment or maintenance renewals in 2026.

How tariffs are reshaping key lab sectors

The impact of 2025's tariff escalation isn't uniform across the laboratory landscape. Each major sector faces its own version of the same challenge: higher costs, shifting supply chains, and tighter purchasing flexibility.

Clinical and diagnostic laboratories

Clinical labs remain vulnerable to tariff-related disruption because their operations depend on validated instruments and reagents that cannot be easily substituted. Even minor supplier or material changes can require revalidation, adding both time and cost.

Sterile disposables, assay kits, PPE, and analyzers have

all become more expensive. US manufacturers such as Abbott Laboratories have responded by increasing domestic production capacity to reduce import exposure, a move that may gradually stabilize pricing and improve supply predictability.[7]

International trade policy remains another key variable. The European Union and Japan were exempted from proposed 100 percent tariffs on pharmaceuticals, while Singapore-based manufacturers continue to seek clarity on their exemption status.[8,9] For clinical laboratories, these regional differences could influence pricing and reagent availability through 2026.

Applied and industrial laboratories

Applied and industrial laboratories are experiencing some of the most direct effects of tariffs. The White House's decision to double Section 232 tariffs on steel and aluminum immediately raised the cost of key infrastructure and analytical components. These metals form the backbone of many lab systems, from test stands and containment units to facility upgrades.

In response, manufacturers and service providers are relocating production closer to end-users. The 2025 Reshoring Survey Report from the Reshoring Initiative found that nearly half of the surveyed US manufacturers have relocated or plan to relocate some operations back to North America, citing supply chain risk and tariff volatility.[10]

For laboratories that support industrial or applied R&D, these shifts mean shorter lead times but higher baseline prices for domestically-sourced equipment. Many organizations are turning to lease- and service-based models to manage high capital costs. IBISWorld's *Laboratory Equipment Leasing in the US* report projects a 4.7 percent increase in leasing activity in 2025, reflecting growing demand for predictable monthly expenses as labs navigate tighter budgets and market uncertainty.[11]

Pharmaceutical and biopharmaceutical laboratories

Pharma and biopharma organizations sit at the intersection of global supply and regulatory oversight. Many depend on imported intermediates, sterile consumables, and active pharmaceutical ingredients, particularly from China, India, and Singapore—regions now affected by varying tariff policies.

According to *Clinical Leader's 2025 analysis*, new duties on pharmaceutical imports could alter outsourcing decisions and increase production costs for US-based operations.[12] The OECD's September 2025 outlook also warns that sustained tariffs could weigh on investment in pharmaceutical infrastructure.[1]

In response, companies such as Sanofi and Roche have announced expanded US manufacturing footprints to insulate operations from trade disruptions. For lab managers, this shift could bring localized supply

advantages and shorter delivery times as domestic production ramps up over the next 12 to 18 months.

Life science and academic research laboratories

Life science and academic research facilities aren't immune to the recent tariff expansions on steel, aluminum, plastics, and imported electronics, which have increased the cost of infrastructure and instruments used in casework, analytical systems, and automation equipment. Interest in refurbished and used equipment is also on the rise. As reported in *Lab Manager*'s article, "How Tariffs and Tight Budgets are Driving Demand for Refurbished Lab Equipment," many certified refurbishment programs now offer stronger warranty and service support. These programs help laboratories replace or expand their capacity at a lower cost than purchasing new equipment.

Monitoring these economic and procurement trends will help life science and academic laboratories plan effectively for 2026, as tariff policies and supply conditions are likely to remain subject to change.

Planning ahead for 2026

Regardless of sector, three themes stand out for 2026:

- Costs will remain elevated as tariff policies and interest rates keep upward pressure on materials and equipment
- Sourcing will diversify, with more suppliers building domestic or near-shore capacity
- Procurement flexibility will matter most—managers who track supplier changes, build contingency into budgets, and negotiate adaptable contracts will be best positioned to sustain operations

Trade policy will continue to evolve, but its effects are already tangible in laboratories across the country. For lab managers, the task now is practical: stay informed, plan ahead, and make purchasing decisions that protect both science and sustainability in an unpredictable year ahead.

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Simplifying the Complexity of Pump Selection

HOW LAB MANAGERS CAN SIMPLIFY PUMP SELECTION TO SAVE TIME, REDUCE COSTS, AND AVOID FRUSTRATION

*◂**Barry Cowen** is the president and founder of New Era Pump Systems, Inc., established in 1996. With over 30 years of experience developing liquid handling equipment, Cowen has made lasting contributions to the field. Drawing on his computer science degree from Rensselaer Polytechnic Institute, he developed the software for the industry's first programmable syringe pump—an innovation that helped shape modern liquid automation. Through decades of collaborating with end-users to understand their needs, he recognized a persistent gap in the market for advanced, cost-effective laboratory solutions. Motivated by this insight, he founded his own company to introduce a "New Era" of service: delivering affordable, high-quality laboratory equipment.*

Q: Could you share how you first got involved with syringe and peristaltic pumps, and how that experience influences your work today?

A: The short version is that I started out working for a competitor, where I invented the technology that became the programmable syringe pump, before breaking off on my own to focus on advancing it further.

What drew me to this work was the opportunity to take a simple, existing technology and upgrade it. Early on, small electronic devices were always designed by electrical engineers, not software people. Think of the old joke about VCRs blinking "12:00" because end-user interface design was an afterthought, or not thought of at all—that's what these devices were like.

Coming from a computer science background, I saw a chance to bring high-level software concepts to laboratory devices, upgrading their interfaces and functionality. That's how I realized I could make a meaningful difference for labs.

Q: What advice would you give to a lab evaluating pumps?

A: This touches on a major theme I find myself repeating often: Don't get lost in the forest of your application; focus on what you're trying to accomplish.

A lot of times, people come to us with complex questions about their application. When I dig deeper and ask them what they're trying to achieve, there's usually a much simpler way to get there. They don't need all the extra hardware or complicated processes.

Researchers often start with "Rube Goldberg machines." For instance, we've had customers purchase a syringe pump, along with an analog interface, software, and all sorts of additional components. When they call us for help setting everything up, I'll take a step back and ask, "What are you really trying to accomplish?" Sometimes the answer is simply, "We need the pump to turn on when we have a five-volt signal and turn off when we have zero volts." In that case, all they need is our transistor-transistor logic (TTL) interface. They can plug their signal directly into the back of it and skip all the extra equipment.

It's easy to get lost in the process, but often there's a simpler, cheaper way to do it. That's why I always encourage people to start with their goal and then work backwards to figure out what they actually need.

Q: What are the key takeaways from comparing syringe and peristaltic pumps, and how does this determine which is best suited for a given application?

A: Researchers often default to the equipment they're most familiar with. When they call us, we commonly ask, "Have you considered a syringe pump?" if we think it would be better for their application, or we'll ask syringe pump users

if they've considered a peristaltic pump. Many researchers don't initially think about the trade-offs between the two.

If you're working at very low flow rates, down to nanoliters or microliters, that's really the realm of syringe pumps. Peristaltic pumps are better suited for higher flow rates, like 50 mL/min, 100 mL/min, or even 500 mL/min. When people try using a syringe pump at those higher flow rates, that's when I suggest switching to a peristaltic.

Volume is another factor. If you're dispensing 25 to 50 mL, that can generally be handled with a single syringe. For larger volumes, you can use a two-syringe pump infusion/refill system, which is a much more complicated setup. Such complexity may not be necessary or justified, in which case we will suggest a simple, low-cost peristaltic pump. A key factor in this decision is precision. My rule of thumb is that if you need one to two percent, or better, precision, and/or pulse-free dispensing, you need a syringe pump. If you can tolerate higher variability and pulsations, a peristaltic pump can do the job and save you money.

Pressure is another consideration. Peristaltic pumps are generally limited to lower-pressure applications, about 50 to 75 psi at the high end. If you need hundreds of psi, you're going to need a syringe pump.

A nice feature of all our pumps is that they can be networked together, so you don't always have to choose one or the other. For example, you could have a syringe pump handle precise dispensing while a peristaltic pump delivers bulk buffer, and automate the system from a single computer port.

Q: How can labs simplify experimentation iterations?

A: One thing we offer that's fairly unique is an Excel spreadsheet interface for our pumps. We've customized Excel with pull-down menus to assist in entering pumping programs. Once you build your pumping programs, it's one click to upload them to the pump.

Many researchers already have their equations and formulations in Excel, so they can link their data directly to our spreadsheet and send it straight to the pump, without anyone retyping numbers or transposing data into a pump's user interface. This is a huge help in the R&D process. If one formulation doesn't work, they can tweak the numbers in their spreadsheet, upload them, and try it out immediately.

Each version of the spreadsheet can be saved as a separate file, so their work is documented as they go. We've had customers call us after a pump failure, saying, "We don't know what flow rate we were running—we didn't write it down." Doing the experimentation in the spreadsheet prevents this issue, as it keeps a record of every run.

Overall, it simplifies documentation and makes iterations faster and easier.

Q: When working with a limited budget, what's the best way to approach pump selection?

A: The most important thing is to be realistic about what you need. Start with what you're trying to accomplish, and then look for the features that will meet your application's needs.

You don't need the most expensive device out there. Try not to get swayed by slick salesmen trying to convince you to buy a Mercedes when you just need to go around the corner at 15 miles an hour.

Very often, you can even use something you already have on the shelf. We get calls from people with 20-year-old equipment that we'll still support. We still have parts for that 20-year-old pump, and they are often still being manufactured. We don't care if they bought the pump on eBay, as long as they're using our pumps, we'll support it.

The bottom line is, be realistic about your requirements, use what you have when possible, and you can almost always find a solution that works within your budget.

Q: What's the one piece of advice you'd like to leave our audience with?

A: I'd say it comes back to the theme we've been talking about: Be realistic and focus on the result. Don't get lost in building an overly complicated "mouse trap."

If the system you're designing feels too complex, step back and look at it with fresh eyes. Often, you'll find there's a simpler way to accomplish what you want. Don't just assume the solution has to be complicated. Very often, the simplest approach is the best one.

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2026 Lab Manager Leadership Summit: The Must-Attend Event for Lab Leaders

NOW IN ITS SIXTH YEAR, THE LEADERSHIP SUMMIT RETURNS WITH A STRONGER-THAN-EVER PROGRAM **by Lauren Everett**

Leading a lab today means navigating tighter budgets, higher expectations, and rapidly changing technology. The 2026 Lab Manager Leadership Summit is your chance to step away from daily pressures and find the solutions, tools, and strategies to meet those challenges head-on.

The Leadership Summit returns April 20–22, 2026, at the Gila River Resorts & Casinos—Wild Horse Pass in Phoenix, Arizona. Now in its sixth year, the in-person Summit stands as the premier event for laboratory managers, directors, and senior leaders who want to strengthen their leadership skills, connect with peers, and return to their organizations with strategies that deliver real impact.

For 20 years, *Lab Manager* has been producing content and events specifically designed to support lab managers in every stage of their career. Building on that legacy, the 2026 Leadership Summit delivers a program that is more dynamic, interactive, and actionable than ever before.

What's new in 2026

The Leadership Summit has always been about practical insights and peer-to-peer learning. This year, several exciting enhancements make the program even more valuable for attendees:

Diverse, interactive sessions

The 2026 Summit introduces a new level of variety to the program. Attendees will engage in expert-led presentations, collaborative roundtables, lively panels, and new breakout sessions that foster small-group discussion and hands-on activities. This mix of formats ensures you are not just listening but actively participating—leaving with deeper insights and strategies you can put into practice immediately.

More workshop offerings

By popular demand, the Summit now features an expanded lineup of workshops to kick off the first day. Covering a range of topics—management, safety, technical operations, and more—these sessions provide practical, skills-based learning opportunities tailored to your needs. Whether you are a new manager or a seasoned leader, there is a workshop designed for you.

A resort-style experience

Professional development should also be energizing. This year's Summit venue—the Gila River Resorts & Casinos—Wild Horse Pass—offers attendees the chance to recharge in a resort-style setting. Enjoy stunning desert views, poolside relaxation, and on-site amenities, creating the perfect balance of retreat and intensive learning.

Content for senior leaders

The program also introduces advanced content designed specifically for experienced leaders. These sessions focus on the complex challenges facing today's senior lab managers and directors, including multi-site operations, strategic decision-making, and navigating economic and regulatory pressures. You'll gain insights that speak directly to the realities of high-level leadership.

Why you should attend

Laboratory leadership today requires more than technical expertise. It demands strong communication skills,

a business mindset, and the ability to lead teams through change and uncertainty. The Leadership Summit is built to equip you with exactly that.

Current managers will find strategies to tackle pressing issues like staffing, resource allocation, and operational efficiency. Senior leaders will benefit from advanced discussions on cost efficiency, business-minded decision-making, scalable capital planning, and protecting sensitive scientific data. Aspiring leaders will gain early exposure to leadership frameworks and tools that accelerate their growth.

Attendees leave the Leadership Summit not just with inspiration, but with concrete takeaways:

- Actionable strategies for managing people, processes, and resources
- Peer-tested solutions to common challenges faced by labs across industries
- Fresh perspectives from expert speakers and fellow leaders
- Networking connections that extend beyond the event

Building on a strong foundation

The Leadership Summit reflects two decades of *Lab Manager*'s dedication to the laboratory leadership community. For 20 years, we have produced trusted editorial content, training resources, and events specifically for lab managers. The Summit, now entering its sixth year, represents the pinnacle of that commitment—an immersive, in-person experience designed to empower leaders at every stage of their journey.

Invest in yourself and your team

We know how demanding your role can be, and how difficult it is to step away from the lab. But investing this time will pay dividends, equipping you with fresh strategies, actionable tools, and renewed energy to return to your team ready to elevate performance and productivity.

Join us in Phoenix this April for the 2026 Leadership Summit, and experience firsthand why this event has become the go-to gathering for lab leaders nationwide.

For more information and to register, visit: summit.labmanager.com/leadership

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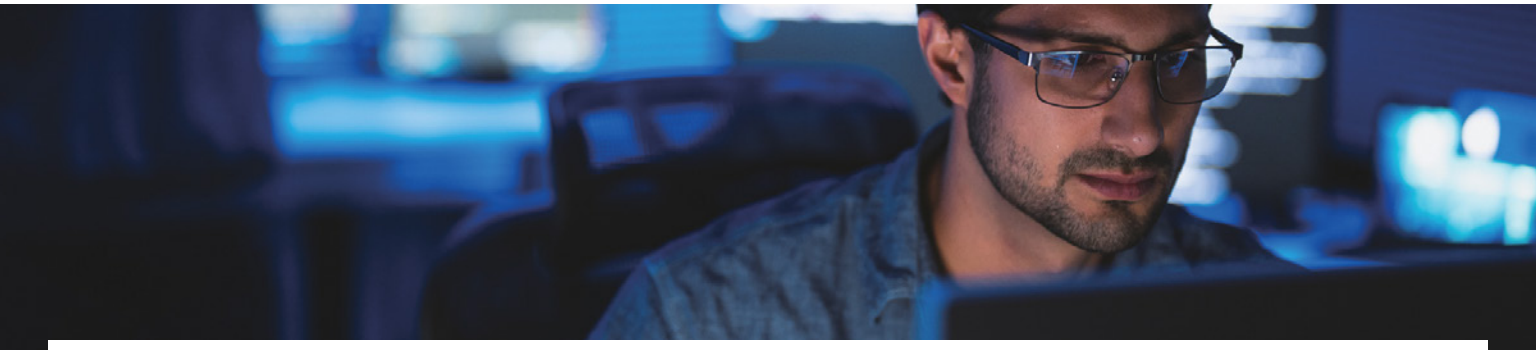

How to Address Cybersecurity as a Lab Manager

CYBERSECURITY IS A SHARED RESPONSIBILITY, NOT A SOLO MISSION

by Holden Galusha

Cybersecurity may seem like a technical challenge outside your purview as a lab manager, but effective leadership is a vital part of keeping a laboratory secure. Lab managers play a key role in the governance, risk awareness, and training for cybersecurity. To shed light on where a lab manager's responsibility for cybersecurity begins, ends, and how they should best collaborate with IT, we spoke with Stefan Lüders, PhD, longtime computer security officer at CERN.

Q: Which cybersecurity duties fall to lab managers versus IT?

A: Cybersecurity is not the core business of most lab managers—we should acknowledge that their skills, expertise, and knowledge lie elsewhere. So why put the burden on them?

Their only (but essential) responsibility is governance over cybersecurity, just as they have over budgeting, human resources, operations, business continuity, and so on. That means ensuring cybersecurity is considered at every step—development, deployment, testing, and operation of all equipment, including software—and ensuring appropriate awareness and training for all team members.

They must liaise with relevant bodies in their organization, especially the IT department, to make sure their equipment is secured, protected, or at least listed in the organization's risk register as a potential cybersecurity risk. Their primary contacts will likely be IT, but also the training department, the CIO, and the enterprise risk manager.

In short, cybersecurity is a cross-functional responsibility involving many parts of the organization, and teamwork is essential.

Q: What baseline practices should every lab manager implement, regardless of technical expertise?

A: Good practices are usually described in IT and cybersecurity standards like ISO 27000 or CIS Controls (CISv8). The starting point is a thorough risk analysis of the lab's operations and their impact on the broader organization.

Any cybersecurity risk should be listed and either mitigated (if it's too large to accept) or accepted as residual risk. As I said earlier, this must happen together with experts—the IT department and other partners—who can provide the right controls.

While governance belongs to the lab manager, and implementation of protective controls belongs to IT, a good lab manager should still ensure hardware is up to date, software is developed with cybersecurity in mind, access is tightly controlled, and backup, business continuity, and disaster recovery plans are in place and tested.

Q: How can lab managers ensure a collaborative relationship with IT?

A: It's essential to understand the core responsibilities of both lab managers and IT, and to focus on the ultimate goal of the organization. Both roles are key to achieving that success.

The IT department should not be seen as a hurdle but as an enabler—they provide the expertise to help labs run smoothly, including cybersecurity measures appropriate to the organization's risk appetite.

Trust is key. Sharing the workload is key. Everyone has their own expertise, and that should be used fully:

lab staff for equipment operations, IT staff for IT provisioning.

This also means IT should be given the chance to understand lab operations—ideally through internal mobility, internships, or regular discussions. Again, working hand in hand is essential because the goal is shared.

Q: How should a lab manager approach security training for their lab staff?

STEFAN LÜDERS, PHD

A: Training should take a multi-pronged approach, depending on the team's maturity level. General awareness is essential—understanding the impact of a cyberattack, the attack vectors, and the possible consequences.

Once that foundation is set, more specialized training can follow—for example for programmers: how to design, architect, develop, and program software securely. Similar trainings exist for IT system deployment.

The IT staff should already have that expertise and can provide training; if not, they should be included and required to complete the same courses.

Q: Phishing and "vishing" attacks are on the rise, according to CrowdStrike's *2025 Global Threat Report*. What roles do lab managers and IT leaders play in preventing these attacks?

A: These attack types have been around for years, with many variations. All staff—lab managers, HR, IT—need awareness and training to recognize phishing and follow the principle of "STOP—THINK—DON'T CLICK" when browsing or handling emails.

Leaders must ensure staff complete the necessary training. IT leaders, ideally the CIO, must ensure appropriate trainings are offered and technical countermeasures are in place: spam filtering, email quarantining, anti-malware, multi-factor authentication, firewalls, web application firewalls, monitoring, and intrusion detection.

Importantly, the organization must also be ready to respond swiftly and thoroughly when incidents inevitably occur. Prevention (training), protection (technical safeguards), detection, and response are all critical.

Q: With internet-connected lab instruments and IoT devices becoming common, who's responsible for keeping that hardware secure?

A: First, operation-critical lab instruments should never be directly connected to the Internet—doing so is a major error and cannot be justified.

Second, you can't "ensure" that such hardware stays secure. Maybe it's secure today, but IoT is often called the "Internet of insecure things" for a reason. Security conferences are full of examples of cracked IoT devices—they excel at their core functions but often lack proper security layers.

Therefore, IT staff are primarily responsible for protection. The organization's perimeter firewall should never allow lab instruments or IoT devices to be openly accessible from the Internet. Any exceptions must go through an extensive approval process, including risk assessment. Personally, I would never authorize such a firewall opening.

Q: For labs running aged instruments, what should lab managers know about security for old operating systems and software?

A: It's not unusual for lab equipment to run outdated OS or firmware versions that can't be updated or patched. Generally, this isn't a problem if other protection layers are in place: network segregation, VLANs, firewalls, and strict access control.

These protections should exist anyway, because lab equipment can't be patched as promptly as office computers. Maintenance windows are needed, and in some cases, they're scheduled weeks, months, or even years out.

Patching also isn't always straightforward, as it requires thorough testing and sometimes recertification. That's why layered defenses—"defense in depth"—are essential.

Stefan Lüders, PhD, graduated from the Swiss Federal Institute of Technology in Zurich and joined the European Organization for Particle Physics (CERN) in 2002. Since 2009, he has been heading up the CERN Computer Security Incident Response Team as CERN's computer security officer.

Holden Galusha *is an associate editor for* Lab Manager. *You can reach him at hgalusha@labmanager.com.*

Solving Central Lab Challenges with Precision Logistics

UNPREDICTABLE SHIPMENTS AND EVOLVING REGULATIONS PUT SAMPLES AND PATIENTS AT RISK

David Lee *brings over 20 years of experience in logistics, supply chain management, and international business development to his role as vice president of alliance management and strategic accounts at Marken. He leads the alliance management team, supporting top global clients, and plays a central role in pricing, commercial decisions, and initiatives that strengthen global operations. David is recognized for his pragmatic leadership and passion for advancing cold chain logistics solutions that help healthcare innovations reach patients.*

Q: Can you share a little about your career path and how your journey shaped your current work with central labs?

A: I've worked in logistics for about 28 years and spent 15 of those with a major international carrier. A client I supported at the time was one of the largest diagnostic and testing companies in the US, which was my introduction to working with central labs. Since then, I've continued to work closely with major central labs. These relationships, and the work itself, have shaped my career and kept me focused on what matters. We're not just moving packages, we're supporting patients. Every shipment represents someone waiting for a diagnosis or treatment, and our job is to make sure samples arrive on time and in good condition.

My experience has allowed me to drive innovation. One thing I've pushed for is sustainable, recyclable packaging to reduce EPS waste. I also helped build our operational excellence team, which investigates deviations and oversees corrective and preventive actions. For me, this is a game-changer. By getting down to the root cause of an issue, we can prevent it from happening again.

Q: What do you see as the most pressing challenges facing central labs, and how can lab leaders best mitigate these risks?

A: The trick for central labs is staffing and visibility of incoming samples. It's not just about getting the right people in the right place—it's knowing when samples will arrive. If deliveries are delayed, staff waste time waiting or miss testing windows.

That's where visibility comes in. Labs are using e-requisition systems that connect barcoded vials to the patient, study, and shipment. When we can see where each sample is in the supply chain, we can give labs advance notice so they can schedule staff for when samples will actually be there.

Regulatory requirements are also evolving. A good example is the recent change to de minimis exceptions for shipments into the US. Previously, we didn't have to make customs declarations for biological samples. Now we do. That means making process changes across multiple origins, countries, and studies, which is a huge undertaking. If you don't get it right, you risk delays that can push samples out of stability and impact study timelines.

This is where precision logistics can make a big difference. At Marken, we use GPS tracking and proactive notifications to safeguard samples and support planning. Being part of the UPS network means we can also choose the best transportation option, whether that's a commercial airline or a UPS flight, to move samples quickly and predictably. We stay ahead of regulatory changes and work with central labs to communicate what's required—everything from updating documentation and invoices to ensuring the right information is declared at customs. We also build contingency and mitigation strategies to keep shipments moving.

Q: What improvements can central labs expect when precision logistics are in place?

A: Labs can expect accountability and on-time performance. We have a commitment that 99.5 percent of the time, samples are going to arrive within the allocated window.

Using proactive tracking, real-time interventions, and advanced technology, from temperature monitors to GPS trackers, we protect sample integrity and provide reliable delivery, no matter where the lab is located.

Governance is another key element. Each central lab has a dedicated alliance manager who serves as a single point of contact, so they're not chasing answers. This close coordination helps us address any service deviations and minimize disruptions. It's about working together and understanding that things can happen.

We work with labs to make sure contact details, pickup locations, and customs documentation are correct. We also collaborate with clinical sites, many of which are unfamiliar with logistics processes, to explain requirements and ensure samples are ready on time. For highly sensitive studies, we provide hypercare monitoring with localized training and bespoke SOPs, so samples are handled correctly at every step.

We're also constantly thinking about innovation. For example, we've recently introduced our InfiniDI reusable shipper. Traditionally, dry ice shipments offered up to 96 hours of temperature control, meaning any customs delay required intervention. InfiniDI uses specialized packaging to keep samples in range for up to 140 hours, offering greater confidence and improved sustainability.

Q: How are AI and digital technologies improving specimen visibility and traceability?

A: Routing is the most complex part of shipping. We've implemented AI within our booking system to analyze airline reliability, flight performance, delays, and offload data to help us select the best routes.

In the past, we'd have someone manually track all that data. Now AI does it for us. The benefit isn't cutting headcount, it's freeing up our people to focus on higher-value work. Instead of spending their time manually routing shipments, they can concentrate on shipments that require extra care and think about how to improve our services for central labs.

We're also investing in automation to make things easier for clinical sites. During study setup, we create a template linking samples with their storage conditions and destination. When a nurse enters the study ID, the system, as if by magic, automatically populates. All they need to do is enter the number of samples. The quality of data we're getting from this means the output is far better, with fewer delays and issues.

On top of that, we use advanced software to provide real-time milestone updates for more transparency and accountability. It also builds a digital chain of custody for future quality reviews and audits.

Q: When selecting a logistics partner, what questions should lab managers ask?

A: I think the question labs should ask is, "What differentiates you from other logistics providers?" Look for expertise and a proven track record. You want a partner who understands this isn't just another package; there's a patient at the end of it. They should back this up with clear KPIs and be able to explain how they maintain quality and compliance.

Innovation is another key differentiator. You don't want a provider who is sitting on their laurels. You want one that continually improves and thinks about the future.

Proactivity is also an essential differentiator. It means understanding the deep intricacies of sample transport, anticipating potential disruptions, and taking action early. For instance, if we know your patient is coming in on Monday and a storm is due on Tuesday, we'll route the shipment around the storm. This proactive thinking prevents patients from having to return to the hospital and prevents labs from waiting for samples.

Q: Looking ahead, what innovations do you see shaping the future of central lab operations?

A: I think there are a few key areas that will really drive improvement. First is the work of our operational excellence team, which is vital for quality assurance. If we can mitigate issues ahead of time, we can not only improve report quality and turnaround time but also drive continuous improvement.

Another big step is integrating lab management platforms with courier transport systems. We're close to doing this with a couple of labs. I think that will make a vast improvement in the site's experience, because they won't need to look for a courier website or think about logistics; they're just using their platform. With this integration comes a secure chain of custody and visibility. Labs get real-time information and don't need to rely on periodic updates from couriers.

Discover more at **marken.com**

TRENDS IN BIOPHARMA

Building Scalable Gene Therapy Workflows

by Roman Necina

Viral vector-based gene therapies are rapidly evolving from niche treatments for rare diseases into promising solutions for more prevalent and chronic conditions. This shift presents both exciting opportunities and significant challenges for lab managers tasked with supporting the development, manufacturing, and commercialization of these therapies.

As the industry moves toward broader applications, the pressure is intensifying to deliver high-quality therapies quickly, affordably, and at scale. Lab managers play a critical role, ensuring that scientific innovation is matched by operational excellence.

THE RACE TO THE CLINIC: BALANCING SPEED WITH STRATEGY

Time to clinic has always been a defining feature of gene therapy development. The urgency to address unmet medical needs and the potential for transformative outcomes have driven companies to accelerate timelines from discovery to clinical trials. A challenging funding environment is now layered on top of this, adding complexity. With tighter capital markets, companies often rely on reaching key value inflection points—such as an IND filing or initial patient dosed—to unlock further investment.

Researchers and developers must support this pace without compromising safety, efficacy, or the eventual commercial viability of the product. This means designing workflows that are both fast as well as adaptable to future needs. Early-stage processes must be built with an eye toward commercialization, even if initial production is small-scale.

FROM RARE TO COMMON: THE SCALABILITY IMPERATIVE

Historically, gene therapies targeted rare diseases with limited treatment options, where cost considerations were secondary to proof of concept. Today, the field is expanding to include conditions like Alzheimer's, Parkinson's, and diabetes—diseases with large patient populations and existing therapies.

This shift demands a new approach to manufacturing. Lab managers must evaluate whether current processes can scale efficiently and cost-effectively. The challenge is twofold: producing enough drug product to meet demand and ensuring that the cost per dose is sustainable for healthcare systems and payers.

"As the industry moves toward broader applications, the pressure is intensifying to deliver high-quality therapies quickly, affordably, and at scale."

Pricing sensitivity becomes a critical factor when competing with established treatments. Even highly effective therapies may struggle to gain traction if their cost to the healthcare system is too high. Therefore, optimizing productivity across the entire manufacturing workflow must be a priority.

CELL LINE STRATEGY: CHOOSING THE RIGHT PLATFORM

One of the most impactful decisions in viral vector manufacturing is the choice of production platform, for which cell line is the critical starting point. Many developers begin with transient transfection, which is fast and flexible but relies on costly components and repetitive inputs. While suitable for early-stage trials or lower vector demand, these methods may not be viable for large-scale production.

Stable producer cell lines are the industry standard for other large molecule-based therapies and offer a more cost-effective alternative for viral vectors as compared to transfection. Integration of the necessary components into the cell removes the need for transfection components and enables greater control over biological processes. Researchers and developers must consider transitioning to producer cell lines as therapies progress toward later-stage trials and commercialization.

Culture format is another key consideration. Adherent cell cultures are uncomplicated to initiate and ideal for early testing, but they may not meet the demands of high-volume production. Suspension cultures, supported by bioreactor systems, offer better scalability and higher titers, making them a preferred choice for commercial manufacturing.

PROCESS OPTIMIZATION: UPSTREAM AND DOWNSTREAM SOLUTIONS

Improving the quality of the viral vector product and increasing productivity requires attention to both upstream and downstream processes. Process intensification, optimization of media, feed strategies, and fermentation

parameters increase productivity and improve scalability for commercial supply. These technologies enable more consistent growth conditions and better control over vector production as compared with legacy adherent processes.

Downstream, the focus shifts to minimizing product loss and improving purity. One major challenge is the presence of empty or partially full capsids—viral particles that lack the full therapeutic transgene. Removing process- and product-related residuals is essential for maintaining therapeutic potency and meeting regulatory standards.

"As the field matures, the focus must shift from feasibility to accessibility."

Chromatography is a key technology for purification. Multiple chromatography steps are often employed, allowing first for capture of the viral capsids followed by separation of full, partial, and empty species. Lab managers should stay informed about advances in purification technologies and be prepared to integrate them into existing workflows.

REGULATORY CONSIDERATIONS: PLANNING FOR CHANGE

Process changes are often necessary as therapies move from early development to commercialization. While these changes have regulatory considerations, the key is to demonstrate that product quality remains consistent. Regulators focus on critical quality attributes—measurable properties that define safety and efficacy—rather than the specific manufacturing methods used.

Developers should document all process changes thoroughly and develop comparability plans, demonstrating that critical quality attributes are maintained. Early communication with regulatory bodies is essential. By outlining proposed changes and providing supporting data, labs can avoid delays and maintain momentum toward approval.

Transparency and preparation are vital. Regulatory agencies expect developers to take ownership of their processes and provide clear, science-based justifications for any modifications. Lab managers should work closely with quality and regulatory teams to ensure that all changes are well-supported and compliant.

COLLABORATION AND INTEGRATION: BUILDING A UNIFIED ECOSYSTEM

Gene therapy development is inherently multidisciplinary. Success depends on collaboration across research, manufacturing, regulatory, and commercial teams. Lab managers serve as a bridge between these functions, ensuring that scientific goals are aligned with operational capabilities.

Partnering with technology providers can help accelerate progress. Think about which company can offer end-to-end solutions for viral vector manufacturing, from cell line development to purification technologies. Leveraging external expertise allows labs to focus on core competencies while accessing the right tools and insights.

Internal collaboration is equally important. Developers should foster a culture of knowledge sharing and continuous improvement. Regular cross-functional meetings, shared data platforms, and integrated planning tools can help teams stay aligned and responsive to changing needs.

LOOKING AHEAD: A FUTURE OF ACCESSIBLE INNOVATION

The promise of viral vector-based gene therapies is immense. As the field matures, the focus must shift from feasibility to accessibility. Lab managers are at the forefront of this transition, tasked with building processes that are not only scientifically sound but also economically viable.

By prioritizing scalability, optimizing workflows, and engaging proactively with regulators, developers can be helpful tools in bringing these therapies to more patients, faster, and at a lower cost. The journey is complex, but a future where gene therapies are widely available and affordable is well worth the effort.

Roman Necina *is the vice president and general manager, viral vector, genomic medicine at Cytiva. Roman studied food and biotechnology in Vienna, Austria. He began his doctoral studies on developing novel affinity chromatography resins and optimizing industrial affinity chromatography. He earned his PhD from Vienna's University of Natural Resources and Applied Life Sciences.*

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Replacing Stickers with Laboratory-Grade Labeling

HANDWRITING AND ADHESIVE LABELS WASTE HOURS EACH WEEK. DIRECT PRINTING MAKES SAMPLE IDS PERMANENT, ACCURATE, AND FAST—FINALLY MODERNIZING THE MOST OVERLOOKED STEP IN THE LAB.

***Rusty Bishop**, PhD, serves as Chief Commercial Officer at TubeWriter. Trained as a biochemist, he brings both lab experience and commercial insight to improving everyday research processes. His work centers on helping scientists reclaim time and consistency in sample management through smarter labeling solutions.*

Q: If it can take only one missing label to throw off an entire experiment, why do labs still rely on handwriting and stickers to track critical samples?

A: It's legacy. It's one of those things that just stuck around for decades. Every scientist has done it since the Sharpie was invented—or before that, probably with a pencil. Every part of the lab has seen innovation: automation, liquid handlers, all these amazing tools. But labeling got overlooked.

When I started out, it was, "Here's your labels, here's your tubes, go to town." Then came the small thermal printers that spit out barcode stickers, but that's still old technology. There's no automation, no real time saving, no thought behind it. It just became part of how people work, and no one ever thought to innovate on it.

Q: You've worked in and visited a lot of labs. What have you seen when it comes to labeling in the real world?

A: I've seen just about everything—Sharpies, masking tape, stickers that don't stick. My own handwriting's terrible, so I've been that person who ran the critical experiment, froze the samples, and left them for the next scientist who couldn't read a thing. I've dug through liquid nitrogen freezers trying to find the right cell line or protein because the labels smeared or fell off.

Some labs try to fix it with tape or extra steps. I was at one site where they printed sticky labels, then wrapped tape around each one so it wouldn't peel off in the freezer. It still did.

And it's not just isolated cases. I've been a part of teams that have spend nights labeling. One customer told me they literally buy pizzas and have everyone sit down to label 6,000 tubes. Another lab I worked with in France was pre-labeling 2,000 tubes every morning before they could even start collecting samples. That's just what people do to keep up.

Q: How do the costs of labeling show up in daily lab work?

A: The first cost is rework. If a label falls off or no one can read it, you have to redo the experiment. That's wasted samples, wasted reagents, and wasted time. It sounds small until you start adding it up.

Most labs think they label a few hundred tubes a day, but that's never true. Take something as simple as isolating proteins from twenty cell lines. You start with twenty tubes, then you spin them down and aliquot the samples so you have backups. That doubles the count right there. Add a few DNA extractions, positive and negative controls, a couple of replicates, and you're at a hundred tubes before lunch.

Now multiply that across ten people in the lab. That's thousands of tubes a day, not hundreds. Each one takes half a minute or more with a Sharpie or sticky label. Over a week, you've lost hours to nothing but labeling. And if one label is wrong, or falls off, you lose even more time redoing the work.

That's why I compare the current labeling process to Uber. No one knew they had a taxi problem until Uber came along. It's the same with labeling. You don't realize how much of your day disappears until you stop and think about it. Most of the scientists who come to TubeWriter are at that stage—they've just done the math and realized how much science they're losing to stickers and handwriting.

Q: What is TubeWriter, and how does it work?

A: TubeWriter is a direct to labware print system that replaces handwriting and stickers. It uses a fine inkjet head to place UV-curable ink on the surface of a tube, then sets the mark instantly with light. The cured ink bonds to the plastic or glass, creating a label that stays legible through freezing, thawing, or solvent exposure.

It sits in the middle of the labeling world. On one side are Sharpies and stickers—cheap but slow and unreliable. On the other are large industrial robots built for massive, single-format batches. TubeWriter bridges that gap. It gives labs automation that fits their daily work, fast enough to keep up but flexible enough for every kind of experiment.

Q: What kinds of tubes or labware can it print on?

A: Almost anything a scientist puts in front of it. We've printed on NMR tubes that are barely thicker than a pencil and on large bottles used for cell culture. The printer adjusts to the height and diameter of each item, so the same system can handle 50-milliliter conicals, 15-milliliter conical tubes, Eppendorfs, PCR strips, and cryovials without changing hardware.

People send us the strangest things to test. We've labeled the caps of frozen tubes pulled from liquid nitrogen, the sides of 96-well plates, even the metal caps on HPLC vials. Our team likes those challenges; it's part of what makes the system flexible. If it fits under the print head, we can usually print on it.

Q: How do labs work TubeWriter into their daily routines?

A: It depends on the lab. Some teams batch-label before a big collection day. They'll load racks of cryovials and print a thousand labels in about an hour. Others keep a TubeWriter at the bench so scientists can print what they need as they go. High-throughput sites run several systems in parallel, labeling tens of thousands of tubes a day. The setup adapts to how people already work instead of forcing a new routine.

The ROI shows up quickly. A typical lab can label about 1,000 tubes an hour with TubeWriter, or around 600 if they are not aiming for maximum speed. By hand, that same job takes four to five hours. One large pharma customer measured the difference and found they were saving about three hours for every 1,000 tubes—roughly 3 hours per week x 52 weeks – 156 hours per scientist.

Q: What kind of reaction do you get when people see TubeWriter in action for the first time?

A: It's the first job I've ever had where a customer hugged me. They saw the print come out clean and just said, "Thank you." It's that kind of relief when people realize how much time they're getting back.

Reactions vary. Some labs see it and immediately get it. Others look at the system and wonder what this black box is doing on their bench. That's why we spend time on post-sale training. We bring the team together, show them the simple 3-step process of loading a rack, uploading tube identifiers, and pressing print. Once they see how easy it is to use and how it fits into their workflow, the skepticism disappears.

That's the part I enjoy most. It's not about the machine. It's about what happens next: scientists doing science again instead of spending hours peeling stickers.

TRENDS IN CHROMATOGRAPHY

The Future of Chromatography: AI, Automation, and Sustainability Converge

by Shiama Thiageswaran

Chromatography is at a turning point. Demands for faster results, greater accuracy, and greener practices now collide with breakthroughs in digital technology. This convergence is driving fundamental changes in how laboratories operate, from the instruments they purchase to the skills their teams need. In this article, experts from SCIEX, Thermo Fisher Scientific, and Cytiva explain how these forces are reshaping chromatography, and what lab managers can do to stay ahead.

WHAT THE EXPERTS ARE SAYING: KEY TRENDS

The following expert perspectives highlight the most important shifts influencing chromatography today and forecast how they will shape the field in 2026.

1. Holistic, multi-class analysis

Craig Butt, senior manager, Applied Markets, SCIEX:

In recent years, there has been a significant focus on various factors that impact our environment and bodies—PFAS contamination everywhere, mycotoxins in crops, veterinary drugs contributing to antimicrobial drug resistance, carcinogenic pesticides, and UV filters harming coral reefs, among others. What is becoming clear is that these factors intertwine and have to be viewed and tested together. What's in the water impacts

the fish we eat, impacts the plants we water, and impacts the food we consume.

In the future, we see a need for targeted screening of multi-class chemical pollutants to better safeguard our environment and food supply chain. To better understand the impact on human health, we have to look at these chemicals together, not in isolation.

Key takeaway: Prepare for broader testing panels and adopt workflows that can analyze complex, multi-class datasets.

2. The central role of automation and AI

Greg Staples, senior director, Product Management, Thermo Fisher Scientific:

A major trend is the integration of artificial intelligence (AI) and machine learning (ML), which will be used to optimize method development, predict chromatographic outcomes, and enhance data analysis.

Ultimately, the growth of AI may also ease the high demand for technically skilled operators and allow scientists to concentrate on results, rather than ion chromatography (IC) system mechanics.

Martin Ruehl, director, HPLC Product Management, Thermo Fisher Scientific:

Looking ahead, liquid chromatography (LC) instrumentation will continue to evolve, with improvements in detectors, columns, and system design that enhance performance, reliability, and sustainability.

Automation and digitalization will continue to expand, supported by AI and ML, to optimize separations, predict outcomes, and enhance data analysis. These advances will drive greater efficiency and accuracy across workflows.

Key takeaway: AI will ease repetitive tasks and reduce reliance on highly skilled operators; however, labs should retrain their staff to manage AI-driven systems and interpret results.

3. Miniaturization and hyphenated techniques

Staples:

Looking ahead, the practice of ion chromatography is expected to be shaped by several key trends. Hyphenated techniques, such as combining IC with mass spectrometry (IC-MS), will become more widespread and will provide greater sensitivity and selectivity for complex samples. We also expect to see further miniaturization of systems and consumables, allowing for portable, on-site analysis and reduction of eluent waste.

Key takeaway: Adopt modular, portable systems that reduce solvent use and operating costs while expanding on-site testing capabilities.

"A major trend is the integration of AI and ML, which will be used to optimize method development, predict chromatographic outcomes, and enhance data analysis."

4. Sustainability as a strategic imperative

Ruehl:

Environmentally friendly methods have gained traction, with labs using less toxic solvents and reducing solvent consumption. This trend aligns with the growing emphasis on sustainability and the demand for transparency around instrument energy use, resource consumption, and packaging.

Clement Bassens, general manager, Fiber Chromatography, Cytiva:

Membrane chromatography (MC), traditionally used for polishing, is now being adapted for capture steps—especially protein A affinity—driven by the need to reduce clinical manufacturing costs and handle larger biologics.

Additive manufacturing has enabled more efficient device designs with lower hold-up volumes and easier scalability. Innovations that combine convective and diffusive elements are increasing membrane capacity and performance. Looking ahead, hybrid workflows combining membranes and resins will become standard.

New membrane materials will enhance binding capacity and reduce costs, while a sustainability focus—including regulatory alignment and device recycling—will drive eco-friendly designs and processes.

Manager takeaway: Begin embedding sustainability into purchasing and workflows now. Solvent reduction, recyclable device adoption, and buffer management planning will soon be mandatory.

5. Evolution in biopharma and personalized medicine

Kerstein Pohl, senior global market development manager – BioPharma CE, SCIEX:

Vaccine development and hesitancy is a highly debated topic right now. mRNA vaccine development has moved from emergency use to full approval status in the United States, which makes more treatments possible. On the other hand, vaccine hesitancy also brings up concerns about safety and efficacy. Analytical science is a key player in this space as we discover more ways to ensure vaccine safety and support development.

"Looking ahead, LC instrumentation will continue to evolve, with improvements in detectors, columns, and system design that enhance performance, reliability, and sustainability."

Ruehl:

LC will also play a central role in personalized medicine, enabling detailed biomarker analysis and precise quantification of therapeutic drugs to support tailored treatments.

Bassens:

MC is expected to see broad adoption in advanced therapies and personalized medicine development due to its scalability and ability to handle large molecules.

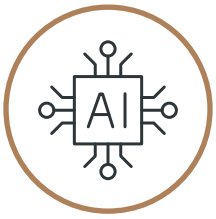
Key takeaway: Personalized medicine and advanced therapies mean smaller, variable batch sizes. Chromatography investments must align with these evolving clinical and manufacturing demands.

These insights underscore a future where chromatography is faster, smarter, and more sustainable—demanding lab managers to think strategically about technology, people, and processes.

HOW LAB MANAGERS CAN PREPARE FOR THE UPCOMING YEAR

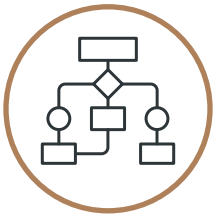
To ensure their labs remain competitive and successful, lab managers should take a proactive and strategic approach.

1. Invest strategically in technology, prioritizing modular design and advanced, upgradable software. This foresight enables the adoption of new technologies, such as AI and automation, safeguarding your investment.



2. Start preparing your team for a smooth transition by testing AI tools now, and prioritize professional development for staff in the new software, data analysis, and maintenance.

3. Evaluate workflows and adopt smaller ID columns and reagent-free systems to cut waste and costs. For new membrane-based workflows, plan early for buffer demands and management.



By focusing on these three areas—strategic investment, staff training, and sustainable practices—lab managers can successfully navigate the evolving landscape of chromatography and set their labs up for long-term success.

Shiama Thiageswaran *is an assistant editor at Separation Science. She brings experience in academic publishing and technical writing and supports the development and editing of scientific content. She contributes to editorial planning and helps ensure the delivery of clear, accurate, and relevant information for the analytical science community.*

Lab Manager ACADEMY

Academy Study Break

Five Tips to Improve Data Integrity in the Lab

Labs are valuable for producing a wide range of technical outcomes for stakeholders, from complex, cutting-edge research to routine standard testing. The data, methods, and products developed in labs enable these stakeholders to take the next step toward growing their organizations. Stakeholders rely on the integrity of the data produced by the labs to make informed decisions. The labs build trust and a positive reputation by consistently delivering high-quality results with significant data integrity.

To explain how data systems and electronic records can meet data integrity criteria, Dan Zuccarello, principal consultant at the RBF Consulting Group LLC, developed an acronym for trust:

Tangible

Labs need to present tangible evidence of the outcomes of the lab's technical work. This documentation clearly demonstrates the connections between the lab's activities, the data produced, and the results reported to the stakeholders. These documents must be reviewed and witnessed to ensure accuracy, compliance with required procedures, and appropriateness.

Reliable

Data integrity is based on reliability. The people, training, hardware, and software must all work in concert to perform the required activities. People need sufficient training to be proficient, and systems must be properly specified, qualified, and maintained. Building coherence into the hiring, training, and system specification processes yields a robust approach to data generation that provides stakeholders with reliability and consistency they can count on.

Unique

Data integrity relies on the generation, storage, and protection of original data. The lab and the stakeholders must be able to review data when new knowledge or insights become available. The digital systems must add time and date stamps when new files are created or copied. The uniqueness of data must be protected by eliminating paths that allow the removal, alteration, or deletion of elements of the original raw data.

Sustainable

For a digital system to maintain data integrity, the lab must demonstrate the ability to store, back up, and recover data from any location where it was initially stored. The system must also include traceability of the qualification and validation data used to bring new systems online in the lab. A fully sustainable lab protects all forms of original data. This could include paper-based systems and legacy digital systems. Creating and properly storing backups provides redundancy in the case of unexpected upsets or disasters.

Tested

It is vital to fully test systems to ensure that they will perform, even under stress and at high usage volumes. Create test scripts that push every aspect of the electronic system to ensure that the data produced and stored adhere to high-integrity standards. In GxP environments, this is part of equipment qualification and software validation. However, a robust testing process is valuable for any lab, regardless of the quality management system, to ensure it will positively contribute to the trust built with stakeholders and to grow the lab's reputation.

Digital systems are integrated into most labs today. These systems must work in concert with the rest of the data integrity process to ensure delivery of trusted data to stakeholders and to uphold the lab's hard-won reputation. Lab managers can ensure a robust testing process that delivers full data transparency through consistent, reliable systems that support the tangible data delivered to stakeholders.

TRENDS IN CLINICAL LABS

Clinical Lab Trends for 2026 Indicate Regulatory and Revenue Burdens

by Scott Wallask

Regulatory uncertainty. Revenue pressure. Technology decisions. These three trends for 2026 point to outside forces squeezing clinical laboratory managers, but optimists are hoping for at least a sprinkling of relief.

Medical laboratories should expect continued murkiness from the administration of President Donald Trump over how his anti-regulatory stance will affect labs. Clinical lab advocates are also lobbying Congress to pass a reform bill that could save them billions in Medicare reimbursement dollars—all while the threat of Medicaid cuts looms in coming years.

Artificial intelligence (AI) will produce more use cases in clinical lab settings, particularly in reimbursement activities. As the technology expands, the protection of patient data involved in AI algorithms will become a growing concern. Meanwhile, eyes will be on how AI integrates into the digital pathology market, which will continue its sluggish path to wider adoption in 2026.

Let's look in further detail at these shifts:

REGULATION: NEW BILL AIMS AT CUTS TO MEDICARE REIMBURSEMENT

Among the biggest clinical labs trends for 2026 will be the effect of regulations. Diagnostic labs have experienced a swell of regulatory activity since 2024.

In September, a bill was filed on behalf of the medical lab industry called the Reforming and Enhancing Sustainable Updates to Laboratory Testing Services (RESULTS) Act. The proposal calls for reforming the Protecting Access to Medicare Act of 2014 (PAMA).

"If labs are not already doing so, a good New Year's resolution would be to consistently review HIPAA compliance with AI tools."

Among its provisions, PAMA has annual reductions in the Medicare reimbursement rate for hundreds of common lab tests. Early cuts were devastating to labs, but more recent cuts have been averted due to temporary moves by Congress. However, the next round of up to 15 percent decreases will come on January 1, 2026, unless something changes. Should those cuts occur, many labs will experience serious reductions in Medicare reimbursement.

The RESULTS Act, if passed, will cap annual cuts to five percent permanently and change how the government collects data on reimbursement rates. The lab industry is in strong support of the bill.

"We are hopeful the RESULTS Act will gain traction in Congress," A. Joe Saad, MD, CPE, FCAP, a member of the board of governors at the College of American Pathologists (CAP), said in a brief interview. "It has bipartisan support and reflects a growing recognition of the essential role laboratories play in patient care."

Trump's anti-regulatory stance has left mixed messages for clinical labs since his second term started. Labs were generally relieved when the Food and Drug Administration (FDA) declined to appeal a federal

court ruling that vacated an agency regulation on laboratory-developed tests.

On the other hand, lab industry associations were caught off guard when the Trump administration disbanded the longstanding Clinical Laboratory Improvement Advisory Committee, which counseled federal health officials about diagnostic lab matters. Many lab advocates now are not clear how their voices will be heard at the federal level.

Most expect Trump to cull more regulations, oversight bodies, and potentially divisions of agencies. The *Washington Post* reported in July that the Department of Government Efficiency (DOGE) had circulated a slide deck discussing how to use AI to identify and reduce federal regulations by 50 percent. Should that occur in 2026, it's reasonable to speculate that lab the industry would see significant compliance changes.

REVENUE: MEDICAID CUTS AND TARIFFS COULD TRICKLE DOWN TO LABS

Clinical labs are also facing wider financial concerns in health care beyond PAMA. Trump's "One Big Beautiful Bill," which he signed into law in July, is expected to cut from $880 billion to $1 trillion from the Medicaid program over the next decade. Those cuts will result in fewer Medicaid recipients and changes to cost sharing for individuals.

"If a lab has significant Medicaid revenues, it could start to feel the crunch if a meaningful portion of its patient population loses coverage and becomes uninsured," Mike Ryan, a partner at law firm McDermott Will & Emery, told *The Dark Report*, a sibling brand to *Lab Manager*.

Clinical labs serving areas with poorer populations may take the brunt of this eventual hit. Meanwhile, the continuing trade war between the US and other countries has resulted in healthcare organizations absorbing higher costs caused by tariffs. Lab Manager has chronicled tariff repercussions, such as increased costs for personal protective equipment and diagnostic test kits.

Becton Dickinson, one of the world's largest *in vitro* diagnostics companies supplying clinical labs, noted tariff strain during an earnings call in August. "The landscape remains fluid, but based on policies in place today, we currently anticipate a full year 2026 tariff impact of around $275 million," said chief financial officer Christopher DelOrefice.

AI: INTERACTION WITH HIPAA PRIVACY RULES WILL GROW IN IMPORTANCE

It will not come as a surprise to see AI listed among the top clinical lab trends for 2026. The real debate is exactly how much influence the technology will wield given its rapid evolution.

For example, AI's use in revenue cycle management activities, such as prior authorization for tests and insurance claims submissions, can help labs flag concerns before they reach a commercial payer. But labs should be careful to properly find the best return on investment when picking duties for AI to integrate with.

An AI aspect unique to the healthcare industry that labs need to monitor is how well algorithms steer clear of HIPAA privacy violations. If labs are not already doing so, a good New Year's resolution would be to consistently review HIPAA compliance with AI tools. The nature of technology is that it continues to learn from new data, healthcare attorney Charles Dunham IV said during an interview at the 2025 Executive War College on Diagnostics, Clinical Laboratory, and Pathology Management, a partner event of *Lab Manager*. "That data must be obtained, utilized, shared, and secured in accordance with HIPAA and in accordance with state privacy laws," Dunham said.

DIGITAL PATHOLOGY: MARKET AND MONEY REMAIN FLUID

Digital pathology and whole-slide imaging have long been touted as a pivotal change that clinical laboratories need to make. Yet adoption of the technology has been slower than anticipated, largely to due to costs.

As payer reimbursement of digital pathology claims slowly increases, it may become easier for labs to justify the tens to hundreds of thousands of dollars they must spend on scanners and software if they want to move forward with digital pathology.

Europe is ahead of the US with adoption, which may portend more favorable conditions in America for whole-slide imaging in 2026, particularly at labs in academic medical centers. The niche market of AI in digital pathology is ripe for consolidation. Several years back, investors started pouring money into AI startups that crunch data within whole-slide imaging software. But the slow adoption by labs stymied the startups, and some of those nascent companies are running out of cash and other support. Witness the August acquisition of AI company Paige by healthcare technology firm Tempus. In five rounds of

funding since 2017, Paige raised $220 million, yet the acquisition cost Tempus $81 million. It was clear that Paige's AI software was not the prime target, but rather Paige's data. "The acquisition allows Tempus to grow its dataset, expand its experienced technical team, and establish a strong footprint in digital pathology with an industry leading technology portfolio," Tempus stated in a press release. Similar AI digital pathology deals may bubble up in 2026 as the niche market adjusts.

DECISIONS LOOM FOR CLINICAL LABS IN 2026

As we wrap up this review of clinical lab trends for 2026, medical laboratory managers have two prevailing decisions facing them in the new year:

- How can they absorb added costs and federal cuts to keep lab operations intact? In some respects, 2026 looks gloomy for clinical labs due to financial concerns.
- Does a new investment in technology, such as digital pathology or AI, make sense in the long run? As more use cases for digital pathology and AI receive publicity, it may be easier for lab managers to approach executives about operational investments supported by practical baseline assumptions.

Clinical labs will not have it easy in 2026. But there are at least slivers of hope in the crystal ball that may take some pressure off the diagnostics industry in the coming year.

Scott Wallask *is senior editorial manager at* Lab Manager *and sibling brands* The Dark Report, Today's Clinical Lab, G2 Intelligence, *and* Lab Design News. *During his 30-year career, he has covered the laboratory, healthcare, and high-tech markets during stints at TechTarget, HCPro, ZoomInfo, and the SAPinsider family of online publications. A former newspaper reporter, he graduated from Northeastern University with a bachelor's degree in journalism. He can be reached at swallask@clinicallab.com.*

Expert Perspective: Designing Effective Lab Containment Solutions

FROM MATERIAL SELECTION TO REGULATORY COMPLIANCE, LEARN WHAT IT TAKES TO DESIGN ENCLOSURES THAT SUPPORT SAFETY AND AUTOMATION

***Jesse Coiro**, director of business development at Plastic Concepts, Inc., has over 20 years of experience serving the biopharma, pharmaceutical, medical device, and educational markets. He has helped hundreds of labs implement engineered control solutions that protect personnel from hazards, advance sustainability goals, and ensure compliance with regulatory standards.*

***Michael Thompson**, founder, owner, and president at Plastic Concepts, Inc., has over 35 years of experience in plastics fabrication, design, and industrial ventilation, particularly in highly corrosive environments. Thompson also specializes in controlled environment and containment design for liquids, powders, and live species studies.*

Q: How is the rise of automation changing containment and safety needs in the lab?

JC: With automation, containment can be very challenging for the end user. As robotics are introduced, there are always variables to consider as part of the design. Sometimes we're protecting users from bioaerosols or chemical emissions; other times, we need to provide user and product protection. We also have to consider if connecting to the house exhaust is an option or if we need a fully filtered system.

Labs often don't realize until late in the process that their autosamplers or liquid handlers require an enclosure. Even if filtration is built into these systems, it only considers one safety factor and can't account for all variables. At Plastic Concepts, we take on these complex requirements and design customized enclosures that meet our clients' equipment and safety needs.

MT: For us, the key difference is that we're building an enclosure around the automation, rather than trying to fit the equipment into a pre-existing one. That customization provides a better fit, greater flexibility, and smoother interaction between the machines and operators, and of course, an increased level of safety.

Q: Can you walk us through your design process for enclosures?

MT: We start by sitting down with the client to gather all the specifications for their process and equipment, including dimensions, access points, and where products are transported into the process. Once we have that information, we begin developing concept ideas and drawings. From there, we'll make any necessary revisions to make sure everything meets the client's needs.

JC: There are many variables to consider during design. It's not just about the equipment going inside the enclosure, but also how that enclosure will get into the facility. If that's not planned for, it could create some challenging obstacles. Every detail has to be reviewed, and there are many meetings between our team and the customer before delivery.

Q: What technologies do you build into containment solutions to support lab workflows?

JC: For containment, there are two main approaches: exhausting air through filtration or connecting the system to the facility's exhaust. The details—what handlings are performed, what chemicals are used, and whether bio-

aerosols are a concern—determine the technologies we integrate. These can include high-efficiency particulate or high-capacity carbon filtration, or both, as well as sensing technology. In some cases, we need to detect spikes in VOCs, acids, formaldehyde, or particles. We may also monitor air flow or integrate controls that communicate with a programmable logic controller, for example, to shut down a robotic arm if an enclosure door is open.

Q: When selecting materials for enclosures, what factors guide your decision-making?

MT: Chemical compatibility is an important part of the design process. Clients provide a full list of the chemistries used, along with concentrations, temperatures, and other relevant details. We use that information to ensure every material in the environment is chemical-resistant.

JC: With pharmaceutical clients, there are often additional requirements. For example, the enclosure may need to be made from USP Class VI-certified material, which means it won't leach or contaminate the product. We also comply with fire safety standards, such as FM4910 and NFPA 45, by selecting materials with appropriate fire ratings.

There's a lot of variability, and these factors, along with chemical compatibility, guide our material selection.

Q: How does polypropylene compare to traditional materials when it comes to safety and sustainability?

JC: Sustainability really comes down to the longevity of the product. Polypropylene is very durable and non-corrosive, so it could last a lifetime in almost any environment. If you can get 20, 30, or even 40 years of use out of a product, that's inherently more sustainable than materials like metal or wood, which corrode and rot.

MT: Polypropylene is also a virgin material, which offers process protection and prevents contamination. Other materials, like Teflon, can do this, but they're more expensive. Polypropylene is a good balance as a mid-cost material that satisfies sterile requirements.

Q: What do lab managers need to know about regulations for containment solutions?

JC: For both ductless and ducted containment devices, we comply with ASHRAE 110, ANSI Z9.5, CSA Z316, and NFPA 45. These standards are really about the system's structure, containment, and, if applicable, the filtrations level of efficiency and allowable exhaust threshold limit value release.

There's also the AFNOR NF X 15-211 standard, which emphasizes the filtration efficiency and is based on an assessment of the customer's specific application. The evaluation is performed by trained laboratory technicians who verify that the filters are appropriate for the chemicals being handled.

MT: For ducted applications specifically, we comply with the ACGIH Industrial Ventilation recommendations, which outline design parameters for the hood, ductwork, and ventilation system. There are many relevant standards, and the exact ones we follow depend on the client's process and requirements.

Q: How does Plastic Concepts help labs navigate the world of containment and automation?

JC: We don't want to tell customers about ourselves; we want to understand what they do so we can support their workflow. That's what differentiates Plastic Concepts. We make a point of understanding each client's challenges and pain points so we can develop solutions that meet their needs.

MT: We work closely with our clients throughout the process, which may take anywhere from a few weeks to a few months. We look at every part of their workflow, including pre- and post-operations. Asking these questions early helps us create better-designed equipment that supports their workflows and automation equipment.

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TRENDS IN PHARMA

Domestic Pharmaceutical Manufacturing Reshapes US Labs

by Betsy Baer

A key priority for the current US administration is strengthening domestic pharmaceutical manufacturing to reduce reliance on foreign sources of critical medicines. Persistent drug shortages—driven by low margins, complex manufacturing processes, and quality, among other factors—have underscored vulnerabilities in the global supply chain.[1] More than 80 percent of the active pharmaceutical ingredients (APIs) and key starting materials (KSMs) used in US drugs come from China, India, and the EU, creating both national and health security risks.[2] Generic medicines, which account for approximately 90 percent of all US prescriptions, are most affected by these shortages.[3]

"For lab managers, these shifts have direct implications for how and where to invest."

For lab managers, these shifts have direct implications for how and where to invest. In response to national security concerns, public health priorities, and new tariffs and incentives, many organizations are expanding or modernizing facilities, adopting advanced technologies, and integrating automation and AI/ML

to improve efficiency. Lab leaders must now weigh decisions around long-term cost savings, speed to market, scalability, and sustainability. Labs must also attract, train, and retain a skilled workforce aligned with quality and regulatory requirements.

These choices set the stage for how laboratories will adapt and compete as new technologies and business drivers redefine pharmaceutical development and production.

TECHNOLOGY INVESTMENTS TRANSFORMING PHARMACEUTICAL LABS

Advanced manufacturing technologies: Many laboratories are leveraging AI and ML, from discovery through production, and are employing advanced manufacturing technologies such as 3-D printing, continuous flow, process analytical technologies (PAT), biotechnology, and the development of new synthetic routes that may be more efficient and sustainable.

In June 2025, US Pharmacopeia (USP) opened an Advanced Technologies Laboratory to support and accelerate the adoption of newer technologies that may be used to produce and analyze quality medicines.

According to Dennis Hall, VP of advanced manufacturing technologies at USP, one focus is expanding the use of flow chemistry in pharmaceuticals to replace slower, batch-based synthesis. Andy Carpenter, chief scientific officer at Phlow, adds that continuous flow can eliminate unnecessary unit operations and improve manufacturing efficiency when combined with PAT tools and automated reaction design.

New processes for manufacturing APIs and KSMs have also been developed by innovative companies such as Antheia, Capra Biosciences, and Ginkgo Bioworks. Using bio-derived starting materials, bioengineering, and bioprocessing, these organizations are creating efficient and scalable routes for API and KSM production.

Advanced modeling software and process automation, medium- and high-throughput robotics, and multi-unit operations can add efficiencies, along with data-driven optimization and data analytics to inform and accelerate drug development and manufacturing. AI can be leveraged for designing new synthetic routes and to increase efficiency, quality, and real-time monitoring/real-time release, according to Ryan Littich, chief technology officer at the Medicines for All Institute. "The use of AI as an enabling technology for solving problems at lower costs offers an extra set of hands to enhance current talent. Robotics can be effectively applied, especially based on the complexity of molecules (e.g. higher molecular weight, sophisticated scaffolds, chiral compounds) and for more complex projects."

Power of collaboration: Public-private partnerships—such as those led by the USP, the API Innovation Center, and the BioMaP Consortium—are helping labs coordinate and access shared infrastructure, training, and technical expertise. Federal programs from agencies including the FDA, ASPR, DoW, ARPA-H, EDA, and the NSF are also funding initiatives that advance domestic manufacturing and workforce development through regional innovation hubs. These regional efforts are creating ecosystems that drive innovation and growth.

For lab leaders, these collaborations create opportunities to pilot new technologies, access specialized capabilities, and build talent pipelines. Engaging with academic partners, contract development and manufacturing organizations (CDMOs), and government-backed programs can help labs expand capacity, validate new methods, and position themselves for future growth.

Practical considerations: For expanding pharma laboratories and CDMOs, there are a variety of important decisions to consider:

Lab readiness

- Will new equipment need to be purchased to accommodate additional capacity? Is this a good time to evaluate newer technologies, both for manufacturing and for analytical QC? Can current regulatory systems accommodate new technologies, and how will compliance and quality systems need to be adapted?
- As new technologies are introduced, it's critical to understand future maintenance support from the supplier with respect to current technologies, and how long current platforms will be supported
- Is leasing equipment a viable option for short-term projects or if technology is rapidly advancing? Often, leases will include service coverage, so the ROI of lease vs. buy decisions can be calculated based on anticipated lifetime, current cashflow considerations and depreciation schedules.
- Are there incentives for adding new technologies? Tax incentives or accelerated regulatory pathways (e.g., via the FDA FRAME program with goals to modernize drug production and

improve supply chains) may facilitate the adoption of newer technologies.
- Flexibility and scalability for future growth are key in adding equipment. Modular solutions that can be repurposed or used for multiple projects/products are important for maximum instrument utilization.

Planning, sourcing and collaboration

- Early planning and engagement (both internally and externally) with facilities, QA/regulatory, EHS, suppliers, and procurement teams are key for site preparation and meeting required timelines
- Will multi-year supplier agreements yield greater discounts and savings? What is the turnaround time for delivery and installation? Have alternative suppliers been identified and contacted to ensure continued supply? Do vendor audits need to be scheduled? Have required software platforms and applications been reviewed and approved by IT and regulatory teams to reside on internal networks?
- Are there project partners that can be identified early on that provide complementary expertise/capacity (upstream or downstream capabilities) for joint investment? Very often, CDMOs and universities can provide additional capabilities, capacity, or specialty services for faster start up.

Data management tools and compliance

With new instruments, software systems, operating systems, and validated solutions are critical for data acquisition, analysis, storage, and archival. Platforms such as ELN, SDMS, LIMS, and cloud-based solutions should be reviewed with all suppliers, as well as IT and regulatory, to plan and align early on specific applications that control systems and acquire data. Qualification and validation of these systems in a seamless fashion, with SOPs established by the lab and QA personnel, should be planned and coordinated with any new equipment acquisitions. Data integration among different software platforms is an important consideration for decision-making, compliance, and easy retrieval of results.

Data sharing capabilities are also important, especially among collaborators and CDMOs with their sponsors, while ensuring data integrity and protection of intellectual property. Cloud labs and secured open-access platforms are examples of how results can be shared while maintaining system security.

Adoption of digital and AI tools

This is probably one of the fastest growing areas, with the importance of automation and AI-driven tools to improve and optimize processes throughout the drug development and manufacturing lifecycle. These enhancements can inform discovery, development, and production, including new synthetic routes, predictive analytics, modeling software, intelligent maintenance platforms with automated troubleshooting, feedback and usage metrics, automated method validation software, process analytical technologies with the potential for real-time release testing, and the use of digital twins for QC optimization via sensors and simulations.

Building and retaining a strong workforce

Talent is one of the most valuable resources of an organization, thus investment in training and employee development is important in attracting and retaining talent. Especially with advanced technologies and platforms, skill-based competencies, and expertise are a competitive advantage for any organization. Some resources and best practices include:

- Continued training and skill development, as well as ensuring there is a career path for employee advancement
- Working closely with local universities and community colleges to identify and attract talent, participate in career days, and partner on continuing education or online training programs for employees. Attending local meetings, professional societies, discussion groups, and conferences, where applicable
- Mentoring and cross-training programs within the organization
- Practical hands-on training opportunities, as well as the use of online and virtual reality platforms
- Skill-based learning via micro-credential programs and digital badges for specific laboratory competencies

PREPARING FOR THE FUTURE OF PHARMACEUTICAL PRODUCTION

The renewed focus on domestic pharmaceutical manufacturing gives labs a clear mandate: modernize, collaborate, and invest in the systems and people that

ensure quality and resilience. Lab leaders who align technology adoption with workforce development and strong partnerships will be best positioned to sustainably drive efficiency, compliance, and innovation in the next era of drug production.

Betsy Baer *is a scientific business development leader, most recently leading the federal practice business development efforts at US Pharmacopeia. In this role, she developed projects and key collaborations with US government agencies and partner organizations to advance supply chain resilience, advanced manufacturing, emerging biologics, and healthcare quality and safety. With over 30 years of experience leading teams and strategic initiatives, Baer previously led the east coast business operations for Waters Corporation, a leader in analytical technology solutions, and then created and led a new team at Waters leveraging the expertise and agility of CDMOs to expand development and manufacturing of vaccines and therapeutics during the COVID-19 pandemic. She holds a B.S. in chemistry from the University of Virginia and began her career as a forensic research chemist with the FBI.*

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Jason Croy

ASK THE EXPERT

ADVANCEMENTS AND CHALLENGES IN NEXT-GENERATION BATTERY DEVELOPMENT

by Lauren Everett

From manganese-rich cathodes that reduce reliance on critical materials to AI-driven material discovery, **Jason Croy** and his team at Argonne National Laboratory are tackling some of the most pressing technical and economic barriers in battery innovation. In this conversation, he shares insights on overcoming performance limitations, navigating the dominance of lithium-ion, leveraging advanced national lab capabilities, and fostering collaborations that accelerate next-generation energy storage technologies.

Q: What are some of the common technical barriers when developing new battery materials or architectures? How are you working to overcome them?

A: The properties of battery materials in general rely on complex interactions across length scales and across the battery cell as a system. For example, the arrangement, or ordering, of elements on the atomic scale in a cathode material will have an influence on the larger-scale physical and electrochemical properties of the cathode material itself as well as the cell system (cathode/electrolyte/anode), and everything in between. To develop new materials or enhance the properties of existing materials, we need to understand these correlations.

My group at Argonne National Laboratory specializes in the development of cathode materials made from earth-abundant elements such as manganese. Manganese-rich cathodes can decrease dependence on critical elements (e.g., cobalt and nickel) while lowering costs in applications like electric vehicles. However, discovering and developing materials that can compete with current technologies, optimized by industry over several decades, is a daunting task. To tackle the challenges, we utilize the tools and expertise available at Argonne to design, synthesize, and understand materials and complex correlations.

We bring together capabilities like the Advanced Photon Source, novel synthesis methods, microscopy, supercomputers, artificial intelligence/machine learning, and techno-economic modeling in a collaborative and iterative fashion. This allows us to make continuous progress towards our goals. In short, the major challenge is that materials science is "big science'" and sustained, focused efforts, supported by unique capabilities and expertise, are required for success.

Q: What do you see as the biggest obstacles facing the commercialization of next-generation battery technologies?

A: I think one of the most significant challenges to the commercialization of "next-gen contenders" is the maturity, commercial success, and continued improvements of lithium-ion. For example, my own work is focused on greatly reducing the cost of lithium-ion by decreasing dependence on critical materials, all while maintaining sufficient performance for electric vehicle applications. Likewise, a lot of R&D is focused on making the processing of lithium-ion materials and cells more efficient, less energy-intensive, and less expensive. These efforts continue to move forward with success, constantly moving the goal post for competitors. Batteries must simultaneously meet many stringent performance demands while being economically viable—very difficult for newcomers. However, if there is continued growth in demand and application, new technologies will certainly find a way in.

Q: What advancements in materials science are helping overcome limitations like energy density, lifespan, or raw material availability?

A: In our work in the Materials Research Group at Argonne, we are making advances to help enable Manganese-rich cathodes as low-cost,

high-energy materials made from earth-abundant elements. One of the challenges with the Mn-rich materials we are developing is that the final cell-level energy density is limited by the density of the material itself when synthesized as cathode particles. It turns out, for reasons related to the atomic structure of this material, that low-density, porous particles perform better than high-density counterparts. We conducted a rigorous experimental and electrochemical modeling study of these particles to determine the optimum particle architecture for both density and performance. Our team then worked to develop a new synthesis and processing method to achieve that architecture. This advance in materials synthesis is currently the subject of a new patent filing out of Argonne and helping to boost the energy density of our earth-abundant cathodes.

"I think one of the most significant challenges to the commercialization of 'next-gen contenders' is the maturity, commercial success, and continued improvements of lithium-ion."

Q: How do you manage collaboration between research labs, industry partners, and government programs?

A: We have a long history of collaboration among the national labs; it's a natural part of how we work. I currently lead a consortium of six national laboratories, known as the Earth-abundant Cathode Active Materials (EaCAM) consortium funded by the US Department of Energy's (DOE) Vehicle Technologies Office (VTO). This is where our work on manganese takes place. Consortiums are a great way to bring together the wide range of expertise and tools that are available across the national lab complex to focus on specific challenges and there are several consortia currently operating across DOE programs.

Industry is also engaged with these consortia in various ways. In addition, individual groups and/or scientists across Argonne are continuously engaged in collaborative work with many industrial partners. It's a way for companies to take advantage of the capabilities at DOE labs like Argonne to help solve the specific challenges they face. To this end, the Argonne Collaborative Center for Energy Storage Science (ACCESS) works directly

with both public and private organizations to help them leverage the lab's capabilities and people to help solve technological challenges.

Q: How do AI and automation figure into your lab's battery development process? Are they helping accelerate discovery or improve reproducibility?

A: Certainly, AI has become part of our work in many areas, including energy storage. There is a dedicated page on Argonne's website highlighting our work in autonomous labs, artificial intelligence, and robotics. We use AI to help us understand and discover materials and material properties, as well as system-level performance.

Q: How do you evaluate when to invest in new equipment, tools, or automation platforms—and what factors help you justify those decisions?

A: One of the things we do is try to predict where technologies will go. In that regard, Argonne's first efforts on technologies like sodium-ion and metal-air batteries began over a decade ago. We also try to establish efforts to guide where technologies will go. For example, the Energy Storage Research Alliance (ESRA), a DOE-funded Energy Innovation Hub led by Argonne, is focused on making fundamental scientific breakthroughs to bring about new technologies that will shape a more secure energy future.

Because doing novel, cutting-edge research often requires new capabilities, investments in equipment, tools, or personnel are typically vital. If the possibilities surrounding a new field or idea are exciting enough, then we look to invest. Almost two decades ago, for example, Argonne and VTO saw a huge opportunity in developing expertise in the design and fabrication of lithium-ion electrodes and cells. Out of that, Argonne's Cell Analysis, Modeling, and Prototype (CAMP) Facility was born. A first-of-its-kind facility across the national labs, CAMP has since become a recognized leader in lithium-ion electrode and cell R&D across the world.

Likewise, Argonne houses one of the world's first exascale supercomputers, known as Aurora. The idea of Aurora has roots that are much older than the supercomputer itself. The exciting possibilities that developments such as artificial intelligence stirred many years ago, set in motion a long effort to make Aurora a reality.

> "As scientists, we must continue this legacy of championing the work we feel is important."

In the end, big investments are usually driven by Argonne's desire to stay on the cutting edge of technological and fundamental discoveries.

Q: What do you think labs and lab managers need to do differently to prepare for the scale and complexity of future energy challenges?

A: Although the challenges and complexities related to our energy future have gained considerable attention in recent times, most scientists have been quite aware of the scale and complexity for many years. From Svante Arrhenius to the famous Carl Sagan, close to 200 years of modern science have been dedicated to issues related to the way we produce and use energy. As scientists, we must continue this legacy of championing the work we feel is important. In addition, we must remain dedicated to mentoring young scientists in our field as well as educating young students of all disciplines about our work.

In this regard, when it comes to doing things differently, I think scientists have typically not been great at communicating on topics of importance to non-scientists. Whether this is a part of our character or an oversight, I think we should strive to be better at telling our stories in order to make meaningful impressions on the importance of science.

Jason Croy, PhD, is the group leader for the Materials Research Group at Argonne National Laboratory and the project lead for several Department of Energy programs focused on materials development for battery technologies. Since 2016, Jason has served as the program lead for the Department of Energy's Deep Dive consortiums on Next-Generation and Earth-Abundant Lithium-Ion Cathodes, directing research efforts across seven national laboratories and more than 60 individual researchers developing and implementing program goals related to sustainable cathode technologies.

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INFORMATICS

THESE INTERLOCKING TRENDS SHOW THAT LABS ARE SHIFTING TO BE EVER MORE DATA-DRIVEN AND DIGITAL-FIRST

by Holden Galusha

Laboratories are in the midst of a major shift in how they handle data. For years, data management was treated as an afterthought—something relegated to disparate systems, spreadsheets, and siloed instruments. But that's no longer sustainable. Today, three interlocking trends are defining how organizations approach lab informatics: breaking down data silos, adopting cloud-hosted platforms, and embracing FAIR data governance. These developments are not isolated. Together, they represent a symbiotic evolution toward a more holistic, digital-first laboratory—one that is positioned to take full advantage of artificial intelligence.

> "Some OEMs replicate lock-in by creating proprietary cloud ecosystems in which only their instruments can exist."

1. Breaking down data silos

For decades, labs operated as islands of information. Instruments generated data in proprietary formats, lab software systems didn't talk to one another, and sharing results required tedious manual effort. These silos limited collaboration, reduced efficiency, and kept valuable insights locked away. And for many labs, this situation is still their reality.

The problem is not unique to science—knowledge workers across industries spend nearly 12 hours per week chasing down siloed information, according to a 2022 article by VentureBeat.[1] Another 2022 survey by Aspen Technology found that about half of pharmaceutical companies say silos hinder cross-functional collaboration.[2] For labs handling high-value data like clinical trial results or genomic sequences, the stakes are even higher: if datasets cannot be easily combined, important discoveries may be delayed or missed entirely.

Instrument manufacturers often reinforce the issue by keeping labs in "walled gardens" of lab software that only work with their own products. While this ensures smooth internal communication, it discourages interoperability. Fortunately, companies such as Ganymede and TetraScience are addressing this, offering cloud-based data lakes and other features that consolidate data from various equipment.

Garrett Peterson, chief strategy officer of Yahara Software, points out that the push to break down silos is also part of a broader "lab-in-the-loop" vision, where workflows across LIMS, QMS, ERP, instruments, and human-driven steps are integrated. "Done well, this enables hyper-acceleration of discovery through rapid, top-to-bottom process iteration," he says. Even without full automation, labs can bootstrap with existing systems and layer in agents or AI to operate within their current

toolchain. This incremental approach allows organizations to see tangible benefits while minimizing risk.

Cloud SaaS platforms

If desiloing is the "why," then cloud-hosted platforms are often the "how." Software-as-a-service (SaaS) solutions have become integral to the way labs centralize and interact with their data. By migrating to the cloud, labs gain scalability, accessibility, and reduced IT overhead. Labs no longer need to maintain expensive on-premises servers or patch local installations.

Cloud SaaS also enables collaboration in ways that on-premises systems cannot. A principal investigator can access results from home, a collaborator across the country can analyze shared datasets in real time, and IT teams can roll out security updates instantly. This flexibility has been especially important in recent years, as remote and hybrid work models have become more common in research organizations.

Still, cloud solutions aren't a silver bullet. Some OEMs replicate lock-in by creating proprietary cloud ecosystems in which only their instruments can exist. Labs must weigh whether a given SaaS platform fosters openness or just relocates the walled garden. Peterson notes that many labs are navigating this balance between custom, high-fit solutions—which may carry higher costs—and waiting for generalized SaaS offerings to mature. Both paths aim at the same goal: freer data flow and faster iteration.

When chosen wisely, cloud SaaS platforms provide the backbone for modern lab informatics—and a launchpad for AI.

3. FAIR data governance

Desiloing and cloud adoption solve the problems of access and storage, but there's another hurdle: making data usable. That's where FAIR principles—Findable, Accessible, Interoperable, and Reusable—come in.

FAIR is no longer aspirational. Major institutions like the National Institutes of Health have formally adopted FAIR principles as guiding policy, and Google Trends shows steady growth for interest in "FAIR data" as a search query.[3, 4]

FAIR data is significant because it is a prerequisite to actionable data. This is especially important for labs in highly regulated or collaborative environments. In drug development, for example, data needs to move seamlessly between preclinical, clinical, and regulatory teams. Without FAIR structuring, that data often requires manual reformatting, introducing delays and errors. With FAIR, it can flow smoothly through each stage of the pipeline.

The synergy of these trends

Taken individually, each of these trends offers tangible benefits. But together, they are transformative. Cloud platforms provide the infrastructure to centralize data. That centralization enables desiloing. Once data is consolidated, FAIR principles ensure it is structured for maximum utility. With these pieces in place, labs reach a tipping point: they are primed to become more data-driven, streamlined, and AI-ready. Instead of relying on generic models trained on external datasets, labs can fine-tune AI systems on their own unique data, yielding insights that are specific, accurate, and actionable.

Key takeaways

The path toward a fully digital, AI-enabled laboratory isn't built in a day. It requires careful steps: dismantling silos, embracing the cloud, and structuring data according to FAIR standards. These aren't isolated initiatives but interconnected trends that reinforce one another.

Labs that act now to align with these shifts will be best positioned to thrive in the coming decade. The labs of tomorrow will not simply generate data; they will harness it—fluidly, intelligently, and with a digital backbone designed for innovation.

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Application vs Operator Protection

Which One Do You Need?

AirClean® Systems
The Fume Control Experts.

aircleansystems.com

AC600 Series Ductless Chemical Workstation

Flexibility and mobility for today's ever changing laboratory environment

The AC600 Series ductless chemical workstation is an economical, operator protection product that protects the end user from toxic vapors, gases, fumes, and particulate. Smaller and more mobile than a standard ductless fume hood, AC600 Series ductless chemical workstations are the perfect solution for performing low-volume applications with known chemicals.

AC648A Ductless Chemical Workstation

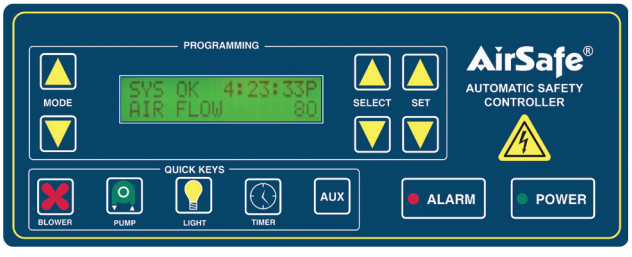
Standard Features:

- AirSafe® automatic safety controller
- Bonded carbon filtration
- Integral base with deep spill lip
- No installation required - plugs directly into a standard 110V electrical outlet
- Clear polycarbonate shell for 360° visibility
- Extremely quiet operation < 49dBA
- Available in standard height or tall version

Options:

- Cart with locking casters (34" height)
- Stand with leveling feet
- Polypropylene cup sink
- Deck-mounted fixtures
- Pass-through port

AC632A Ductless Chemical Workstation



AirSafe® Safety Controller

Features:

- Constant airflow control and monitoring
- Real-time hydrocarbon gas detection
- Lab event timer
- Visual display of face velocity

UL, CSA and CE COMPLIANT

For a FREE Application Assessment, Call (800) 849-0472 or Scan QR Code

Polypropylene Ductless Fume Hood

A ductless solution for most common applications

Polypropylene ductless fume hoods protect both the operator and the environment by filtering toxic fumes, vapors, or gases through AirClean® Systems' proprietary bonded carbon filtration. Standard with a thermally-fused integral spill tray, polypropylene ductless fume hoods are chemically resistant to virtually all corrosive applications.

AC4000 Polypropylene Ductless Fume Hood shown on optional base cabinet

Features:

- AirSafe® automatic safety controller monitors airflow face velocity and carbon filter saturation
- Polypropylene construction for chemical resistance
- Wide range of bonded activated carbon and HEPA filters for containment of virtually any toxic vapor, fume, gas, or particulate
- AirZone™ baffling establishes a proper horizontal airflow pattern and directs toxins away from the operator in a predictable pattern, eliminating "dead spots" within the hood
- Integral vapor-proof fluorescent lighting

Options:

- Vented and unvented polypropylene base cabinets
- Pass-through port
- Polypropylene sink and deck-mounted fixtures
- Sturdy stand with leveling feet

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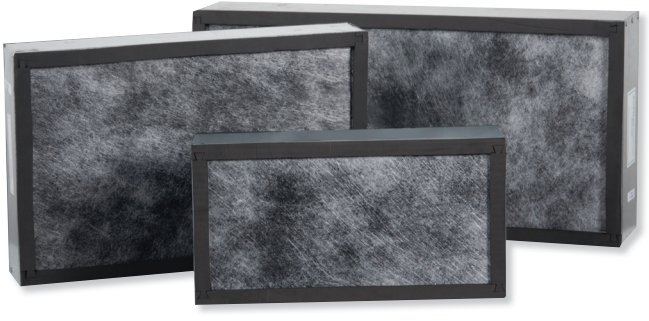
AirClean Systems ductless hoods, workstations, and enclosures meet and exceed relevant OSHA and ANSI Z9.5 standards



Bonded Gas Phase Filtration

Predictable and reliable filtration

AirClean Systems manufactures gas phase bonded carbon and multi-layered filters that are available with standard coconut shell carbon or chemically impregnated carbon, depending on your application.

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Endeavour™ Ductless Fume Hood

Monitoring and fume hood control at the touch of an icon

Endeavour™ ductless fume hoods provide the operator with user-friendly controls, superior construction materials, and market-leading safety features needed for effective fume containment. Endeavour ductless fume hoods can be placed virtually anywhere, without the need to connect to building infrastructure, giving you the flexibility expected from modern laboratory equipment.

Features:

- AirSafe® NXT Touchscreen with variable airflow controller and constant filter monitoring
- Structural thermally-fused polylpropylene construction
- ChemMinder chemical class confirmation
- AirZone™ baffling to promote uniform airflow and containment
- Dual wall design to allow for placement of fixtures, taps, and electrical outlets like a typical total exhaust fume hood
- Sliding safety glass sash
- Large capacity filtration bed to handle a variety of chemical applications
- Energy Use Meter — displays real-time and lifetime energy use
- Built-in gas detector

Options:

- Polypropylene base cabinets, vented and unvented
- Electrical outlets
- Polypropylene sinks and remote fixtures

ASHRAE110 TESTED

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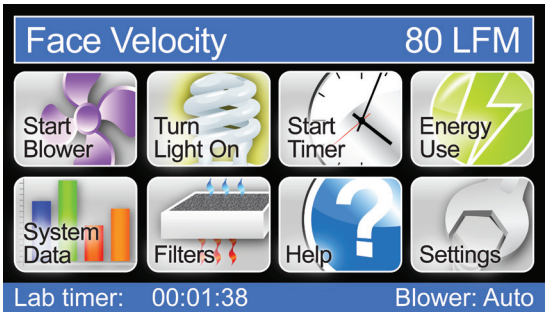
ACPT4000S Endeavour shown on optional base cabinet

AirSafe® NXT

User-friendly ductless fume hood control and operation with vivid icons

AirSafe NXT provides touchscreen access to all critical operation and monitoring functions of the Endeavour ductless fume hood. Automatic blower control, filter monitoring, alarm notification, and energy use meter are just a few of the features available.



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PowderSafe™ Type C Enclosure

A universal enclosure built with the application and operator in mind

AirClean® Systems Type C PowderSafe ductless balance enclosures incorporate the airflow dynamics and HEPASafe™ technology with the user-friendly features and chemical fume containment capabilities of an AirClean Systems ductless fume hood. Thermally-fused polypropylene construction makes the PowderSafe Type C enclosure perfect for weighing powders or solvents.

AC760C PowderSafe Type C

Features:

- AirSafe® automatic safety controller
- Horizontal laminar airflow pattern
- Chemically impervious construction
- HEPASafe filter change-out
- High mass — solid polypropylene construction
- LED lighting

Options:

- Bonded carbon filtration
- Contrasting base color
- Stand with leveling feet
- Waste port for weighing vessel disposal

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USP 800 COMPLIANT

HEPASafe™ Filtration Technology

Redundant filtration for increased operator safety

HEPASafe Filtration Technology incorporates multi-stage filtration, for both toxic powders and chemical vapors, while increasing safety during routine filter change out and enclosure maintenance.

All PowderSafe enclosures that incorporate HEPASafe Filtration Technology manage contaminants with rear wall pre-filter and HEPA filtration. This unique design pulls potentially harmful particulate away from the operator's breathing zone in an even horizontal airflow path, increasing particulate and vapor capture.

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Get results – not background

Cross-contamination during amplification of DNA and RNA can lead to results that are inaccurate, costing the lab technician valuable time and reagents. PCR Workstations minimize this risk by keeping airborne contaminants away from samples and irradiating work surfaces and tools between amplifications.

AC632LFUVC PCR Workstation

UL, CSA and CE COMPLIANT

ISO CLASS 5

Features:

- No ductwork required
- No installation required - plugs directly into a standard 110V or 220V electrical outlet
- Clear polycarbonate shell for 360° visibility
- Extremely quiet operation < 49dBA
- Available in standard height or tall version
- UVTect® microprocessor controller
- ISO 5 vertical laminar flow air
- Seamless plastic design -no joints or gaps in construction
- UV shelf with built-in pipettor holder
- Lab event timer
- Digital UV light timer :01-59 minutes
- Access port for electrical cords
- UV and LED lights

Options:

- Sturdy cart/trolley with locking casters for mobility
- ULPA filter
- Hard surface disinfectant

UVTect® Controller

- Standard feature on AirClean® Systems Combination PCR Workstations. (32" and 48" models)
- Constantly monitors workstation effectiveness, alerting the operator if HEPA filter(s) or UV bulb(s) need replacing
- Allows the operator to manually adjust airflow speed, accommodating the most fragile samples

Clean ISO 5 air for a variety of applications

Constructed from all white seamless polypropylene, AirClean® Systems horizontal laminar flow clean benches are the ideal solution for ISO 5 (Class 100) applications. Standard on all horizontal laminar flow workbenches, the UVTect® controller constantly monitors filter conditions, alerting the operator of insufficient airflow.

AC6000HLFSW Single-Wall HLF Clean Bench

Options:

- Custom sturdy cart or stand
- Electrical cord access port
- Polyproylene cupsink

Typical Applications:

- IV Admixture Preparation
- Drug Compounding
- Plant Cell Culture
- Tissue Culture (non-biological)
- Media Preparation
- Pharmaceutical Procedures
- Electronic Assembly

Features:

- Single-wall design
- UVTect microprocessor controller
- NO RUST — all polypropylene construction
- Seamless, smooth construction minimizes air turbulence
- Built-in fluorescent lighting
- All-white polypropylene — surfaces are easy to clean
- Available in 110V or 220V AC

UL, CSA and CE COMPLIANT

USP 797 COMPLIANT

ISO CLASS 5

UVTect® Controller

- Constantly monitors workstation effectiveness, alerting the operator if HEPA filter(s) need replacing
- Allows the operator to manually adjust airflow speed, accommodating the most fragile samples or delicate applications

Solutions for Today's Laboratory Environment

Manufacturers of:

• Ductless Fume Hoods • Laminar Flow Workstations
• Total Exhaust Hoods • Balance Enclosures
• PCR Workstations • Microscope Enclosures
• Robotic Safety Enclosures • Walk-In Enclosures
• Custom Enclosures

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Manufacturing Green Products Since 1992

LPA Laboratory Products Association

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