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July 2012 Volume 7 • Number 6

EFFECTIVE GLOBAL LEADERSHIP

WHAT TODAY'S LAB MANAGER MUST KNOW TO SUCCESSFULLY MANAGE REMOTE & CULTURALLY DIVERSE TEAMS

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TAKING THE ANALYZER TO THE SAMPLE

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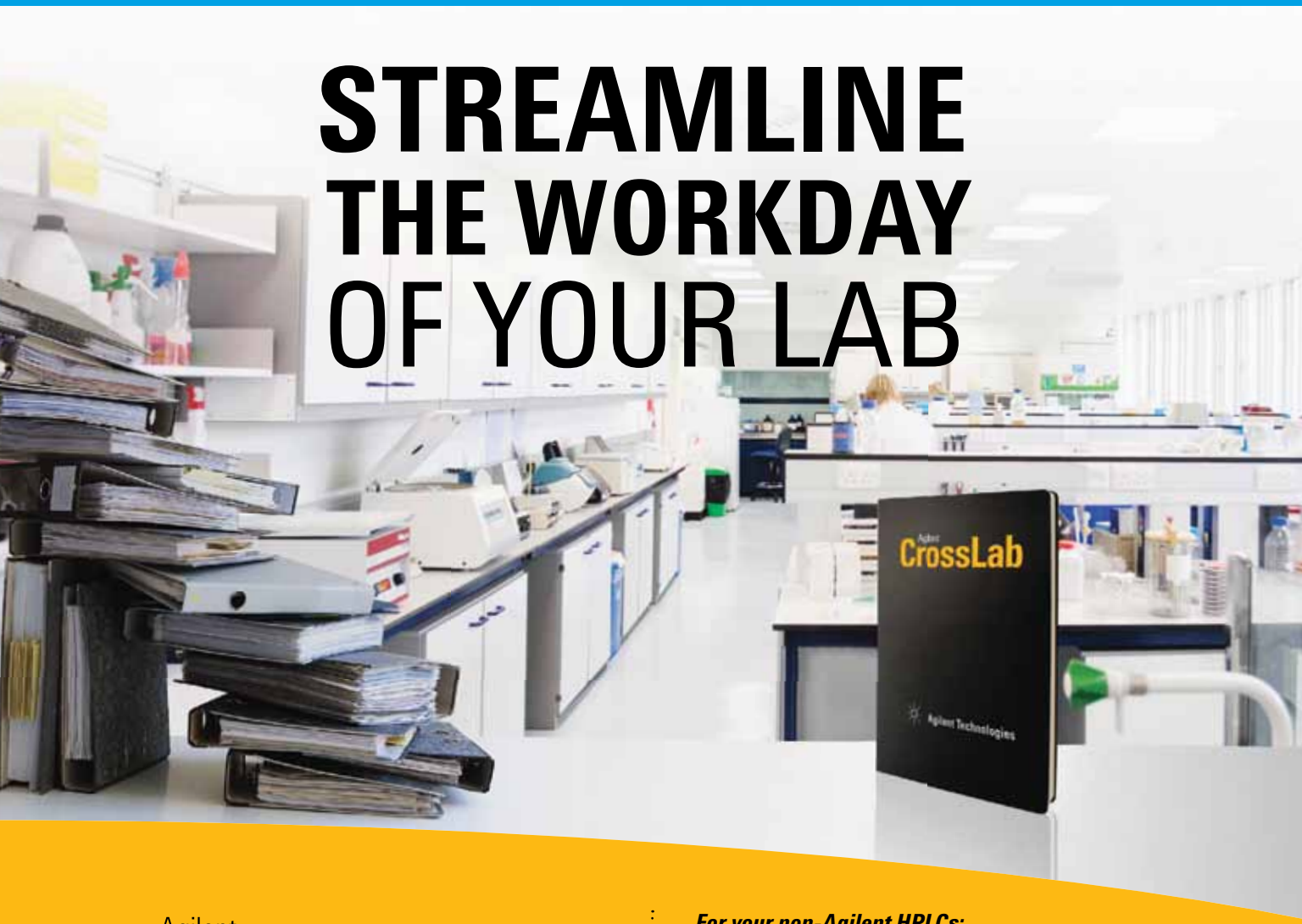

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Are Data Management Systems Right for Your Lab?
It's been a while since our last *INSIGHTS* supplement, but never fear, this feature is still alive and well at *Lab Manager Magazine* with the next issue set for September 2012. September's *INSIGHTS* will focus on data management systems, providing all you need to know about selecting the right system for your specific lab and research goals. You'll learn about the latest trends in LIMS, ELNS, and integrated management systems and the many different features you'll want to consider when you're buying any one of these systems. Like our past *INSIGHTS* supplements, September's will include a section on how data management systems can affect a lab's bottom line and a Q & A with data management system end-users in which they will discuss the specific systems they use and what works best for them. If your lab has been wondering if it's worth it to invest in an ELN, LIMS or other data management system, the September 2012 *INSIGHTS* will help you make that decision.

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Opposite Ends of the Earth

Last month we provided important and practical information about project management techniques and their usefulness in laboratory management. This month we turn our attention to a different management challenge that becomes more commonplace every day in every industry—global management. As Key Kidder writes in this month's cover story, "Conventional [management] strategies that worked well enough when collaborators were down the hallway lose their efficacy in this greater global arrangement." And, according to Dr. Nicholas Steneck, director of the Research Ethics and Integrity Program of the Michigan Institute for Clinical and Health Research, "Training in the U.S. tends to focus heavily on the content and method of the science, not on how to manage a project responsibly." But fear not; the article goes on to provide a comprehensive checklist of what to do and not to do when managing the cultural, national, and communication issues that come with global collaborations. Something clearly worth the effort, as Alan Edwards reiterates in his Science Matters column this month: "Largely because of the vast amount of knowledge sharing that has occurred as a result of the Internet and cross-collaboration, life sciences companies both large and small quite frankly would be limiting themselves if they didn't explore how partnering with people around the globe could add value to their projects and, ultimately, their businesses."

Introduced last month with an article on cloud computing, our new editorial section, "Computing & Automation" this month covers the topic of Enterprise Resource Planning. While ERP systems traditionally focus on the administrative and managerial functions needed to run businesses, they have begun to find application within research organizations. "The utility of ERP systems in the laboratory may be facilitated or even enhanced when they are integrated with laboratory information management systems (LIMSs) in a way that harmonizes the lab's internal and external business processes," says author Bernard Tulsi. However, challenges remain, particularly in terms of quality, security, and compatibility of systems. Turn to page 26 to learn more.

"Field instruments have been around for decades, but advances in computing and electronics miniaturization have spawned a new generation of instruments that are more approachable, smaller, and lower in cost," says Angelo DePalma in this month's Technology & Operations article, "Field-Worthy Instrumentation." (page 32) While not appropriate for every lab, this burgeoning technology now allows Raman and XRF spectrometers, quadrupole MS and GC-MS systems, and FTIR gas analyzers out of the lab and into the field. The article discusses the breakthroughs behind these ever-smaller devices, new applications, and their various strengths and weaknesses.

In September 2012, the Institute for Laboratory Automation and *Lab Manager Magazine* will offer a series of webinars under the heading "Lab Automation Is Inevitable: Are You Ready?" as part of the Lab Automation University program. Turn to page 30 for details and sign up information.

And, if you're in the market for an ultrapure water purification system, check out this month's Ask the Expert column on page 40 where, with the help of two different experts, you can get good information on what to consider when making this important purchase.

Happy reading,

Pamela Ahlberg
Editor-in-Chief

Correction: On page 35 of the June issue, we identified author Mike Weaver's company name and contact information incorrectly. That should have been Mike Weaver, CEO and founder of Audit Weaver, LLC. mike@auditweaver.com. 646-666-9620.

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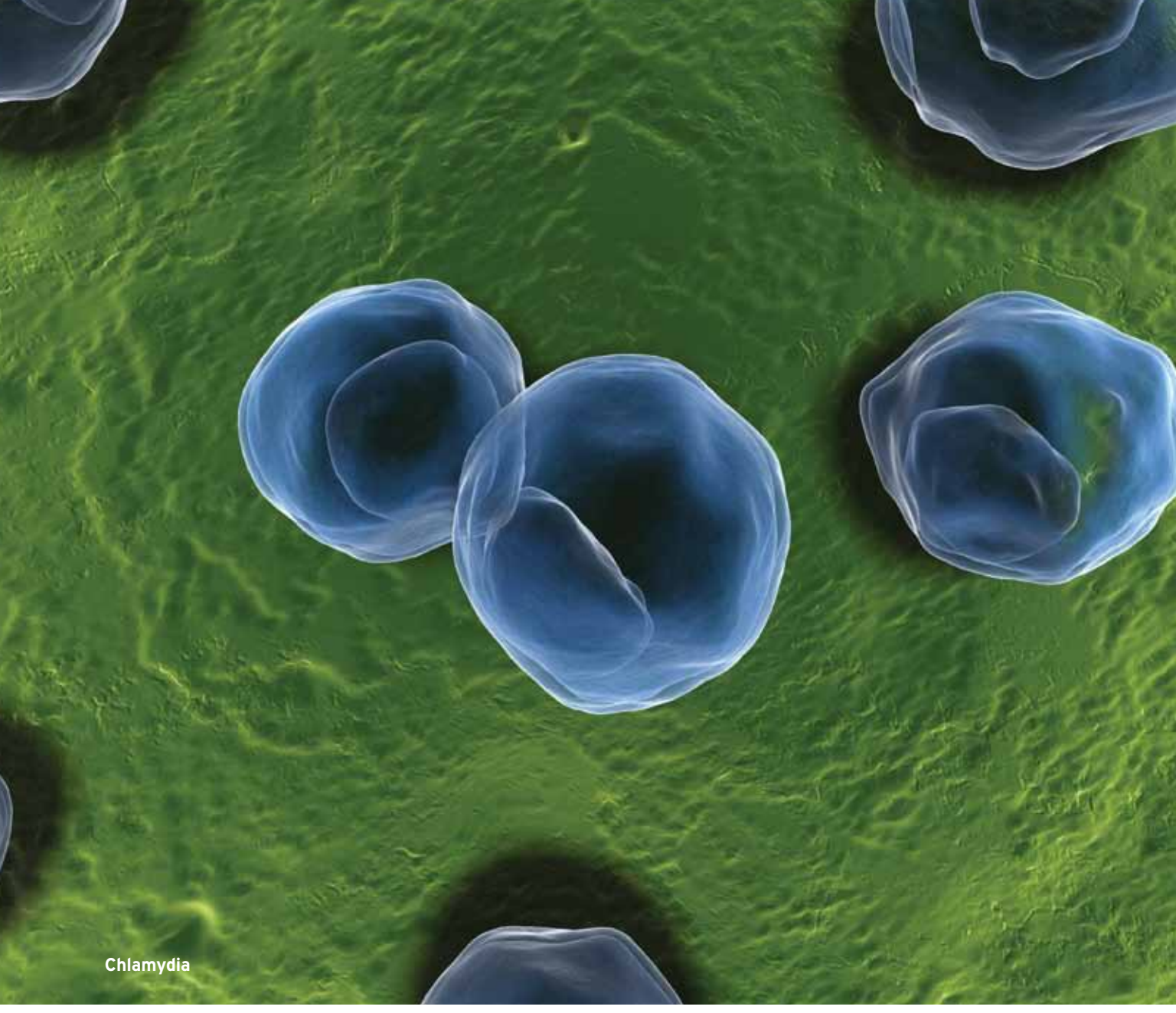

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EFFECTIVE GLOBAL LEADERSHIP

WHAT TODAY'S LAB MANAGER MUST KNOW TO SUCCESSFULLY MANAGE REMOTE AND CULTURALLY DIVERSE TEAMS by F. Key Kidder

Two lab managers strike up a conversation at an international conference. Their research is complementary and their ambitions meld—surely they will do great science together. Gripped by great expectations, they agree to collaborate on a project. In the blush of their bond, the fact that they work at opposite ends of the Earth seems almost inconsequential.

Not so fast—distance matters. Conventional strategies that worked well enough when collaborators were down the hallway lose their efficacy in this greater global arrangement. Upon returning to their respective labs, the managers' honeymoon glow is subsumed by a swarm of problems. Effective leadership of dispersed global teams is a critical competency for managers. But do they measure up?

> "Effective leadership of dispersed global teams is a critical competency for managers."

Global collaborations are booming. In 2009 more than half of all papers published in *Science* were co-authored by international teams. According to the U.S. National Science Board, the percentage of worldwide science and engineering articles with international authorship worldwide rose from 8 to 22 percent between 1988 and 2007.

As international collaborations increase, so does research into improved performance. Critics say the task is a minefield for managers, arrayed with multiple layers of hazards. The practical problems of collaborating across temporal and geographic boundaries are exacerbated by cross-cultural issues, then subjected to confusing operational differences in national research systems and further complicated by assorted dilemmas arising from the use of virtual communication technologies that tether remote collaborators.

This trifecta of troubles—cultural, national, and communication issues—isn't the sole culprit. In many instances, managers are their own worst enemies. Assumption is the mother of many problems. Managers who enter into collaborations in haste—not fully informed with eyes wide open—are prepositioned for a rude awakening. In sum, say many observers, the promise of international collaboration still exceeds the delivery.

"Scientists are more enthusiastic about these collaborations than their experience can [accommodate]," said Dr. Melissa Anderson from the University of Minnesota's Department of Organizational Leadership.

"If lab managers are like other managers, they are woefully underprepared for global collaboration," said Dr. Bradley Kirkman from Texas A&M's Mays Business School, who consults for multinational business clients. Maybe more so, he adds, because of their inward orientation. "[More than] 80 percent of the Fortune 500 expressed concern that U.S. companies have a dearth of truly 'global' managers. We talk global a lot but don't practice what we preach."

"In my experience, researchers don't have checklists they go through on how they will collaborate [on matters such as] authorship, intellectual property, and protection of animals and human subjects," said Dr. Nicholas Steneck, director of the Research Ethics and Integrity Program of the Michigan Institute for Clinical and

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Health Research, who consults for the Office of Research Integrity at HHS. "Training in the U.S. tends to focus heavily on the content and method of the science, not on how to manage a project responsibly."

National research system issues

Rule number one is to anticipate challenges, say Steneck and Anderson. When things go awry, cultural differences are the usual suspect. Instead, they say, problems often stem from systemic differences in national organization, support, and conduct of research around the world. Their 2010 book—*International Research Collaborations: Much to Be Gained, Many Ways to Get in Trouble*—pinpoints four dimensions of national research systems that commonly trip up scientists.

- Organization of national systems can vary by authority structures, communication networks, and decision-making methods, complicating researchers' work. Nations have different levels of support—or nonsupport—for cross-cultural initiatives, both at the local and national levels. Management protocols become baffling absent harmonization.
- When working domestically, researchers rely on institutional legal staff to deal with legal and regulatory matters. Abroad, legal staff can be out of their element. Most critically, collaborators must decide whose laws take precedence and when.
- Integrity oversight becomes vexing because there is no central body to either investigate or adjudicate allegations of misconduct in human or animal research. Researchers often must adhere to different standards than their domestic policies require, and the project overall must meet the strictest provisions of all regulations brought to bear. Steneck, an authority on research misconduct, says scientists more than likely "will see the data. That's not the problem. It's the actual day-to-day collecting of the results. You can't drop in and see what's going on in their lab or check on a notebook."
- Graduate students and postdocs may have been trained in national systems whose methods and conditions are not in sync with the experiences of senior project researchers. Nations differ in terms of the extent of independent or individual doctoral study and graduate coursework and teamwork.

Communication issues

As teams become more geographically dispersed, face-to-face interaction is increasingly supplanted by virtual technologies. In turn, these technologies exert significant interpersonal and cognitive impacts—influencing team relationships and collaborative performance on the one hand and communication processes and performance on the other, says Dr. Patricia Holahan, associate professor of management at Stevens Institute of Technology Management. Her research interests include technology management and virtual team collaboration.

Virtual communications, she says, inhibit transmission of critical social information—visual and voice cues and body language—that humans rely upon to make judgments about one another. (Body language is a primary communication vehicle. Research results vary, but estimates of the percentage of face-to-face communication that is nonverbal range from 60 to 90 percent. Without face-to-face interaction, humans are flying blind interpersonally.) Holahan says there is "wide agreement that no technology can substitute for face-to-face [communication]" but the gap is closing.

> "Without face-to-face interaction, humans are flying blind interpersonally."

Without the human touch that face-to-face interaction provides, it becomes difficult to establish trust. Interactions become depersonalized when team members operate under "situational invisibility," says management researcher Catherine Cramton.

"People are always going through this process of making sense and making attributions, like why did so-and-so do this or that? When we lack rich contextual information, the default position is to make more dispositional attributions, and they tend to be negative," said Holahan. As a result, virtual teams have more contentious communication and dysfunctional conflict than face-to-face teams do.

By not being on-site to observe lab staff attending to an urgent equipment failure, a distant team may erroneously conclude that colleagues who didn't respond to an email query are uncommitted or unreliable. To prevent such

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misunderstandings, managers must ensure that partners are provided with a prompt explanation of the facts. Left unattended, negative attributions can wreak havoc with a team's ability to learn, willingness to collaborate, group cohesion, satisfaction, and leader-member relations.

"Managers [need to] begin virtual technology training as soon as new employees come on board."

With experience, Holahan says team members achieve "behavioral integration." By working together, virtual teams improve their ability to understand others and assess trustworthiness more accurately. They begin to cohere, and performance improves.

Geographically distant situations can differ greatly, said Cramton, requiring collaborators to communicate their local constraints and circumstances or risk inaccurate assumptions. These can include equipment quality and features, measurement processes and standards, distances people must travel to accomplish tasks, pressures from supervisors and co-workers, and local holidays and customs.

Underlying characteristics of communication technologies also affect interpersonal collaborative relations. Technologies that are "rich" and "synchronous"—that transmit information with greater clarity and are timely—provide superior social context and clues and improve shared meaning and group identity, says Holahan. TelePresence, a state-of-the-art video wall, is at the top of the scale. Email, leaner and asynchronous, is near the bottom. Email, said Dr. Gary Olson from the University of Michigan, promotes "(behaving) in a mostly self-serving way."

Holahan urges managers to begin virtual technology training as soon as new employees come on board. Staff skills need periodic refreshing; personnel should be competent with all virtual technologies, she says, because communication improves when a variety of virtual media are employed.

Convincing staff to adopt different technologies is another issue altogether; most prefer using just one or two. If perceived ease of use and usefulness (to achieve work goals) are high, acceptance becomes easier. Holahan says managers can facilitate adoption of new technologies by asking for staff feedback and presenting the results to the decision makers. "More often than not, organizational leadership assesses technology from their perspective, never thinking that project leads may think otherwise.

"Another driver of technology acceptance is what we call 'climate'—the extent to which intended technology users perceive such use

as expected, supported, and rewarded in the workplace. Many times organizations spend a lot of money on technology and put it in place, and that's about it!" Without training, users master only a limited number of features. "They're getting only 30 or 40 percent of a technology's true capabilities."

From Kirkman's perspective, concern about virtual technologies doesn't match the reality. He says the telephone (and phone conferencing) remains the "lifeblood" of global collaboration, and many nations lack the bandwidth to support high-resolution videoconferencing or computer-assisted conference tools. Email "hasn't been very effective for entire teams to communicate … it is very inefficient in terms of keeping a linear track of ongoing communication. Electronic discussion threads are more useful. One of my colleagues found that most successful virtual teams banned email completely for team communication."

Cross-cultural issues

Kirkman's research into cross-cultural management builds on the seminal studies of Geert Hofstedt, who demystified cultural differences by creating a framework of beliefs and values specific to more than 50 countries. Hofstedt is required reading for collaborators, says Kirkman, since his work predicts what leaders will experience cross-culturally and prescribes management behaviors to improve organizational performance. So managers can be coached about the most effective leadership styles, using cross-cultural prototypes formulated by Hofstedt, Shalom Schwartz, or the Global Leadership and Organizational Behavior Effectiveness Research Project. All provide "rules of thumb."

But it's not fail-safe—there's too much variation at the individual level. Kirkman says there's more to it than "when in Rome, do as the Romans do." The most successful managers will want to get to know the Romans as individuals.

His advice for leaders:

- Don't assume anything; or, if one does make assumptions, assume differences, not similarities. When managers assume there is similarity, they wind up "making way more cross-cultural mistakes."
- Create a team charter at the beginning, a written document that specifies how the team will act—the vision, mission, goals, tasks, and decision-making process. Wrap in important concepts such as deadlines and quality that are often culturally sensitive.
- Leaders need finely honed meeting management skills to make effective use of face-to-face team meetings likely to be "short in duration and few in number." They should pay close attention to meeting preparation and to what happens during and immediately after meetings and then note what happens during intervals in order to improve the next meeting.
- A sense of humor doesn't hurt. When managers make mistakes, the ability to make light of uncomfortable situations can make team members feel safer. "Psychological safety," the degree to which team members feel safe for interpersonal risk-taking, is a key ingredient in creating a learning culture for a global team. Kirkman says, "It starts the leader" creating a safe psychological climate, and he adds that the value of psychological safety increases as teams become more culturally diverse.

F. Key Kidder *left journalism to pursue a career in government relations, politics, and PR, but he still likes to keep one hand in writing. He can be reached at k2@keykidder.com or by phone at 410-963-4426.*

QC FAILURES HAPPEN

METHODS FOR DETERMINING WHICH UNDESIRABLE CONDITIONS REQUIRE ROOT CAUSE ANALYSIS AND WHICH DO NOT

by Ned Gravel

Quality management systems (QSM) have been a reality in nearly 4,000 North American laboratories for some time. Almost everyone has heard of a quality system. Many relate the term to ISO standard ISO 9001:2008. However, for laboratories the more appropriate standard that defines laboratory, quality systems is ISO/IEC 17025:2005: *General requirements for the competence of testing and calibration laboratories.* This standard focuses primarily on the technical validity of laboratory results.

> "The starting point for both preventive and corrective action is the analysis of root causes of the problem."

ISO/IEC 17025 provides all the tools that a laboratory should have in place in order to demonstrate that it can consistently produce technically valid results. Laboratories that provide such demonstration to an accreditation body can then be accredited to ISO/IEC 17025 by that accreditation body.

Since the first publication of ISO/IEC 17025 to replace ISO/IEC Guide 25 in 1999, the laboratory industry has demonstrated substantial improvements in the quality (consistency) of laboratory results. This progress can be directly linked to the quality assurance, quality control, and quality management system tools contained in specifications such as ISO/IEC 17025.

One of the best quality system tools in a laboratory's arsenal is the good and reasoned approach to handling the things that go wrong in the lab. This includes the determination of what actually caused the problem, to ensure that it does not recur. This tool is called corrective action if the problem has already occurred, preventive action when it has not yet occurred, or continual improvement to capture both in one holistic system.

Regardless of when the problem occurs (or may occur), the starting point for both preventive and corrective action is the analysis of root causes of the problem. Good root cause analysis normally involves:

- correctly identifying the undesired condition,
- determining the immediate and intermediate causes of the undesired condition, and finally,
- determining the root or underlying cause of the undesired condition.

More than any other laboratory quality system tool, root cause analysis provides clarity on the real issue that underlies a problem. If the underlying issue is not addressed, it is very likely that the problem will recur and impede the production of technically valid results.

There are some simple approaches available to determine root causes. They are objective and based on developing an understanding of the issue, its environment, the science, and the organization involved. However, few laboratory quality system practitioners can identify objective criteria that can determine if full corrective or preventive action is needed, along with the concomitant root cause analysis, and that is the reason for this article. In fact, root cause analysis is not needed to effectively address all undesirable conditions. What follows here is a method of determining which undesirable conditions require root cause analysis and which do not.

Root cause effort

First, it is important to understand that the ISO definition of nonconformance (nonconformity) comes from ISO 9000:2005. Clause 3.6.2 defines it as *nonfulfillment of a requirement,* where the requirement can be any written specification such as an instruction, a procedure, a set of limits to meet, or even a regulation. Whenever a condition does not meet a requirement, nonconformance has occurred. Just to show how far this concept can go, not finishing sentences with a period could be considered nonconformance.

So which nonconformances need root cause analysis?

The short answer is: all those that impede the laboratory's ability to produce only technically valid results or create an unacceptable level of risk to the organization, its people, or other stakeholders.

These are simple and objective considerations. Combined with a third consideration that compares the effort for permanent resolution with the effort for repeated correction, any laboratory can implement objective criteria in determining the necessity for root cause analysis.

Root cause analysis can involve a lot of individual and laboratory energy and effort, and for this reason some managers and supervisors are reticent to implement it as a matter of course. As a result, shortcuts may involve blaming a person for having made a mistake (nonconformance). This is often deemed sufficient root cause analysis and the solution selected to solve the problem can range from a verbal warning to actually firing the person who made the mistake. Neither of these approaches demonstrates understanding of quality systems or root cause analysis.

ISO/IEC 17025 already describes the tools for labs to demonstrate their competence in that the lab has:

- the people with the requisite skills and knowledge;
- the required environment, including the facilities and equipment;
- the required quality control and quality assurance; and the required procedures…to produce technically valid results.

None of these objective criteria have anything to do with a person "making a mistake." They all have to do with the laboratory quality system's ability to help the laboratory consistently produce technically valid results.

When this is understood, it is possible to objectively determine if root cause analysis is actually needed whenever a nonconforming condition (the problem) is encountered. Such determinations can be objective and fact based, depending on the objective answers to three simple questions.

Objective criteria to determine the necessity for root cause analysis

Whether the undesirable condition is nonconformance, potential nonconformance, or even opportunity for improvement, there are normally only three conditions that require the use of full corrective or preventive action involving root cause analysis. They are the following:

- Does the condition cause us to have invalid (incorrect) results? Or could it?
- Does the condition present us with unacceptable risk (to the lab, to our people, to our visitors) such as health and safety concerns?
- Will it be easier to conduct full corrective or preventive action than it will be simply to continue to correct the situation?

If any of these questions are answered with a "yes," then full corrective or preventive action is required, starting with root cause analysis.

Otherwise, the situation has fairly little impact on the laboratory, its people, its visitors, or its ability to consistently produce technically valid results, and it is apparently easier to just keep correcting the situation than attempt to permanently prevent its recurrence (corrective action). Corrective action and root cause analysis are not required.

Documenting the condition, however, is always required. A condition that recurs should be documented so that the laboratory can examine the impact of its continuation and make considered decisions on the value of undertaking full corrective action versus continuing to simply correct it. For example, one QC failure resulting in a rerun of the samples every six months may not be indicative of a systemic problem, while a once-per-week recurrence may indicate a problem that should be addressed.

"Root cause analysis provides clarity on the real issue that underlies a problem."

Some laboratory approval schemes want the extra work done anyway

There are some laboratory approval schemes that will require laboratories to undertake corrective or preventive action beyond what is suggested here. For example, pharmaceutical testing laboratories approved or licensed under Food and Drug Administration (FDA) or Health Canada (HC) regimes may be required to define nonconformances and corrective actions differently than are laboratories accredited under a voluntary conformity assessment program. Often, a laboratory may have more than one set of approvals and it will select the most stringent of the requirements to implement across the whole of its quality system.

Laboratory QMSs working to ISO/IEC 17025, based on standard voluntary conformity assessment approaches, are not as prescriptive as the FDA and HC regulatory regimes on this issue, and these regulators may insist on root cause analysis for everything that is documented as a departure or nonconformance by the lab. This also raises the issue about an out-of-specification condition—but that is a whole other topic for a later article.

As well, those laboratories approved under the Performance Review Institute NADCAP program for the aerospace industry may also be required to "do it anyway." NADCAP no longer accredits laboratories against ISO/IEC 17025, but its requirements are still fairly specific.

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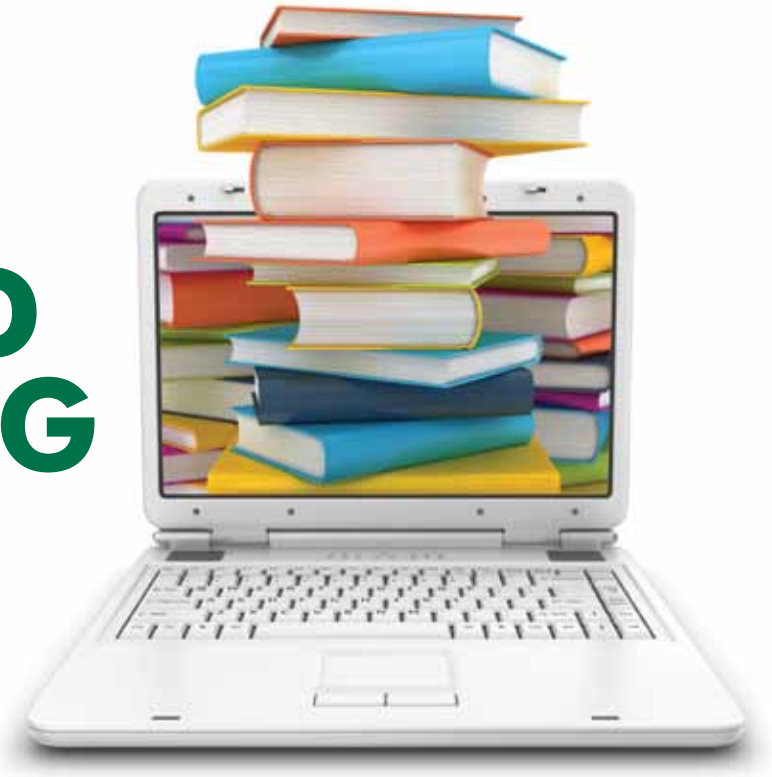
THE BLENDED TRAINING MODEL



CLASSROOM TRAINING SANDWICHED BETWEEN PRE- AND POST-COURSE ONLINE ACTIVITIES DELIVERS STRONG RESULTS

by Charles A. Zona

Budget cuts force companies to spend every dollar effectively, and training, especially when it requires travel, is often the first line item slashed. Cuts in continuing education can have a negative effect on a company's bottom line. A proficient staff builds an overall sense of achievement among the employees, leading to increased productivity and innovation in the workplace. A staff trained to operate equipment properly can offset maintenance costs. Specialized equipment, such as research-grade microscopes, become mere inventory without the proper training required to use them.

Allowing staff members to attend off-site training programs can pinch productivity while depleting ever-shrinking training budgets. We sympathize with managers who face the temporary loss of an employee and the impact that has on meeting output goals. We have found that using a "blended learning" approach, one that augments classroom training with online resources accessed from the student's lab, seems to work well.

Student feedback regarding the blended learning model at Hooke College of Applied Sciences has been overwhelmingly positive. Students comment that the post-course activities helped reinforce the concepts and practices learned during the course. Students are incorporating course information into their day-to-day work and standard operating procedures and using some of the online exercises as internal proficiency examinations for their colleagues. Inspired by this feedback, we wanted to share our experiences thus far with our blended model so others may benefit.

Pre- and post-courses form a "Web sandwich"

The blended learning model begins before students step into a classroom. Introductory Web-based modules reviewed prior to the course ensure that learners are ready to take full advantage of the classroom sessions, understand the course's purpose, start at the same knowledge level, and learn terminology to be used in the course. The online content consists of narrated learning modules, each lasting approximately 30 minutes, followed by a brief quiz. Students also have the opportunity to fully explore virtual versions of microscopes used during the course, so they have a greater understanding of each part's functionality before beginning hands-on instruction in the classroom.

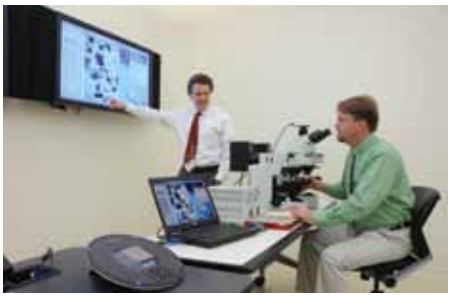
At the close of classroom instruction, students are given unknown samples to analyze back at their laboratories—offering students an opportunity to put into practice the skills learned in the classroom using equipment available at their workplace labs. After the students complete their own analyses, the post-course phase of Web-based activities begins. Students gather online with the instructor and former classmates to discuss the unknowns. Each one-hour online session is structured to allow students the opportunity to lead a discussion of at least one unknown sample. Students take turns describing their findings, while the other students who attended the session make comments and offer feedback

in the order in which they queued up. These post-course sessions allow those with little experience to build confidence, while those with more experience can share insights with their less experienced colleagues.

The post-course environment encourages the exchange of ideas, such as for alternative techniques and approaches to identify the unknowns. New sample types more pertinent to the student's own work can also be explored.

When the rubber meets the road

The post-course sessions also help to uncover equipment and supply deficiencies in a given laboratory. Students have reported basic supplies such as refractive index liquids for unknown particle identification were not available in some labs. In several instances solvents required for novel sample preparation techniques were on a prohibited list.



Chuck Zona (author) and a Hooke College of Applied Sciences instructor help students reinforce and apply their classroom training in a post course Web conference session.

Students also faced unforeseen challenges when participating in post-course sessions. When their obligation must be to their workload, students are encouraged to email their results, which instructors evaluate; they then schedule a discussion with the student when it is mutually convenient. A small percentage of students who used specialized equipment such as scanning electron microscopes commented that it was either difficult to reserve instrument time to analyze the unknowns or that those instruments were not working properly. We recommend to students who could not analyze the samples that they still attend the post-course sessions and participate passively, listening to those classmates who had analyzed the samples.

"Cuts in continuing education can have a negative effect on a company's bottom line."

Students are asked to complete a six-category post-course survey rating the impact of the course. The categories receiving the highest ratings were: sharing of course materials, course value, teaching staff training, and workload. Based on their feedback, the knowledge and skills learned during the course are being integrated into the students' day-to-day work, and they are sharing their new knowledge and course materials with their colleagues. This type of "hands on" distance learning clearly is of great benefit to those interested in professional development and continued learning.

In the end, a company's bottom line can be strengthened from the bottom up. We all look for ways to trim budgets; our blended learning training method ensures that staff receive thorough instruction while minimizing absence from the workplace, maintaining productivity.

Chuck Zona *is vice president and dean of Hooke College of Applied Science. He can be contacted at czona@hookecollege.com.*

GLOBAL R&D DEMANDS EFFECTIVE COMMUNICATION

By Alan Edwards

Over the course of my career in the sciences, I've had the opportunity to see firsthand the power of long-distance collaboration. For one research and development project, work was done in San Diego, California; Madison, Wisconsin; France; Germany; and Switzerland.

"Jobs that need to get done are rarely conducted in isolation."

To the outsider, this may have seemed like a logistical nightmare, and in some respects, trying to work with people around the globe is indeed a challenge. But in the sciences today, any perceived inconvenience in such collaboration is overshadowed by the quality of work that can come about when project managers are open to gaining knowledge and perspective from those most qualified to give it.

In the case of this particular R&D project, things that could be done in Madison couldn't be done in France—and vice versa—but each workforce in each location was a critical component in the overall process.

Such "sequential" work is fast becoming the norm, as everyone in the sciences knows. Jobs that need to get done are rarely conducted in isolation. Largely because of the vast amount of knowledge sharing that has occurred as a result of the Internet and cross-collaboration, life sciences companies both large and small quite frankly would be limiting themselves if they didn't explore how partnering with people around the globe could add value to their projects and, ultimately, their businesses.

Collaborating and communicating effectively around the world, therefore, should be a top priority for most science companies and labs if they hope to compete on a global level. It seems easy enough—and obvious—that this should be the case. But I wonder if managers actually think about such communication and collaboration in a strategic way with the goal of getting the most out of their workforce and what their talent can do for them.

After all, something as simple as "communication" and the inability to do it well can potentially derail a project that is vastly more complex in its details than the process required to effectively relate with colleagues around the globe.

So managers in today's labs need to take effective communication seriously. First, they must learn the soft skills required to relate to their own colleagues close to home. It's something I've talked about several times in this column over the last year, but it always bears repeating: knowing the emotional and social pulse of your organization—and having the core skills to deal with everyone on a more human level—will strengthen practically every aspect of your business, no matter the industry. This means knowing the culture of the workplace well so that managers can relate to and communicate with employees through means they are used to.

If you're working with a team from France, for example, it's essential that you commit to knowing how these foreign work cultures work as well—just because everyone is working in a scientific environment does not mean that certain processes will be completed in the exact same way.

"If you're working with a team from France, for example, it's essential that you commit to knowing how these foreign work cultures work as well."

"Lab managers must definitely do their homework when it comes to researching all the [communication] tools available."

Luckily, technology has made it easier to communicate and learn the skills necessary to foster the most effective communication. Social media, as well as specialized scientific communities on the Internet, allows collaboration to take place as if in real time. But using all these tools is not necessarily intuitive. Lab managers must definitely do their homework when it comes to researching all the tools available, such as cloud computing and specialized social media for the sciences, in order to take full advantage of the ways these powerful tools can facilitate communication and collaboration.

As the science industry continues to evolve and increasingly rely on many moving parts to achieve business goals, the value of good communication and collaboration will only become clearer. When processes are in place to not only do the best work but also communicate in the best way possible, overall costs will shrink, research and development will become more efficient, and products will get to market faster.

Alan Edwards *is vice president and science product leader, Americas Products Group, Kelly Services®. Kelly Services, Inc., a leader in providing workforce solutions, is headquartered in Troy, Michigan. For more information, visit kellyservices.com. Alan can also be followed on LinkedIn® and Twitter®.*

THE THREE-LEGGED STOOL FOR TRAINING SUCCESS

By Rebecca Morgan, CSP, CMC

The 16-session manager training program was phenomenally successful. Ninety percent of the attendees were offered promotions within a year of their graduation. Why was the program so successful? Because all of the legs on the Training Success 3-legged stool were strong.

The components of the Training Success 3-legged stool are:

- Learner's manager
- Learner
- Instructor/content provider

Most training puts the onus of success solely on the instructor. Occasionally training will include participant accountability for the learning of information and showing proficiency in behavior. However almost never does any part of the responsibility for success reside with the learner's manager. But that component of the training is essential to success.

If one of the parties doesn't do their part, the stool becomes wobbly or collapses. Here are the responsibilities of each leg of the Training Success stool:

1. The learner's manager has to:

- Talk to the learner(s) before the training to determine areas of needed improvement and to ensure the identified training is the best way to acquire the needed skills and/or information.
- Be clear on how s/he expects the learner to perform differently as a result of the training.
- Co-create measures with the participant for determining if the learner successfully integrated new skills/information.
- Encourage the learner to take charge of his/her learning by being active in the training and getting what s/he needs from the session(s).
- Release the learner for training sessions, ensure s/he attends, and arrange coverage for the learner's duties while in training.
- Talk with his/her learner(s) regularly to discuss adapting the new skills to their department.
- Coach the learner when needed.
- Give the learner positive feedback for observed behavior changes.
- Model effective behavior him/herself.
- Talk with the instructor regularly to get feedback on his/her learner.
- Support any reinforcement offered.

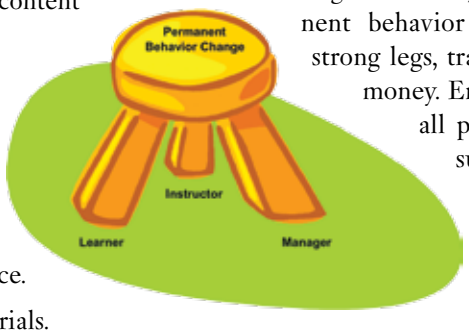
2. The learner has to:

- Talk to his/her manager before the training to determine areas of needed improvement and to ensure the identified training is the best way to acquire the needed skills and/or information.
- Be clear on what s/he wants from the training and actively makes sure s/he gets it.
- Be fully committed to strengthening or learning new skills.
- Attend the sessions and be fully involved in the discussions and processes.
- Actively seek real-life, job-specific application of the principles discussed/skills learned.
- Complete any pre-reading or homework.
- Accept coaching from the instructor and/or manager.
- Participate in any follow-on reinforcement offered.

LABCAST Be sure to attend Rebecca Morgan's Lab Manager Academy webinar, "Effectively Growing Your Key Talent: Are You Sunlight and Water—or Just Manure?," on Wednesday, August 1st, or afterwards at **www.labmanager.com/growing to watch the archived video.**

3. The instructor/content provider has to:

- Provide stimulating, useful, and clear content and processes.
- Prepare pre- and post-learning assessments.
- Be approachable and open to dissenting opinions.
- Provide an integrated approach to learning, including job aids and practice.
- Create useful tools and resource materials.
- Give learners needed coaching/feedback.
- Make modifications to the program/tools when appropriate.
- Offer the learners' managers suggestions for coaching the learner.
- Provide appropriate follow-on reinforcement.



As a result of all the legs of the Training Success stool working in tandem, a solid base is created for permanent behavior change. Without three equally-strong legs, training is often a waste of time and money. Ensure success in your lab by having all parties committed to successful results of your training effort.

Rebecca L. Morgan, *CSP, CMC, specializes in creating innovative solutions for people-productivity challenges. She's appeared on* 60 Minutes, Oprah, National Public Radio and USA Today. *She's authored four books and co-authored three more. For information on her services, books, and tapes, or for permission to repost or reprint this article, contact her at 800-247-9662, Rebecca@RebeccaMorgan.com, http://www.RebeccaMorgan.com.*

ENTERPRISE RESOURCE PLANNING

SUPERHIGHWAY FOR LAB COMMUNICATION AMONG DISPARATE LABORATORY SOFTWARE SYSTEMS

by Bernard Tulsi

A highly valued operational goal of most technology-driven enterprises such as research and service laboratories is the seamless integration of processes and data into a tightly unified continuum to provide accurate updates on key metrics such as income versus expenditures, workflow rates, the status of samples, time expended on particular tasks, the demand for products and services, and the state of inventories, among others. One of the most important contributors to the success of this goal is an innovative combination of computer hardware and software tools that incorporate bundles of applications and capabilities—commonly referred to as enterprise resource planning (ERP).

The origins of ERP systems may be traced back about 20 to 30 years to materials resource planning (MRP) systems, which handled inventory, scheduling, and planning in the manufacturing sector, says Pat Phelan, a research vice president at Gartner who advises IT outfits and businesses on ERP strategic planning; ERP globalization; and a variety of related implementation, support, and development issues.

"The term ERP was coined at the time when software vendors were starting to package or bundle different components of their offerings into suites of software. This transcended materials planning and started to include back-office functionality such as finance, human resources, and payroll," says Phelan. She explains, "There was a transformation from bundled packages that had several applications for manufacturing functions to bundles that enabled business management, including back-office administration."

Turning to the question of ERP systems in laboratory operations, Phelan says that ERP systems do not typically include industry-specific, technical data handling. Some aspects of pharmaceutical operations may be exceptions that include inventory management or sales processing, which may be linked to order, customer, or vendor masters with built-in product expiration dates. "Some of that kind of information may be found in the basic ERP solution, but technical laboratory results, experimental tracking data, and other specialized information would not be found in any generic ERP solutions," she says.

Phelan explains that ERP systems are focused mainly on the administrative and managerial functions needed to run businesses. "In manufacturing entities, there may be some way to leverage the MRP aspect—inventory, supply chain, planning, and scheduling—into the laboratory environment," she says. One caveat is that such systems may not "instinctively be a good fit out of the box because they are not necessarily designed with [the] laboratory environment in mind."

The utility of ERP systems in the laboratory may be facilitated or even enhanced when they are integrated with laboratory information management systems (LIMSs) in a way that harmonizes the lab's internal and external business processes. As they become more established, it is evident that LIMSs have broadened out from their laboratory-centric focus on the management of samples and reports. LIMSs are now integrally involved in the enterprise-wide dissemination, sometimes globally, of technical and scientific information. They are increasingly being deployed to optimize and improve quality control, resource allocation and deployment, cycle time, and overall productivity and quality.

"LIMSs are now integrally involved in the enterprise-wide dissemination, sometimes globally, of technical and scientific information."

Because they touch almost all operational areas, ERP systems have evolved into the integration hub for other information management systems in many business enterprises. The work assignments of in-house QA/QC laboratories in manufacturing entities, for example, are initiated in the ERP system, which typically alerts the LIMS and other relevant functions such as the manufacturing execution system (MES). Communication between disparate systems such as LIMSs and MESs is facilitated by the ERP.

In an *American Laboratory* article (March 2004) entitled "Integrating LIMS Into a Large-Scale Manufacturing Environment," Colin Thurston, LIMS product manager with Thermo Electron (Cheshire, UK), noted that a typical ERP-LIMS interaction entailed downloading "quality data plus any reference data to [the] LIMS" and uploading "either summary results or disposition decisions to [the] ERP [system]." Thurston wrote that once results are entered into the LIMS and all the parameters are verified, they may be sent to the ERP [system] automatically for any additional processing. He noted, "Either the LIMS or ERP [system] can be the trigger for usage decisions regarding product disposition, delivery, or shelf life."

Addressing initiatives to promote the integration of LIMSs and ERP systems to drive the uniform distribution of quality information in organizations while raising the efficiency of operations, Thurston wrote, "… some LIMS vendors have introduced standard interface solutions to integrate LIMSs with leading ERP systems, such as the Enterprise R/3 (SAP Software AG)." He explained that such interfaces required "a special, functionally rich enterprise-centric LIMS to expedite the bidirectional data flow between the laboratory and manufacturing, streamline data handling, and integrate data collection and reporting."

Pointing to the flexibility and user-friendliness of LIMS-ERP system interfaces, Thurston pointed out that some progressive LIMS vendors have created "user-driven mapping functions as part of their ERP integration solutions." He explained that these gave LIMS users easy access to information from the ERP system in a familiar LIMS format. "Advanced inspection point processing functionality allows inspection points to be created within the LIMS via a configurable mapping process so that recognizable data objects can be sent, for example, to the R/3 quality management module." He added that upgrades only required "simple reconfiguration of the objects in the LIMS interface."

"Some progressive LIMS vendors have created user-driven mapping functions as part of their ERP integration solutions."

Not unexpectedly, there are often problems using this interface. In many quarters it is considered unacceptable to implement laboratory software systems that are not able to communicate effectively, and there is the growing expectation that beneficial interfaces should be automatic. While there have been notable improvements over the years, by and large interfacing between software modules has not been trouble free.

Then there is the question of duplication—as labs increasingly assume the posture of a business that has to manage planning, inventory, and accounts payable and receivable functions, among others, LIMSs are being viewed as surrogate laboratory ERP systems. This leads to the inevitable question: If both the ERP system and LIMS are robust and can deliver all the necessary information as well as facilitate laboratory activity, is it necessary to have both?

In an article in *Scientific Computing World* (January/February 2005), Mark Gonzalez, technical director of LabWare Europe, noted that while ERP systems work well as the central dominant software system in production, requirements such as terminologies and detailed workflows of laboratories are quite different and may sometimes conflict with those on the production side. Gonzalez used the example of the term "sample" to elucidate: "From production's perspective, a 'sample' is a jar full of some liquid, powder, or solid that is sent to the lab; from the lab's perspective, a 'sample' is a collection of tests to be done. One jar can easily lead to many LIMS samples, such as aliquots and subsamples. Equally, LIMS samples are sometimes created from composites of several production samples."

He explained that labs have detailed workflows that cover sample handling. "These workflows include basic elements such as sample login and result entry, as well as more complex elements such as sample sequencing and data review."

The dynamic nature of labs—complete with constant workflow changes—is seen by Gonzalez as added justification for deploying and using LIMSs versus the exclusive reliance on ERP systems in laboratory settings. "Large-scale ERP systems can be updated to reflect these changes, but these updates tend to have an effect on non-lab-related activities. Since a LIMS is primarily a laboratory system, it can be updated and reconfigured to address workflow changes without affecting the rest of the business," Gonzalez explained in his article.

What seems clear now is that after about 25 years on the market, vendors are not rushing to change the core functionalities of ERP systems. At the heart of ERP systems are the financial and accounting modules, which remain largely unchanged. To be sure, there have been innovations among the supporting technologies around the core capabilities. In practical terms those innovations responded to a strong need for simplification among users—easier ways to enter and use the data that has been collected and inputted into ERP systems. In fact, one of the distinct current trends is toward simpler interfaces and deployment methods for users. In its 2010 Magic Quadrant for ERP for Product-Centric Midmarket Companies report, Gartner observed the following: "The improved ease of use, extended search capabilities, and more-integrated analytics features drive the use of ERP by more types of users."

As mobile and wireless devices such as smartphones and tablet computers become more ubiquitous—and more widely accepted in the laboratory setting—vendors are striving to make their ERP tools accessible via simple user interfaces on heavily used mobile tools such as the iPad or optimized Android applications.

"Vendors are striving to make their ERP tools accessible via simple user interfaces on heavily used mobile tools."

Looming as the largest area of change in the ERP arena now is the growing enthusiasm for cloud computing by companies, along with the software as a service (SaaS) model for making ERP software available to end users. A cloud-based approach to ERP could simplify the complexities typically associated with the technology, while SaaS substantially reduces the need to build in-house capabilities to accommodate ERP tools—appropriate software can be accessed from a provider's repository, as needed, over the Internet.

Gartner's Phelan says, "Today we are watching for new and old vendors to reinvent themselves in the cloud. We don't think that all the ERP in large complex organizations will ever be completely in the cloud, but there are some aspects of ERP that would be a good fit … [so] we are watching this very closely right now."

Turning to the question of future challenges, Phelan sees some troubling issues around security.

"Not all the vendors are transparent about how they are securing things and ensuring quality, security, and compatibility among different ERP components. A system may be secure by itself but changes substantially when you combine components that are not compatible," she says. In addition, she sees some future challenges in the use of disparate data taxonomies and policies across organizations and countries. The pace, management, quality, and control of change in the ERP arena also constitute important future challenges, according to Phelan.

Bernard Tulsi *is a freelance writer based in Newark, Del. He may be contacted at btulsi@comcast.net or by phone at 302-266-6420.*

LAB AUTOMATION IS INEVITABLE

ARE YOU READY? by Joe Liscouski

Institute for Laboratory Automation

Lab Manager MAGAZINE Run Your Lab Like a Business

In September 2012, the Institute for Laboratory Automation and *Lab Manager Magazine* — as part of the Lab Automation University program — will offer a series of webinars under the heading "Lab Automation Is Inevitable: Are You Ready?" The title emphasizes the direction in which technology is moving and the need for lab management to become involved in the planning required to take full advantage of these inevitable changes.

The collection of technologies that fall under the heading of "lab automation" affects every aspect of your lab's operations: instrumentation, sample preparation, data analysis, data organization, and tools to help manage the lab's work. If we think of them as options that we can select, we'll miss some significant points:

- Lab data is being generated in digital form, in a variety of formats, and stored in multiple databases. Lab managers need to actively oversee these systems or risk losing control of the results their labs have worked to produce. Take a look around your lab. How many instrument data systems are there, and how many sources put data in digital form?
- The evolution of laboratory equipment is shifting toward computer-controlled systems, including instruments, electronic lab notebooks, and LIMS — all of which contain your lab's intellectual property.
- Improvements in lab productivity and effectiveness and in testing, research, and clinical environments will be more heavily impacted by information technology than by any other technological development.

For those of you who have come from the sciences into management positions, it can be difficult to get your head around this rapid development of lab technology. But the technology MUST be understood and managed if you are going to effectively use the tools available and get the most value from every dollar of your budget.

There is a need to shift from a mind-set of discrete incremental improvements in capability to one of well-managed technology that avoids unnecessary expenditures. The goal is to develop the ability to devise a plan for technology use that guides purchases and implementations that work together.

"LAB AUTOMATION IS COMING TO A LAB NEAR YOU!"

The webinar series will cover:

- What lab automation is — and it is NOT just a collection of technologies
- The structure of the field and why it is important to you
- Classes of implementation
- Skills managers and lab staff need in order to plan and manage systems — skills that have changed significantly
- Options for improving productivity
- Management's role in lab automation
- Issues such as system integration and paperless work environments
- Considerations in making purchases
- An overview of the technologies and product classes available

Put it all together and you have the knowledge needed to address a major change in the development of laboratory work, one that will inevitably change the nature of that work and the way people carry it out.

For more information, visit Lab Automation University On-line at http://www.institutelabauto.org/LAUOnLine/index.html

***Joe Liscouski**, executive director of the Institute for Laboratory Automation, can be reached at liscouski@InstituteLabAuto.org or by phone at 978-732-5122. The Institute for Laboratory Automation is a nonprofit organization focused on education and the development of methodologies for successful lab automation programs, as well as the development of the field of laboratory automation engineering.*

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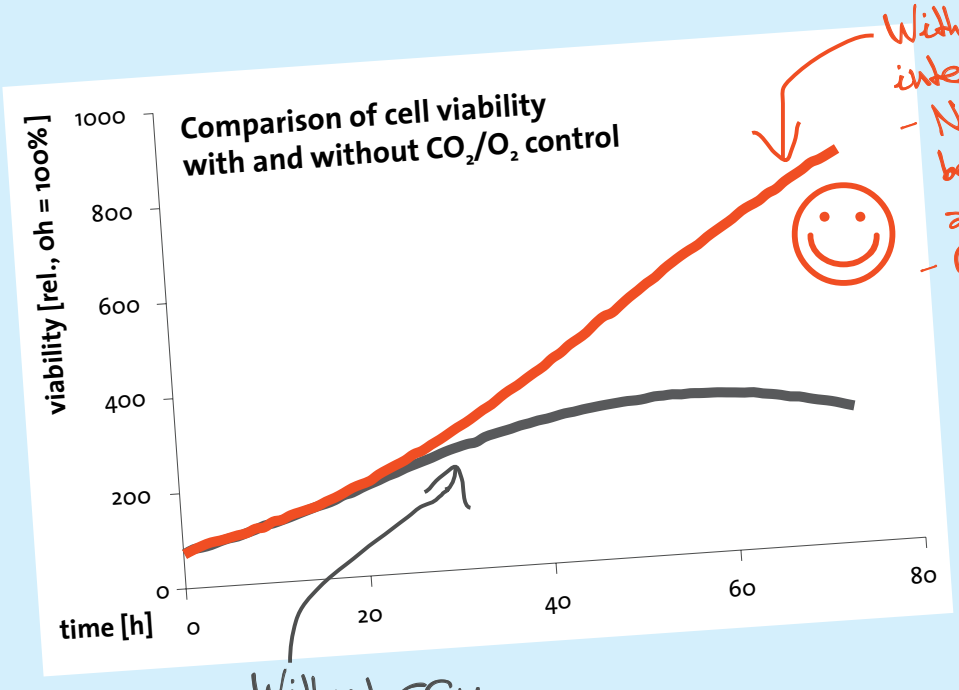

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FIELD-WORTHY INSTRUMENTATION

TAKING THE ANALYZER TO THE SAMPLE

by Angelo DePalma, Ph.D.

Portable instrumentation and analyzers are a booming business if recent announcements are any guide. Rigaku's handheld Raman spectrometer, Thermo Fisher's handheld X-ray and Raman analyzers, Centice Corp.'s Raman-based narcotics screener, a Bruker handheld X-ray fluorescence (XRF) spectrometer, and Dynasil's XRF lead paint detector are just a sampling. Meanwhile a California academic group has transformed the iPhone into a microscope platform for medical-quality imaging and chemical detection.

Field instruments have been around for decades, but advances in computing and electronics miniaturization have spawned a new generation of instruments that are more approachable, smaller, and lower in cost.

When Forston Laboratories (Fort Collins, CO) introduced the LabNavigator multi-technology meter in 2010, few devices could boast "multi-parameter" capabilities—essentially multiple, distinct detection modalities in one instrument. The handheld LabNavigator plugs into analysis modules for turbidity, colorimetry, oxygen, pH, gas chromatography, and others. Users acquire the sensors they need and attach them to create a "lab on the fly."

"The single-parameter meter is now a commodity," says Forston president Steve Zelenak. "With the new generation of pen-type meters, handheld, single-parameter meters are becoming strictly low end."

The Forston Frack Tracking Kit with radiation monitor.

Looking into his crystal ball, Zelenak sees instrumentation following ideas from consumer industries to improve "the user experience far beyond just hardware and interface issues." He mentions computing cloud, data aggregation, and connectivity technologies as enablers of a new paradigm for seamlessly collecting and processing data from the field.

MS and tandem techniques

In March at Analytica 2012, Microsaic Systems (Surrey, UK) debuted "the world's smallest mass spectrometer system." Developed with three pharmaceutical companies, the 3500 MiD® sports just ten percent of the footprint of a conventional instrument.

The keys to the design are interchangeable chip-sized components. The 3500 MiD integrates with analytical or preparative LC, flash, or supercritical fluid LC and provides in-line analysis with no additional footprint or infrastructure requirements at 10 percent of the operating cost of a conventional MS.

Company founder Eric Yeatman, Ph.D., notes the significant miniaturization limits of quadrupole MS. A quadrupole consists of four parallel, precisely positioned, conducting electrodes that form a "tunnel" inside the instrument. Charged particles travel along the length of the rods into the detector. Conventional quads are a foot long; Microsaic's was fabricated in a silicon foundry and is about the size of a matchbook. The vacuum system and pumps can be much smaller than those of a conventional quadrupole MS, but they are still approximately the size of a desktop PC.

"Research labs have built smaller devices," Yeatman says. The system could get even smaller if the device operated through ion mobility, a technique for analyzing gases, instead of as a quadrupole, which is more suitable for liquids analysis.

The Microsaic 3500 MiD compact mass spectrometer with electrospray ionization source is based on a quadrupole filter fabricated using silicon micro-engineering. This allows the vacuum system to be reduced in size sufficiently that it, including all pumps, can fit in the desktop unit shown.

Microsaic is not marketing the MiD as field-capable, instead focusing on biotech and pharmaceutical applications that demand versatility and easy setup. "We have no illusions that we'll be driving large analytical mass spectrometers from market." But the MiD is field-transportable due to its low power requirements. "We will be looking at a battery-powered version," Yeatman adds.

Smiths Detection's (Danbury, CT) partnership with Torion Technologies (American Fork, UT) has resulted in GUARDION™, a miniaturized, ruggedized GC/MS instrument for identifying volatile and semi-volatile organic compounds.

"With the new generation of pen-type meters, handheld, single-parameter meters are becoming strictly low end."

"Due to its low thermal mass GC and unique toroidal ion trap mass spectrometer, it is ready to operate from a cold start in five minutes. A typical analysis takes three minutes or less," commented Kenneth J. Fredeen, Ph.D, senior product manager at Smiths Detection. "We designed the operating software so that non-experts can run the system with minimal training."

Despite providing chromatographic and mass data typical of a benchtop instrument and sophisticated data handling, GUARDION's main trade-off is in flexibility. Users have fewer options for inlets, ionization sources, columns, and detectors. GUARDION also lacks the sensitivity range of lab-based systems.

The main focus in creating a person-portable GC/MS is minimizing power requirements. The more power required, the larger and heavier the power supplies and the less likely the device will run on batteries. "We focused on the power required for the GC, the MS, and the vacuum system," Fredeen explains. For the GC, Smiths employed a low thermal mass design where the heating element is intertwined with the capillary GC column. For the MS they selected an ion trap design rather than the more popular quadrupole that operates at lower vacuum levels—hence requiring smaller pumps.

The GUARDION GC/MS from Smiths Detection ships to where the samples are and is up and running in minutes.

Infrared portability

In May Gasmet Technologies (Helsinki, Finland) launched the DX4040 portable FTIR gas analyzer that performs laboratory-quality field analysis of gases arising from fumigants, pesticides, soils, contaminated land, fires, chemical warfare agents, and many others.

When used in stand-alone mode with the "lite" version of its operating software, it displays spectra as well as concentration readouts for up to 25 gases. When connected to a laptop running the full software package, it operates as a full-fledged sophisticated spectrometer with access to a large spectral library and 50-gas capability. Mixtures and interfering gases are easily deconvoluted.

Miniaturizing FTIR usually involves balancing portability and capabilities. "But a trace gas analyzer should not be miniaturized at the expense of analytical performance," says Antti Heikkilä, export manager at Gasmet Technologies. FTIR's spectral resolution depends on the path traveled by moving mirrors in the interferometer. The lowest practical resolution for gas analysis is between 4 and 16 cm-1; Gasmet uses 8 cm-1.

▲ *The Gasmet DX4040 portable multicomponent FTIR gas analyzer.*

Another consideration is the weak absorption signal of trace gases, requiring a large beam diameter within the interferometer to provide adequate light intensity. "Mirrors need to be a certain size to provide good sensitivity," Heikkilä explains. And room must be made for an internal calibrating laser. Finally, sub-ppm measurements call for an optical path length of at least five meters. Gasmet uses 9.8 meters but "folds" the path length in a multipass cell, which nevertheless adds up to one liter of volume to the device.

ASD's (Boulder, CO) introduction of its TerraSpec 4 line of portable mineral analyzers in January exploits the power of near-infrared (NIR) for mineral exploration field work. The company's LabSpec 4 uses full spectrum NIR reflectance, from 350-2500 nM (most portables focus on a slice of the spectrum). Bundled with each instrument, ASD's Indico® Pro software collects spectra through reflectance, transmittance, or absorbance. It operates on battery, line, or vehicle power and has wireless capability for measurements away from the controlling laptop.

"We take field portability seriously," comments Dan Shiley, application chemist at ASD. "These full-featured instruments perform equally well as or better than laboratory instruments and provide data that is just as good."

Agilent Technologies (Danbury, CT), which acquired FTIR specialty company A2 Technologies in 2011, has been continuing innovation in handheld FTIR, transportable GC/MS, and the transportable 1220 Infinity Mobile LC. The company's portable FTIR handhelds provide accuracy and precision comparable to Agilent's laboratory equipment. Because they use non-hygroscopic ZnSe optics, water vapor and atmospheric conditions have no effect on the instruments.

According to John Seelenbiner, Ph.D., mobile FTIR marketing manager, the next few years will see "significant developments" in portable FTIR. Advances in software and algorithms will improve response and measurement times to make the systems

easier to use. "The real growth for mobile instrumentation, though, lies in systems dedicated to providing actionable results. Dedicated systems will require method and applications development to make technology accessible to nontechnical users," which will create even larger markets, Seelenbiner says.

XRF

X-ray fluorescence exhibits many characteristics of a detector-worthy analysis method, including the ability to operate in non-destructive mode. In February XOS (Orlando, FL) introduced HD Mobile™, the latest in a line of high-definition X-ray fluorescence (HDXRF) analyzers. For practical reasons XRF is most often used with metals lower in the periodic chart than sodium. This makes the technique ideal for quantifying samples containing heavy or toxic metals.

HDXRF provides heavy metal analysis in consumer products with precision similar to that of wet chemistry but non-destructively and with quicker turnaround times and lower costs.

According to XOS product manager Satbir Nayar, XRF analysis is all about "counts"—the number of fluorescence events picked up by the detector. Counts are a function of the intensity of the exciting radiation and the concentration of the target (e.g., lead in paint). XOS uses a miniaturized monochromator system that focuses the intense X-ray beam on an area 1 mm in diameter. "This allows measuring very small features of products such as circuit boards."

The XOS HD Mobile™ analyzer easily switches from stationary to handheld analysis and back again with its self-contained smart case design.

The design of the optics also allows examining specific layers within a product—for example, a spray-painted coating—and distinguishing it from the substrate. Vertical spatial discrimination is critical for inspecting toys, for which allowable concentrations of heavy metals differ between coating and base materials.

Like other portable tools mentioned in this article, HD Mobile does not replace benchtop XRF spectrometers but rather serves as a screen—a starting point for further investigation. An untrained user can examine a product shipment or every *nth* part in about 30 seconds (full-sized instruments are faster) and obtain a yes or no answer. "They can even examine the spectrum on a small screen on the device, but the majority of users are simply screening," Nayar explains.

Assay-based analyzer for biotech

The need for at-line and in-line bioprocess protein monitors is critical. Current instrumentation quantifies properties such as pH, turbidity, and gases but not protein titer and quality. Mediomics (St. Louis, MO) has created a proof-in-principle handheld fluorescence reader that provides deep insight into the ultimate target of process analytics—the product itself.

The device utilizes Mediomics' Pincer® "sandwich" assay, similar to ELISA, where two modified antibodies to the protein of interest bind to different regions of the target and then to each other to emit fluorescence. Assays are available for titer as well as for extent of glycosylation, a measure of quality. When fully developed, the handheld analyzer will incorporate reagent and sample wells, an LED light source, and a fluorescence detector similar to those found in microplate readers. "The analyzer could even be finger-sized," says company president Yie-Hwa Chang, Ph.D.

Mediomics' proprietary assays, which will work with the new analyzer, have already been adapted for rapid detection of such molecules as cAMP, tryptophan, S-adenosyl methionine, PDE assay, biotin, insulin, C-peptide, albumin, C-reactive protein, and pathogens.

It becomes apparent that much innovation in instrumentation will occur at the lower-size end, where—protestations to the contrary notwithstanding—functionality and versatility are sacrificed for speed, immediacy, and portability. Moreover, instruments that provide a yes or no answer in the field do not demand a high level of skill from operators, a trend we see over and over in fully featured instruments. Forston's corporate tagline, "We're the chemist so you don't have to be," nicely encapsulates the philosophy behind this idea.

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FLEXIBLE GAS HANDLING

COMPUTERIZED AND EXPANDABLE SYSTEMS ALLOW FOR CONTINUOUS PROCESSING AND COST EFFICIENT LAB EXPANSION

by Larry Gallagher

Specifying gas handling systems that are as expandable as a child's LEGO® set is a reality today, thanks to innovative systems designed for laboratory use with flexibility in mind.

By using switchovers, manifolds, and the like, you can start with a small system and expand as need and frequency of use increase, moving from cylinders to dewars and micro-bulk storage without having to replace original equipment. This means processes remain continuous and efficient, and savings are measurable.

Manifolds enable multiple cylinders or containers of the same gas to be connected to a common supply line that delivers gas to the pressure-control device or process. This setup can be as simple as two cylinders connected to a pressure regulator using flexible hose assemblies, such as in a protocol switchover station (Photo 1), or as complex as a fully automatic switchover that can interface with remote alarms and building management systems or even send email alerts when cylinders need replenishment (Diagram 1).

▲ *Photo 1.*

Though it may seem simple enough to increase the available gas on hand for almost any instrument or process, the design and functions of needed equipment are dictated by the specific process and gas involved. Where possible, the system should be able to expand to accommodate more cylinders without requiring that the process be shut down. Essential features in the manifold design include diaphragm isolation valves to ensure leak integrity and positive closure, and metal-to-metal seals with a modular design that allow for system expansion. Additionally, high-quality construction is important, preferably employing 316L stainless steel diaphragms and high-quality, appropriately rated flexible hose assemblies with integral check valves that prevent the backfilling of cylinders and reduce system exposure to ambient air.

The gas supply connected to any particular system should be sized so that one side of the system has enough gas for a minimum of one to two weeks' use. As instruments are added and more cylinders are needed to keep up, a cylinder header system with a modular design allows for expansion by simply adding additional pigtails to auxiliary ports or by attaching extensions that add more stations, as shown in Photo 2.

Today's laboratory instruments or systems, such as gas chromatographs (GCs) and inductively coupled plasma mass spectrometers (ICP-MSs), require gases of 99.999 percent purity or better. Typically, for gases such as helium used as a carrier gas for GCs, the only supply option is high-pressure gas cylinders or pallets of high-pressure cylinders. The conventional manifold for this type of application has been a differential pressure switchover in which the switching pressure and pressure of the residual gas in the cylinders could be as high as 200 psig over the required line pressure.

Depleting the cylinders to below approximately 150 psig is not only impossible but undesirable because the resultant pressure drop in long pipelines impedes performance, and a lower residual pressure in the cylinders increases the risk

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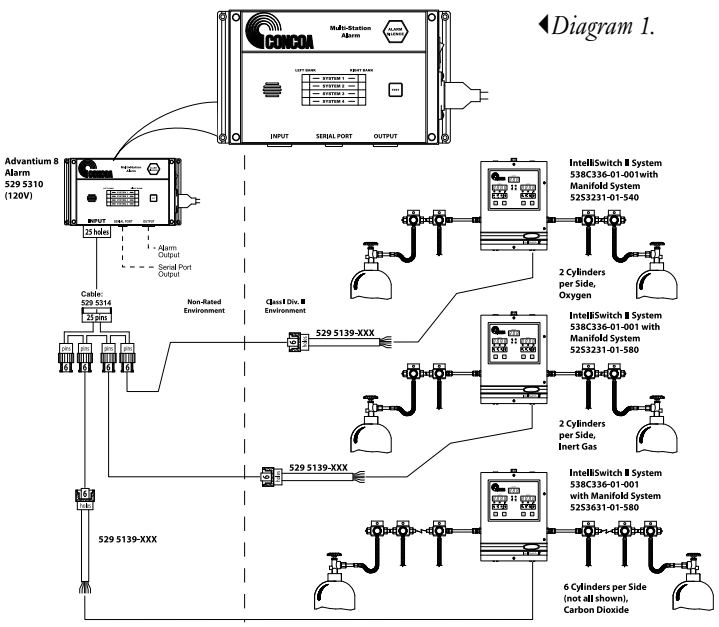
Photo 2.

Photo 3.

of impurities, particularly moisture. With the increase in cost per cylinder of high-purity helium, the ability to easily change switching pressure can be cost-effective, but this can be accomplished only with a system in which the switching pressure is programmed by an electronic or computer-controlled input value to switch at as low a point as realistically possible. If such a system can reduce the switching pressure by 100 psig, the savings could be as much as 5 percent of the helium costs per year.

Diagram 1.



With respect to gases such as nitrogen, argon, oxygen, and carbon dioxide, which may be supplied initially in high-pressure cylinders, alternative supply sources may become attractive as the needed volume of gas increases. These gases can also be supplied in a cryogenic form in insulated, portable cryogenic vessels, commonly called *dewars*, which have a storage volume equivalent to that of 18 high-pressure cylinders; or the gas can be supplied in small, stationary, cryogenic microbulk tanks that are filled on-site and contain three times that volume. The benefit is that the purity levels, particularly for nitrogen and argon delivered in cryogenic form, are in most cases equal to that of high-purity cylinder grades at a fraction of the cost. Fortunately, today's systems can be used not only with high-pressure cylinders to meet a particular demand for, say, argon to feed only one instrument, but also with cryogenic sources, as shown in Photo 3, by simply pushing a button that configures the system for the lower pressures found in cryogenic delivery forms.

However, when gas is supplied in cryogenic form, two pitfalls can reduce the financial savings potential. First, any container that is not in use will build pressure to a level in which the dewar or microbulk pressure-relief device actuates and causes the container to vent between 2 and 3 percent of its contents per day. Consequently, as much as 10 to 15 percent of the product disappears in what is termed *evaporation loss*. Fortunately, some of the systems that can now be used for either cryogenic or high-pressure sources have what is called an *economizer*—the system recognizes that the container not in use is about to start venting and switches to supply the end-use

points from that container, reducing its pressure so it does not vent.

The second pitfall is termed *residual return*, which is caused by false alarms when the pressure in the primary container drops below the switchover point, even when a significant volume of liquid remains. It is caused by overdrawing the capacity of the dewars to maintain pressure as the containers get closer to being empty. This can mean that as much as 15 to 25 percent of the container's contents are not used and typically remain in the container when the container is thought to be empty.

To address residual return, units such as the CONCOA IntelliSwitch incorporate what is called a *look-back* feature. This ensures that the first time the primary side drops below the programmed switching pressure, the device will switch over but not alarm, and the system goes through a residual contents test that challenges the primary unit to prove it is truly empty. If the primary side builds pressure within a specified period of time to a point above the programmed switching pressure, the device will switch back to the primary side and continue to use what it is capable of supplying. On average, the residual return is reduced to as little as 3 percent or less.

As an example, the typical ICP-MS would use approximately 175 cu. ft. of argon per day if running 24/7. If initially it were to be used at most for four hours every other day so that in purge mode the system is using a fourth of that volume, a system with four high-pressure cylinders each containing 336 cu. ft. would be sufficient to supply that single-use point. However, if the system were joined by three other ICP-MSs each running 24/7, consumption would exceed 525 cu. ft. per day—a demand that could easily be met by using one cryogenic container as the primary and one as the reserve.

But if the reserve container vented for five days, 10 percent of the contents, or nearly 52 days' worth per year, would be wasted, which translates into many thousands of dollars. In addition, a failure to minimize the residual return would result in an additional 12 percent of wasted expense.

Gas costs in the laboratory can be considerable if not dealt with by using intelligent, computerized, and expandable systems that incorporate an algorithm to monitor and limit these risks and are flexible enough to switch from one supply source to another if usage drops or increases.

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ASK THE EXPERT

WHAT TO KNOW BEFORE INVESTING IN AN ULTRAPURE WATER PURIFICATION SYSTEM

by Tanuja Koppal, Ph.D.

Sarah Haviland, lab manager and graduate student in the Department of Regenerative Medicine and Cell Biology at the Medical University of South Carolina, shares her experiences with contributing editor Tanuja Koppal, Ph.D., on choosing and installing a new point-of-use water purification system. Jeffrey Denoncourt, the North America custom water systems manager for EMD Millipore Corporation, discusses the importance of knowing about the type and quantity of water needed in order to make informed decisions on the design and size of the purification system.

Q: Can you tell us why and how you went about evaluating your options for a new water purification system?

A: Three and half years ago our laboratory moved from Georgetown University to the Medical University of South Carolina. When we moved, we were sort of at a loss because we didn't have the same resources in terms of knowing people and knowing where to find everything. So it took a little bit of time to figure out where the central water system was. The system looked pretty old, and we weren't sure who was involved with the upkeep, which made us nervous because it would cause us some delays if ever there were a problem and the purity of the water was compromised. It was really in our best interest to purchase our own system, which would support the postdoctoral fellows, graduate students, and technicians in our lab. As an electrophysiology lab, we are required to have ultrapure water because different ions in the solution can cause a lot of problems with cell patch clamp recordings. We also use ultrapure water for making stock solutions for our recordings, for molecular biology and cell culture work, or for rinsing labware after it's cleaned.

Q: What were you looking for in a new system?

A: We needed a system that had a decent flow rate because we use a lot of water every day and sitting there waiting for the equipment to fill with water is not our favorite thing to do. We wanted something that could provide savings in terms of bench space. We also wanted something that could get rid of bacterial endotoxins for some applications. We didn't want to have someone from the company come to install filter cartridges every few months, so we wanted a system that was user friendly, where we could replace filters ourselves. We wanted something that was reliable, because our lab will shut down completely if we don't have pure water. Although we need water, we didn't want to spend a fortune, and so a good price point was important too. Last, we needed something that could be moved easily, because we were in an interim space and our lab was moving to a new building. So this system was going to have to be moved as soon as our new building was completed, which took about three years. We have now moved into the new building, and we were able to easily move the water purification system and reinstall it in less than two hours. We were very nervous about this, but it actually worked out very well, and we are happy with the decision we made.

Q: Can you provide some details on what you have to do on a regular basis to maintain the system?

A: Our building provides reverse osmosis water, which is actually a lower grade than deionized water. Since the quality of the starting water is not as good, we have to watch our cartridges more carefully because they can get used up quicker. We change our cartridges probably about twice a year. We could probably get away with changing them a little less frequently, but we'd rather be safe than sorry. We have the system calibrated by the company probably once a year, and they also check the flow and output of the water. As long as the reading shows 18.2 megohms [which signifies ultrapure water], we know the quality is there and there shouldn't be a need to change anything.

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Customizing and Optimizing Water Purification Needs

Jeffrey Denoncourt, North America custom water systems manager in the lab water business field in the lab solutions business unit of EMD Millipore Corporation, says that the biggest challenge, especially for a new facility, is trying to understand the users' requirements and needs. "I think there's still a tendency to jump to the old solution of putting a very large system in the basement or in the penthouse and running lots of distribution pipe throughout the facility." That can work, because common practice has been to distribute lower-quality water—a type 3 or type 2 water—throughout the building, and the researchers purify the water to type 1 quality at individual points of use. But identifying the requirements early on certainly opens up different design options. "You're more likely to get a solution and a system design that will meet the individuals' and the facility's requirements in the long run and provide long-term flexibility," he says. For instance, there might be individual users or areas that have some special needs, and their pure water requirements can be better met by smaller, individual systems. Or there might be a floor or a wing of a building that requires more water volume. A smaller central system that doesn't have distribution piping through multiple floors but runs piping through a few laboratories may be a good design alternative.

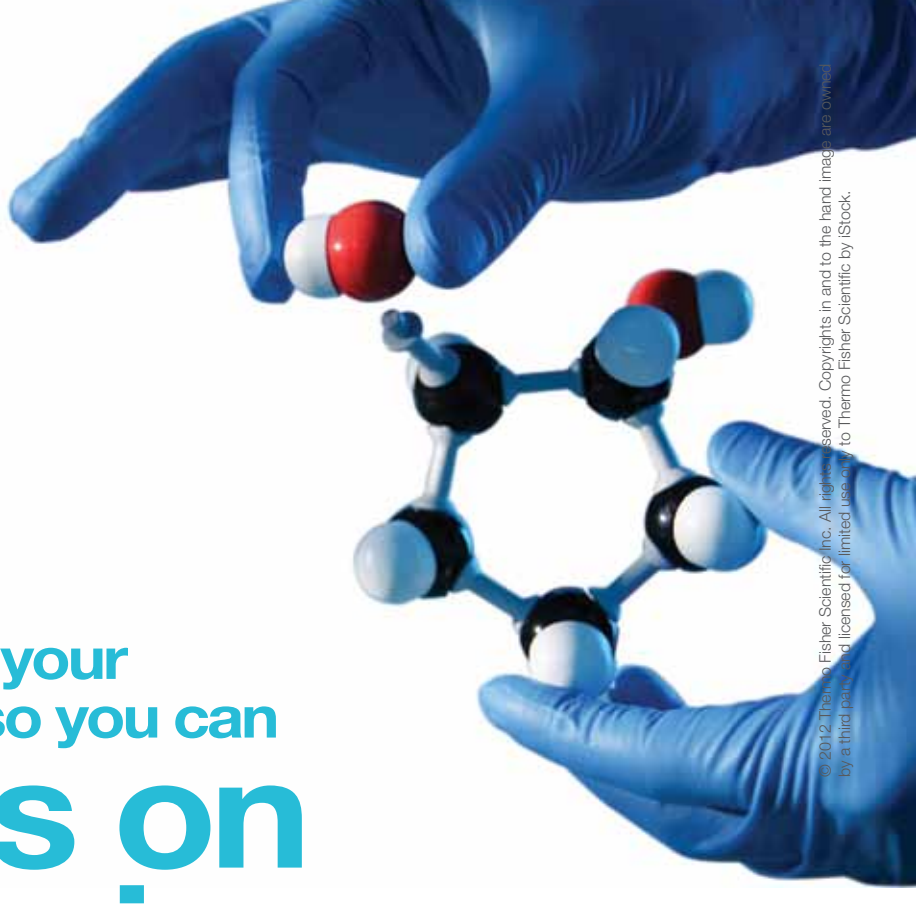
Which Water Quality for Which Application?

Water Quality	Applications
Type III water	**General and non-critical applications** Feed to: washing machines for final rinsing of glassware, heating baths, autoclaves, etc.
Type II water	**Standard applications** Buffer preparation; pH solution preparation; Microbiological media preparation; Feed to: clinical analyzers, weatherometers, washing machines, all SST autoclaves; Preparation of reagents for chemical analysis or synthesis; Feed to Type I ultrapure water systems, etc.
Type I water	**Critical applications** HPLC mobile phase preparation; Blank preparation; Sample dilution in GC, HPLC, UHPLC, AA, ICP-MS and other advanced analysis techniques; Preparation of buffers and culture media for mammalian cell culture; Reagent preparation for molecular biology, etc.

There is also a growing trend toward installing smaller, individual point-of-use systems instead of trying to install distribution piping throughout a building, which can be expensive. These are systems that supply type 1 or type 2 purified water direct from tap water to an individual researcher or to a few researchers in a laboratory. The individual systems can be either bench-top units, installed under the bench, or wall-mounted, and they offer some advantages and more flexibility. Compared to a large central system, the individual systems provide the users with a higher level of control over the pure water. It's easier to move or change these systems simply because they are smaller. If the user's application changes and a different purity of water is needed, the smaller system is easier to modify without impacting the entire facility. If the demand for water increases, it's a lot easier to add another system than to add or modify distribution piping in a building. If labs move and don't need the water, the individual system can be shut off and moved to another location or another floor in the building. "If you have a large central system in the facility, to modify or add to it involves changing the piping in the building, and it impacts all the users in the facility," says Denoncourt.

Whether for an individual user or a facility, Denoncourt works hard to identify the requirements for pure water by working with researchers and designers to understand their applications. "That helps us define a target for the level of purity so we can provide the purification technologies we need to design and build into the system. We also try and understand from a demand standpoint the daily usage of water and when it's being used. Factors like these impact the size and design of the system," he explains. He also tries to figure out where the water is going to be used within a facility, how many use points will be on each floor, and how much water will be used at each use point, and then he works with the architects and designers to create the best solution for water purification.

◀ *Table courtesy of EMD Millipore.*



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VHP SAFETY BASICS

VAPORIZED HYDROGEN PEROXIDE STERILIZATION IS EFFECTIVE, BUT NOT WITHOUT HAZARDS

by Vince McLeod

A research technician enters a freshly decontaminated sterilization room to prepare or collect implements for research procedures. Almost immediately her nose and throat feel a tingling irritation, then she begins coughing and feeling a shortness of breath. In a few minutes she begins experiencing a stinging sensation on her skin, and her eyes are watering and burning to the point that seeing is difficult. She is trying to find the door to get out and thinking that she didn't see or smell anything out of the ordinary upon entering the room. What went wrong?

"Solutions used in typical VHP decontamination processes contains more than 30% hydrogen peroxide, or at least 10 times more than the OTC product."

Vapor phase hydrogen peroxide decontamination technology is relatively new, having been available since 1991.[1] Vaporized hydrogen peroxide (VHP), or hydrogen peroxide vapor (HPV), is gaining popularity, and we are seeing rapid expansion of its use in everything from biological safety cabinets to animal rooms. In fact, HPV is challenging formaldehyde, a widely used sterilizing agent with many associated hazards, as the sterilizing agent of choice, and you can easily find information on its use for equipment decontamination, its efficacy and material compatibility, and some of the pros and cons of HPV compared to formaldehyde.

Most of us have heard of hydrogen peroxide and probably purchased it occasionally at the local pharmacy. Maybe your mom used it to clean out a small wound, cut, or scrape when you were a child. The commonly sold over-the-counter (OTC) product is typically a 3 percent aqueous solution of hydrogen peroxide. The product used in vapor phase hydrogen peroxide decontamination is much more potent. Solutions used in typical VHP decontamination processes contains more than 30 percent hydrogen peroxide, or at least 10 times more than the OTC product. The

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SAFETY TIP

DEVELOP PLANS AND CONDUCT DRILLS FOR DEALING WITH EMERGENCIES SUCH AS FIRE, EXPLOSION, POISONING, CHEMICAL SPILL OR VAPOR RELEASE, AND PERSONAL CONTAMINATION By James. A. Kaufman

Add to that bleeding, burns, medical situations, electric shock, and weather emergencies.

The only good way to prepare for an emergency situation is to think through how you should respond and then practice doing it correctly. Regular drills and exercises are essential. In most cases, the first decision involves deciding whether to evacuate or not. No one will ever fault you for saving your students and losing the facilities.

If you are starting from scratch in your department, have an emergency of the month. Assign one of the above emergencies to a pair of employees and ask them to draft a model response to be discussed at the next department meeting. The following month, pick a new emergency and a new employee pair. In small companies, invite the office and maintenance people to join with you.

One last word of advice ... PRACTICE. You can't get good at anything without practice. Dealing with emergencies is no exception. Each month, ask the folks in one of your labs to decide what would be the worst thing that could happen in their lab. Let them stage a mock event and have everyone else respond (hopefully) appropriately. Afterwards, sit down together and ask two simple questions:

1) How did we do?

2) How can we do it better?

Source: Kaufman, James A., Laboratory Safety Guidelines - Expanded Edition, The Laboratory Safety Institute, www.labsafetyinstitute.org.

concentrated hydrogen peroxide is vaporized in self-contained portable generators using proprietary and patented methods. These generators are available from a couple of different companies and in several configurations depending on the size of the room or equipment to be decontaminated. Most applications involve sterile manufacturing and/or packaging of pharmaceuticals or medical devices; the VHP generators are relatively small and operate in a closed-loop system. The goal here is to prevent contamination of products by environmental microorganisms.

Research applications can run the gamut from decontaminating tools or equipment before removal from biological safety level 3 or 4 laboratories to entire rooms. Work usually involves pathogens, and the primary concerns are to protect the researchers and to prevent cross-contamination between experiments. Reduction of environmental microbial contamination can also be targeted in the case of care and breeding of specific pathogen-free animals. When large rooms are decontaminated, the ventilation system is used to maintain the desired pressure balance and to aid in the decontamination cycle. Usually the fresh air makeup is shut off, and in many cases the air handling system is used at the end of the cycle to flush out the room. Regardless of the configuration and construction materials used, the room must be well sealed during decontamination to prevent exposure of workers in adjacent areas.

The VHP decontamination cycle has four general phases. First is dehumidification, where the relative humidity is reduced to a predetermined level so the VHP can be most effective. Next is the conditioning phase, where the generator rapidly increases the VHP level to the desired concentration. This level of VHP is maintained by the generator during the decontamination phase. Following the optimum dwell time for decontamination is the aeration or purge phase, where the VHP is flushed from the enclosure or room until it is safe to open or enter. The times for each phase are highly variable depending on what is being decontaminated. The concentration of VHP during the decontamination phase can exceed 1,000 parts per million (ppm), and dwell times are typically around 80 minutes. The entire decontamination cycle can take as long as six or more hours.

As the use of VHP technology expands to larger and larger facilities, our opening scenario comes into the realm of possibilities should a worker inadvertently enter a room during the conditioning or decontamination phase or a self-contained system develops a leak. Overexposure to HPVs can cause serious health effects. It is colorless and odorless. Detection through a bitter taste is possible, but this is noticeable only at concentrations that are considered hazardous. Hydrogen peroxide is extremely irritating and corrosive, especially to mucous membranes such as those of the eyes, nose, throat, and lungs. Inhalation is the primary exposure route. Contact or exposure to concentrations as low as 7ppm can produce eye, skin, and pulmonary irritation and bleaching of the skin and hair. Prolonged exposure or high concentrations can produce burns, blistering, and severe permanent eye damage that could result in blindness. Systemic toxicity following extremely high exposure can result in nausea, diarrhea, and central nervous system effects such as headache, dizziness, numbness, tremors, and unconsciousness[2,3]

According to the American Conference of Governmental Industrial Hygienists (ACGIH), hydrogen peroxide is a confirmed animal carcinogen with unknown relevance to human carcinogenicity. In other words, experimental animal studies indicate evidence of tumorigenisis, but available epidemiologic studies for exposed humans do not confirm an increased cancer risk. Evidence currently available suggests that hydrogen peroxide is unlikely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.[4]

Given the associated hazards of hydrogen peroxide, the ACGIH, OSHA, and the National Institute of Occupational Safety and Health (NIOSH) all have set an average daily occupational exposure limit of 1 ppm. NIOSH and at least one material safety data sheet recommend use of supplied air respirators or self-contained breathing apparatuses for concentrations above 10 ppm. Concentrations above 75 ppm are considered immediately dangerous to life and health. Recalling our typical decontamination levels of 1,000 ppm or more, we must ensure worker safety. The major manufacturers of VHP equipment offer specific training for operators and safety. These are highly recommended and in fact may even be required with purchase by some manufacturers. Operators should check the equipment for damage and proper function prior to each use. Safeguards in the form of specialized lockout/tagout procedures must be in place and strictly followed during the decontamination cycle. All workers with access to the equipment enclosure or room as well as those working in close proximity must have hazard awareness training on hydrogen peroxide. The minimum personal protective equipment for operators includes full-cover protective clothing (e.g., Tyvek), rubber gloves, and chemical splash goggles.

VHP has many advantages over widely used sterilents such as formaldehyde and ethylene oxide, but it is not without hazards. Studies have shown it to be very effective for bio-decontamination; compatible with most materials, including electronics and sensitive equipment; and cost-effective. Combining comprehensive health and safety procedures with VHP can prove an efficient decontamination technology.

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FOR THIS ANTIBODY DEVELOPMENT LAB, A SENSE OF PURPOSE IS ITS OWN REWARD

by Rachel Muenz

Started up in 2000, A&G Pharmaceutical is an antibody-based drug theranostic (therapeutic and diagnostic) company focused on improving the screening, detection, and treatment of cancer as well as other diseases that affect people. Based in Columbia, Maryland, the company's lab has 22 employees.

Co-founder and vice president of research and development Jun Hayashi, Ph.D., says there are two main aspects to the company.

"We develop therapeutic and diagnostic antibodies and they're for our own purpose—that is, role number one, our drug development aspect," Dr. Hayashi says. "It's very early stage drug development that we really participate in."

The second part of A&G Pharmaceutical is a service-oriented arm called Precision Antibody. "Precision Antibody is a service entity that many of our pharmaceutical clients use to develop their own pipelines—we provide custom monoclonal antibody development," Dr. Hayashi explains.

"At the end of the day, if you do not get the antibody that works in your assay … then it is totally wasted money, resources, and effort."

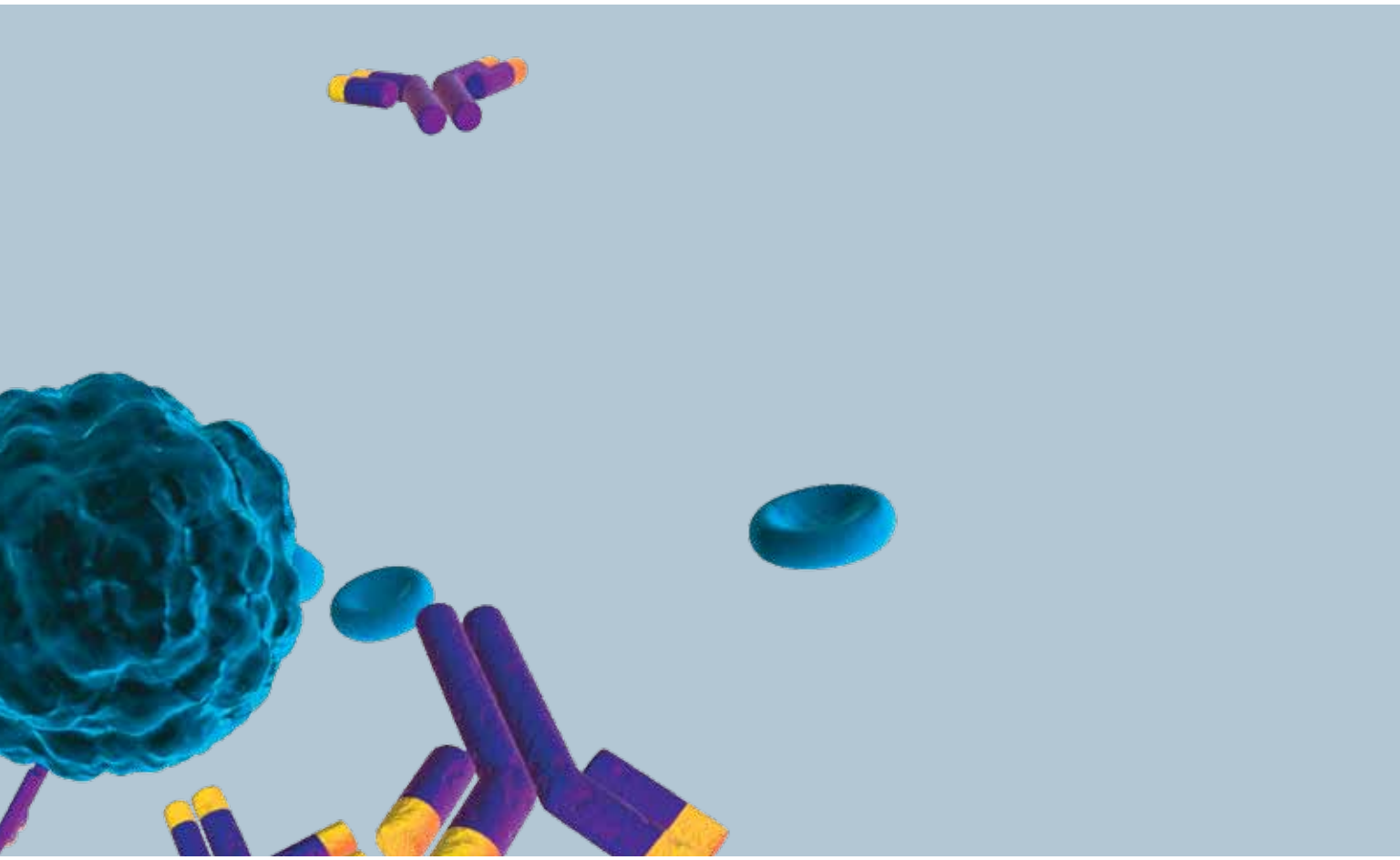
It's all about quality

Two other factors set the company apart from similar organizations.

"There are many antibody development companies out there, but something that we have that really differentiates us from other people is, number one, the speed," he says. "We [also] make very high-quality antibodies."

By "high quality," Dr. Hayashi explains he means "high affinity"—antibodies that are against many different parts of the molecule, which are known as "epitopes."

"We can generate those in about thirty to forty days," he says of the antibodies. "It all depends on the antigen and immunogenicity, but usually in about thirty or forty days we know that we have a clone."



That process isn't easy or cheap, but Dr. Hayashi says that A&G has a 90 percent success rate in delivering the antibody that meets a client's specific needs, something that's very important considering the costs involved.

"Monoclonal antibody development is an expensive and labor-intensive activity, so at the end of the day, if you do not get the antibody that works in your assay … then it is totally wasted money, resources, and effort," he says. "Our technology, over 90 percent of the time, avoids that [waste]."

The company's unique structure, with its Precision Antibody arm, also helps with its internal projects.

"Being a small biotech company, offering this platform technology that we have will provide funds for our internal projects as well," Dr. Hayashi explains. "That's the unique setup that we have and we've been quite successful doing that."

Management and training

As head of R & D, Dr. Hayashi's role is to oversee the Precision Antibody part of the company, with his work focusing on the company's clients.

"When the client comes in with a specific project—if they want to get diagnostic antibodies or therapeutic antibodies out—then I get really engaged in the initial conversation, trying to understand the science, trying to come up with the best strategy for generating the antibody that they need," he says. "From there, we develop SOWs [statements of work] that will be transmitted to the people in the lab."

On the internal side of things, Dr. Hayashi is involved in the development of theranostic targets. The company also has an internal portfolio of antibodies against molecules that are involved in breast and lung cancer, and Dr. Hayashi's work focuses on developing those antibodies as well.

"There, I work very closely with the CEO [and figure out] the first target on the molecule and have a market survey and those kinds of things, and then we will come in and aid their project by developing an antibody that meets their goal," he says of the process.

As for education, many of A&G's managers have a B.S. or M.S degree, while some of the R & D employees have Ph.D.s or M.D.s, and the CEO is also a Ph.D. And, of course, all new employees must go through the company's training program, Dr. Hayashi says.

"Employees are trained and then we have all the SOPs [standard operating procedures] [where] we are training employees to do specific tasks," he says of the training program. "It depends on the speed [at which] people learn, but usually I would say the training of people [who] are fresh out of college who have never really done any hands-on lab work … takes about three months or so."

And what is an average day in the lab like?

"Hectic," Dr. Hayashi says with a laugh, adding, however, that the days have a fairly simple structure: lab staff are tasked with several projects and are left to their own devices.

"Once a project starts, it goes on its own, so you just have to keep up and do certain things at certain times," Dr, Hayashi explains, adding that the manager will keep tabs on who is doing what and how many projects are in the pipeline.

However, most of the daily activities are managed by lab workers themselves rather than by management ordering staff around.

"They're very good at keeping track of multiple projects that are going on at any given time," Dr. Hayashi says of his lab's employees. "Sometimes they're handling more than ten projects at once."

Each task also has an SOP and every step is documented and recorded, with that information being shared with clients.

"That's very important for us, that we have a consistent performance," Dr. Hayashi says. "Each project is different … but the basic flow of the project itself is pretty much the same."

Dr. Hayashi notes that having a great work environment is a big part of keeping staff motivated, but the work itself is most important of all.

"It's not just a pat on the shoulder and saying, 'nice, nice' and those kinds of things," he shares. "I think the people do challenging work and at the end of the work, they deliver a successful antibody. Right there, there's a reward. It's not a monetary reward; it's the reward of feeling that you accomplished the goal."

He adds that being a part of discoveries that could save lives is also important. "I think people engaged at the lab level doing that work feel that they delivered something, especially if it's for a large pharmaceutical company—hopefully, they [played] a small role in future drug discoveries."

The tech

With its staff working on more than 100 external and internal projects at any one time, instrumentation—which includes liquid-handling robotics and advanced analytical equipment—is a very important part of A&G Pharmaceutical.

"All of these instruments are tied into antibody development, because when you're looking for diagnostic and then therapeutic antibodies, just merely making an antibody against the target is not good enough," Dr. Hayashi explains. "You really have to identify the monoclonal antibody that will target the site where it can exert its biological function or prevent the biological function."

In order to identify the antibodies that fulfill the many requirements that clients or A&G itself may be looking for, the drug discovery lab must understand cell biology, immunology, biochemistry, and the broader sciences involved, Dr. Hayashi says.

"It cannot be just a really focused attempt," he says. "I think you really have to understand the general biology—everything combined—and that really requires those in-depth understandings of the project at various levels."

That's where the proper screening methods and technology come into play.

"Unlike many of the custom antibody makers that are just sending out the antibodies merely based on enzyme immunoassay, many of the diagnostic and therapeutic antibodies [we produce] cannot be captured by run-of-the-mill technology," he says. "Application-specific screening must be applied to each project, and that application-specific screening is different from project to project."

Over the past two years alone, A&G has invested nearly $1 million into that special technology so it can meet both its clients' and its own antibody needs, Dr. Hayashi says.

Big challenges and enjoyment

Dr. Hayashi says the drug discovery lab's biggest challenges are also its main goals—to figure out what is required for a client or internal project, comprehend the science involved, and deliver the antibody that is needed.

"Every project is different, and I think understanding the biology and what [the client] really needs and then delivering the antibody that meets their final goal—that is the biggest challenge," he says. "And we do that quite well."

Keeping up with its growing business while keeping quality high is a newer challenge for A&G.

"Maintaining that quality and then to deliver the product in a timely fashion, as the business expands, that's really a big challenge and change," Dr. Hayashi says. "That was also the motivation for modernizing and putting in all those robotics in the discovery platform."

However, the variety involved in the work, along with meeting a project's goals, is what Dr. Hayashi says he enjoys most about his job.

"Every day is different, a different challenge, and also when we deliver," he says of his favorite aspects of his work. "When one [project] is done, you feel you've accomplished something and also for our internal projects … that really could be used for any of the applications outside, then you feel you've really done a decent job."

Having worked in academia at the University of Maryland before officially joining A&G in 2007, Dr. Hayashi says he likes the differences of working in industry.

"I enjoy it very much," he notes. "It's quite different than being in academia where every project is more or less open-ended—but in industry you have to have a conclusion, and the conclusion is the delivery of the antibody that works in our client's or our own hand."

Major changes and looking ahead

As for what's changed for A&G since it began in 2000, Dr. Hayashi says the company is more well-known to the pharmaceutical industry now and it also works closely with the U.S. government, making many of the antibodies for the National Institutes of Health, Centers for Disease Control, National Institute of Allergy and Infectious Diseases, and the Food and Drug Administration.

"The biggest change has been that a lot of pharmaceutical companies are using us, and also we are known in the federal government, in the research end, that we make quality antibodies," he says. "For example, we make what we call gold-standard antibodies for cancer biomarkers for the NCI [National Cancer Institute]."

An increase in outsourcing from industry has also meant more work for A&G as other companies look to focus on other areas of their businesses.

"Understanding the biology and what [the client] really needs and then delivering the antibody that meets their final goal—that is the biggest challenge."

For the future, the company hopes to continue delivering quality antibodies through its specialized instrumentation and is also getting started on a humanization service.

"The next challenge and where we are going is a sort of one-stop shop where people can start making antibodies to their targets and go all the way to drug development, utilizing our humanization service," Dr. Hayashi says, adding they will likely get into developing fully human antibodies as well.

Dr. Hayashi couldn't go into too much detail about the most interesting projects currently being worked on in the lab, only that he is very enthusiastic about the work being done.

"I'm quite excited right now about the things that are going on," he says. "We are looking into new targets and also we are looking into some really neat ideas that we hope will change the face of detection in the future. I can't wait to come to work."

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MAIN INSTRUMENTS:

- Hamilton STAR liquid handling system with 96-tip head, i-swap, and 8 independent channel pipettor/gripper with BioTek plate washer and Molecular Devices plate reader interface
- STEMCELL ClonaCell EasyPick
- ForteBio Octet RED96
- GE Biacore™ 3000
- GE ÄKTAprime plus and ÄKTApurifier
- BD FACSCalibur

▲ *The Hamilton STAR liquid handling system is operated in the A&G drug discovery lab.*

THE RIGHT CHOICE FOR

MASS SPECTROMETRY SYSTEMS

by Rachel Muenz

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- Provides high performance
- Half the size and half the price of conventional single quadrupole systems
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- Incorporates newly improved ion optics (UF-Lens™), which integrate two multi-pole RF ion guides, and UFsweeper™ II collision cell technology
- Provides higher multiple reaction monitoring (MRM) sensitivity
- Other improvements also yield higher sensitivity for scan mode measurements, expanding the potential range of LC/MS/MS applications
- Features very fast polarity, switching at 15 msec

An analytical method that involves generating charged molecules or molecular fragments and measuring their mass-to-charge ratio through the ionization of chemical samples, mass spectrometry (MS) is a key part of many laboratories. For example, MS is utilized for determining the chemical structures of molecules, such as peptides, and can also determine the elemental composition of a sample. MS systems come in two main types: standalone and integrated. Standalone systems involve just MS and there are several different techniques to ionize the sample, such as ICP-MS, MALDI, FTICR mass spectrometry, and TIMS. The average MS system is made up of a detector, a mass analyzer, and an ion source. Integrated systems combine MS with different separation techniques in one powerful instrument. Examples of integrated systems include a variety of different GC-MS systems and LC-MS systems, along with GC-MS-MS. With so many choices when it comes to MS, choosing the right system for your lab can be very difficult but the main question you need to answer is what samples you will be analyzing. Consulting your vendor is also a good idea to help you pick exactly what you need.

APPLICATIONS

- Food testing
- Environmental analysis
- Clinical research
- Protein characterization
- Forensic analysis
- Space exploration
- Trace gas analysis
- Isotope dating and tracking

BIOLOGICAL SAFETY CABINETS

SEEKING IMPROVEMENTS IN EFFICIENCY AND ERGONOMICS

by Mike May, Ph.D.

The phrase "biological safety cabinet" sounds straightforward enough. It's clearly a cabinet meant to keep biological hazards safely contained. This technology, though, comes in a broad range of classes: Class I; Class II, Type A1 and Type A2; Class II, Type B1 and Type B2; and Class III. The different types of biological safety cabinets must meet different specifications and work in different applications. For example, Class I and II cabinets can be used with moderate- and high-risk microorganisms while Class III cabinets are totally enclosed, thereby providing the highest level of protection. Consequently, Class III cabinets tend to get used in research at biosafety level (BSL) 3 or 4 labs. The Class I cabinets protect the worker and environment, while Class II and III cabinets protect the product as well.

Marina Cassin, U.S. representative for ADS Laminaire (Chicago, IL), says that the Class II Type A2 or B2 makes up the most common biological safety cabinets. Overall, cabinets get used in biological research labs, pharmaceutical companies, hospitals, and more.

Minimizing the maintenance

Most facilities provide specific guidelines for when a biological safety cabinet should be recertified. For example, it might need recertification once a year or anytime it gets moved. Any suspicion of malfunction should also trigger recertification. In some cases, changing the type of research being done also requires the instrument to be certified again. In addition, BSL-3 and BSL-4 labs often certify biological safety cabinets every six months.

Nonetheless, Wayne Wood, associate director for safety at McGill University (Montreal, Canada), says, "It is very expensive to be testing and certifying them so often—annually—and from a safety point of view, that is not so reliable. Ideally, they should have the technology to analyze and detect failures rather than wait for that once-a-year visit from a technician. If something happens the day after certification, a cabinet can run almost a whole year with a faulty HEPA [filter] and nobody will know." Consequently, newer cabinets include improvements in leak detection in the HEPA filter.

Cassin points out that some manufacturers hope to simplify the maintenance. For example, she says, "Sometimes it's a nightmare to change the filters, and we're trying to make that easier."

In addition, best practices dictate that a biological safety cabinet gets cleaned and disinfected before and after every use. Even the ease of cleaning a biological safety cabinet depends on the design. Marian Downing, biological safety project manager at Alliance Biosciences (Richmond, VA), says, "I don't have a problem with most biological safety cabinets, but I have seen some with perforated work surfaces and/or the work surface split in half down the middle. I don't think those are very practical for spill cleanup, since liquids will leak down underneath the main work surface."

> "It is very expensive to be testing and certifying them [BSCs] so often ..."

Enhancing the operation

A better biological safety cabinet should also be easier to use, but that's not always the case. As Wood says, "My second

biggest beef is ergonomics, as there is very little, if any, adjustability built into the cabinets to accommodate the different needs of users. We are still not able to genetically engineer our people to fit the biological safety cabinets, so until we are, the manufacturers have to do a better job in engineering their cabinets to fit the people."

The manufacturers agree. Brian Raymond, sales and marketing manager at Microzone Corporation (Ottawa, Ontario), says, "One of the biggest trends is focusing on ergonomics." As examples, he mentions the addition of armrests and/or supports that "can be an add-on at the time of order or offered as an after-market installation." He also notes that adjustable-base support stands and footrests are requested quite often. The trends in ergonomics even include positioning the cabinet relative to overhead lighting. "Consideration as to where the cabinet is placed within the lab or room can reduce the glare off the glass face shield," Raymond says. "Some companies have gone as far as to add special coatings to the glass to reduce glare."

> **"Sometimes it's a nightmare to change the filters, and we're trying to make that easier."**

Raymond also points out the trend to make biological safety cabinets more efficient. "The motor is the biggest energy draw," he says, "but ECM [electrically commutated motor] technology increases a motor's efficiency and longevity." He notes that even the type of lighting inside a cabinet can help improve its efficiency.

Trends in biological safety cabinets also involve the users. "One big push these days is for hands-on biological safety cabinet training with a competency test at the end," says Downing. "Not many places are doing this yet, but it is an eye-opener since most people think they know how to work in a cabinet but are not doing it correctly." For example, she says that trainers should demonstrate airflows in a biological safety cabinet with dry ice, incense, or a smoke stick. "This is very informative for trainees who will understand why they are supposed to work in the rear of the cabinet, avoid crossing their arms or covering the front/back grillwork while they are working in the cabinet, etc."

> **"One big push these days is for hands-on biological safety cabinet training with a competency test at the end."**

So the trends in biological safety cabinets range from various aspects of the technology to its implementation. By building more advanced devices, the technology operates more efficiently and safely. Nonetheless, users must properly maintain these cabinets—from having them certified as required to keeping the filters changed on schedule. The use goes beyond maintenance to the actual way that scientists work in the cabinets. Given the danger that can result from a mistake, it pays to use these cabinets properly. That also creates a line between manufacturer and user because a more ergonomic biological safety cabinet should reduce risks associated with working long hours in an uncomfortable position. Improving comfort improves safety.

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FOR ADDITIONAL RESOURCES ON BIOLOGICAL SAFETY CABINETS, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT WWW.LABMANAGER.COM/BIOSAFETY-CABINETS

HOMOGENIZERS

IMPROVING AND EXPANDING THE WAYS TO PREPARE SAMPLES

by Mike May, Ph.D.

Turning a sample into a suspension—the essence of homogenizing—occurs in a wide range of laboratory applications. In life science and clinical research, scientists often homogenize tissue samples for various analytical studies. One of the most common is the absorption, distribution, metabolism, and excretion process for testing new chemical entities. Homogenizers also assist scientists when formulating new food products or cosmetics. These devices even appear in a range of manufacturing processes, such as grinding silica and developing new resins with special additives to make computer components, says Stuart Gibb, director of lab and analytical sales at IKA Works (Wilmington, NC).

Homogenizers come in two main categories. Lab-size homogenizers handle small volumes, from the microliter scale to several liters. Process homogenizers—for large-scale manufacturing—handle volumes of 50 and more liters. Within those categories, the kinds of homogenizers seem nearly as broad as the range of manufacturers. For example, some homogenizers use sonication to break up tissue and others use mechanical mechanisms. Users can also equip the same homogenizer with a range of rotor-stator elements, including ones made specifically for the homogenization of soft or more fibrous tissue.

Kathrin Hielscher, marketing manager at Hielscher Ultrasonics (Teltow, Germany), says, "Ultrasonic homogenizing is very efficient for the creation of very small droplets, the disruption of cells, and the reduction of soft and hard particles." With this technology, she says, "Homogenization is caused by ultrasonically generated cavitation. Ultrasonication allows for the variation of the specific parameters and thereby for the optimization of the whole homogenization process."

Despite the variety of options that are currently available in tissue homogenization, researchers continue to want more features and capabilities out of their homogenizers. In addition, advances in other technologies—such as next-generation sequencing—can force advances in homogenizer technology.

Better beating

At the Geisel School of Medicine at Dartmouth (Hanover, NH), Niles Donegan, Ph.D., a postdoctoral student in the department of microbiology & immunology, says, "Our lab uses two types of bead beaters to homogenize our bacteria, and one is definitely better than the other. One takes eight samples and the other takes 16, and the extra capacity is very much appreciated at times when I'm processing samples from a variety of time points."

Speaking of time points, Donegan adds, "Having a timer is pretty useful on those machines, as it lets us do other things during the homogenization." Still, Donegan would like more control. "What I would like to see is the ability to add a defined pause in a homogenization run. It may just be superstition, but our lab believes that homogenizing our cells for one minute, then [resting them] for [one] minute, then [doing] a second one-minute homogenization gives a good result," he says. Nonetheless, "That means hanging around the homogenizer when I could be doing something else for those three minutes."

"Ultrasonic homogenizing is very efficient for the creation of very small droplets, the disruption of cells, and the reduction of soft and hard particles."

Donegan also prefers reduced operating noise in the homogenizers he uses. "Noise production is probably the other major difference between our two machines, and while it's usually tolerable to the person doing the procedure, it's probably much less so to those in neighboring labs," he says.

Top trends

Most homogenizers can be used by hand, which is similar to using an immersion blender when cooking. In addition, such homogenizers can be placed in a stand to add a bit of automation to the process.

To give a user options, Hielscher says, "Our customers have the choice between analog and digital homogenizers. Further, we provide additional solutions such as indirect homogenization where the cavitational forces are transmitted via the test tube or vial into the liquid. The advantage is the avoidance of cross-contamination, as no tip/sonotrode has to be immersed into the liquid."

"From a safety standpoint," says Gibb, "you can also get a closed system." In such devices, the material to be homogenized goes into a sealed tube with a self-contained, built-in rotor-stator. Moreover, these are disposable and can be used when handling contaminated samples. "This lets you homogenize safely and store the sample for later," he says. This approach protects the user from the sample and the sample from potential contamination.

Gibb also points out ongoing trends in preparing samples for next-generation sequencing. "This uses very small volumes, and you need very reproducible results," Gibb says. "We have many customers using our closed system to prepare their samples for their next-generation sequencers." So specialized approaches to homogenization must be developed to handle specific tasks where ordinary homogenization does not provide the needed results. As Gibb says, "This is a core competency for IKA Works and we continue to push the technology to meet the customers' needs."

Adding endurance

A homogenizer will spin faster in some applications and slower in others. "To meet the needed specifications for various applications," says Gibb, "the device needs to be built from high-quality materials or the motor burns out easily." IKA Works provides customers a three-year warranty, but Gibb says that a unit's life expectancy sometimes depends on the abrasive nature of the samples being homogenized. So to meet that guarantee, IKA Works utilizes high-quality parts and strict quality control during manufacturing.

"Given that so many research labs use homogenizers in so many different ways, scientists expect reliability—a long life—from these devices."

Given that so many research labs use homogenizers in so many different ways, scientists expect reliability—a long life—from these devices. Furthermore, researchers will continue to expect more features from this technology, and those features often revolve around increased user control and flexibility in how a homogenizer can be used. As the features in homogenizer technology expand, they will undoubtedly be integrated into other technologies that are concerned with mixing and stirring, be it for small- or large-scale applications.

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pH METERS

BALANCING ACCURACY AND SPEED

by Mike May, Ph.D

In the mid-1930s, Arnold Beckman created one of the first commercial pH meters—made originally to measure the acidity of lemons. Then an assistant professor of chemistry at the California Institute of Technology, he started selling his device as the Model G acidimeter, later known simply as the Model G pH meter. This work led him to start Beckman Instruments, known today as Beckman Coulter, which continues to make pH meters. Today, though, pH meters provide many features beyond those of the Model G.

In part, the expanded features in pH meters reflect the broad use of this technology. Researchers use pH meters in a wide range of research fields—including biological and chemical, agricultural and environmental, and more—and virtually all kinds of manufacturing. As Jon Bormann, global product manager for HQd series meters at Hach (Loveland, CO), says, "You'll find a pH meter in almost any kind of lab you can imagine." He adds, "pH is the most commonly measured parameter."

A meter is only one part of a pH system, because an appropriate electrode is crucial to the application. For example, if you are measuring samples with high solids or samples that are low in ionic strength, the pH electrode design will influence the overall system accuracy, maintenance schedule, and the expected life of the electrode.

"A meter is only one part of a pH system, because an appropriate electrode is crucial to the application."

My own days in a "lab"—like those of many other scientists—started with a chemistry set that included pH paper, better known then as litmus paper. Given the time to use that process, dipping the paper in a solution and then comparing the strip's color to a reference chart, it seems as though any real pH meter would have seemed fast by comparison, but I did not always find that to be the case. I remember sometimes waiting and waiting in real labs over the years for the pH meter to settle on a reading for some solutions. In some cases, a fairly wide pH range would work, so speed meant more to my research than precision did.

Scanning the selection

In general, today's pH meters fall into one of three general categories. So-called testers come at a low cost—typically a couple hundred dollars—and provide only limited features, such as a compact size. The next class is usually called "portable," and they come with a probe on a cable that can be from three to 100 feet long. Then there are benchtop pH meters, which typically stay in a lab.

"In the benchtop and portable split," says Taylor Sundby, life cycle product manager at Hach, "some of the meters on both sides are more high-end." For example, some users—such as R&D or pharmaceutical researchers—might need a higher-precision pH meter than other users. "Typically, both meters are equivalent in terms of precision and accuracy," says Sundby. "Benchtop pH meter users, however, require greater flexibility to allow such precision."

A fourth category of pH meters could be called process devices. "A process meter could be a panel, maybe in a brewery, that connects to a probe inside a pipe," says Bormann, "and it takes pH measurements in real time."

Using the measurements

Process pH meters tend to be used to control a manufacturing process. For example, in a petrochemical process, a change in pH might indicate a problem that needs to be addressed or a parameter that should be adjusted.

Other pH meters tend to be used to calibrate process meters. "In some manufacturing processes,"

says Sundby, "most will take 'grab samples' to either take back to the lab—typically with a benchtop pH meter—or test on-site with a portable pH meter." When using an in-line process meter, many users want easier ways to calibrate it. "They often use a benchtop meter to calibrate an in-line meter," says Bormann. "They'd like to have them talking to each other."

Sundby points out that some users also want more control over the measurement itself. "Most users are not terribly concerned about controlling how the instrument works, and they just use the value on the screen," says Sundby. "Some people, though, have a very precise application, and they want to be able to adjust the criteria for accuracy or the speed of the measurement."

When making such adjustments to how a pH meter works, researchers might also want to set it up just so and then password-protect any other changes. "Maybe in pharma or even food processing, you might have R&D where you need to dial in a meter and then make sure it stays that way," says Sundby.

Distributing the data

Just getting a pH reading on a meter is not always enough. "For some applications," says Bormann, "people want getting the data off the meter to be an easier process." He notes that some users just look at the meter and then write down the pH. "People collecting the information electronically, though, want easier ways to do that, such as using Bluetooth or hooking to Wi-Fi somehow."

For example, a manufacturer probably uses a laboratory information management system (LIMS) and would like the pH data automatically feeding into the LIMS. "We're seeing a demand to make that as intuitive as possible," says Bormann. "They want it more like an iPhone so they don't need to look at any manuals."

How a pH meter is used determines what features matter the most. For some, getting the data into a LIMS is a high priority. For others, accuracy matters the most. In some cases, the time required to get a stable reading is important. The latter two features, though, tend to be a trade-off. "In many cases, the response time is five seconds to a couple of minutes," says Bormann. "Anytime you can take that down, it's a welcome reduction." He adds, "The faster you go, though, the more you sacrifice accuracy." In the end, a pH system must balance accuracy and speed.

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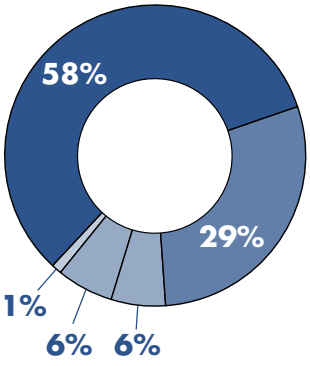
TYPES OF pH METER RESPONDENTS ARE USING OR PLANNING TO PURCHASE:



BENCHTOP pH METER	58%
HANDHELD pH METER	29%
TESTER pH METER	6%
IN-LINE pH METER	6%
OTHER	1%

FOR ADDITIONAL RESOURCES ON pH METERS, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT WWW.LABWRENCH.COM/pH-METERS

HIGH-PURITY LABORATORY WATER SYSTEMS

ESSENTIAL "UTILITIES" FOR ANALYSIS AND OPERATIONS

by Angelo DePalma, Ph.D.

Every laboratory requires high-quality water. Many labs or their parent organizations maintain dedicated plants to transform municipal water into a product lab managers can trust for routine jobs such as glassware rinsing and formulation of non-critical solutions. To take that product to the next level requires a separate, additional process with all its associated duties.

As stills have given way to reverse osmosis, ultrafiltration, and ion exchange technology, water purification has become less labor-intensive. Removal of ions, organics, sediment, and even molecular species has become so efficient that end users have become almost as concerned with monitoring or validating the quality of their water as with the purification process itself.

Users and technology factors

Julie Akana, Ph.D., product manager for water purification products at Thermo Fisher Scientific (Waltham, MA), defines water purification trends as user-centered and technology-based. On the tech side, users are interested in more direct monitoring of both product and feed water. With municipal feedstocks of sometimes dubious quality and universities losing funding for pre-treatment plants that feed into ultrapure water systems, lab managers need to be apprised of feedstock water quality. Feed water carrying a high ionic and sediment load significantly reduces the usable lifetime of water purification cartridges.

"Many schools are moving toward all-in-one solutions that take tap water and purify it all the way to ultrapure," Dr. Akana tells *Lab Manager Magazine.*

Managers are becoming savvier with respect to total organic content (TOC) as well as sediment and mineral impurities. Some systems today employ an ultraviolet bulb that oxidizes organics, and many employ ultrafilters to remove pyrogens and nucleases. These functions usually come bundled with high-quality water systems, says Dr. Akana, but they also require a higher level of monitoring to achieve conductivity values of 18.2 MΩ•cm at 25°C at less than 5 ppb TOC—the characteristics of ultrapure water.

With pretreatment a differentiating factor, top water system vendors supply test kits or conduct testing to measure impurities that might overwhelm purification cartridges. Thermo Fisher Scientific sells particulate filters, activated carbon for organics, or ion exchange cartridges to remove high levels of certain salts. "We have a diverse bag of technologies to draw upon," says Dr. Akana, "to customize systems for each user's situation."

> **"Many schools are moving toward all-in-one solutions that take tap water and purify it all the way to ultrapure."**

With carbon monitoring becoming a significant part of water purification, users want assurance that their systems achieve less than 5 ppb of TOC. Thermo Fisher Scientific supplies a UV intensity monitor that sits next to the UV bulb to ensure that the bulb is always properly illuminated. Dr. Akana admits that this is "an expensive add-on" but worth it to ensure that TOC removal is adequate.

Smaller is greener

Shrinking laboratory space has been one driver behind miniaturization of lab equipment and instruments. Water systems have evolved into smaller footprints as well, and many systems today may be located on floors, walls, or in utility areas outside the lab proper. Many systems today have remote dispensing options that allow delivery of ultrapure water some distance from where it is generated. Such systems

have alarms and monitors located not on the system but where operators can see them.

Maintaining such systems can be challenging, especially when cartridges are located below lab benches, on raised platforms, or in hallways surrounded by other equipment. Vendors have countered with larger resin cartridges that require less frequent changeout. Some suppliers have cartridge return programs as well, which offer the opportunity to refill an existing cartridge housing.

A related feature is environmentally conscious operation that purifies water with minimal power input and with a smaller carbon footprint. Although it uses electricity to regenerate the module, which avoids throwing an exhausted cartridge into the garbage, electrodeionization (EDI) is thought to be more environmentally friendly than ion exchange. EDI uses small quantities of ion exchange resin that are rapidly and continuously regenerated to their active form with an electrical current.

A difficult squeeze

Vendors say that water systems are becoming easier to maintain, but results vary.

Deborah Hoffer, quality systems manager at Rogosin Institute (Xenia, OH), uses a five-cartridge purification system that delivers pretty close to type 1 water. Her lab works on live cell encapsulation therapy for diabetes and cancer.

Ms. Hoffer's requirements for purified water are minimal, as her lab purchases critical supplies such as media and buffers already formulated. Yet the quality must be very high since she works in a sterile environment.

Her water system from Millipore (now Siemens) "works as advertised," but cartridge replacement is tough. "I have a very difficult time accessing them." Three cartridges are in front of the unit and two are in back. "I have to use a plastic wrench to torque them down, and I've broken several."

Ms. Hoffer's situation is a bit unusual, as the water system resides in a cleanroom where space is limited.

"It would help if the cartridges could be located outside the cleanroom where they might be more accessible and not require gowning for performing routine service." Consumables costs are another issue for her lab. Cartridges are replaced twice a year, and the 0.2-micron filter is replaced every week.

Only as strong as its weakest link

No matter how efficiently your purification system removes impurities, the final verdict on water purity is only as favorable as the "dirtiest" operation. According to Bob Applequist, product manager at Labconco (Kansas City, MO), the only way to ensure that purified water is sterile is to transfer it from the purification system to an enclosed container through a closed transfer system. "Ultrapure water should never come into contact with open air." Aside from sterility, an improperly prepared receiving vessel can introduce enough ions to lower the resistivity by several orders of magnitude. Not every water application demands sterility or 18.2 MΩ•cm quality, but those that do require the utmost care.

Cell culture is one of those critical applications where sterility is mandatory. "Culture media absolutely must be free of bacteria, mold, and viruses, so the water system must deliver its product to a vessel inside a laminar flow system or directly into a sterilized, closed system," says Mr. Applequist.

Culture labs might also consider an ultrafilter, which removes not just microbes but their cellular products as small as 1,000 daltons.

Angelo DePalma *is a freelance writer living in Newton, NJ. You can reach him at angelo@adepalma.com.*

FOR ADDITIONAL RESOURCES ON HIGH-PURITY LABORATORY WATER SYSTEMS, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT WWW.LABWRENCH.COM/WATER-PURIFICATION

TITRATORS

ACCURACY, REPRODUCIBILITY, AND WALK-AWAY OPERATION

by Angelo DePalma, Ph.D.

Titrators are basic laboratory tools that add solutions of one reagent to solutions of another with varying degrees of precision. Labs employ titrators mostly in analytic mode to measure concentrations of analytes. Labs also use titration to prepare reagents and stock solutions tightly controlled for pH or some other characteristic. Vital components of modern titrators are electrodes or detectors that monitor the desired property—pH, oxidation, or alkalinity, for example.

Titration end points and how they are determined may be based on almost any chemical state or interaction. The most prevalent are pH, chemical complexation, oxidation reduction, and Zeta potential. Each technique requires a separate detector, and assays involving more than one quantity require multiple electrodes.

Lab Manager Magazine's 2012 survey of end users reflects how end users acquire and employ titration systems. Half those polled had at least one titrator in their labs, suggesting that titration remains a specialized technique even in quality control environments, which comprised eight percent of workplaces surveyed. Potentiometric (47 percent) and Karl Fischer (coulometric 22 percent; volumetric 27 percent) made up the lion's share of titration modes. Sample preparation techniques were common and varied, reflecting the diverse nature of titration assays. Forty-eight percent of users employed an autosampler, 12 percent used a homogenizer, and 32 percent required some form of drying (evaporation 11 percent; oven 21 percent). Not surprisingly, 98 percent of respondents cited "accuracy" as the number one characteristic they looked for in a titrator.

User-independent determinations

Those who took high school chemistry recall using a manually operated burette and separate pH meter to quantify acid or base concentrations. Measurements were only as good as the operator's eye and acumen in plotting graphs of volume versus pH or whatever quantity was being measured. Today's titrators are automated, typically sold with the detector(s) of choice, perform basic calculations unattended, and provide a level of accuracy unheard of in the "old days."

"I have often thought about colorimetric acid-base titrations that we did in high school with indicators like bromthymol blue and phenolphthalein red," muses John MacFarlane of JM Science. "I'm certain I always over-titrated. Not anymore!"

Titration, in particular Karl Fischer titration, is a mature lab technique used in many industries that rely on "wet" analysis. With liquid dispensing reduced to settled engineering, most improvements in recent years have centered on automation, software, and user interface.

Automatic and accurate endpoint determinations, color touch screens, built-in printers, enhanced storage data handling capabilities, and compatibility with existing lab data networks are now relatively common. Titration software now stores methods, automatically calculates end points, and adheres to regulatory guidelines for both operation and audit purposes.

Technical instrument improvements tend to be incremental. For example, Japan's Hiranuma Company, whose instruments JM distributes in the United States, has developed a background compensation method that suppresses the production of interfering substances on the anode electrode for coulometric Karl Fischer titration. This results in improved determination and precision for ultra-trace moisture determinations (lower than 10µg). "They have also improved the AC polarization current detection method for volumetric Karl Fischer determinations, which is now user-selectable to match specific applications," MacFarlane says.

Automation

Robert Menegotto, president of Mantech (Guelph, ON), claims his company is the only remaining North American manufacturer of titrators. Automated titrators,

he says, provide accuracy, precision, labor savings, automatic reporting to LIMS or data networks, error-free data transcription, and elimination of user bias. "The smallest drop from a burette is 250 microliters. Our instruments get down to less than one microliter. They allow you to pinpoint the end point."

Automation has transformed titration, he says, and not just in the traditional sense of robotics. Through automated functions, users can schedule sampling and calibrations, initiate unattended quality checks through the software, and of course dispense reagents with superhuman accuracy. Moreover, these functions may be deployed at or near a process line with minimal human intervention.

Automated titration has also contributed, albeit modestly, to the "greening" of laboratory operations. Systems can operate on very small samples, which means extremely low reagent consumption and much less waste. Some systems can measure three or more quantities—for example, pH, alkalinity, chloride, and hardness—from the same sample, provided the instrument has the right detectors or electrodes. Newer capabilities for quantifying such things as fluoride, conductivity, and turbidity—not traditional titration measurements—further reduce the time and reagents required to set up separate measurements.

Perplexing purchase

Fairfax Water (Herndon, VA) uses automated titrators to measure alkalinity, conductivity, total hardness, and calcium hardness. The latter two tests use a colorimetric monitoring probe. The public utility has also recently acquired an ammonia ion-sensitive electrode.

Lab supervisor Craig Rice describes titrators as one of the most difficult equipment purchases. "Titrators are so modular, especially for a lab running as many tests as we do." Mr. Rice concedes that other instruments offer many options, "but by the time you figure out what you require in an autotitrator, determine the modules you need, and consider the varied approaches different vendors take, comparing 'apples to apples' becomes difficult. It would be easier if we were just doing alkalinity."

One would think that mixing and matching titrators with detectors would be a simple matter. Not so, says Mr. Rice. Depending on the vendor and model, instruments may require extra ports to accommodate all those electrodes. Autosampler and liquid handling capabilities may also require upgrades, depending on the number of reagents demanded by typical workflows. "Some reagents and buffers may require precisely monitored piston-operated dispensing, while some will get by with a peristaltic pump. Plus you need enough room on the autosampler head."

Overall, says Mr. Rice, vendors are "working very hard" to find the proper balance between satisfying a wide range of users and providing instruments at reasonable cost. "The technology is improving, moving in the right direction."

Angelo DePalma is a freelance writer living in Newton, NJ. You can reach him at angelo@adepalma.com.

ARE YOU IN THE MARKET FOR A... CHROMATOGRAPHY DATA SYSTEM?

The right chromatography data system (CDS) can spell the difference between a streamlined data collection process and one that is haphazard. CDSs are software packages that collect, store, and help users interpret data. Some have instrument control functions as well. CDSs come in many different varieties, which can make selecting one a daunting exercise. The good news is that vendors can provide expert advice on features most suitable to specific workflows. And, in recognition of the diverse chromatography system designs, CDSs are evolving toward improved cross-company integration and modular systems that adapt to a lab's changing needs. Data system packages can run on desktops (single workstation) or servers (networked) and cost anywhere from several thousand to several hundred thousand dollars, depending on the size of the network and the CDS's capabilities. Software capabilities range from basic instrument operation, data collection, and storage to highly integrated network systems designed to meet strict FDA quality control and security standards.

What type of CDS installation do you have?

Web-based	**16%**
Stand-alone	**45%**
Thin client/server	**8%**
Client/server	**28%**
Other (please specify):	**2%**

If you use a CDS in your lab, please choose the primary purpose for this CDS:

Improved communication between instruments and related software	**18%**
Accelerating the documentation and reporting of experimentation	**16%**
Centralized data repositories	**14%**
Improve productivity	**12%**
Infrastructure for capturing, accessing and sharing experimental information	**7%**
Enabling scientists to collaborate effectively on multi-stage projects	**7%**
Streamlined regulatory compliance	**2%**
Workflow coordination across geographic and business boundaries	**1%**
All of the above	**20%**

The biggest challenge facing labs in purchasing a CDS is "migration of existing data into the new system."

What is your biggest challenge in this CDS purchase?:

Migration of existing data into the new system	**31%**
Determining the right system for our lab	**29%**
Investing in software that will become obsolete	**25%**
Demonstrating ROI to senior management	**12%**
Staff adoption and training	**8%**
Integration with other software programs in the lab	**8%**
Gaining user buy-in	**2%**
Other	**8%**

How many users / locations access the CDS?

	1 -10	11 - 25	26 - 50	50+
Users	**58%**	**22%**	**10%**	**10%**
Locations	**74%**	**10%**	**8%**	**8%**

Basic CDS software can integrate signals from multiple detectors (UV-Vis, refractive index, photodiode array detectors, electrochemical detectors, evaporative light scattering, and others) and transform those signals into chromatograms. A CDS can also integrate chromatographic peaks and assist in method development. More advanced functions include managing and storing data for integration with data from other runs. More complex capabilities like sample preparation, finer instrument control, and data management can usually be added onto a basic software package later.

The top 5 most important factors in our readers' decisions to buy a CDS:

	Important	Not Important
Ease of use	**97%**	**3%**
Service and support	**98%**	**2%**
Price	**97%**	**3%**
Versatility	**94%**	**6%**
Seamless communication between different instruments and software	**93%**	**7%**

For more information on chromatography data systems, including useful articles and a list of manufacturers, visit www.labwrench.com/CDS-GC or www.labwrench.com/CDS-LC

ARE YOU IN THE MARKET FOR A...
VACUUM PUMP?

Vacuum pumps are an essential piece of equipment and are used in a wide variety of processes in most laboratories. However, despite numerous advances over the past 70 years, many lab professionals still believe that vacuum technology has not progressed and that there is no benefit from updating a laboratory pump. However, over the past 25 years, it becomes apparent that vendors have made significant innovative improvements to vacuum pumps, with important developments in high vacuum technology, corrosion resistance, vacuum control, and improvements in the efficiency and ecological impact of vacuum pumps.

Vacuum pump performance curves map a pump's performance between the free air displacement (flow rate) specification and the ultimate vacuum. Depending on the pump engineering, the actual pumping speed falls off at a greater or lesser rate as the pressure approaches the ultimate vacuum. The better the pump, the more the specified pumping speed is preserved closer to the ultimate vacuum. This is why pumps that have identical specifications for ultimate vacuum and flow rate perform very differently—and are priced very differently as well.

Vacuum pumps are suited for a wide variety of laboratory applications. Below are some of the applications the respondents use their vacuum pumps for in their labs:

Vacuum or pressure filtration	48%
Vacuum oven	29%
Degassing	29%
Mass spectrometry	28%
Rotary evaporator	26%
Freeze drying	18%
Gel dryer	10%
Liquid aspiration	3%
Other	15%

The most important factor selected by respondents in their decision to buy a vacuum pump is performance. There are two ways to determine pump performance at the vacuum pressure you need. One is to ask your vacuum pump vendor. Your vendor is used to thinking in these terms and can advise you. The other is to rely on vacuum pump performance curves that all reputable vendors will provide on request.

The top 10 factors/features for our readers when they are buying a vacuum pump:

	Most Important/Important	Not Important	Don't Know
Durability/performance	96%	3%	1%
Price	92%	4%	4%
Ease of Use	91%	7%	2%
Leak-tightness	89%	8%	3%
Pump speed	85%	9%	6%
Warranties	85%	12%	3%
Safety and health features	82%	12%	6%
Low maintenance costs	81%	14%	5%
Availability of supplies and accessories	80%	16%	4%
Noise level—quiet	80%	17%	3%

Types of vacuum pumps our readers are using in their labs:

Rotary vane pump	45%
Dry diaphragm vacuum pump	37%
Water or air aspirator	36%
Deep vacuum pump	28%
Filtration pump	26%
Turbo Pump	2%
Other	3%

→ For more information on vacuum pumps, including useful articles and a list of manufacturers, visit www.labmanager.com/vacuum-pumps

ARE YOU IN THE MARKET FOR A... MICROPLATE HANDLER?

Microplate handlers are specialized robotic devices that transfer microtiter plates in three-dimensional space from one location within a workflow to another. The "locations" are actually operations such as solvent addition (through liquid handling), aspiration, heating, shaking, incubation, washing, reading, and storage. Plate handlers are common in laboratories that process hundreds or thousands of microplates per week, for example, high-throughput screening labs in the life science and pharmaceutical industries. Most plate handlers are used in life science industries, particularly pharmaceuticals and biotech. One can make the case for incorporating some type of robotic handler even for low-volume labs. Unfortunately, cost and complexity frighten off many potential users. Microplate handlers are indeed the "glue" that binds mission-critical microplate applications. Their value accrues from accurate, timely, unattended plate transfer that frees lab workers to perform more complex analytical tasks such as secondary screens. Many users acquire microplate handlers for speed, but their greatest benefits are the abilities to standardize microplate operations and workflows, provide greater consistency, decrease the chance of error, and track every operation that plates undergo.

Respondents who are using a microplate handler are also using the following components:

Barcode scanner	52%
Additional stacker cassettes	25%
De-lidding stacker cassettes	16%
Other	11%

The specific types of microplate handlers our readers are using in their labs include:

Microplate centrifuge	36%
Microplate stacker	24%
Microplate sealer	18%
Other	14%
Microplate labeler	8%

Main purposes our respondents are using their microplate handlers for in their labs:

Assay development	43%
Cell biology	32%
Bioassay validation	32%
DNA quantification	21%
PCR setup and cleanup	21%
High-throughput drug screening	16%
Compound investigation	14%
Biomarker research	14%
Disease studies	11%
Quality control	11%
Biomolecule concentration measurement	9%
Proteomics	7%
In vitro fertilization (IVF)	2%
Stem cell research	2%
Other	5%

The top 10 factors in our readers' decisions to purchase a microplate handler:

	Important	Not Important	Don't Know
Ease of use	92%	8%	0%
Performance of product	92%	5%	3%
Durability of product	89%	5%	5%
Low maintenance/ easy to clean	89%	8%	3%
Availability of supplies and accessories	87%	13%	0%
Service and support	85%	13%	3%
Total cost of ownership	84%	8%	8%
Warranties	84%	11%	5%
Price	82%	16%	3%
Easy integration with other products	79%	21%	0%

For more information on microplate handlers, including useful articles and a list of manufacturers, visit www.labmanager.com/microplate

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TECHNOLOGYNEWS

ANALYTICAL

PRODUCT SPOTLIGHT

SMARTEN UP WITH NEW SPECTROMETER

MINI CCD INSTRUMENT FIRST TO INCLUDE EMBEDDED PROCESSOR

B&W Tek recently released its Exemplar™—the first miniature spectrometer to include an embedded processor, allowing for on-board data processing, including averaging, smoothing, and automatic dark subtraction.

This feature and several others have impressed users so far, says B & W marketing manager Robert Chimenti.

"They [customers] are really excited about the ability to perform onboard data processing in order to provide higher SNR and faster analysis times all at once," Mr. Chimenti says. "Customers are also telling us that the ability to synchronize multiple spectrometers to within nanoseconds is opening up new applications in biosensing."

He explains that the system has four first-of-its-kind benefits which the company refers to as the "4 S's"—smart, speed, synchronization, and small. Along with its processing abilities, the Exemplar features USB 3.0, which allows for up to 900 spectra/second data transfer speeds; and boasts a 14ns trigger delay with +/-1ns gate jitter across up to 16 simultaneous channels. It also provides users with 1μs control over the CCD's integration time, allowing for great control over the spectrometer's SNR.

Mr. Chimenti adds customers are already doing some very cool things with the instrument.

"One very exciting application that a customer presented to us was to combine both spatially and time resolved spectroscopy in one setup, for measuring absorption of tissue from a laser source," he said. "This is accomplished by combining 16 Exemplars, which are placed at varying points along the tissue's surface and then, utilizing the ultra-low gate jitter of the spectrometers, a spectral timeline is created for each point which is then mapped onto the surface."

For more information, visit http://bwtek.com/product/spectrometer/exemplar.html

Raman Microspectrometer

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High Resolution Wavelength Measurement System

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- Quickly determines the quality of fatty acid methyl esters (FAME) in blending stock for diesel fuel
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Automated Benchtop Gas Sorption Capacity Analyzer

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- Measures high pressure adsorption, absorption and desorption of gases
- Available with one or two sample ports
- Capable of reliably measuring sorption isotherms, also called PCT curves, at pressures up to 200 bar at temperatures up to 400°C
- Computer-controlled
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Triple Quadrupole LC-MS

8040

- Incorporates newly improved ion optics (UF-Lens™), which integrate two multi-pole RF ion guides, and UFsweeper™ II collision cell technology
- Provides higher multiple reaction monitoring (MRM) sensitivity
- Other improvements also yield higher sensitivity for scan mode measurements, expanding the potential range of LC/MS/MS applications
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Shimadzu www.ssi.shimadzu.com

Benchtop LC-MS System

Exactive Plus

- Includes Thermo Scientific Orbitrap technology
- Extends the capabilities of the Exactive system with advanced signal processing, ion optics and transmission technologies
- Features full field upgradeability to the Thermo Scientific Q Exactive high-performance quadrupole-Orbitrap LC-MS/MS system
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Thermo Fisher Scientific www.thermoscientific.com

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- Fritless SPE product range provides greater reproducibility with cleaner, more consistent extracts
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Air Science USA www.airscience.com

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- New 6x50ml fixed-angle rotor (FA-45-6-30) fits both the 5804 R and the 5810 R
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- New aerosol-tight deepwell plate, swing-bucket rotor (A-2-DWP-AT), fits the 5810 and refrigerated 5810 R

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- Delivers reproducible measurements and are ideal for high-pressure water, wastewater and chemical applications
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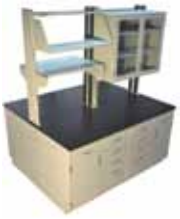
HI 22091

- Provides a high level of accuracy
- Redesigned HI 2209 (pH/mV Meter), HI 2314 (EC meter), HI 2315 (EC meter), HI 23151 (EC meter with analog output), and HI 2316 (EC and resistivity meter) also recently released
- Includes larger, easy to read LCD, space saving built-in solution holders and an attractive redesigned case

Hanna Instruments www.hannainst.com

Laboratory Cabinets

Premium Series



- Offers a modular design that allows users to configure their laboratories to meet their requirements
- Traditional casework, islands or hanging cabinets also available
- Featuring sound-deadening doors and drawers, stainless steel pulls and hinges; drawers offer 90 percent extension slides with 150 pounds capacity
- Adjustable uprights allow shelving, cabinets and other accessories to adjust on ¾" centers

Hatfield Laboratory Furniture
www.hatfieldlaboratoryfurniture.com

10mL Disposable Multichannel Reagent Reservoir

INTEGRA

- Low dead volume (650µL) generates significant savings on reagent usage
- Pour back spout helps control liquid flow allowing users to neatly and easily return excess fluid to a source container
- Now available in 10mL, 25mL, and 100mL sizes
- Packaging options include portable, standalone sleeves and individually sealed bags for sterile applications

INTEGRA www.integra-biosciences.com

Volumetric Karl Fischer Titrator

AQV-300

- Allows measurement of moisture content from low to high concentrations quickly and accurately
- Calculation functions include: concentration, factor standardization, statistics, and recalculation
- Has six built-in calculation modes to accommodate solid, liquid and gas samples
- Comes with a small footprint with integrated magnetic stirrer
- Includes two RS-232C ports

JM Science www.jmscience.com

Mobile pH Meter

826

- Suitable for use in harsh environments
- Easy to use meter features level IP67 protection, meaning that it is sealed against dust and submersion in water up to 1m
- Also includes wireless printing and a choice of 1 – 3 calibration points
- Features memory capable of holding 200 results and an impact-resistant carrying case

Metrohm www.metrohmusa.com

Manual Adjustable Repeater Pipette

Rainin AutoRep™ S

- 25% lighter than its predecessor, the AutoRep M
- Features many enhancements to improve ergonomics and ease of operation
- Can dispense 59 different liquid volumes, ranging from 2 µL to 5 µL
- Stroke-setting wheel makes selecting application-specific sample dispense volumes and iterations for specific application requirements fast and easy

METTLER TOLEDO www.mt.com

Homogenizing Packages

Micro, MaX, Multi-Gen 7, and Multi-Gen 7XL

- Homogenize various volumes (.03ML to 20L) at speeds of up to 30,000 RPM
- Packages have been preselected to better assist users in selecting a homogenizer setup that best suits their needs
- For example, Micro packages are suited to processing 0.3-2ml volumes and the MaX- packages are best for processing small-large volumes

PRO Scientific www.proscientific.com

Ultra-Low Pressure Drop Mass Flow Controller

SmartTrak® 140

- Controls gas mass flow up to 500 slpm (nlpm) with an ultra-low P of 4.5 psid (310mBard)
- Offers an accuracy of +/- 1.0% of full scale, repeatability of +/- 0.2% of full scale, and flow range up to 500 slpm (nlpm)
- Features 316 stainless steel construction and control valve with large flow coefficient

Sierra Instruments www.sierrainstruments.com

UV Lamp

MiniMAX™ UV-5G

- Suited for many laboratory applications including UV sanitizing of disease-causing microorganisms and UV degradation studies
- Battery-operated, 5-watt, short-wave (254nm) UV lamp
- Combines mini size with maximum power, making this lamp very portable and highly effective
- Weighs 11 oz (312g) and measures 9 x 2¼ x 1¼ in (22.9 x 5.7 x 3.2 cm)

Spectroline www.spectroline.com

Vacuum-Jacketed Tank Switcher

MiniMAX™ UV-5G

- Provides a continuous supply of liquid nitrogen using dewars or liquid nitrogen cylinders
- Vacuum-jacketed lines prevent dripping, sweating, and ice on the lines; they also provide a quicker cool-down time for faster cryogen delivery
- Includes a programmable logic controller (PLC) to provide greater accuracy and cryogen control

Technifab Products www.technifab.com

Hot Plates and Stirrers

ST15, HS15, ST19, HS19

- Large 12" (30.48cm) square ceramic heater tops have a temperature range to 400°C
- 5-position stirring units can stir 5-800ml beakers and the 9-position units can stir 9-500ml beakers of aqueous solutions
- Stirring units feature stirring range from 100 to 1500 rpm
- Units available with voltages and agency certifications for use all over the world

Torrey Pines Scientific www.torreypinesscientific.com

Stimulus Isolation Unit

SIU-202

- Features battery power and optical coupling that isolates the stimulator from the pulse source, keeping stimulus artifacts to a minimum
- Compatible with electrophysiological applications
- Control timing pulses with any device capable of generating a TTL level positive pulse
- Constant current output features 100 volt compliance with a LED over-voltage indicator

Warner Instruments www.warnerinstruments.com

PRODUCT SPOTLIGHT

SAMPLE PREP AT THE SPEED OF LIGHT

NEW LASER EXCELLENT FOR GETTING TO DEEPLY-BURIED TARGET STRUCTURES

Carl Zeiss looks to speed up sample prep with the launch of its AURIGA® Laser, a new system combining the specific advantages of the AURIGA® CrossBeam (FIB-SEM) workstation with the capabilities of a pulsed micro-focus laser for fast ablation of material.

"Customer response has been exciting," says Jerry Lehman, director of technology at Carl Zeiss Microscopy, about the feedback they've received on the new instrument so far. "The Auriga Laser overcomes the problem of spending hours of FIB beam time removing material that is in the way of getting a deep cross-sectional image. The graphical-assisted alignment of the laser beam to the feature/regions of interest also adds to the user's confidence and time savings."

He adds that the first-of-its-kind laser has been shown to be 500 times faster than a plasma FIB for bulk removal of material.

"Taking some consideration [into] the additional time to remove the heat affected zone (HAZ) using a traditional high current Ga FIB, the pulsed laser is still hundreds of times faster than a plasma FIB," he says.

Ablation with a pulsed micro-focus laser beam also does not damage the sample and it enables ablation rates comparable to mechanical removal, according to the company. And the system's scanning laser—a nanosecond pulsed, diode-pumped solid-state laser operating at 355 nm— makes it a good fit for the demands of preparing structures for SEM examination, the company adds.

"The selection of the DPSS 355nm laser for the Auriga Laser was made to address the broadest range of materials," Mr. Lehman says.

For more information, visit www.zeiss.com/micro

CHEMICALS, KITS & REAGENTS

Mass Spectrometry Reagents

iChemistry Solutions™

- Enable new applications through advanced chemistries
- Improve sensitivity, productivity, and data precision
- Simply your workflow to save time and money
- Ensure the optimal performance of your mass spec—day-in and day-out
- Help boost a variety of mass spec applications

AB SCIEX www.absciex.com

Supermixes

iTaq™ Universal and iTaq Universal Probes

- Compatible with any real-time PCR instrument
- 2x concentrated, ready-to-use reaction master mixes
- Made with a proprietary optimized buffer formulation for maximum sensitivity, efficiency and reproducibility
- Particularly useful when utilizing real-time PCR instruments that require ROX fluorescent dyes
- Eliminate the need to change reagents between experiments and instruments

Bio-Rad www.bio-rad.com

Ultrapure LC/MS Reagents

Optima®

- Range now includes three new reagents that modify the mobile phase to minimize background noise and enhance MS detection
- Designed for use with the existing ultrapure Optima LC/MS solvent range
- Comprise ammonium formate, ammonium acetate and acetic acid
- Improve chromatographic peak shape and provide stable analyte signals in a MS detector

Acros Organics (Thermo Fisher Scientific) www.acros.com

LAB AUTOMATION

Microplate Stacker

BioStack3

- Features a dual plate carrier and rotational wrist to quickly move plates from the source stack to the instrument and back to the destination stack
- Designed to provide increased throughput for batched processes
- Can remove one plate from an instrument carrier and replace it with another microplate in less than 10 seconds total transfer time

BioTek
www.biotek.com

HTS Multi-Mode Microplate Reader

Synergy™ NEO

- Tailored for smaller cell-based screening assays, and maintains ultra-fast, high performance found in traditional HTS readers
- Includes multiple parallel detectors to decrease measuring time, and dedicated filter-based optics for live cell assays
- Combines filter-based and monochromator-based systems in one compact unit
- Optional integrated plate stacker allows increased efficiency and walk-away automation

BioTek www.biotek.com

Automated Cell Manipulation Platform

Cellaxess® Elektra Discovery System

- Developed in close collaboration with leading pharmaceutical and biotechnology companies
- Can be applied to a wide variety of cellular manipulations in cell biology research
- Enables in-situ manipulation and monitoring of cell cultures directly in HCA compatible 96- and 384-well microplates at any cellular developmental stage
- Provides excellent viability and completely retained cellular morphology

Cellectricon www.cellectricon.com

Tube Bar Code Scanner

Shift-N-Scan

- Patented module for the Microlab® NIMBUS automated liquid handling platform
- Enables hands-free bar code reading of sample tubes
- Compatible with the NIMBUS4 benchtop system
- Provides significant time savings while reducing errors inherent in manual tube scanning
- Detects and records errors if a tube cannot be scanned and reports empty spots in the rack

Hamilton Company www.hamiltoncompany.com

LIFE SCIENCE

Sensor Chip

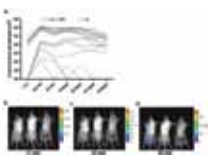
ProteOn™

- Capable of label-free interaction analysis of membrane proteins with peptides and small molecules
- Allows researchers to screen and identify protein targets easier during drug discovery
- Two surface plasmon resonance (SPR) kits have also been recently released for the ProteOn XPR36 protein interaction analysis system

Bio-Rad www.bio-rad.com

In Vivo Electroporation System

AgilePulse®



- Possesses unique, variable pulse amplitude technology for vaccine delivery or gene therapy applications
- Includes resistance measurement for proper needle placement and reproducibility
- Features specially-designed needle arrays for intra-muscular or intra-dermal applications
- Provides enhanced immune response and increased Ag-specific T-cell response
- Gene expression is 100-fold higher

BTX www.btxonline.com

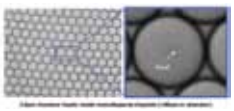
PCR Purification Product

RapidTip®2

- Enables one minute, one step PCR purification with polymerase removal for use prior to cloning or Sanger sequencing using just a single functional pipette tip and pipettor
- Does not require additional reagents, consumables, or equipment
- Comes pre-packed in a single pipette tip
- Available in two different tip formats

Diffinity Genomics www.diffinitygenomics.com

Droplet System



- Featuring Dolomite's standard microfluidic components, the new system allows users to load single cells or beads into droplets
- Benefits a wide range of applications including single cell analysis, high throughput screening and droplet PCR
- Providing users with the tools required to perform assays on individual cells in picolitre volume environments

Dolomite www.dolomite-microfluidics.com

Antibody Coated Paramagnetic Particles

Captivate™

- Extended range will cover all 'The Big Six' strains of non-O157 Shiga-toxin producing E. coli (STECs)
- Accelerates the isolation of micro-organisms, primarily from food and environmental samples
- Particles consist of a magnetite core enveloped by a ceramic zirconium oxide coating
- Can also serve as a capture system for rapid detection systems

Lab M www.labm.com

HT System

ReliaPrep™ 96 gDNA MiniPrep

- Complements the recently released ReliaPrep RNA Cell MiniPrep system
- Provides a robust method for purifying gDNA from blood and Oragene®-DNA sample collection devices in a multiwell format
- Captures using paramagnetic particles and without the need for an organic solvent
- Eliminates the need for centrifugation or vacuum manifolds

Promega www.promega.com

Bioreactors

miniPERM®

- Feature two compartments separated by a dialysis membrane for production of highly concentrated cell products of several mg/ml and biomass of more than 107 cells/ml in small volumes
- A nutrient module with membrane-vented cap serves as the media reservoir with a capacity of 550ml
- Media is easily changed in the nutrient module without disrupting the cell culture

Sarstedt www.sarstedt.com

DMV-Bio Cell

Starna

Starna scientific

- Uses advanced precision micro-machining techniques and materials to produce a patented high energy through-put, ultra-low volume (<2.5 µl), direct sampling solution for life science samples
- Design ensures that sufficient optical energy is available to measure low volume samples accurately across a wide absorbance range
- Can be used in most UV-Visible spectrophotometers without compromise

Starna Scientific www.starna.com

DNA/RNA Safe Dye

UltraSafe Blue™

- Non-toxic, non-carcinogenic fluorescent dye specifically developed as a safer and more sensitive alternative to Ethidium bromide for staining agarose and acrylamide gels
- Allows detection of 0.5pg of dsDNA using Syngene's new UltraSlim-LED blue-light transilluminator
- Cost effective, with 1ml of stain being sufficient for up to 10,000 samples

Syngene www.syngene.com

Thermal Cyclers

Prime Series

- Performs user-friendly programming functions with prompted protocol templates displayed on a large color touch screen interface
- Six models, with numerous options, are available to accommodate a wide range of PCR processing requirements
- Basic models offer cost effective upgrade flexibility to meet changing cycling needs
- Sample blocks are also fully interchangeable

Techne www.techneusa.com

LIMS & SOFTWARE

Computational Suite

forgeV10

- Gives computational chemists control and insight into activity data, allowing easier planning and direction of projects
- Uses the shape and electrostatic character of molecules to create qualitative and quantitative 3D models of activity
- Aligns, scores and compares molecules from a biological viewpoint

Cresset www.cresset-group.com

Particle Analysis Software

VisualSpreadsheet© V3.2

- Automatically detects, images and identifies thousands of particles and microorganisms in seconds
- A companion to the FlowCAM® particle imaging and analysis system
- Features a suite of advanced shape characterization properties
- New measurement properties provide expanded pattern recognition capabilities for higher levels of discrimination among elongated cells and particles such as diatoms and fibers

Fluid Imaging Technologies www.fluidimaging.com

Sequencing Analysis Software

Omixon Target

- The first NGS tool to introduce analysis quality control based on repeat analysis with mutated reference as well as with simulated short reads
- Offers built-in simulation-based analysis quality control
- Provides combination of automated and manual approval of mutations
- Includes multi-sample comparison for controls and family trio analysis

Omixon www.omixon.com

Applications Library Function

Structure Search

- New Structure Search functionality for accessing Phenomenex's library of over 6,000 HPLC/UHPLC, GC, and sample preparation applications
- Enables researchers to simply draw the chemical structure instead of entering the analyte compound name or keyword
- Makes searching easy for researchers at all experience levels
- Once structure is drawn online tool provides information on all similar compounds

Phenomenex www.phenomenex.com

Immunoassay System Software Upgrade

ADVIA Centaur® CP v6.0

- New system startup protocol helps shorten overall testing turnaround time by reducing the time to the first result (TTFR) by approximately two minutes
- Cuts initiation time approximately in half, from about four minutes to now only about two minutes
- Printed reports now include normal ranges to make results reporting faster and easier

Siemens Healthcare Diagnostics www.siemens.com/healthcare

Data Management System

CentraLink™

- New functionality synchronizes automation workflow to increase efficiency and quality, as well as expands connectivity
- Consolidates patient and quality-control data from multiple instruments and provides centralized control over critical lab processes
- Delivers expanded connectivity to multiple LIS, plus the Bio-Rad Unity System
- Can now detect if an instrument connected to an automation track is offline

Siemens www.siemens.com

Phospholipid Removal Plates

Phree™

- Provide fast cleanup of plasma samples in pharmaceutical and clinical research laboratories
- Removes both proteins and phospholipids and delivers the prepared plasma to a collection plate in one step
- Phree sorbent can process up to 400 µL per well and removes 99.0 to 100 percent of lysophosphatidyl and phosphatidyl cholines

Phenomenex www.phenomenex.com

Glass Bottom Assay Plates

Krystal™

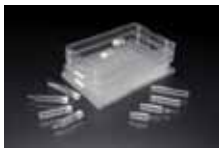
- Available in a choice of 24-, 96- and 384-well formats
- Combine the advantageous optical properties of glass, low background and low birefringence, with the versatility of a microplate
- Proven to demonstrate higher performance than standard polystyrene plates for fluorescence assays, luminescence detection, scintillation counting and high-resolution microscopy using confocal imaging

Porvair Sciences www.porvair-sciences.com

SUPPLIES & CONSUMABLES

Vials and Snap Top Caps

Snap Seal™



- Adapted for the 96 Well Multi-Tier Micro Plate System
- Provide secure, solvent resistant containment for samples in a 96-well format with simple snap-on closures
- 9 mm OD vials come in three sizes for sample volumes of 0.5mL, 0.75mL, and 1.0mL
- Sealing the vials is simplified with Snap Top Caps

J.G. Finneran Associates www.jgfinneran.com

Distillation Accessories

Fi-Streem

- Line of accessories now includes additional storage carboys and a distribution accessory
- Give customers more storage options to ensure that pure water is readily available in the lab
- New water storage carboys are configured to operate automatically when connected to Fi-Streem Stills
- The distribution accessory kit connects to the B00121 LabStrong 40 liter storage tank

LabStrong www.labstrong.com

A Rinse Station

Problem: Cleaning and rinsing lab and process carboys and containers by hand inevitably leads to problems with cross-contamination. Hard-to-reach areas in carboys, like the bottoms and necks, and around the tops of other vessels can be difficult to get at with hoses and brushes and leave harmful contaminants in place.

Cleaning carboys and containers manually, with hoses and brushes in a big sink, is also slow and cumbersome—not to mention messy. Water ends up on otherwise clean work surfaces or on the floor, making for slippery conditions and a potential safety hazard.

In short, cleaning and rinsing carboys by hand can increase the risk of cross-contamination and create productivity and safety issues in an otherwise well-run lab or process facility. Until recently, the only other option: invest in a costly—$100,000-plus—automated system.

Solution: The non-metallic TerraSpray™ rinse station is one example of a cost-effective solution to the long-standing problem of how to clean carboys efficiently and completely. Stations like these free up time for more important tasks while improving lab sanitization.

▲*The TerraSpray™ rinse station.*

The process for cleaning and rinsing a carboy or other vessel is as follows. The carboy is scrubbed with a long-handled brush and a little detergent and water then placed upside-down on top of the rinse station. This, in turn, activates a fluid-driven spray nozzle that rinses the container quickly and thoroughly—a full 360 degrees around. All water is contained within the rinse station, eliminating the potential for wet work surfaces or floors and associated contamination and/or safety hazards.

The rinse station accepts any style carboy or container up to 50 gallons (200 liters). It connects via standard plumbing fixtures to a water inlet (1/2" NPT female) and drain (1 ½" NPT female). Special connections are also available. No electricity is necessary for operation of the TerraSpray unit.

Two floor models are available—a standard and large size. Both offer a foot-controlled valve attached to the bottom platform of the units that turns them on and off. A smaller tabletop version of the rinse station places the control valve on the side of the unit.

Manual cleaning cannot consistently sanitize carboys and other containers to the standards required by many of today's labs and R&D facilities. For those looking to address this issue, rinse stations such as the the TerraSpray warrant further consideration.

For more information, go to www.terracon-solutions.com

Heat Effect in Fume Hoods

Problem: Chemical procedures commonly require the introduction of heat. This is typically in the form of a hot plate or open flame. While the best place to perform these types of chemical procedures is inside a chemical fume hood, most people are unaware of heat's effect on the airflow through the fume hood, and the potential impact on containment.

A fume hood under normal operation has air entering through the face opening, as well as through an upper by-pass opening. As the sash is raised, less air enters the by-pass, and as the sash is lowered, more air enters through the by-pass.

Sometimes there is a level of heat generation inside a hood greater than the volumetric rate of air (CFM) can adequately dilute. When the rate of heat generation is sufficient enough for the temperature of the hood interior to increase, it can generate a resulting increase in pressure, or decrease in the pressure differential, at the upper portion of the fume hood. This ultimately can result in a reversal of airflow through the upper by-pass opening on the hood, pushing contaminated air into the laboratory. This chain of events is called heat effect.

Solution: To eliminate or mitigate heat effect, we look at two criteria:

1. Dilution: There must be an adequate volumetric rate of air (CFM) to maintain a level of heat dilution that keeps the interior change of temperature below the individual hood's specific temperature threshold for heat effect.

2. Face velocity compensation: There must be a minimum base line velocity (fpm) maintained when no heat is present, to overcome an increase in internal pressure as a result of the temperature increase. This is especially critical to the upper by-pass, and is directly related to the design of the hood, including size and shape of the opening, as well as baffle design.

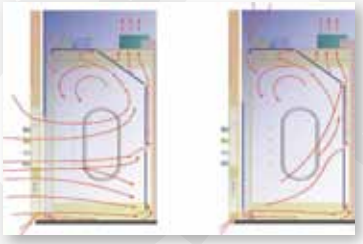
If dilution is maintained, face velocity compensation is not critical as the internal pressure of the hood will never increase. If the rate of dilution is not significant enough to prevent temperature increases at the top of the hood, face velocity compensation can temporarily mitigate heat effect via localized heat dilution at critical openings in the hood.

Sizing the mechanical system airflow for heat effect is critical. Fume hood manufacturers should be familiar with their fume hood's heat effect threshold and be able to provide users with required airflow data for a specific heat source power output (BTU/hour or watts).

If the fume hood will be part of a variable air volume (VAV) mechanical system, the controller should be programmed to maintain a minimum volumetric rate (CFM) for adequate dilution. This means that as the sash is closed, the volumetric rate of air is reduced, the system reaches a minimum CFM higher than is typical on a standard VAV fume hood, strictly for the purpose of controlling the interior temperature.

If a by-pass style hood is set up on a constant volume installation, there is not a VAV controller and as the fume hood sash is closed, the face velocity will increase. This is of concern because face velocities above 120 fpm can create significant turbulence in front of the operator, and it can be difficult to work deep enough into the hood so that the operator's hands are not in turbulent air. Working in turbulent air caused by excessive face velocity may result in periodic exposures to chemicals. If the velocity of air around the operator is reduced, the area of turbulent air in front of the operator will be reduced as well. However, low face velocities and volumetric rates are in direct conflict with mitigating heat effect. The optimal design CFM should include a combination of low enough face velocity to prevent periodic operator exposure, and fast enough face velocity to prevent catastrophic failure from heat generation. This is achieved by setting the volumetric rate requirement for the hood based on dilution with the sash at its operating height, and face velocity compensation with the sash in its fully open position, whichever of the two figures is greater.

For more information, visit http://www.labconco.com/category/ventilated-enclosures-exhausters



▲*Sash open (left) with a small amount of upper by-pass air; sash closed (right) with a large amount of upper by-pass air.*

A Non-Contact Sensor for Monitoring Solvent Levels Automatically

Problem: The use of laboratory automation increases productivity and precision, making it attractive for use in the pharmaceutical industry. However, in order to ensure that the automated equipment operates at optimal output, manual input is frequently required. For example, users need to continually monitor the supply and waste levels of solvents in analytical instruments, such as those used for UPLC/MS and HPLC/MS. This can prove problematic as waste vessels are often located in fume cupboards or below benches, which makes it difficult to quickly and easily determine the solvent quantity remaining. In addition, as supply bottles are often kept closely together in drip trays, it is hard to accurately monitor the solvent levels, particularly in the bottles located at the back of the tray or in bottles made of dark glass. However, failure to effectively regulate the solvent levels could lead to the burnout of columns and unwanted down-time, even if there is only a small amount of solvent within the supply vessels. There is also the possibility of potentially dangerous leakage and blockages if too much solvent is contained within the waste vessels.

Analytical instrumentation can be set to estimate solvent usage. However, this is dependent on users accurately setting the starting levels and resetting the system each time a bottle is changed. Devices such as weighing cells and dip tubes can also measure solvent levels, although these are not ideal. For example, weighing cells need taring after every bottle change and it is not practical to fit six weigh cells in an HPLC/UPLC/MS drip tray due to their size. Dip tubes are useful, but could cause contamination, so require careful cleaning to remove any solvent or bacterial growth. In addition, they need to be resistant to the solvent to ensure they do not cause a reaction, which could also lead to contamination.

Solution: In order to automatically monitor solvent levels during laboratory automation processes, a non-contact sensor would provide the ideal solution to eliminate the risk of contamination, as well as the size and calibration constraints associated with currently-used devices. One example, the aequus from TTP Labtech, simply requires a single preliminary calibration to configure it for use with a given vessel and solvent. aequus' interface control unit contains 12 sensor inputs and can be used as a bench-mounted device or clipped to the rear of a solvent drip tray. The sensors attach to the vessels using an adjustable Velcro strap or a stainless steel spring clip, making them easy to move and fit onto round or square vessels. Using capacitance-based technology, the sensors work with a wide variety of non-conductive vessels, accurately compensating for vessel material (including glass and plastic) and wall thickness. Utilizing the dielectric property of the solvent, the sensors reliably measure the level of the liquid in the vessel with a resolution of better than 0.5mm. The touch screen display provides local feedback and a display of the current levels in all monitored vessels, including an independent, configurable warning alarm to alert the users if any vessels are running too low, are empty, or are getting full. aequus also incorporates a data logging and graphing facility for detecting leaks or keeping track of those solvents that are only used slowly, or that deteriorate over time. The remote monitoring offered via the software interface allows aequus to be controlled by automation systems or incorporated into inventory systems for solvent procurement and disposal.

By providing an automated non-contact sensor, TTP Labtech's aequus delivers accurate fluid monitoring without the need for manual input, increasing efficiency and reducing hands-on time.

For more information, please visit http://www.ttplabtech.com/aequus/index.html

▲*TTP Labtech's aequus for automatic monitoring of solvent levels in analytical instrumentation*

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Tune into our live webinar to hear Cecilia Björkdahl, Robert Wade and Mike Stroz describe their ELN implementations, challenges and successes in research, development and QA/QC environments.

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Our experts will share their perspectives on some of the new tools and protocols to minimize and simplify sample prep and how you can choose one that works best for your analyte, your separation requirements, and your instrumentation.

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For the Better

Optimized Lab Equipment Maintenance

Problem: The pharmaceutical and biopharmaceutical industries are experiencing watershed changes that are directly driving the need to increase research efficiency while minimizing costs. This "perfect storm" includes pressure to reduce the cost of healthcare, blockbuster drugs reaching their patent end of life, biosimilar proliferation and weak pipelines—to name a few issues.

Solution: For individual laboratories, these complex factors are resulting in ambitious cost savings requirements. One place to look for those savings is in an analysis of equipment and instrument maintenance and repair. Three approaches: Run-to-Fail (RTF), Preventive Maintenance Only (PM Only) and Full-Service Contract (FSC) are the classic equipment management options. All are valid, but you can achieve significant cost savings when you look at whether a given piece of equipment has been assigned the contract appropriate for its cost, criticality to the research at hand, age and nature of use.

Run-to-Fail (RTF) is generally the most efficient approach for equipment and instruments for which replacement may be more cost-efficient than repair. Technically, this approach does not require any maintenance contract at all, but it should be a conscious and structured choice nonetheless. To determine which pieces of equipment fall into this category, try setting a replacement cost ceiling. If the replacement cost for a particular piece of equipment is below the ceiling cost, use RTF as your approach because it will be more cost-efficient to replace the item than to repair it. Other equipment that may be a good fit for RTF include those items that are well past their full depreciation point (age), frequently break down, or are infrequently used, unless they serve a critical function when needed.

Preventive maintenance on an item is almost always recommended by the original equipment manufacturer. This type of contract covers preventive maintenance but does not cover labor or repairs when the equipment fails. PM Only is generally well-suited for items with moving parts, liquid or gas flow, filters, or optical systems, yet not critical to day-to-day operations. Since your researchers will invariably tell you that everything is critical, you can determine whether a piece of equipment is truly critical by looking at availability of an alternate piece of equipment, ability to generate data in another way, utilization and the cost of parts.

For example, a PM Only contract for a fairly typical mass spectrometer (triple quad or better) can carry a yearly cost of $20,000. Under this type of contact, you will likely be entitled to two preventive maintenance calls, and all on-demand repairs (parts and labor) with a maximum 24-hour response time. If you elected to secure a PM Only contract, your yearly costs would be reduced by 30 to 50 percent. However, on-demand repair costs will be time- and materials-based and you will likely be relegated to a 48- to 72-hour response time.

A Full-Service Contract typically covers preventive maintenance as well as all on-demand repairs, including parts and labor. Sometimes chosen as an "insurance policy," it can be a viable option both for highly critical equipment—and for less critical equipment that has one or two very expensive parts that, if they failed, would be burdensome to replace. For example, an imaging system may not necessarily be highly critical to your operation, but the camera on the instrument can be very costly to replace, so investing in a FSC may be warranted.

The pressures in the pharmaceutical and biopharmaceutical industries will continue to motivate research organizations to pursue research in the most efficient and cost-effective manner possible. One way that this can be accomplished is to decrease the cost of R&D operations, including the maintenance of laboratory equipment and instruments. Properly categorizing the laboratory equipment support category as RTF, PM Only or Full Service can greatly reduce an organization's operating costs.

For more information, visit http://www.labwellservices.com/

IMPROVING PERFORMANCE AND SENSITIVITY OF LC/MS INSTRUMENTS USING OPTIMIZED LC/MS SOLVENTS

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ABSTRACT: Increasing the sensitivity and resolution of LC/MS instruments has been an ongoing focus for instrument manufacturers. As a result of this increased sensitivity of today's analytical instrumentation, the choice of high purity solvents can greatly influence the test results that are achieved.

INTRODUCTION: To meet the needs of the most demanding ultra-high pressure liquid chromatography (UHPLC) and mass spectrometry research and analytical testing applications, such as proteomics, drug discovery, pharmacokinetics, and clinical research, instrumentation is not the only parameter to be considered. Solvent design and selection is also very important. Performance of three specific solvents, (1) **Acetonitrile,** (2) **Methanol**, and (3) **Water** was examined in detail and the solvents were assessed for their suitability in selected LC/MS applications. In particular, the impact of packaging materials on the quality of LC/MS solvents was evaluated. The performance of LC/MS grade solvents was compared using LC/UV/MS gradient, MS infusion, and trace metals analysis. One way to ensure that high purity LC/MS grade solvents meet stringent purity requirements is by improving the packaging associated with the storage and delivery of these solvents. For example, certain containers can leach metal ions during storage, and lead to the formation of metal adducts, which can adversely impact test results.

EXPERIMENTAL CONDITIONS:

Materials:

- LC/MS grade Acetonitrile, Methanol, and Water from various suppliers
- J.T.Baker® ULTRA LC/MS™ solvents
- Standards **(Sulfadimethoxine, Chloraphenicol)**

Methods:

- LC/MS gradient **(Waters ACQUITY UPLC® System/LCT TOF mass spectrometer)**
- Positive/Negative ESI **(electrospray ionization)**
- Direct infusion to mass spectrometer **(Waters Quattro Micro)**
- Trace metals **(Perkin-Elmer ICP-MS)**

RESULTS: Results indicate that J.T.Baker® ULTRA LC/MS™ solvents and solvent packaging show better performance than other traditional LC/MS grade solvents. The J.T.Baker® ULTRA LC/MS™ water packaged in the borosilicate bottle maintained sodium levels < 9 ppb in two months while material packaged in amber glass bottles presented sodium levels > 150 ppb. Sodium metal adducts (m/z 333) were also reduced. The J.T.Baker® ULTRA LC/MS™ grade exhibited adducts of 40% compared to 150% for the material packed in amber glass bottles.

CONCLUSIONS:

Based on the data compiled for the study, the test results indicate that J.T.Baker® ULTRA LC/MS™ solvents are more suitable for use on UHPLC and high sensitivity mass spectrometry instrumentation. J.T.Baker® ULTRA LC/MS™ solvents also offer better performance than the other brands tested by delivering:

- Lower trace metals
- Reduced adduct formation
- Minimal suppression

REFERENCES / TRADEMARKS

ACQUITY UPLC System™ and Quattro Micro™ are trademarks of Waters Technologies Corporation.

Other trademarks are owned by Avantor Performance Materials, Inc. or its affiliates unless otherwise noted.

Figure 1: ULTRA LC/MS Water—Sodium level (Borosilicate vs Amber Bottle)

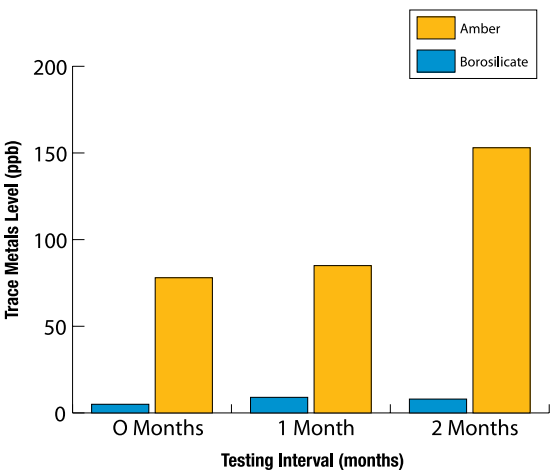

Figure 1a contrasts the sodium leaching for water packaged in amber bottles to borosilicate bottles over a two month time interval.

BioTek Continues to Set the Standard in Microplate Washing with the New 405™ Touch

For nearly 30 years, BioTek has led the market in developing microplate washing technologies, and is well recognized for the industry standard ELx405™ Microplate Washer. As a market leader, BioTek closely interacts with customers, responding to feedback and monitoring market trends. Combining their microplate instrument and software expertise with responsiveness to customer needs, BioTek introduces the 405™ Touch Microplate Washer. This radically new touch screen interface will reshape 96- and 384-well microplate washing routines, and set the microplate washing standard yet again.

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Touch Screen Interface

A high-resolution, LED backlit touch screen provides the same simple, graphical interface seen in today's mobile devices. This modern interface provides users with enhanced, intuitive custom protocol creation, pre-defined wash protocols, flexible wash process execution and complete instrument maintenance. Users can start their wash process with as few as two screen touches! The touch screen uses resistive technology, so it can be used while wearing gloves. It can also be operated with a pointing device, if preferred. The large 5.7" screen allows open access for programming and viewing comfort.

USB Ports

Two integrated USB ports allow multiple users to conveniently store, run or transfer programs and settings. Users can operate the 405 Touch from their own personal memory stick via the USB ports, from the touch screen, or from a computer, thus enhancing operator convenience and increasing efficiency.

Software

The 405 Touch is powered by a fast Intel® processor for immediate instrument start-up and instant command responsiveness. BioTek's Liquid Handling Control™ (LHC™) Software is on-board for complete programming capability and full-color instructional videos provide clear direction on instrument setup and basic use. The context-sensitive Help system provides recommendations, links, diagrams and images and is available at the touch of a finger. LHC Software is also available in a 21 CFR Part 11 compliant version for regulated labs or those simply looking for extra security.

Legacy Features

The 405 Touch incorporates many of the features of the industry-leading ELx405 washers, including the Dual-Action™ manifold for independent control of tube position during filling and evacuation, overfill washing and overflow protection, and the patent-pending Ultrasonic Advantage™ for complete ultrasonic cleaning of salt or protein deposits in the tubes. The 405 Touch brings new features like tool-free quick-change manifolds and optional integrated buffer switching to allow automatic selection of up to four fluids without an external valve module. Several 405 Touch models are available for many applications, including optimized cell washing with gentle, low-flow rates ideal for loosely adherent cell monolayers, vacuum filtration and biomagnetic separation bead-based assays. The 405 Touch can be coupled with BioTek's BioStack™ Microplate Stacker and other robotic systems for unattended batch processing.

For more information on the 405 Touch, visit www.405touch.com

Burkert Life Sciences division of Burkert Fluid Control Systems is the global leader in microfluidic systems and fluid control products. Employing innovative designs and lean manufacturing principles, we offer the most reliable fluid separated valves and micropumps in the market. Burkert is the original manufacturer of Rocker and Flipper style valves, ranging from 4.5mm valves for dosing and dispensing into 96, 384, and 1536 well microtiter plates to 32mm valves for waste handling. Our new patented Twin Power valves offer "Twice the Power in Half the Size," reducing space by 50 percent, decreasing heat transfer to the media, and reducing power consumption. Capabilities at our Systemhaus located in Charlotte, NC include engineering and design consultation, flow simulation, CNC manifold machining, fabrication of sheet metal brackets and enclosures, welding, electronic integration, rapid prototyping, reliability testing, automated assembly and testing, and support for lean manufacturing through KanBan and JIT delivery systems.

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TWIN POWER TECHNOLOGY IN 10MM, 16MM, AND 22MM SIZES

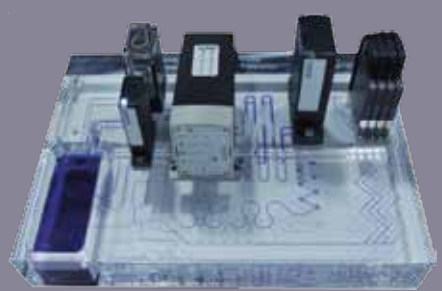
Burkert Life Science releases Microfluidic valves with Twin Power technology, now available in three sizes – 10mm, 16mm, and 22mm. Twin Power technology combines the industry-proven rocker principle with a highly innovative new actuator. This dual-solenoid design allows the use of a smaller valve with lower power consumption and improved reliability, without sacrificing performance.

Smaller, faster, stronger. Twin Power valves have the flow and pressure resistance typically found in larger valves, making them ideal for applications where space is critical or higher performance is needed. The 10mm Twin Power valve is available with an orifice size up to 1.6mm and pressure resistance up to 5bar (73psi). The 16 and 22mm Twin Power valves are available with 3.0mm orifice, with pressure resistance up to 2 bar (29psi) for the 16mm valve and up to 5bar (73psi) for the 22mm valve.

In addition to size reduction, the Twin Power design gives the advantage of integrated power-reducing ("hit and hold") electronics. This decreases energy consumption by 75 percent and reduces the risk of heat transfer between the coil and the media.

Further benefits of the new Twin Power rocker valves include a more robust separating diaphragm and a low dead volume fluid cavity, resulting in less carryover, better flushability, and better cleanability. By offering high performance wetted materials, such as PEEK, FFKM (Simrez and Kalrez), FKM, and EPDM, Twin Power valves can handle most aggressive fluids without deterioration or loss of performance.

Available in both 2-way and 3-way versions, Burkert's microfluidic valves with Twin Power technology can replace virtually any standard valves in the marketplace, reducing space and power consumption without sacrificing reliability or performance.



Ultrapure water enables excellent chromatographic performance for LC -MS analysis

Liquid chromatography mass spectrometry (LC-MS) is a powerful analytical technique which combines the separation capabilities of either high performance liquid chromatography (HPLC) or ultra high performance liquid chromatography (UHPLC) with mass analysis by mass spectrometry. The need to ensure that standards, organic solvents and HPLC mobile phases are of the highest purity is widely recognized, yet water quality, which may have an impact on chromatographic performance and the quality of mass spectral data, is frequently taken for granted.

ELGA

www.elgalabwater.com

INTRODUCTION

LC-MS is an extremely versatile, highly sensitive and selective technique, which is commonly used in pharmaceutical, bioanalytical, food and beverage, environmental, clinical, forensic, proteomic, metabolomic and drug development laboratories.

Good chromatographic performance and the acquisition of high quality mass spectral data depend on the purity of the water1. Water may contain a variety of impurities, which can adversely affect chromatographic performance by impacting on resolution, integration and baselines, introducing ghost peaks and altering the selectivity of the stationary phase. Particulates found in impure water may cause damage to the LC system and create column blockages resulting in increased downtime, while ionic contaminants can make interpretation of mass spectra more complicated by interfering with spectral identification and quantification of low-level analytes.

ORGANIC COMPOUNDS

Organic contaminants present in water can cause a number of chromatographic problems. When present in the mobile phase, organic compounds may compete with the analyte to bind to the active sites of the stationary phase. This reduces the amount of analyte retained on the column and subsequently eluted, with a corresponding reduction in method sensitivity. If organic compounds accumulate on the column surface they can restrict analyte and solvent access to active sites, resulting in mass transfer issues and loss of resolution, while any accumulation at the head of the column can cause ghost peaks. Additionally, the accumulation of organic contaminants on the column may result in increased back pressure and, ultimately, a shorter column lifetime. In situations where organic contamination levels are very high, it is possible for the organic compounds to accumulate with time and act as a new stationary phase, causing peak tailing and retention time shifts.

BACTERIA

Bacteria produce organic by-products such as pyrogens, nucleases or alkaline phosphatase, which may result in column and frit blockages and chromatographic issues, such as those described above.

IONS

Ionic contaminants may modify the ionic strength of a solution, which can affect some chromatographic separations. Significantly, analytes may form adducts with metal ion contaminants such as Na+ and K+, which can complicate mass spectral interpretation.

PARTICULATES AND COLLOIDS

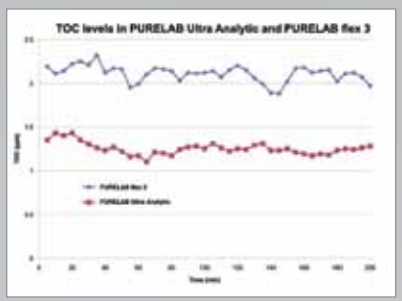
Particulates may cause damage to the HPLC pump and can also cause columns and frits to block. This effect is even more significant for UHPLC users, as the very small particle sizes and decreased diameters of these columns make them more susceptible to premature blocking than their HPLC counterparts. Colloids can be irreversibly adsorbed onto the stationery phase, resulting in a change to the separation efficiency of the column.

ULTRAVIOLET (UV) RADIATION

Passing water through a beam of ultraviolet light breaks down organic compounds. A wavelength of 185 nm effectively breaks down and oxidizes carbon-containing molecules, yielding ionized fragments for subsequent removal by ion exchange, whereas longer wavelength UV radiation (254 nm) disrupts the activity of bacterial enzymes, preventing replication. To maximize breakdown of organic molecules, both the PURELAB Ultra Analytic and PURELAB flex use a full spectrum UV lamp.

MEDIA

The media cartridges in both the PURELAB Ultra Analytic and PURELAB flex contain synthetic, activated carbon beads, which adsorb a wide variety of organic compounds, and high purity ion exchange resins to minimize the release of impurities.



PURIFYING WATER FOR LC-MS

The high sensitivity of LC-MS necessitates the use of ultrapure water for the preparation of all reagents, buffers, mobile phases and any sample pre-treatments2. For ultra-sensitive LC-MS applications requiring very low levels of total organic carbon (TOC), ELGA's PURELAB Ultra Analytic (Type 1+) water – with, typically, a resistivity of 18.2 MΩ .cm, a very low TOC value of less than 2 ppb (figure 1) and bacteria levels below 0.1 CFU/ml – is highly recommended. ELGA's award winning PURELAB flex, with a TOC of less than 5 ppb (figure 1), is suitable for all other LC-MS applications.

CONCLUSION

Ultrapure water with a high resistivity (>18.2 MΩ .cm), free from particulates, organic and ionic compounds, should be used for all LC-MS applications to ensure good chromatographic performance and high quality mass spectral data. To find out more about ELGA LabWater's water treatment technologies and solutions for life science applications, visit www.elgalabwater.com

REFERENCES

1. Whitehead, P. Ultra-pure water for HPLC. Why is it needed and how is it produced? Laboratory Solutions, December 1998

2. ASTM Standard Guide for Bio-applications Grade Water D 5196-06.

For more information please visit www.elgalabwater.com

PURELAB flex- innovating water purity

ELGA's new innovative Type I ultrapure water purification system ensures accurate consistent results. The PURELAB flex 3 & 4 are the latest additions to the award winning PURELAB flex range of systems. Both systems deliver up to 10 liters of ultrapure water per day and up to 2 liters per minute. The PURELAB flex 3 delivers ultrapure water direct from potable tap water and PURELAB flex 4 requires a pre purified feed.

The PURELAB flex offers many advantages for analytical and lifescience applications. It allows users to focus on routine test work, without having to worry about the water quality affecting any test results. The PURELAB flex 3 and 4 are flexible water purification systems which can be adapted to respond to a laboratory's changing water purity needs today and tomorrow.

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The water quality conforms to international water standards e.g. CLSI, CLRW, ISO 3696: Grade 1,2,3, ASTM D1193-06, Pharmacopeia USP, EP and JP. The PURELAB flex can be used for analytical and lifescience applications in all pharmaceutical, university, hospital, food and beverage laboratories.

The PURELAB flex is easily adaptable to facilitate changes to laboratory design layouts and applications.

Handset designed for today's laboratory

- Intuitive to use
- Ergonomic handset design
- Clear water purity for absolute confidence as you dispense
- Handset displays prioritized information shown at all times (system status, TOC, alarm)
- POU filters for multiple applications to remove endotoxins, DNase, RNase and bacteria
- Flexible dispensing in four different ways
    - o Variable flow – drop by drop or up to 2 liters per minute
    - o Autovolume dispense from 50ml to 60ml and repeat dispensing
    - o Hands free with optional foot pedal
    - o Locked dispense for glassware filling

Water Purification made easy

- Fast and simple sanitization to minimize microbial growth
- Data capture via USB port for system validation
- User settings can be customized via the web and uploaded using the USB post in seconds
- Multiple dispense positioning
    - o Wall, bench, height adjustable arm, hand-held dispensing

▲ *The PURELAB flex delivers 18.2 MΩ-cm water quality.*

ELGA is the global laboratory brand name of Veolia Water Solutions and Technologies, the world's leading water service company.

ELIX® UV TECHNOLOGY COMPARED TO SINGLE AND DOUBLE DISTILLATION

Today, newer purification technologies have proven able to compete with long-established distillation. Following a brief review of these purification technologies are data for performances of a single and double distillation system, and the Millipore Elix UV system.

MILLIPORE
www.millipore.com/H20

TECHNOLOGIES

During distillation, water is heated in a boiler. Then water vapor is condensed and purified water collected in a receiving flask. Though it is expected contaminants initially present will not distill and will remain in the boiler, in addition to some specific ions, some organic molecules may be carried away with the water vapor as these molecules distill easier than water or may co-distill with water.

The Elix system combines reverse osmosis (RO), electrodeionization (EDI) and a germicidal UV lamp.

ORGANIC CONTAMINANTS – TOC

ANALYSIS

Levels of organic contaminants, grouped under "Total Organic Carbon" (TOC), were monitored. TOC in tap water can vary widely day-to-day. Graph 1 shows TOC values for Elix, single distilled and double distilled water. RO-EDI is more efficient than single or even double distillation in removing organics. This is partly because filtration by reverse osmosis rejects most organic molecules due to the small pore size (10-8m) of RO membranes. Also, EDI eliminates many of the charged organics. Distillation is less efficient due to the volatility of small organic molecules that can co-distill with water.

INORGANIC CONTAMINANTS – ION CHROMATOGRAPHY

Ion removal efficiency was compared between the Elix and single still and double still systems. Levels of the commonest cations and anions present in tap water were quantified using ion chromatography (IC). Tables 1 and 2 show results for cations and anions respectively. Considering the total number of inorganic ions remaining after each purification step, the Elix provides slightly better global results than single and double distillation. But, if we also take the charged organics into account, the difference is significant.

BACTERIOLOGY

Table 3 reports microbiology data. The distillation process produces sterile water, which was checked by collecting water samples directly at the condenser outlet. No micro-organisms were found on the plates after incubation. However, samples collected at the entire system's outlet appeared to be contaminated. The two boilers are connected by tubing 15 cm long, and analysis performed at the tubing outlet revealed micro-organisms here also, showing the drawbacks of tubing necessary to distillation systems.

But, bacterial content in water delivered by the Elix, including outlet tubing, was consistently between 0 and 1.3 cfu/ml.

ENERGY & MAINTENANCE

Energy consumption: Elix required approximately 35 Wh and the double still system, 6000 Wh.

Water consumption: Elix required up to ten times less water than the double still system to produce the same amount of purified water.

Water recovery: Double still system—2.1 % to 3.3 %.Elix—20.5 % to 22.1 %.

The Elix needed no maintenance during the three months when the experiments were conducted. The double still system required a weekly descaling treatment with strong acid.

EXPERIMENTAL SECTION

Equipment used in experiment:

Double still: Aquatron® 4000D from Bibby Sterilin Ltd, (Staffordshire, U.K.) For single distillation step, water was sampled at entrance of still's second boiler.

RO-EDI system: Millipore Elix 10 UV system, (Massachusetts USA).

Systems were fed with tap water from Saint-Quentin-en-Yvelines, France. Samples were taken when systems had been running for at least one hour. For the IC experiments, 100 ml samples were collected in thoroughly rinsed polyethylene bottles.

IC system: Dionex® DX-500 (Dionex Corporation, Sunnyvale, CA, USA) equipped with pre-concentration columns. Cations were separated on a CS12A column in isocratic conditions, using 20 mM methanesulfonic acid as an eluent. Anions were separated on an AS17 column in isocratic conditions. An EG40 eluent generator was used.

TOC measurements were made using a Sievers® 2244 AP analyzer (Ionics Instrument Business Group, Boulder, CO, USA), combining acid treatment, persulfate oxidation and UV oxidation. To eliminate risk of sample contamination through air exposure, sealed containers were used. Bacteria-free bottles were used for microbiology. Bacteria were grown for 72 h at 30°C on R2A plates. All tubing was changed before experiments.

CONCLUSION

Results showed the Elix was significantly more efficient than the single and double stills in reducing TOC levels and eliminating bacterial contaminants, supporting what is generally admitted in the scientific world: that distillation has been superseded by the RO-combined-with-EDI technology.

This is an edited version of a longer application note

REFERENCES

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2. Halpeth, M.K., "Evaluation of Millipore Elix-3 System", TERI (The Energy and Resources Institute), March 2004.

Eppendorf epMotion 5075: Automation made simple

The epMotion 5075 LH is the ideal solution for advanced liquid handling demands. It offers outstanding accuracy and precision making it an excellent tool for demanding, small-volume applications such as real-time PCR set-up or magnetic bead purification, as well as any routine pipetting task.

The 12 positions and the automatic tool exchange, expand the application range to handle complex patterns and higher sample numbers. With heating and cooling and the gripper option, the epMotion 5075 is one of the most flexible and failure-proof automated pipetting systems available.

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With epMotion automated pipetting systems, you will see things in a new light. All your routine pipetting tasks, whether small or large, will be automated with better precision and safety than you ever experienced with manual pipetting.

Learn how simple it is to automate. The revolutionary and easy to use epMotion lends itself to nearly all laboratory environments. The software is so intuitive you can learn it in just one morning and be up and running protocols that same afternoon. The integrated PC makes the system easy to operate for anyone, anywhere. Features such as pipetting pattern recognition or the ready to go Plug'n'Prep® methods ensure that entering the world of automation is fast and easy.

Learn about our unique pipetting range from 1 µL to 1,000 µL. With epMotion, you can experience utmost precision even at the lowest volumes without complex pipetting commands. Our open platform lets you automate your applications with all your favorite labware. We have more than 2,000 single-tube formats, well plates, and even unusual plastics such as real-time rotor tubes included in our database and available for immediate use.

Discover new possibilities: Save reagent costs in real-time PCR, enjoy the choices in nucleic acid preparation, get more performance out of your cell culture work, finish first in your genomics projects, and experience more reliability in clinical research. With five models, two instrument sizes, and multiple pipetting deck combinations to choose from, epMotion is the perfect companion for your workload.

AUTOMATED REAL-TIME PCR SET-UP

Reproducibility in real-time PCR: Let it multiply!

With epMotion, you can increase reproducibility in real-time PCR experiments significantly. In an experimental attempt to pipette 96 times a real-time PCR sample, the epMotion shows superior results compared to manual pipetting by reducing the standard deviations. This decreases the number of sample replicates needed to statistically confirm an increase in gene expression. With epMotion, your real-time PCR experiments become more significant.

Versatility: Enjoy it with any real-time system!

The epMotion is compatible with any real-time cycler. With epMotion, you have the flexibility of using single tubes, 96- or 384-well plates, or unusual plastics such as real-time rotor tube-strips. You can even save on tips with the multi-dispensing capability of epMotion.

epMotion: Spend less on reagents!

Reagents are a critical cost factor when performing real-time PCR experiments, and sometimes the cost of reagents can even limit your research projects. epMotion delivers utmost pipetting precision from 1,000 µl to 1 µl. Reaction volumes as low as 5 µl can easily be achieved, cutting your reagent costs by as much as 80%.

Introducing the NEW RevElution™ Bio-Concentrator

by Jenny Sprung, Product Manager, Labconco Corporation

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The new RevElution Bio-Concentrator is the front end of rapid microbial detection in food and beverage, water treatment and other industries that require concentration of liquid microbial samples. It's the only concentrator that can process samples as large as two liters at a rate of up to 100mls/minute. Faster and more precise than a centrifuge, the RevElution uses patented technology to pull the liquid sample through a one-time use filter and automatically turns off when the liquid is gone. A buffer foam elution pushes all collected microbes on the filter into a collection vessel. Up to 90% of microorganisms such as ecoli, bacillus thuringiensis israliensis, and MS-2 bacteriophage are recovered, ready and viable for rapid or classical analytical methods such as immunoassay, PCR or cell culture. Bg DNA and whole cells can also be recovered using the RevElution.

The RevElution operates with the press of one button. A single-use filter tip is inserted and lowered into the sample. Pressing the button draws a sample through the filter, liquid passes through the filter and is directed to a drain and discarded or collected for future use. Once all the liquid has been filtered, the same button is pressed to trigger the wet foam elution process, which releases the particles from the filter into a small container. Final sample volume is user set between 200 to 1000 µl (less than 1 milliliter). The entire fluid path is contained within the disposable tip.

Two tips are available—0.1micron and 0.4micron, which can trap parasites, molds, funguses and whole cells. Tris or PBS is used as the elution fluid.

ADDITIONAL FEATURES OR BENEFITS INCLUDE:

- No cross contamination – tips are disposable and one-time use only.
- Up to 2L of sample can be concentrated – if the sample container is large, tubing can run from the filter tip to the container to concentrate the sample next to the RevElution.
- Starter Kit – not sure which tip will work? A starter kit is available, which includes two tips, 0.1 micron and 0.4 micron, and either elution fluid Tris or PBS buffer.

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- Complete network integration – WITHOUT a PC
- 14 user-defined programmable shortcuts
- Built-in intelligence – smart components that track and monitor key parameters for you
- Contact-free reagent exchange in our KF model ensures your safety
- Safety-stop function even prevents the titration cell from overflowing during conditioning in KF mode
- Rugged, chemical-resistant housing and touchscreen display – requires no replacement film and is very easy to clean

See our complete line of titrators at www.metrohmusa.com

Nor-Lake® Scientific -86°C Select™ Ultra-Low Upright Freezers

Designed to meet the demanding requirements for scientific and laboratory research. Advanced engineered design incorporates the latest in cabinet, refrigeration, temperature control and monitoring features. Provides energy efficient, convenient, safe and reliable performance for optimal storage temperature environments necessary for a wide range of life science, pharmacy, biological, medical, clinical, and industrial applications.

Nor-Lake Scientific
727 Second Street
Hudson, WI 54016
800-477-5253
www.norlakescientific.com

CONSTRUCTION

- CFC free polyurethane cabinet and door foam insulation.
- High-impact, smooth scratch and corrosion resistant painted exterior and smooth white painted interior, provides attractive appearance and easy to clean surfaces.
- Interior and exterior of the freezer cabinet are white painted galvanized steel.
- Combination cabinet mounted multi-bulb and door perimeter gaskets provide multiple points of door sealing. Ensures reliable frost resistant performance and enhances energy efficient cold performance for long term sample security and storage.
- Interior doors (5) independent hinged steel inner doors are constructed of insulating material with magnetic catch and easy pull handles. Reduces cold loss during door openings and sample retrieval.
- Five internal storage compartments with four heavy duty reinforced stainless steel shelves. Shelves are adjustable in 1 inch increments. Compatible with optional stainless steel storage racks, fiberboard boxes and dividers for multiple storage needs.
- Multi-feed patent pending cold wall evaporator design provides superior refrigerant flow and maximizes cooling power by ensuring that the evaporator is always 100% in contact with the freezer wall, maximizing cold transfer into the freezer and heat removal from the chamber.

SELECT™ CONTROL SYSTEM

- Advanced PLC (programmable logic) microprocessor controller (door mounted eye level display and interface) includes real time clock, event logging alarm history, advanced alarms, alarm-test, and memory functions.
- Password protection (2 levels, setpoints and parameters) security for power, temperature and alarm settings.
- Key pad, multifunction, menu driven, LCD display for trouble free access on monitoring of all control features.
- Temperature adjustable in 0.1°C increments. Temperature display to 0.1°C increments.
- Control probe located in rear wall bottom left corner for optimal and accurate temperature measurement and control.

SELECT™ REFRIGERATION SYSTEM

- Nor-Lake Scientific's Select™ Refrigeration system is powered by an advanced low noise high performance cascade refrigeration system using two next generation 1 HP hermetically-sealed compressors.
- Exclusive engineered super capacity (tri-tube) capillary tube system (patent pending) delivers refrigerant on demand matching with advanced heat exchanger design providing optimal heat removal and superior low temperature performance.
- Evaporator design enhances refrigerant flow increasing the overall efficiency, temperature uniformity and recovery performance.
- Air cooled condenser, high capacity with large surface area. Washable condenser filter maintains optimal efficiency and performance.

The New Choice in Centrifugation

NuAire has partnered with AWEL International to bring you a full line of centrifuges. This comprehensive line of innovative, and ergonomically-designed centrifuges compliments NuAire's biological safety cabinets, CO2 incubators, ultra low freezers, and laminar flow cabinets as a part of a complete laboratory.

2100 Fernbrook Lane
Plymouth, MN 55447 USA
Toll Free: 1.800.328.3352
Phone: 763.553.1270
Fax: 763.553.0459
www.nuaire.com

AWEL has 25 years of experience in the design and manufacturing of laboratory centrifuges with exclusive patented features that are designed to increase productivity and safety with an emphasis on ergonomics.

AWELook ergonomic and compact blueprint offers excellent capacity per space ratio, saves bench space, increases sight lines, and decreases the technician's reach to retrieve samples reducing fatigue.

AWELight visual end of cycle indication illuminates lights on the centrifuge handle notifying samples are ready for removal increasing workflow.

AWELock System allows technicians to change from one application to the next within seconds. Rapid removal and replacement of rotors are quick and easy by pressing two tabs together to unlock the system; Change rotors without using tools. Improve cleaning efforts with total removal of centrifuge rotor.

MULTIFUNCTION CENTRIFUGES

The MF series include 4 multifunction centrifuges and offer a wide range of speeds, capacities, and accessories for all types of applications. The AWELock rapid rotor exchange system allows for changing of rotors within seconds. Many other patented technologies respond to the different needs and centrifugation protocols of your laboratory.

CLASSIC CENTRIFUGES

The C series classical centrifuges offer an excellent capacity to space ratio. These centrifuges easily find their place in your laboratory for intensive, routine use.

Ventilated and Refrigerated is available in both the Multifunction and Classic models.

ACCESSORIES

Different type and capacities of rotors are available for MF models: Swing-Out Buckets, Fixed Angles, Microtubes, Microplates; and a large choice of inserts for all kind of Collection Tubes.

LINK: http://www.nuaire.com/centrifuge

TOUGH TISSUE HOMOGENIZATION WITH A BEAD MILL

OMNI International
The Homogenizer Company™
935-C Cobb Place Blvd. NW
Kennesaw, GA 30144
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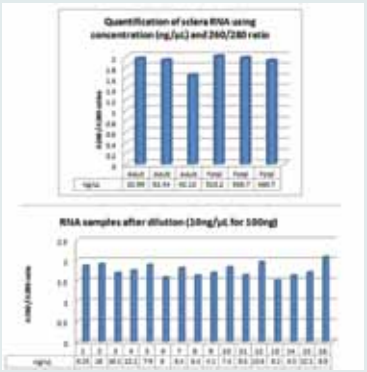
INTRODUCTION

The effectiveness of sample preparation influences not only the quality and quantity of the results, but also the conclusions drawn from experiments. Some samples are easier to lyse, while others, such as fibrous human eye tissue samples are much more difficult. Among the multiple methods of homogenization available, the Omni Bead Ruptor is the most effective for processing multiple small samples at one time.

The Omni Bead Ruptor has the broadest performance range of any bead mill homogenizer. It is gentle enough to extract viable cells or bacteria by preserving the integrity of the protein capsid and cell walls, but powerful enough to lyse the toughest of samples. Using tubes pre-filled with a variety of lysing beads, the Omni Bead Ruptor vigorously and uniformly shakes the tubes providing reproducible homogenization while preserving sample integrity. Its optimized motion ensures maximum processing efficiency, and guarantees minimal heat generation and sample degradation. The unit's brushless motor is virtually maintenance free and allows for nonstop use and high throughput.



RNA EXTRACTION FROM HUMAN OCULAR SAMPLES

For some time, scientists at the University of California at Berkeley had been trying to find a new method of homogenization for their human ocular samples (including retina, sclera, choroid, cornea, retinal pigment epithelium, and the optic nerve). The Omni Bead Ruptor allowed them to process 24 tubes containing 100mg to 1g of tissue with 1mL of lysis buffer. The samples were successfully processed using 2 cycles of 30 seconds each, at 5.5m/s. Omni DNAse / RNAse free sample tubes pre-filled with either 2.8mm ceramic beads, or 2.38mm metal beads were used to process their samples. The advanced processing power of the Omni Bead Ruptor led to significant increases in RNA yield and quality while preserving sample integrity.

CONCLUSION

The bead mill homogenizer from Omni International provided faster and more complete homogenization of tough human ocular tissues. When asked about their experience, the scientists said, "The Omni Bead Ruptor is an excellent product that is highly efficient. It provides desired results with its fast protocol and reasonably high throughput, resulting in a high quality RNA extraction with A260/A280 ratio of 1.9 or greater." To learn more about Omni Bead Ruptor applications, please visit our applications section at **www.beadruptor.com/Applications-13**.

New Series 3Y

Bracka Str. 28
26-600 Radom, PL
Tel: +48 48 384 88 00 ext. 205
Fax: +48 48 385 00 10
www.radwag.com

NEW DESIGN

- In 2Y series cable was hidden under the main housing now is folded behind the indicator
- New bottom design of AS/3Y and PS/3Y.

OPERATING SYSTEM – WINDOWS CE

New operating system enables better communication with external devices and improves efficiency of the balance alongside with graphic transfer to standard office printers.

NEW WORKING MODES

- Differential weighing – enables singleand multi sub sequential weighing of the same sample
- Pipette calibration – after defining pipette id dedicated data base pipette can be checked in accordance to ISO Standard
- Automatic calibration – enables statistical control from the batch in accordance to Pharmaceutical guidelines USP

UPGRADED WORKING MODES

- Formulation – enables formula making form hand or data base of formulas with automatic protection against overdosing and recalculations function
- Mass comparation – enables using balances as mass comparator

GRAPHS

Graph visualization of measurements or Gaussian distribution, zooming function and BMP file printed on PLC printers or exported into a file via USB

ExchangeDATA

Data exchange between balances software enabling programming databases from PC level

MultiUSER

Four level of accessibility to the balance menu and to each database separately

Profile personalization covers language, display and printout content functionality of buttons and proximity sensors, tailored to each working mode independently

ECONDITIONING

Monitoring of ambient conditions by internal and external sensors – THB

Air buoyancy correction calculated from internal sensors or THB2 on line

EXMEMORY

of 3Y - series solution – the size of each database is adjusted dynamically

NEW MODELS IN 3Y FAMILY

- New model – moisture analyzer MAY with all functionality and advantages of 3Y Series
- New model – XA 3Y offering high accuracy mechanism with manual opening door system

Buffer Creation Wizard

AUTOMATE YOUR BUFFER PREPARATION WITH THE TECAN BUFFER CREATION WIZARD

TECAN.
Seestrasse 103
8708 Männedorf, Switzerland
Tel: +41 44 922 81 11
www.tecan.com

The Buffer Creation Wizard is a Freedom EVOware® Add-on and allows the fully automated preparation of your set of buffers e.g. for subsequent screening experiments like High Throughput Process Development.

The user can import a *.txt file with the final buffer layout which has been generated by a Design of Experiment (DoE) software. The Wizard guides the user through six steps for entering all necessary information for the process such as used stock solutions and destination plate or tubes. All stock solutions and their key features are administrated in a data base.

The algorithm of the Buffer Creation Wizard calculates the required volumes of each stock solution for every single destination cavity. The total required volumes are summarized and provided in a 'Shopping List' which facilitates the preparation of the worktable.

Finally the Wizard generates a ready-to-run Freedom EVOware script which can be saved and run at any time.

The applications described here are not available in the US outside of the research market.

Flexibility and automation for toxicology and specialty chemistry testing with the Thermo Scientific Indiko Bench top analyzer

Thermo SCIENTIFIC
46360 Fremont Blvd.
Fremont, CA 94538-6406 USA
Phone: 800.232.3342
www.thermoscientific.com/indiko

Offering quality, flexibility and automation the new Thermo Scientific™ Indiko random access analyzer fits ideally to small clinical laboratory settings wanting to save time and money. Patient oriented testing produces results quickly thus enhancing the quality of patient care. Besides routine clinical chemistry testing, Indiko together with high-quality system reagents serves various dedicated specialty testing needs offering a complete, easy-to-use and cost-effective system solution. Compact design occupies only a small footprint, is easy to install, and does not require external water or drainage connections.

USER-FRIENDLY FEATURES

The Thermo Scientific Indiko offers several user-friendly automated features, like an advanced dilution management and a real-time monitoring of reagent usage, which help to manage a daily workload fluently. Samples, reagents and consumables can continuously be loaded without interrupting the testing process. The test flow definition allows for up to four reagent additions in each test, offering automation even for the most complex methods.

FLEXIBLE, EASY OPERATION

A mix of sample cups and bar-coded primary tubes may be used at any time, thus increasing the flexibility of operation. The self-guiding user interface is easy to learn and allows a streamlined information management. The Thermo Scientific Indiko offers various reporting options, and an advanced result inventory management. The automatic start-up protocol and a minimal daily maintenance maximizes analyzer uptime.

- Loadable application data from a two-dimensional barcode or from a text-file.
- Real-time monitoring of reagent usage, lot follow-up.
- Bi-directional LIS interface.

TRUE WALK-AWAY ANALYSIS

Indiko together with bar-coded, ready to use Thermo Scientific system reagents is a reliable combination providing ease-of-use and flexibility for specialty chemistry and toxicology analysis, like pain management, and drug monitoring. Once loaded, the analyzer provides true walk-away time for the operator.

- Different sample types can be analyzed at the same time.
- Dilutions and re-analysis, when necessary, are fully automated.
- Real-time QC program with multiple Westgard rules.

UNIQUE CUVETTES

The unique cuvette design supports low reagent volumes thus remarkably reducing operating costs, especially important when working with specialty tests. Disposable cuvettes are used, ensuring accurate and precise results.

LARGE MENU OF BAR-CODED REAGENTS

Thermo Scientific bar-coded reagents offer the most extensive menu of homogeneous enzyme immunoassays for drugs of abuse testing, and therapeutic drug monitoring including immunosuppressant testing. Our multiple technologies provide an important advantage of integrating Thermo Scientific™ DRI, Thermo Scientific CEDIA and/or Thermo Scientific QMS technology into the testing program. DRI® products offer high analytical accuracy while eliminating time-consuming steps in reagent preparation. These liquid, ready-to-use reagents are widely accepted in laboratories ensuring optimized productivity and effective cost control. CEDIA® Reagents offer excellent performance in precision and lot-to-lot dependability as well as a stable shelf life. QMS® Reagents (particle-enhanced turbidimetric technology) represent the method of choice for the measurement of blood levels of therapeutic drugs including Immunosuppressants.

Now, the extensive menu of DAT, TDM and ISD assays is available as "Open and Go" system reagents on our self-contained bench-top analyzer, the Thermo Scientific Indiko. Our system packaged reagents are bar-coded to allow flexibility and ease of use for the operator.

Thermo Scientific Indiko bench top analyzer.

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PRE-OWNED EQUIPMENT MARKETPLACE

PARTING POINTS

Takeaways from this month's issue:

EFFECTIVE GLOBAL MANAGEMENT

Conventional strategies that worked well enough when collaborators were down the hallway lose their efficacy in a greater global arrangement. Some tips for the effective leadership of dispersed global teams include:

- Don't assume anything
- Create a team charter at the beginning
- Prepare more carefully for the few face-to-face meetings that do occur
- A sense of humor doesn't hurt

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THE BLENDED TRAINING MODEL

Budget cuts often force companies to cut training, especially when it requires travel. However, cuts in continuing education can have a negative effect on a company's bottom line. Blended training is a cost-effective solution that involves:

- Introductory web-based modules reviewed prior to the course
- In-class, hands-on instruction
- A second hands-on portion that students complete in their own labs
- Post-course web activities where students discuss their independent work

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ENTERPRISE RESOURCE PLANNING

One of the most important contributors to the seamless integration of processes and data into a tightly unified continuum in the lab is enterprise resource planning (ERP). ERP systems:

- Do not typically include industry-specific, technical data handling
- Are focused mainly on the administrative and managerial functions needed to run businesses
- May be enhanced when they are integrated with LIMS

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FIELD-WORTHY INSTRUMENTATION

Field instruments have been around for decades, but advances in computing and electronics miniaturization have spawned a new generation of instruments that are smaller, cheaper, and easier to use. The latest trends include:

- Continued growth in the portable instrument market
- Improved user experience, particularly for non-experts
- Software advances
- Possibility of cloud computing in the future

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VHP SAFETY BASICS

Vapor phase hydrogen peroxide decontamination technology is relatively new, having been available since 1991. Safety tips for handling vaporized hydrogen peroxide (VHP), or hydrogen peroxide vapor (HPV) include:

- Make sure the room is well sealed during decontamination to prevent exposure
- Take advantage of safety training offered by VHP equipment manufacturers
- Check the equipment for damage and proper function prior to each use
- Ensure all safeguards and personal protective equipment are in place

NOR-LAKE® SCIENTIFIC

LABORATORY AND SCIENTIFIC EQUIPMENT

For Life Science, Hospital, Clinical, Biomedical, Scientific and Industrial Applications

Nor-Lake® Scientific Select™ Ultra-Low Upright Freezers

- Upright Models Available in 18.9, 23.3 & 27.5 ft.^{3} Internal Storage Capacity
- Operating Temperature Range -50°C to -86°C
- Next Generation 1HP Low-Noise, High-Efficiency Compressors
- Exclusive Cascade Refrigeration and Cabinet Design
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- High/Low Audible and Visual Temperature Alarms, Remote Alarm Contacts
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- Available Options: CO2 and LN2 Backup Systems, Chart Recorder, Inventory Storage Systems
- UL/CUL Listed

Nor-Lake® Scientific Environmental Rooms

- Suitable for Research, Biological Studies, Shelf Life, Stability Testing, Blood and Plasma Storage and General Life Science Applications
- Mini-Rooms Available in Standard Sizes and Temperature Ranges
- Custom Rooms Available to Suit Specific Storage and Application Requirements
- Modular Construction for Easy Installation and Relocation
- Available Microprocessor Controllers, Alarms, Monitors, Temperature and Humidity Chart Recorders, Shelving, Ramps, Lighting, Humidification and Dehumidification

Nor-Lake® Scientific Select™ and Premier Laboratory & Pharmacy Refrigerators and Freezers

- Available in 1, 2 and 3 Glass or Solid Door Models with 5, 24, 33, 52 & 80 ft.^{3} Storage Capacity
- Pass-Thru: Chromatography - and Sliding Glass Door Models Available
- Microprocessor Controller, Digital Display, Hi/Lo Audible & Visual Alarms with Remote Alarm Contacts, Key Lock Doors, Shelving, Casters
- Options: Internal Electrical Outlet, Temperature Recorder, Stainless Steel Interior and Exterior, Access Ports, Drawers
- UL/CUL Listed

Nor-Lake® Scientific Blood Bank Refrigerators Plasma Freezers

- Meets AABB, ANRC and FDA Blood Storage Requirements
- Available in 1,2 and 3 Glass Door Models with 24, 33, 52 & 80 ft.^{3} storage capacity Microprocessor Controller, LCD Digital
- Display (Air and Product) Password Protection, Hi/Lo Audible & Visual Alarms with Remote Alarm Contacts, Temperature Chart Recorder, Drawers, Glass Doors, Key Lock Doors, Casters
- UL/CUL Listed

Nor-Lake® Scientific Stability Test Chambers BOD Refrigerated Incubator CO_2 Incubators Lighted Chambers Warming Cabinets

- Various Models with Temperature only or Temperature and Humidity Control
- Available with 1,2, and 3 Doors with 24, 33, 52 & 80 ft.^{3} storage capacity
- Programmable Microprocessor Controller, LCD Digital Display, Hi/Lo Audible & Visual Alarms with Remote Alarm Contacts, Key door lock, casters, Shelves, Stainless Steel Interior
- Options: Chart Recorder, Access Port, Internal Electrical Outlet, Extra Shelves, RS485, Stainless Steel Exterior
- UL/CUL Listed

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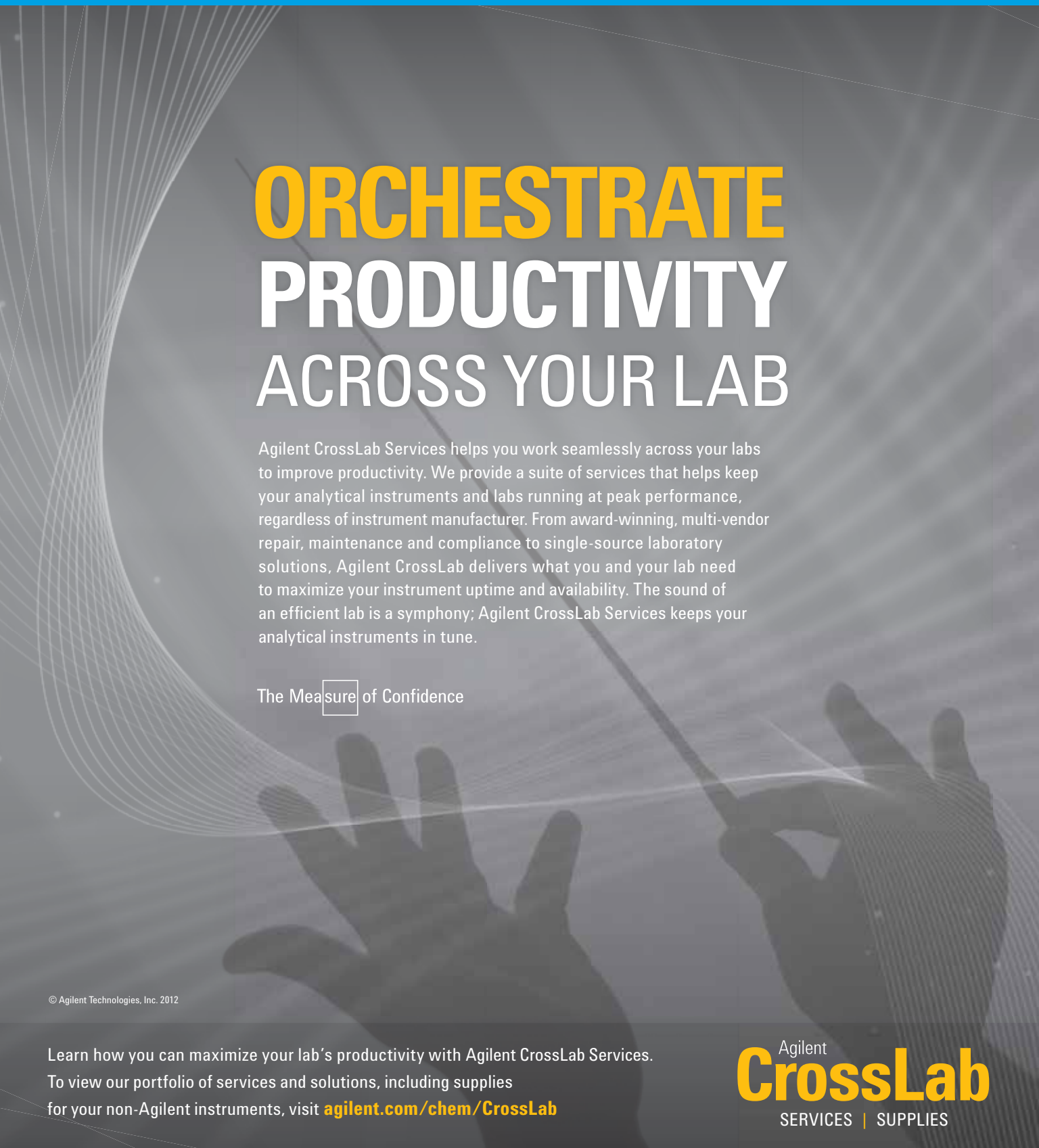

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