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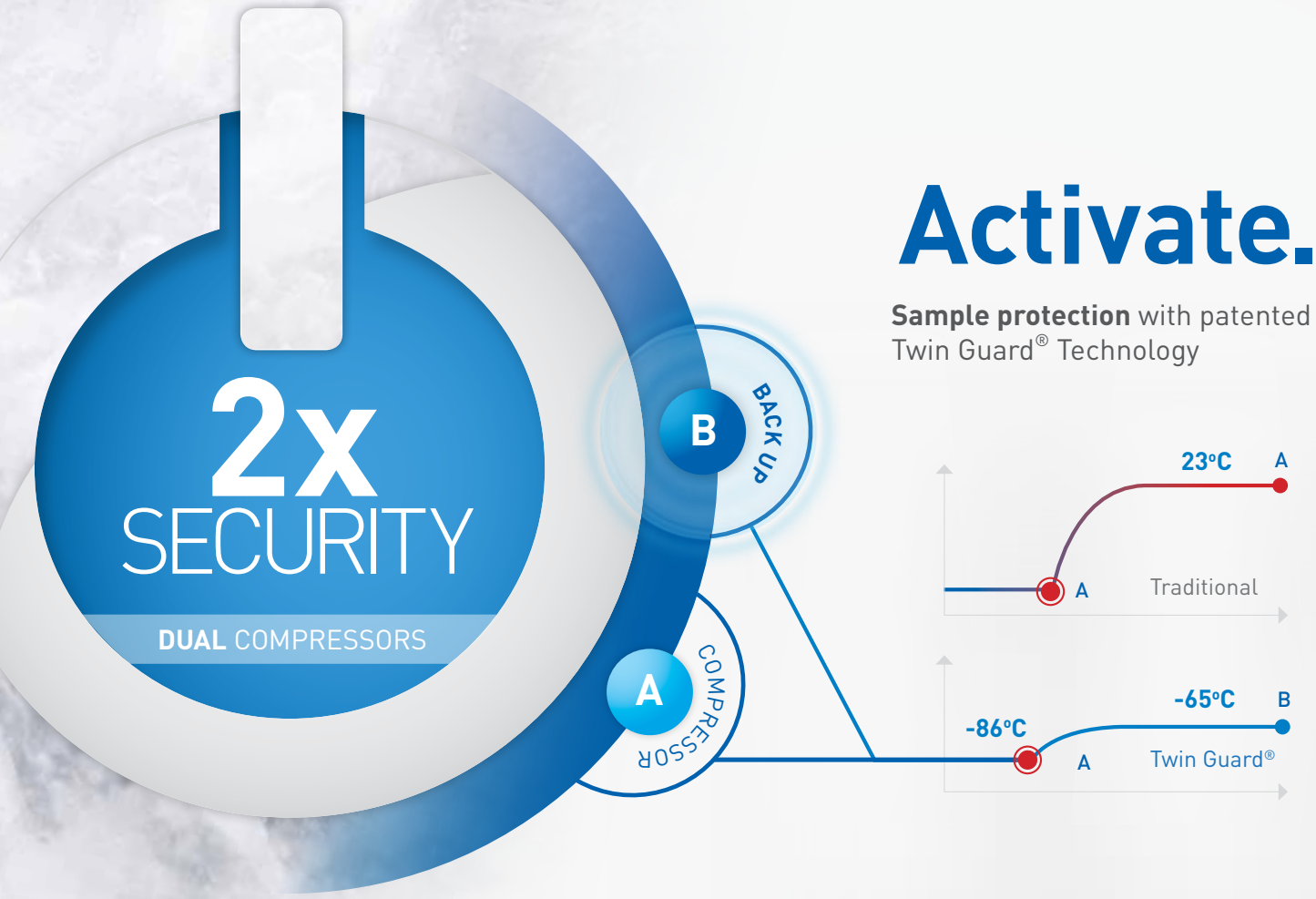

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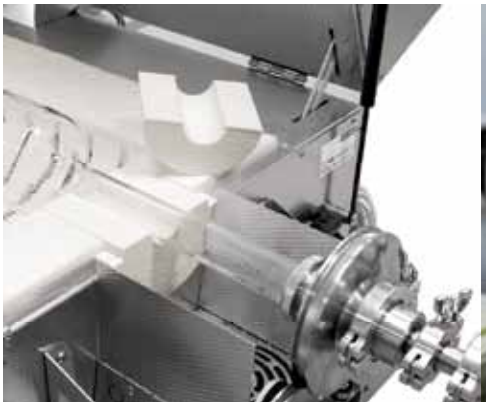

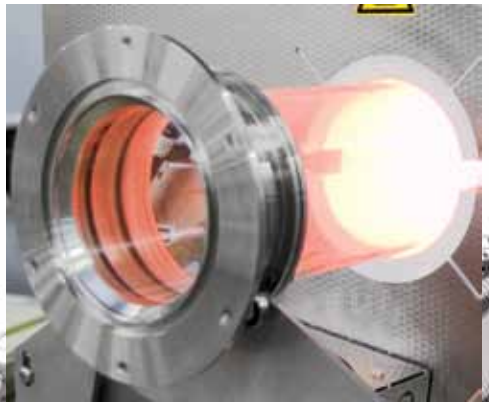

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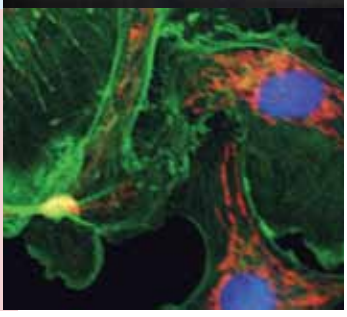

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MUSIC IN THE LAB

We know that you and your staff work hard every day, but you also take time to have fun, whether through staff lunches, parties, or small prizes for work well done. For example, the winner of the **$50 Amazon gift card** in one of our recent "fake ad" contests let us know that he would be using the prize to buy music for his lab. That got us wondering about what the rest of you think of music in your labs. Is it distracting? Does it cause any conflict? Who chooses what music gets played? Is there a special policy for music?

We are planning to create a new section in *Lab Manager* that deals with the fun or whimsical side of running a lab and we'd like the first article to focus on music or other forms of personal/public entertainment. For that, we need your feedback. Please send any comments about music in your lab (or lack thereof) to *Lab Manager*'s assistant editor Rachel Muenz at **rachelm@labmanager.com.** Your help is greatly appreciated.

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There's gold in that data

In last month's cover story, "Your Lab, Your Business," we touched on the idea that business opportunities for many of today's labs will come from their data. "The focus now is to be as operationally efficient as possible and to reassess the data being created in order to maximize value to the business," said Trish Meek, director, product strategy, life sciences at Thermo Fisher Scientific. This month's expert, David Patterson, PhD, professor of computer science at UC Berkeley, echoes that message, saying "The fundamental argument underlying big data is that, if only we have the right tools to process and analyze all the data that we have, then we can get "gold" (from the data) to drive future discoveries." Obviously the time has come for lab managers to partner with their IT departments to begin developing ways to best mine that gold.

The idea of data mining as the next big business opportunity comes at a good time, especially in light of this month's Sixth Annual Investment Confidence Report, which—not unsurprisingly—is less than cheery. Evaluating the results of this year's survey, author Angelo DePalma says, "The business outlook for 2014 shows a persistent lack of optimism, a trend that has become familiar over the past several annual surveys. Most negativity appears related to the macroeconomic and political outlooks for the U.S. as a whole." Turn to page 10 for the good, bad and ugly. I'd be curious to know if these results ring true for you.

Continuing the search for ways to add to growth and contain costs to sustain growth, author Paul McMinn in this month's Business Management article, "Strategic Sourcing," looks to the area of procurement. Making a case for outsourcing this important function, he says, "When it comes to procurement functions and support for the lab professional, many organizations have not made that leap, although there is a strong service segment of organizations expanding to provide those services as an outgrowth of business process outsourcing (BPO)." Turn to page 18 to learn more.

Another weapon in a lab manager's arsenal to optimize laboratory operations is something called "Quality by Design," or QbD. Author Zenaida Otero Gephardt describes the methodology and its benefits in this month's Technology article on page 32. "QbD has its origins in product development and manufacturing. However, it has significant benefits for the laboratory. QbD can enhance the efficacy, robustness (tolerance to small changes in operating conditions), and ruggedness (sample test reproducibility for different standard test conditions—different analysts or instruments) of laboratory methods," says Gephardt.

Despite the fact that 37 percent of this year's survey respondents believe that funding for education and training in their labs will decrease (compared with 32 percent last year), this month's Leadership & Staffing article, "Customized Training," paints a brighter picture. Thanks in part to ever better and more efficient online training offerings, opportunities for keeping your staff up to speed in matters of technology and safety abound. And no one doubts the value. "Most effective lab managers, no matter the specific field, understand the need for continuing education and work through budgetary and time constraints to provide the required opportunities for their staff to grow," says author Sara Goudarzi.

As for developments in laboratory technology, find out what's new in analytical balances, automated liquid handlers, stirrers, and refractometers beginning on page 48. And for everything you ever wanted to know about centrifuges, turn to this month's INSIGHTS article on page 74.

Enjoy.

Pamela Ahlberg
Editor-in-Chief

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Editor-in-Chief	**Pamela Ahlberg** pam@labmanager.com 973.729.6538
Assistant Editor	**Rachel Muenz** rachelm@labmanager.com 888.781.0328 x233
Technology Editor	**Trevor Henderson** thenderson@labmanager.com 888.781.0328 x291
Contributors	**Angelo DePalma, PhD** **Mark Lanfear** **Sara Goudarzi** **Tanuja Koppal, PhD** **F. Key Kidder** **Joe Liscouski** **Vince McLeod, CIH** **Ronald B. Pickett** **Bernard Tulsi** **Mike May, PhD**
Art Director & Production Manager	**Gregory A. Brewer** gregb@labmanager.com 888.781.0328 x241
Graphic Designer	**Danielle Gibbons** danielleg@labmanager.com 888.781.0328 x237
List Rental	**Jen Felling—Statlistics** 203.778.8700
Custom Article Reprints	**The YGS Group** labmanager@theygsgroup.com 800.290.5460 717.505.9701 x100
Subscription Customer Service	info@labmanager.com
Account Managers	**Edward Neeb** Northeast edwardn@labmanager.com 860.350.2761
	June Kafato International junek@labmanager.com 705.812.2332
	Larry Frey Southeast, Midwest & West larry@labmanager.com 845.735.5548
	Alyssa Moore Mid-Atlantic amoore@labmanager.com 610.321.2599
Business Coordinator	**Andrea Cole** andreac@labmanager.com 888.781.0328 x296

Published by LabX Media Group

President	**Bob Kafato** bobk@labmanager.com 888.781.0328 x223
Managing Partner	**Mario Di Ubaldi** mariod@labmanager.com 203.227.1390
General Manager	**Ken Piech** kenp@labmanager.com 888.781.0328 x226
Publisher	**Edward Neeb** edwardn@labmanager.com 860.350.2761

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Lab Manager's 2013 Investment Confidence Survey was conducted during November 2013. The survey consisted of 18 questions related to responders' outlook on current, past, and future business trends. Two hundred seventy-two individuals completed the survey.

Demographics

Of all respondents, 68% held managerial positions. Fifty-six percent indicated they managed labs, core facilities, or research projects. The remainder held managerial or supervisory positions in safety, operations, clinical research, and quality. Thirty-one percent of respondents identified themselves as rank-and-file scientists or technicians.

The following table breaks down respondents by job function.

JOB FUNCTION	%
R&D	30
Technical Services	13
Operations	12
Quality Control/Assurance/Validation	12
Teaching	4
Clinical Research/Trials	3
Corporate Management	3
Manufacturing/Processing	3
Purchasing	3
Regulatory	3
Safety	3
Study Management	1
Other	10

When respondents were asked to identify their industry, clinical laboratories, at 17%, comprised the largest distinct group. Still, 23% of respondents participated in the diverse group of industries related to biology (cell biology, microbiology, biotechnology). Assuming those who listed "biotechnology" are approximately split between pharmaceuticals and foods, those two sectors accounted for 9% and 8%, respectively, of respondents. Chemicals (9%), environmental (9%), and materials (8%) represented three other strong industry categories. Instrument design, agriculture, energy, and "other" brought up the rear with low single-digit numbers.

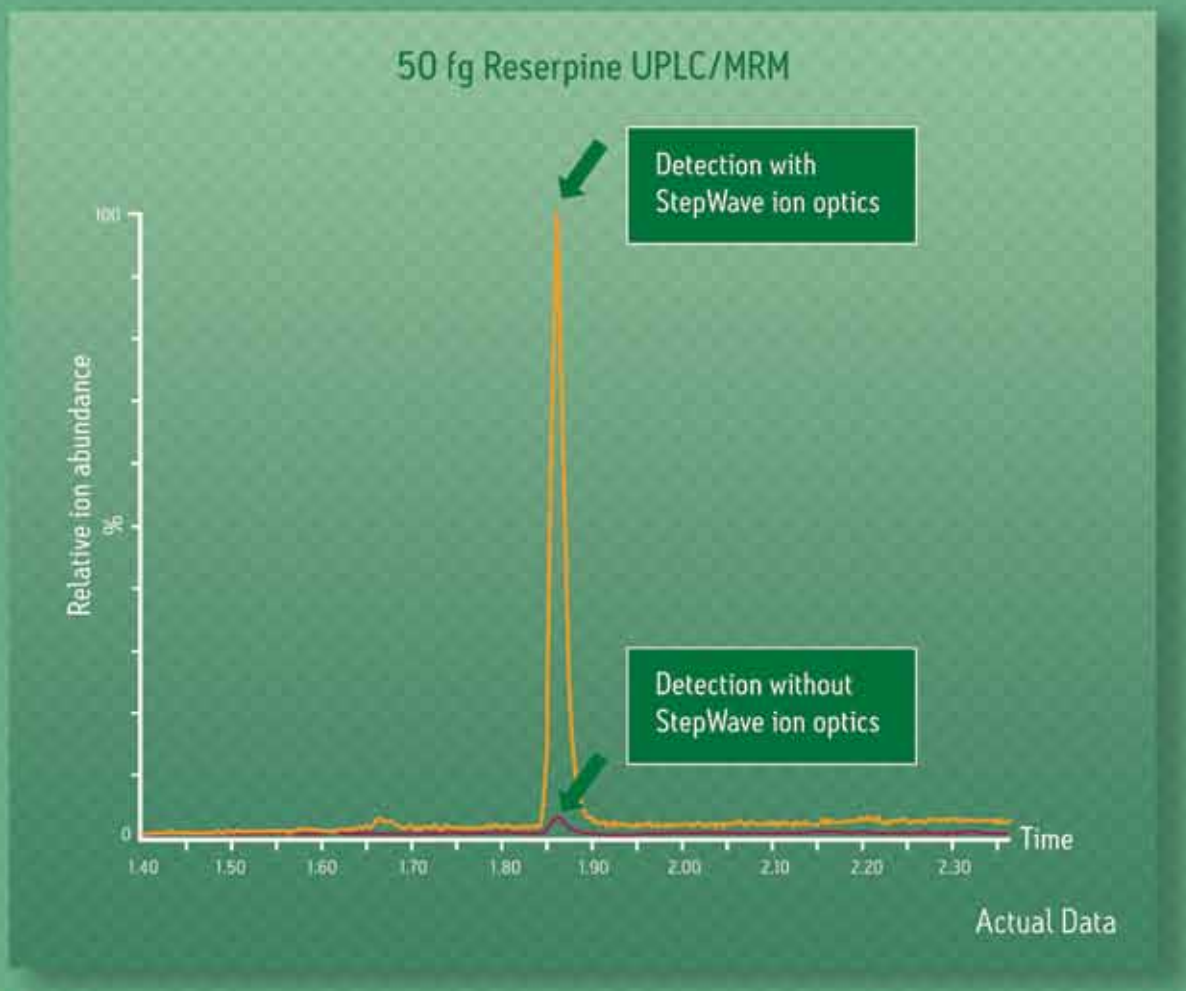
> "The 2013 survey saw a slight weakening in perceived business conditions compared with the 2012 results."

The following table breaks down respondents by type of organization.

ORGANIZATION TYPE	%
University/College Research Lab	33
Industry Research Lab	24
Hospital/Medical Lab	18
Private Research Institution	8
Government Research Lab	6
Contract Research Organization	2
Other	9

[XEVO TQ-S]

You're going to need a bigger graph.



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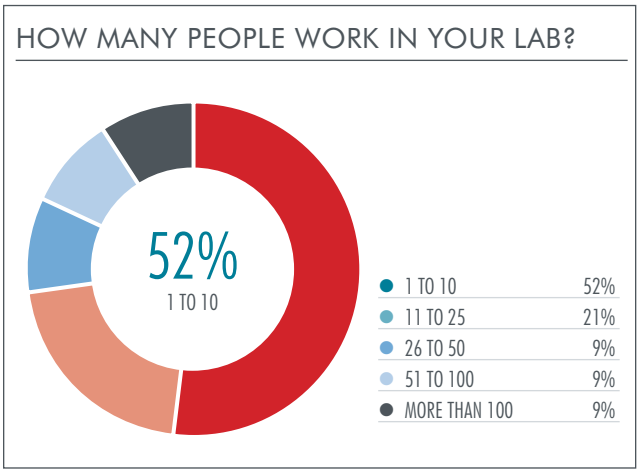
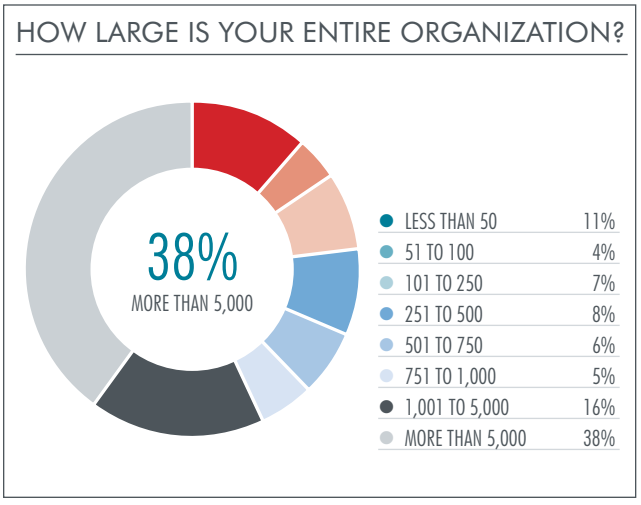
As the following graph shows, 73% of labs have 25 or fewer workers, and 82% have 50 or fewer.

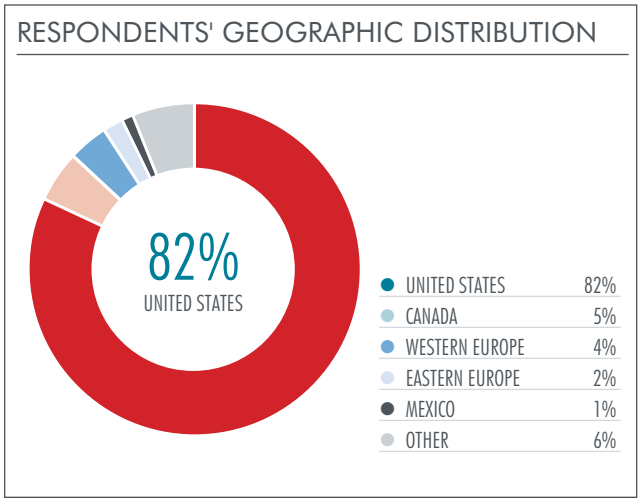


But laboratory personnel is not a pure indicator of organization size, as the following graph shows.



Just 11% of respondents work in companies of fewer than 50 workers, and only 31% work in firms of 500 workers or fewer. A full 38% were located in companies of more than 5,000 employees. Certainly many large organizations have multiple laboratories, but these tend to be relatively small and, it is assumed, dedicated to specific tasks.

Respondents were overwhelmingly located in North America, followed by Europe. Just 6% worked outside these areas.



Business outlook analysis

35,000-foot view

This section reports and analyzes respondent outlooks toward a number of key business activities for 2013, anticipated outlook for 2014, and, where appropriate, compares responses on the 2013 survey with those from the 2012 survey. The first several questions are generic.

How would you assess present general business conditions (4th quarter of current year) in your lab compared to a year ago (4th quarter last year)?

	2013	2012
Better	28%	32%
Worse	26%	21%
Same	42%	39%
Don't know/Not applicable	4%	9%

The 2013 survey saw a slight weakening in perceived business conditions compared with the 2012 results. In both years, nearly half felt the business climate was unchanged or were unsure.

How do you think general business conditions in your lab will be one year from now?

	2013	2012
Better	35%	40%
Worse	19%	16%
Same	37%	34%
Don't know/Not applicable	8%	10%

Similarly, slightly fewer respondents in 2013 than in 2012 were optimistic that the outlook in their labs would improve over the following year, and slightly more believed their situation would deteriorate.

Do you feel that U.S. government sequestration will negatively affect your lab's funding during 2014?

Yes	43%
No	33%
Don't know	24%

Respondents were asked whether they believed that government "sequestration"—forced budget cuts—would negatively affect their labs during the coming year. This question was not asked in 2012, but the results from 2013 may, to a significant degree, explain the erosion in confidence compared with 2012.

One would expect from the responses to the "lab type" question that just 6% of labs would be directly affected by sequestration. However, any lab that receives contract work from the government or is funded through any of the large granting agencies (NIH, NSF, NASA, etc.) could potentially suffer as well. Still, the effects of sequestration may be more a matter of perception than fact. Sequestration did not cut actual spending but only the growth in spending. Regardless, this perception and perhaps fear of government shutdowns appear to be real phenomena for many laboratory managers.

The lack of optimism regarding general lab operations and expectations was reflected in the more detailed questions on specific topics related to investment, purchasing, hiring, budgeting, and outsourcing.

Detailed questions and responses

Analysis methodology

The remaining questions in the survey solicited much more detailed information on specific aspects of a lab's business. The questions alternated between asking for next-year (2014) predictions and previous-year comparisons. Responses were graded on a scale of 1 through 7, where 1 was the least optimistic or confident and 7 the most optimistic.

In assessing respondents' outlooks, the "don't know" and neutral answers were omitted. Then the negative assessments (very negative to mildly negative) were tallied and compared with the cumulative percentages from the added optimistic responses (mildly positive to very positive).

The first question asked participants to rate their level of confidence for the coming year in six categories related to funding and research investments: general business conditions, company financial status, staffing, equipment purchases, outsourcing, and long-term outlook.

When all responses were taken cumulatively and averaged, 30% indicated optimism, while 42% did not. Twenty-six percent gave either a neutral response or indicated they did not know. For no category did optimism exceed pessimism. By far the most negative result was for "business conditions will improve to support or attract significant research investments," with 28% indicating optimism and 41% pessimism. This represented a decline from the same question asked in 2012, where 33% were optimistic and just over 34% were not.

The next question related to research budgets in 2013 compared with the previous year. The categories consisted of commodity and consumable equipment; lab construction, refurbishment, and new lab setup; education and training; funding for new and existing projects; investment in "new lab technology"; compensation and benefits; outsourced services; and raw materials.

The average for all categories combined does not present a bright picture. Thirty-seven percent of respondents indicated that spending had decreased, while just 17% reported increases. This section was not without its bright spots, but first the bad news. The budgets for hiring new staff decreased for 51% of responding labs and

increased for only 15%. As expected, 42% of those surveyed noted a decrease in compensation versus an increase for 12%. The numbers for new construction (49% decrease, 21% increase) and lab modernization (48% decrease, 16% increase) were similarly unpromising.

Comparing these figures to those from 2012 suggests a slight erosion in confidence. For construction 37% saw a decrease and 23% an increase. Decrease/increase tallies for lab modernization were 41%/29% and for staffing 44%/27%.

"Most negativity appears related to the macroeconomic and political outlooks for the U.S. as a whole."

On the positive side, 78% of respondents reported that budgets for commodity and consumable items such as filters, glassware, and protective gloves decreased only slightly, remained flat, or increased slightly. This same trend was noted in last year's survey: if a lab is to remain in business, these are must-have items.

Understandably, this muted optimism spilled over into the category for raw materials. Seventy-three percent of 2013 respondents suggested that spending on chemicals, reagents, etc., was approximately the same as in the previous year. The outliers are even more promising, with 23% reporting that budgets for these items had decreased, while 29% saw increases.

Again, this represents a slight slide in confidence for this category. In the 2012 survey 23% noted a decrease in raw materials purchases, while more than 35% reported an increase.

The other significant category was posed as "new and pre-owned lab technology." Sixty percent of respondents indicated more or less the status quo from the previous year. However, 36% noted a decrease versus 20% reporting an increase. These figures were down from 2012 (31% decrease, 34% increase).

It is perhaps to be expected, in light of budget cuts for personnel, infrastructure, and instrumentation, that outsourcing would fare somewhat better, but this was not so. Thirty-one percent of respondents indicated less funding for outsourcing services, while 20% reported increases. The numbers from 2012 suggest a slight uptick in this category: 35% decrease, 22% increase.

Looking ahead

The final survey question reprised many of the early questions, but here the focus was on expectations for the year ahead, 2014. Specifically, respondents were asked, "In the coming year (2014), how do you think your lab's 2013 research budget for each of the following areas will change?" Responses ranged from values of 1 (decrease significantly) to 7 (increase significantly).

Eleven categories were presented: commodity equipment, construction, education/training, funding for new research projects, new staff hires, investment in existing research projects, investment in lab "technology," worker compensation, lab modernization, outsourced services, and raw materials. The instrumentation/equipment categories were further broken down to basic equipment (e.g., stirrers), lab automation, biological reagents, software, and lab furniture, for a total of 16 categories.

The average values for optimistic versus pessimistic responses were predictable. Many other studies have shown that present conditions are the single most important factor in predicting the

future. Nevertheless, average expectation was skewed toward less optimism. While 63% of respondents believed the 2014 outlook would be similar to that of 2013, the upper and lower ends of the confidence spectrum told a different story—one could say the whole story. Thirty-eight percent believed overall budgets would fall further in 2014, while 21% bet on increases.

The following table summarizes the results. Note that column three compares the outlook in the 2013 survey to that in the 2012 survey, with improved (↑), same (=), or worse (↓).

EXPECTATION LEVEL FOR 2014	SPENDING CATEGORY	COMP. WITH 2012
Increase slightly	Chemicals, reagents, buffers	=
	Raw materials	=
The same	Commodity and consumable equipment	↓
Decrease slightly	Antibodies, RNA, Microarrays, PCR, etc.	=
	Software	=
	Basic lab equipment	=
	Investment in existing lab projects	↓
	Funding for new research	=
Decrease significantly	Lab furniture	=
	Automation	=
	Analytical instruments	=
	Outsourced services	=
	New staff hires	=
	Education, training	↓
Decrease very significantly	Lab modernization, renovation	↓
	Staff compensation	↓
	Investment in new/used lab technology	↓
	Construction, new lab facilities	=

Of the 16 categories for which respondents were asked to predict budgeting during 2014, 12 (three-quarters) remained unchanged from the previous year's survey. That is to say, respondents were equally as optimistic or pessimistic for the upcoming year as were respondents in 2012.

Based on responses to previous questions, the persistent pessimism about lab renovation, investment in new technology, and compensation was expected. On the positive side, confidence in funding for new facilities, while still low (see above), did not deteriorate from 2012 levels. What was surprising was the outlook for funding for education and training.

In the 2013 survey 37% of respondents believed such funding would fall during the year ahead, while 21% believed it would rise. The figures from 2012, 32% decrease and 28% increase, suggest a deterioration of confidence for this category. This might be attributable to sharply lower expectations for compensation and hiring, the other two human resource categories.

The difference between 2013 and 2012 expectations for consumables and existing lab project funding was slight and probably not meaningful. Still, it suggests that respondents are at least somewhat apprehensive, relative to a year ago, about their labs' ability to retain business.

Why the doom and gloom?

The business outlook for 2014 shows a persistent lack of optimism, a trend that has become familiar over the past several annual surveys. Most negativity appears related to the macroeconomic and political outlooks for the U.S. as a whole.

Repercussions from the financial meltdown of 2007-2008 have not yet fully abated. Consumer confidence has

barely returned to the *low* levels of previous recessions, so it is not surprising that feelings of gloom and doom spill over into the business world.

"Repercussions from the financial meltdown of 2007-2008 have not yet fully abated."

Unemployment remains unacceptably high and labor force participation the lowest in 30 years. Laboratory managers and workers see, read about, and, in many instances, experience this every day. The downgrades in lab worker skills and education levels represent a well-known, long-term phenomenon through which higher-paid employees are replaced by those with less experience. This trend will continue to push down compensation expectations in the future as labs continue to seek greater cost savings. The silver lining here is that workers are sometimes but not always replaced by instruments.

A surprisingly high percentage of respondents, 43%, believe that government sequestration will hurt them. Whether these fears are grounded in fact or emotion is irrelevant, as they negatively affect outlook across the board. As one respondent commented, "My lab is directly funded by the NIH. No grant? No lab. Sequestration will kill my entire core."

The systemic pessimism among lab managers and workers will not resolve overnight. It reflects a contraction in many laboratory sectors that will probably not reverse until some equilibrium point is reached and the economy as a whole is restored to vibrancy.

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

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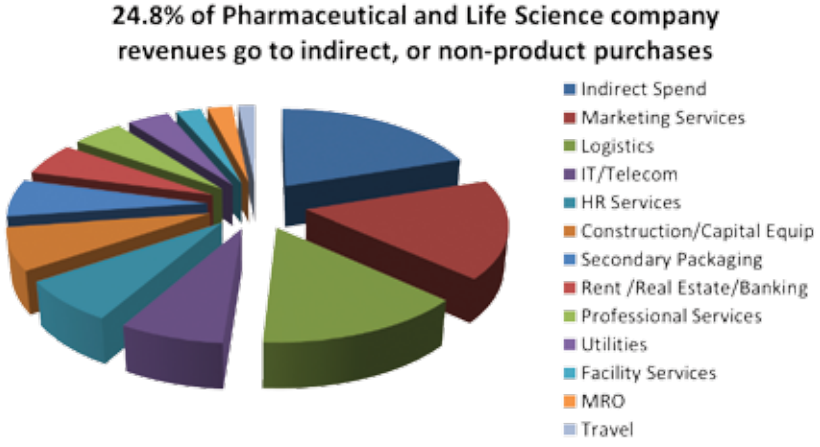
GETTING THE BEST VALUE FOR YOUR PROCUREMENT DOLLARS

by Paul McMinn

My computer sounded the familiar Outlook calendar alarm for an upcoming web conference call that was scheduled for the next hour, and I glanced again at the agenda and attendees with my notes in the margin from a week ago when I'd printed the meeting invitation. For a pre-RFP orientation call for an indirect procurement category such as lab supplies and equipment, my eyes followed down the list of participants of this global company; I saw it was represented by procurement directors from the various divisions and a steering committee comprised of the North American director (whose share of the global spend was greatest) and two team members from finance and accounts payable in addition to the project lead category manager. Under this list of client attendees, I penciled in "lab manager" with a circle and question mark. I knew there was a mix of quality control functions as well as research and development, which are typical. However, for a company this size, with a lab consumables, equipment, and reagent spend close to $10 million a year, the lack of representation from the user community was eclipsed only by the information introduced during the call that the category manager for office supplies had just been assigned to the team and had no experience with lab supplies.

Many would have found this surprising as recently as ten years ago, but in the current economic climate this is a pattern that has become all too familiar. Corporate downsizing has taken a toll in many organizations, especially in areas such as procurement, regarded historically as a cost center. With continued economic uncertainty and instability, companies are continually looking for ways to add to growth and contain costs to sustain growth. While indirect spend can require as much as 20 to 40 percent of an organization's revenue, for a typical pharmaceutical or life science company it is about 25 percent of total revenue, making the savings opportunity for cost containment in this area potentially significant.



The challenges in deriving savings are often part of the organizational culture because many indirect spend categories are managed at the departmental level (e.g., lab supplies managed by R&D in the pharma sector) versus a procurement function reporting up through finance. Finance may not have the degree of control for directing spend in a life science company, and conversely, a lab manager's budget and concerns may often be lost in a top-down finance-driven culture. Add to this mix the natural complexities of the lab supply category as a component of indirect spend that is often highly fragmented across business units with disparate terms and conditions and a lack of current market intelligence,

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given that the buying organization is focused on the contractual agreements only every three to five years. It's not uncommon for the next contract renewal to have a totally different team in place, with some institutional knowledge lost through attrition, reorganization, or downsizing, which all work against the buying organization's competitive posture.

"Corporate downsizing has taken a toll in many organizations, especially in areas such as procurement, regarded historically as a cost center."

Procurian, an Accenture company, refers to this as "information asymmetry" when describing the lack of uniform market intelligence for each category class. The days when procurement had deep domain experience in each category sector are largely gone, as it is no longer economically feasible to maintain that level of expertise indefinitely, and as organizations lose much of this unique knowledge base in procurement, the gap can be filled in a variety of ways for many organizations.

Outsourcing

While many of us are familiar with outsourcing as a concept, perhaps it impacts us only in small ways, such as IT support for a software product or any number of service provider call centers where support roles have been outsourced to contract firms. When it comes to procurement functions and support for the lab professional, many organizations have not made that leap, although there is a strong service segment of organizations expanding to provide those services as an outgrowth of business process outsourcing (BPO). In today's market, there has not been much movement within the lab and research community to outsource this function, with the notable exception of third-party vendors, also referred to as "tail spend." For indirect segments such as core lab supplies and equipment that are often integral to product development and QC processes, many companies would benefit by looking internally to fill those roles on a project basis and designating not only a functional resource in procurement but also a technical resource. The technical person understands the products and their applications for QC and research and can provide the cross-functional team support needed not only to fill the shortfalls in the knowledge base but also to provide ongoing program support to identify savings opportunities that need to be validated and implemented at the user level. Let's take a look at that process today, with a view toward identifying potential roles and contributions by the lab manager in a matrix structure.

The current state

At a fundamental level, both lab managers and procurement professionals want to ensure that they are getting the best value for their procurement dollars and approach this process through a Request for Proposal, or "RFP," process. Capital equipment (more than $5,000) is typically excluded, as this is often addressed through a bid process. Traditionally, procurement may survey its lab managers for their top spend items, or, if their systems can provide the data, an annual market basket of goods or a "hot list" may be derived based on the Pareto

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principle. The hot list typically has fixed pricing for some period of time, which provides some degree of cost control, and a separate discount schedule is added to address "spot buys" with a discount from a price list. Items purchased from "all other" lab supply vendors may fall into the third-party or tail spend domain. Because the buying organization has no concentration of spend in this category, the leverage is limited and spend is optimized for the best terms and conditions offered. This current state is typically comprised of either a primary supplier or distributor for the lab category, a secondary supplier who may be defined, or a combination of both, including regional suppliers that have either unique product offerings or a specialty supplier such as of fine chemicals or biologicals. These buyer-supplier relationships may be formalized with contractual agreements for three to five years or may simply represent price offers with no commitment from either party. Primary contracts or agreements typically have some form of supplier inducement for the buyer to reach an agreed-upon spend threshold or a "loyalty" premium for renewing or agreeing to an extension of an agreement, which will vary depending on the volume of spend.

"Both lab managers and procurement professionals want to ensure that they are getting the best value for their procurement dollars."

The challenges

While the market basket is a key indicator of competitive performance, many organizations lean on it heavily in their award decision process, when, in fact, the Pareto principle falls significantly short of the 80/20 rule, with a natural break in unit spend volume around 55 percent or less for lab supply spend. Coupled with the fact that the delta from competing suppliers on a weighted market basket analysis is typically less than 3 percent and often less than 1.5 percent, we begin to see the limitation of the Pareto analysis in this spend segment highlighted by the lack of market information and widening market intelligence gaps between suppliers and buyers today. Given the fact that the 55 percent market basket analysis is typically inconclusive, the next question is how the remaining 45 percent of the category spend is evaluated. Because the cost of change is most certainly more than 3 percent, it falls to the supplier to clearly demonstrate the value provided in other areas that tend to be more subjective from a buyer's perspective. Projected financial savings that meet CFO guidelines typically fall short due to inability to adequately quantify the savings and to the resource constraints by procurement, finance, and the lab user community they serve to track and drive programs and initiatives successfully to reduce costs. In the scenario above, most organizations may include a supplier scorecard for quality issues and an end-user survey of the incumbent supplier with a list of corrective actions, even a comparison of terms and conditions and payment terms, but most buying organizations would not make a change based on this limited analysis. AT Kearney did a survey in 2010 of procurement organizations and found that "less than half include compliance management metrics such as spend integrity or accuracy and supplier commitments, scorecards, and reviews. This data, of course, helps the realization and sustainability of identified benefits and also informs future supplier selection and negotiations."

The path forward

Ed Cross of Xchanging Procurement Services and Peter Smith of Spend Matters have identified what they call a third "key foundational stone" that adds to the strategic sourcing and category management function with a program and delivery discipline in tracking these proposed initiatives and the actual deliverables of savings programs in conjunction with supplier resources. Given the complexity of the lab category and the importance of user participation and adoption of these programs, the lab manager is best positioned from a skill set perspective to lead this effort in a matrix role as a bridge from the R&D/QC/production environment to the procurement and finance function as a business manager to drive the success of viable savings initiatives that today don't occur for lack of resource allocation. At a minimum, lab managers should take an active role in representation or participation in these steering committees and teams. Doing so would ensure that their interests are represented and they have a working

knowledge of the key business and market drivers that affect the value they receive from these agreements and their impact on the financial health of their organizations. The lab market will continue to consolidate, and the question you should ask as a lab manager is how your cost center and organization will be impacted. What pilot programs can you envision or take advantage of in the marketplace that could potentially enhance your department's performance or productivity or provide cost reductions or efficiencies? Many global lab supply agreements are being implemented by buying organizations with director-level resources aligned with the user community where skills such as project management and Six Sigma certification will be the desired tools in your scientific bag. It's the new normal in lab procurement, and the watchword is value.

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***Paul McMinn** is a supply chain and lab market consultant based in Tryon, NC. He may be contacted at pmcminn@isothermal-group.com or by phone at 404-307-0375.*

FROM LAB TO TEAM

FIVE STEPS TO JUMP-START YOUR TEAM FOR SUCCESS

By Cher Holton, PhD

Does teamwork matter in a laboratory setting? Absolutely! Teamwork contributes to synergy, creativity, enhanced decision-making, customer/client responsiveness, and an engaged, motivated working environment.

In every organization, there are cross-functional teams operating in a lab setting that enjoy a reputation for team performance that outshines other teams in the organization. These teams are not necessarily smarter, more experienced, or even harder working than their peers. However, in their day-to-day activities, they constantly demonstrate a spirit of cooperation and willingness that sets them apart from other teams. How can a cross-functional team enhance its effectiveness as a team?

While time is always at a premium, it is important that a lab team invest time up front to set itself up for a successful experience. Here are five fundamental questions that the lab team needs to answer before it begins working on any projects.

Fundamental Question #1: What is our purpose?

This includes clarifying why this specific group of people has come together in the lab setting as a team and what deliverables or outcomes they will produce. A prerequisite in answering this question is that the team has a shared vision of its purpose. Never assume that any team member automatically knows the purpose for the team.

Fundamental Question #2: How will we operate as a team?

Here the team members determine the key operating behaviors for working together in the lab setting, including how they behave together, handle disagreements, reach consensus, communicate, hold each other accountable, share responsibility and accountability, and determine leadership. While samples of key operating behaviors can be helpful, it is best if each team works together to create its own. The discussions required to create the list is every bit as valuable as the final list itself.

Fundamental Question #3: What are our roles and expectations?

This discussion opens the opportunity for team members to identify the unique skills and abilities that brought them to the lab in the first place. The discussion includes specific roles needed to achieve the agreed-upon results as well as clarification of their preferred styles of working with others.

Fundamental Question #4: What will success look like?

Here the team members share how they will know they have been successful. Together they decide how to measure their outcomes, stay focused, and know when they are done with work on a specific project.

Fundamental Question #5: How will we celebrate and honor team success?

Among the most overlooked keys to successful teams are the recognition and celebration of success. By making time to come together to celebrate things that are going right, a team builds bonds that can see it through difficult situations or testy challenges—plus it strengthens the camaraderie of the team.

When lab teams are working at their best, both the organization and the individuals on the teams benefit! When people understand what is expected and believe they are valued as legitimate team members, they will drive themselves to unbelievable excellence!

Cher Holton, *PhD, is a corporate impact consultant focused on helping leaders and employees "power up their engagement and achieve extraordinary results!" Cher's name is an acronym for her mission: Creating Hope, Enthusiasm, and Results … and she has done just that with corporate, health care, and association clients since starting her business in 1984. She is one of a handful of professionals worldwide who have earned both the Certified Speaking Professional and Certified Management Consultant designations. Check out her books, blog, and programs at www.holtonconsulting.com.*

LABCAST Be sure to attend Cher Holton's Lab Manager Academy webinar, "From Lab to Team: Keys to Powerful Teamwork" on Wednesday, April 2 (or afterward at www.labmanager.com/powerfulteamwork, to watch the archived video).

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WHY CONTINUING EDUCATION MATTERS

By Mark A. Lanfear

Every year it seems the subject of continuing education can creep up on us all. We know we may need it—or want it—but why does it seem we're always doing the last-minute hustle for something that would truly benefit our careers?

In the life sciences in particular, jobs can be demanding. They can come with significant amounts of stress as people work in labs and other environments where the end product or result will likely have huge implications for the safety and health of the general population. It's understandable that the task at hand often takes precedence over other workplace goals.

But continuing education and other types of professional development are investments that both companies and employees must make for themselves. And it's important that both parties realize how important this aspect of the modern workplace has truly become to the future of our workplace culture.

Perhaps most prominently, workers today are demanding more and more perks on the job. But they know that the things they want usually have nothing to do with the more "traditional" perks, such as money.

Workplace surveys, (including the Kelly Global Workforce Index™), in fact, are proving time and time again that money is not the most important factor for many professionals when they are considering where to work. Instead, potential employees today are demanding the opportunity to do meaningful work—whatever that may entail. Often, it has to do with the actual work itself. They just want to know that what they do every day matters.

But they also want the kind of opportunities that will help them move their careers forward. These include the chance to spend time doing on-the-job training. And yes, these also include the chance to take advantage of continuing education that may indeed cut in on their work time but usually will have far-reaching implications for the quality of their work and the future impact they could have on their employer.

For all these reasons, employers today must have at the top of their priority lists training and other continuing education goals for their employees. This doesn't mean that these opportunities need to take precedence over actual work. But employees will truly appreciate the fact that the organizations they work for are taking the time to invest in their knowledge. After all, we already know that the workplace of today and in the future will continually be defined by what kinds of knowledge our workers are bringing to the table. By fostering that knowledge, employers can be assured that their workers will be with them for the long haul and will continue to contribute to important organizational goals.

But, of course, the burden doesn't always have to be on the organization to develop opportunities for continuing education. Employees who care about the jobs they do are just as capable of finding continuing education opportunities for themselves outside the confines of the workplace.

The trick for employers, however, is to foster the kind of environment where workers feel comfortable and empowered to take control in these situations—and where they'll also feel confident that if they suggest going to a conference or other continuing education activity, it will be heard by their supervisors.

Fostering this kind of environment will better help employees feel personal responsibility for their own professional development. And it will assure organizations that their employees care just as much about advancing the organization's cause as do the top stakeholders who are running the company.

Whatever you want to call it—continuing education, professional development, training—it's all critical in today's workplace. Knowledge is power. The sooner you and your employees get on board with increasing your knowledge, the sooner your power will soar.

Mark Lanfear *is a global practice leader for the life science vertical at Kelly Services, a leader in providing workforce solutions. He has operated clinical trials around the world for almost two decades. In addition, Mark is a featured speaker at many life science industry conferences and a writer for life science periodicals. He can be reached at MARL773@kellyservices.com or 248-244-4361.*

CUSTOMIZED TRAINING

THE RIGHT EMPLOYEE TRAINING AT THE RIGHT TIME PROVIDES BIG PAYOFFS

by Sara Goudarzi

Equipped for testing, analysis, and study, the laboratory is full of technologies and setups that require both initial instruction and ongoing training. In addition to possessing foundational knowledge in their fields, successful laboratory professionals contribute to their disciplines by keeping up with methodology and technology through regular training and education, both inside and outside their organizations.

Most effective lab managers, no matter the specific field, understand the need for continuing education and work through budgetary and time constraints to provide the required opportunities for their staff to grow.

"Our laboratory work supports the hazardous waste treatment operation of our facilities, and training is an important aspect that enables us to perform our job at the highest possible standard," says William Fornoff, laboratory manager at Clean Harbors Environmental Services in Maryland. "Safety and compliance training are critical and consistently apply to everything we do in the lab."

> "Although it is a necessary ingredient for growth, it's not always easy to fit training into laboratory schedules and budgets."

Regulated by the Occupational Safety & Health Administration (OSHA) and the Resource Conservation and Recovery Act (RCRA), the staff at Clean Harbors is trained to manage its labs in accordance with the guidelines of the overseeing federal agencies.

"This includes chemical hygiene and the management and disposal of hazardous laboratory chemicals," Fornoff says. "It is important for a new lab chemist to come into the lab having a foundational knowledge of chemistry, a familiarity [with] laboratory practices, and a willingness to be taught. [However,] consistent training creates an overall culture of safety and compliance in the laboratory where we look out for each other, bring up issues, and work to resolve them quickly."

Fornoff's outlook on training is not unique. James Cale manages the distributed energy systems integration group at the National Renewable Energy Laboratory (NREL) in Colorado. His laboratory research focuses on new types of distributed energy systems and their controls, such as microgrids and smart grid technologies, and the impact of large-scale distributed resources such as photovoltaic power on the electric grid. To Cale, who manages up to 30 people at a time, training is a necessary aspect of maintaining an effective and thriving group.

His team typically works on 15 to 30 projects simultaneously at any given time. Considering the nature of the work, the staff is required to possess a certain level of scientific and engineering background. NREL provides general safety training, which is required of all employees, but also specific training based on the type of work or laboratories where the employees work.

"There are several ways employees can get training," Cale says. "First, NREL provides a wide variety of optional training beyond the required training. For instance, we have classes that are offered on personal or career development for staff and more targeted management training for managers. We also have regular training on specific business systems at NREL that employees can take as refresher courses or to learn a new skill.

"Second," Cale adds, "employees can take off-site training on specific tools or development skills that they individually request. Third, employees can complete university degree requirements while working at NREL. Some employees enroll in online courses, take courses in the evening at local colleges, or work part time while they pursue their degree."

Training and economy

Although it is a necessary ingredient for growth, it's not always easy to fit training into laboratory schedules and budgets, especially during times when businesses are going through an economic down cycle. However, many managers often understand the potential returns on investing in continuing education.

"If I can convince my executive management that the additional training will result in higher efficiency—meaning lower costs—or provide skills that will attract additional business opportunities above and beyond the cost of the training, then the decision should be clear," Cale says.

In addition, Cale and many others emphasize that some types of training—such as those having to do with safety and health—are essential and must be completed regardless of the budget environment.

"It is critical to reduce injury and stay in compliance with state and federal authorities," Fornoff says. "Prioritizing safety and compliance training ultimately improves the laboratory workplace and increases productivity. This type of training is a top priority."

Managers at times have a tougher time convincing executives to grant their staff budget and time for further education beyond required training. But executives who understand the ever-changing setting of the laboratory business will be more open to the continual training of their staff.

"I understand that there is an initial cost of training in time and resources, but by matching personnel with a certain training subject, a laboratory manager gets a return much greater than the initial investment," Fornoff says.

The continuing education landscape

Luckily for managers and their staff, budgetary and technological changes within the laboratories are often mirrored in training organizations; therefore, those running training organizations have adjusted their programs accordingly.

When the Association of Public Health Laboratories, through a cooperative training program with Centers for Disease Control (CDC) called the National Laboratory Training Network (NLTN), started providing training about 25 years ago, laboratory professionals interested in

receiving training often had to take off more than a day from their normal duties to travel to a location for the class. If they happened to be lucky, the training came to them.

"In the early '90s, we did a lot of road shows, where we would go around to different cities," says Linette Granen, membership and marketing director at the Association of Public Health Laboratories (APHL) in Maryland. "These days it's more expensive to travel and more expensive to get subject matter experts to actually travel, even if they have time to do that."

"We also found that many times the people in the laboratories, even if they had money to go to conferences or to participate in continuing education, couldn't leave because of the staffing of the laboratory," Granen adds.

Granen and others at APHL/NLTN recognized these constraints and responded by providing satellite courses where attendees with satellite dishes could remotely attend classes. They then started providing training through teleconferences—but this type of schooling fell short because attendees did not have access to the visual components presented during classes.

Things changed with the popularization of the Internet in the 2000s. Organizations such as the APHL started offering many more online courses and webinars than traditional sit-in classes. This turned out to have many benefits, the most important of which are the lower cost of a training session and the number of attendees from different labs who can participate in a given session.

"For example," Granen says, "in a webinar we allow an unlimited number of people to sit in and listen and participate and receive training at a site. We also allow that site six months' access to that webinar when it's archived.

"What we found was that many of the people in our audience might have work going on during the exact time that the webinar is being broadcast, so in order to accommodate that, we actually archive every one of our courses and allow anyone from the site to go into the webinar and participate," she adds. "We find that model works very well and that people really like that."

Because of the new technology and models available to trainees, organizations are seeing an overall upward trend in those receiving training.

"I think the numbers are either stabilizing or going up a little, and I think that's because the technology is allowing more labs to participate and is keeping the costs down," Granen says.

Julie D. Collins, training and membership manager at the American Association for Laboratory Accreditation (A2LA) in Maryland, is also seeing an upward trend.

"A2LA has also been very active in increasing the number of training programs available to members, accredited organizations, and the public," she says. "In addition to our traditional public courses, we offer training provided at your location (upon request) as well as webinars and interactive online training programs on a variety of specific subjects," says Collins, whose organization runs approximately 20 public courses all over the U.S. and some 50 to 75 on-site trainings per year.

> "Executives who understand the ever-changing setting of the laboratory business will be more open to the continual training of their staff."

The right way to train

In most cases, the goals of managers and trainers are the same when it comes to continuing education for lab professionals: to find a means to provide laboratory professionals with the necessary preparation to excel in their work. The key is to ensure that individuals seek and receive targeted education that will advance the overarching goal of the lab team.

"I have had staff [who] wanted to take multiple personal development training courses, but I encouraged them to focus on the skills they most wanted to enhance, [because] from a management perspective I have to ensure that people aren't taking training for training's sake," Cale says.

"For motivated staff who take their career development seriously, there have been great opportunities to advance their career and have a positive impact on the lab's work," he adds. "For instance, I had an employee who recently took an off-site, three-day course on project management fundamentals in support of her goal of becoming a certified project management professional (PMP)."

Fornoff also believes that focused training is imperative—both for the individual and for the organization.

"By knowing your staff, their strengths and weaknesses, you can target training and education that will benefit them and the overall laboratory workplace," he says.

Continuous learning could also come from sources within the laboratory or an organization. For example, at Clean Harbors laboratories, management follows up on safety and compliance training with weekly discussions. Staffs at different sites also share training information online.

"To connect the many Clean Harbors laboratories, we have a Laboratory Share Point site that is populated with training tools and a discussion board," Fornoff says.

Also, some instrument manufacturers and laboratory supply companies offer local information sessions. Many of their websites offer training in the form of literature, videos, and web-based seminars as well.

"I also like to foster mentoring in the lab," Fornoff says. "This type of training offers many benefits over book training, as it opens up the nuances of an instrument or a methodology."

At the end of the day, many managers believe that receiving training and continuing education is the responsibility of the individual laboratory professional and should match with his or her short- and long-term goals. Relaying these goals to the correct management individuals will allow those in charge to help marry the organization and staff objectives.

"The best way for employees to receive training—especially off-site training—is to make it part of their annual goal setting with their manager," Cale says. "If we both agree that it will enhance your contribution to the laboratory and have a positive impact on your career development, that sets the stage for me to not only support your request but [also] make a case to my management on why you need the training."

Sara Goudarzi *is a freelance writer based in New York City. Her website is www.saragoudarzi.com.*

QUALITY BY DESIGN

A SEAMLESS CONNECTION BETWEEN THE LABORATORY, PROCESS DEVELOPMENT, AND MANUFACTURING

by Zenaida Otero Gephardt, PhD, PE

Quality by Design (QbD) refers to the strategies developed and advanced by the US Food and Drug Administration, the International Conference on Harmonisation (ICH), and the United States Pharmacopeia (USP),[1-5] based on scientific principles and risk assessment and focused on product and process understanding. QbD relies heavily on scientific and engineering statistical methods, including design of experiments (DOE) and risk assessment techniques. It is based on the concept that quality cannot be tested into products but should be built in by design. QbD has its origins in product development and manufacturing. However, it has significant benefits for the laboratory. QbD can enhance the efficacy, robustness (tolerance to small changes in operating conditions), and ruggedness (sample test reproducibility for different standard test conditions—different analysts or instruments) of laboratory methods. QbD product development and manufacturing processes are highly dependent on optimized, reproducible, and accurate laboratory methods. QbD processes will not yield maximum benefits to industry and customers without a strong QbD presence in the laboratory.

> "[QbD] is based on the concept that quality cannot be tested into products but should be built in by design."

QbD has received most attention in pharmaceutical product development and manufacturing, to a large extent because QbD can significantly improve both business and regulatory models. On the business side, QbD improves product design, decreases manufacturing problems, and results in fewer manufacturing supplements for post-approval changes and less regulatory scrutiny for new technology implementation. It also reduces cost, waste, and deficiencies and yields faster approvals. From a technical standpoint, QbD results in enhanced product and process understanding, including the interactions among ingredients and process conditions. This understanding yields higher-quality, more effective, and safer products.

On the regulatory side, QbD improves coordination in review, compliance, and inspection and results in more useful information in regulatory submissions. This leads to more consistency, flexibility, and improved review quality. These improvements benefit regulators who must review large amounts of data and documentation. QbD ensures that science is integrated in multidisciplinary decision making, which is more efficient for regulators than relying on empirical information alone. Finally, QbD allows for the allocation of resources according to risk, and that is good for business, regulators, and, most important, customers.[6-7]

QbD is a scientific, risk-based, holistic approach that results in product conception to commercialization by design. It is helpful to compare standard QbD for product development and manufacturing to QbD for laboratory operations. The most important QbD contribution in processing and in the laboratory is that analyses and resulting decisions are based on statistical data analysis and confidence levels and not simply on the analysis of specific sets of empirical information. Table 1 is a side-by-side comparison of process/manufacturing QbD and QbD for the laboratory. QbD starts with defining a target profile. The critical quality attributes that impact and generate the desired profile are then identified. Risk analysis, identification of the design space, control, and continuous improvement complete

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the process. In the case of process QbD, this framework allows for concurrent process and product design and development and manufacturing optimization to obtain a predetermined product quality. The analytical laboratory plays a key role throughout all phases of QbD, and it is an essential partner in the control strategy and continuous improvement of a QbD manufacturing process. QbD components with examples of implementation for laboratory methods are detailed below.

Action	Manufacturing Process QbD	Laboratory QbD
Define	Target Product Profile	Target Method Performance
Establish	Critical Quality Attributes (pCQAs)	Method Critical Quality Attributes (mCQAs)
Conduct	Risk Assessment	Risk Assessment
Develop and Verify	Design Space	Method Design Space
Implement	Control Strategy	Control Strategy
Conduct	Continuous Improvement	Continuous Improvement

▲ *Table 1: Manufacturing Process and Laboratory QbD Phases.*

Target Product Profile (TPP)

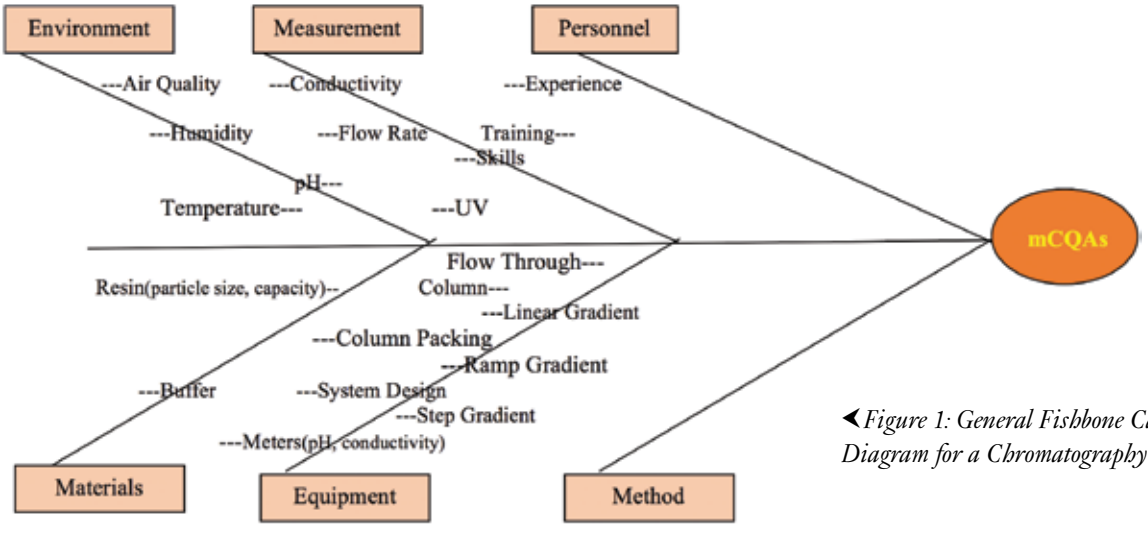
This summarizes the features of an intended product. It provides the structure for an efficient product development program and includes all relevant technical and scientific information necessary for product development and commercialization.

Target Method Performance (TMP)

These criteria must be met by a method. Method performance criteria are derived from product-critical quality attributes (CQAs), as defined below, and must be clearly specified and understood. The required precision and sensitivity for a method are established from process specifications and tolerances. Allowable method variability must be specified, and the method must be sufficiently sensitive to the specification limits. It is also important to clearly identify variables to be measured and monitored and the selectivity required among various measurements (for example, impurities). The routine use of laboratory methods is part of TMP. Understanding process decision requirements is critical to the effective routine use of laboratory methods in manufacturing environments. Method precision, sensitivity and selectivity, and intended use are key elements of target method performance.

Process-Critical Quality Attributes (pCQAs) and Method-Critical Quality Attributes (mCQAs)

These attributes potentially affect the efficacy and safety of the product or method. Cause-and-effect diagrams (fishbone or Ishikawa)[8-9] are widely used to identify pCQAs and mCQAs. Figure 1 illustrates a fishbone diagram for a chromatography method. In the figure, the cause categories are listed as measurement, personnel, environment, equipment, method, and materials. Each variable listed can impact the critical quality attributes of the measurement. Variables most likely to directly impact results are listed on the



◀ *Figure 1: General Fishbone Cause-and-Effect Diagram for a Chromatography Method.*

primary branches, as shown in Figure 1. Variables with secondary impact can be listed on secondary branches ancillary to primary branches. It is also possible to further classify variables as factors to be controlled (C), noise (N), or experimental parameters (X), the acceptable ranges of which need to be determined. The CNX classification helps focus experimentation. Understanding of CQAs evolves as the process or laboratory method is developed and during manufacturing or routine laboratory method use. Understanding of CQAs early in process or laboratory method development has many benefits. Design of experiments, typically employed in the determination of the design space, as highlighted below, can provide guidance in the final steps of CQA identification. Screening experimental designs such as Plackett-Burman[10] can follow a fishbone analysis to identify mCQAs and pCQAs. As part of initial studies, screening designs can be used to pinpoint statistically significant factors from those identified through a fishbone analysis with a minimum of experimentation.

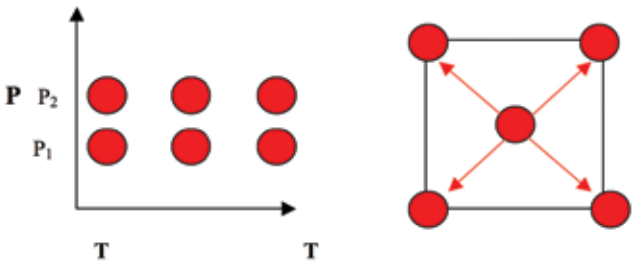
Risk assessment

This is a quantitative analysis of risk associated with products, processes, and laboratory methods. Failure mode effect analysis (FMEA)[6-8] is widely used to quantify risk in processes and in the laboratory. FMEA includes a list of all possible failures and their consequences. Risk for each failure is quantified by a risk priority number, which is the product of the assessed probability of failure occurrence, failure severity (impact on product efficacy and safety), and the detectability of the failure. Assigning values to these three factors is a team exercise and involves some qualitative judgment. A very important part of FMEA is specification of corrective actions for each possible failure. The FMEA team should include members with significant experience with the operation or product under review or similar operations or products. Knowledge bases and databases for processes and laboratory methods can enhance the efficacy of the FMEA team and improve analysis and resulting decisions. Priority matrices can also be helpful risk assessment tools.

Design space

This range of process inputs helps ensure the output of desired product quality. The design space establishes process ranges for variables. Design of experiments (DOE) is often used to identify the design space.[6,8,10] Processes then operate within the design space. DOE consists of a wide range of techniques to investigate process conditions that yield product of the desired efficacy and safety. DOE techniques involve changing more than one variable at a time. Figures 2a and b illustrate the difference

between experimentation varying one variable at a time (one factor at a time: OFAAT) and DOE for a two-variable experiment. Figure 2a shows six experimental conditions holding pressure constant (P_1 and P_2) and varying temperature. Figure 2b depicts a two-variable DOE factorial design.



▲ *Figure 2: Two-Variable Experiment—(a) One Factor at a Time, (b) Two-Level Factorial with Center Point.*

Experiments conducted at the corner points (circles on Figure 2b) and at the center compose a two-factor, two-level factorial design (2^2) with a center point. Experimental designs have been developed for every phase of experimentation, from the screening designs discussed above, useful in identifying significant variables from a large number of potential considerations, to highly optimized designs for complex, highly nonlinear systems. Current USFDA initiatives are designed with significantly less regulatory oversight for process changes made within a QbD design space.[3] Thus, in addition to optimizing processes and products, QbD has the potential to optimize regulatory operations for industry as well as for regulators. Among the many benefits of DOE are increased efficiency in experimentation (fewer experiments), the simultaneous and clear identification of variable effects and their interactions on the output, the analysis-ready data that allows for better conclusions, and accurate models for confidence levels established by process requirements.

Method design space

Method design space can be developed using DOE methods, as is the case for processes. In the laboratory, it is simpler to separate nuisance (noise) factors from method variables. Noise factors can be minimized independently using robustness analysis by varying noise factors to elucidate potential problems.

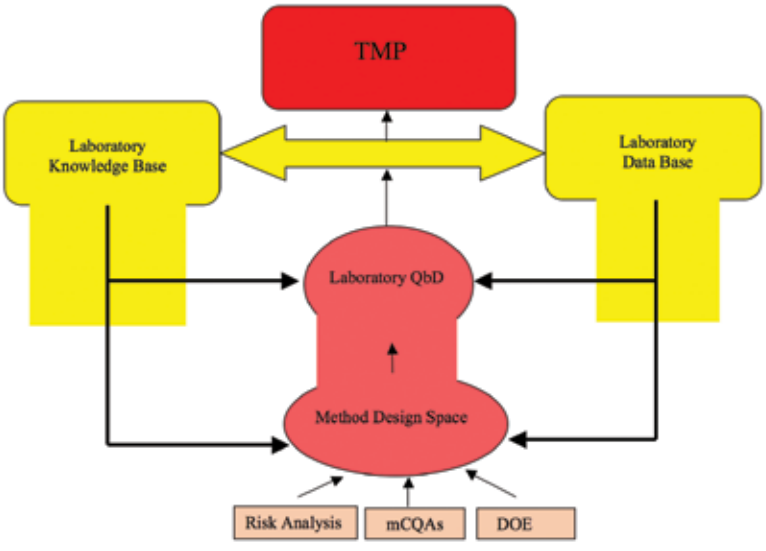
Control strategy and continuous improvement

Process monitoring, meeting target product profiles and process specifications, and introduction of technology and process improvements are critical to process safety, efficacy, and profitability. Analytical methods are key elements throughout the QbD process and are essential to the control strategy and continuous improvement phases. A significant process analytical technology (PAT) component is often part of QbD manufacturing processes. Sensors and measurements monitoring continuous or semi-continuous processes allow for real-time

> "Laboratory QbD can create a seamless connection between laboratory, process development, and manufacturing."

or near real-time adjustments that can yield the desired product profile at every process stage. Similarly, control and continuous improvement must be part of laboratory methods and general laboratory operations. The QbD

▼ *Figure 3: Laboratory Quality by Design (QbD) Map.*



systematic approach makes control and continuous improvement routine and ensures that laboratory methods yield their TMP.

Laboratory QbD, as depicted in Figure 3, can create a seamless connection between laboratory, process development, and manufacturing. This connection is the foundation for control, continuous improvement, and enhanced understanding of all CQAs. Laboratory QbD includes statistical tools and methodologies that optimize methods and develop method-specific databases and knowledge bases. Results obtained for specific methods can provide insight for other methods and products. QbD-developed methods lead to fewer out-of-specification results, shorter turnaround times, more robust measurements, and more efficient technology and knowledge transfer. Continuous improvement is a hallmark of QbD. The databases and knowledge bases result in a more productive, flexible, and innovative environment. In addition, the nature of QbD fosters multidisciplinary collaborations, engendering a team approach to problem solving that enhances links between laboratory work, process/product development, and manufacturing.

QbD in the analytical laboratory can optimize laboratory operations and support 21st-century manufacturing. It requires a common language and industrial commitment to provide the necessary training for laboratory personnel to develop QbD skills. QbD methodology is not simply analytical technology transfer and ICH validation. It is a risk assessment–based scientific approach that results in method improvements from internal controls and method changes for analyses leading to improved target method performance and efficiency with regulatory flexibility and simplification.

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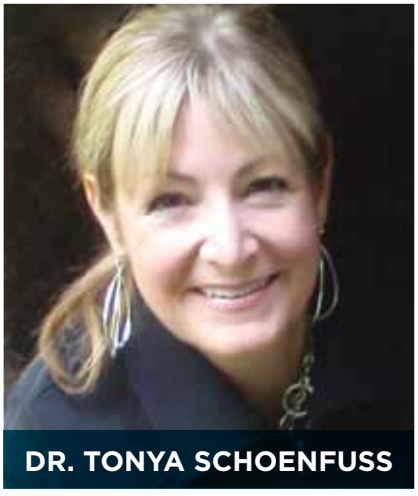
Zenaida Otero Gephardt, *PhD, PE, can be reached at gephardtzo@rowan.edu or by phone at 856-256-5314.*

PROTEIN ANALYSIS

COMPARING KJELDAHL, DUMAS, AND NEAR-IR

by Tanuja Koppal, PhD

WILLIAM H. ICKES



DR. TONYA SCHOENFUSS

In October 2013, *Lab Manager*, along with BUCHI Corporation, hosted a Product Spotlight webinar to discuss the various techniques that are in use for protein analysis. William Ickes, product specialist for Kjeldahl and Dumas at BUCHI Corporation, explained the workings of Kjeldahl, Dumas, and near-infrared (NIR) spectroscopy for protein analysis for various applications and outlined the strengths and weaknesses of each technique. Tonya Schoenfuss PhD, assistant professor in the Department of Food Science and Nutrition at the University of Minnesota, discussed the use of NIR spectroscopy for analyzing proteins in dairy products. Their presentations were followed by a question-and-answer session in which attendees asked questions and received feedback from the two experts. The live webinar was attended by a global audience, with varying levels of expertise and representatives from diverse industries. This event provided them with a unique opportunity to interact with the experts in real time and to seek their guidance and advice on various issues related to the analysis of proteins at different stages of the food process chain. The event was moderated by Tanuja Koppal, PhD, contributing editor for *Lab Manager*. Here are some key topics that were addressed.

What are the analytical challenges that need to be overcome for protein analysis?

ICKES: There are many analytical challenges for measuring protein content in food, feed, and forage in today's modern industries. These challenges include the reliability of the analytical method, compliance with official methods, speed of analysis, sample throughput, unattended operation, variation in sample types, investment, and running costs. The three most important methods for protein determination—Kjeldahl, Dumas, and NIR spectroscopy—can meet the challenges of protein analysis, but the strengths and weaknesses of each technique should be considered according to the demands of the instrument's place in the product life cycle.

What are the pros and cons of some of the existing methodologies available for protein analysis, namely Kjeldahl, Dumas, and NIR spectroscopy?

(See chart below comparing the principles and features of the three techniques.)

Principles and Features

••• Fully applicable
•• Applicable
• Hardly applicable



Solutions:	"Kjeldahl"	"Dumas"	"NIR"
Characteristics			
Range of application	••	•	•••
Variation in sample types	•••	•	••
Automated throughput	••	•••	•
Analysis time per sample	•	••	•••
Reproducibility	•••	•••	• / •• / ••• 1)
Compliance 2)	•••	••	•
Detection of adulterants	•• (NPN)	•• (NPN)	•••
Unattended operation	••	•••	•
No contact with chemicals	•	••	•••
Ingress protection rating	• (IP 20)	• (IP 20)	••• (IP 65)
Low initial costs	•••	••	•
Low running costs	•	•	•••

Chart 1

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HIPAA Patient Safety and Quality Improvement Act of 2005 (Patient Safety Act)

Compatibility:

- PC/MAC
- Tablet
- Smartphone
- Web-based

ICKES: Each technique, whether it be Kjeldahl, Dumas, or NIR spectroscopy, has its pros and cons. The pros of Kjeldahl include a robust technique that has the ability to cope with varying sample matrices, compliance with official methods, a high level of automation, and lower initial costs. The cons include the speed of analysis and use of chemicals for analysis. Dumas has fast analysis time, high throughput, a high level of automation, no use of harmful chemicals, and the ability to quickly reevaluate suspect samples. On the other hand, Dumas has limited ability to cope with sample matrices and to comply with official methods for some sample types, and it has higher initial costs. The advantages of NIR spectroscopy include fast speed of analysis, no use of chemicals, and multicomponent analysis. The disadvantages are its [issues of] compliance with official methods and initial start-up costs.

What are some of the key criteria that determine the best technique that should be used for protein analysis?

(See chart below listing applicability of each technique.)

ICKES: Some of the key criteria that will determine the best technique for protein analysis are determined by where in the product life cycle the analysis will take place and what the data generated will be used for. If the data is used for label claims, then a method such as Kjeldahl may be appropriate because of its compliance with official methods. If the data is to be used to monitor the manufacturing process or to screen incoming goods, then a faster analytical technique such as Dumas or NIR spectroscopy should be considered.

What factors need to be considered when optimizing the technique or method?

ICKES: Some of the factors that should be considered when optimizing a technique or method for protein analysis are the range of protein content in the sample, the homogeneity of the sample matrix, the speed required for analysis to ensure that there are no bottlenecks in the production process, and the analytical accuracy and precision needed for the results.

BUCHI

Applications and Use

••• Fully applicable
•• Applicable
• Hardly applicable

Solutions:	"Kjeldahl"	"Dumas"	"NIR"
Characteristics			
Used for incoming raw materials	•	•	•••
Used for production monitoring	••	••	•••
Used for label claim	•••	••	•
Analysis time per sample	•	••	•••
Compliance [2]	•••	••	•

Chart 2

How would you analyze unknown proteins in your food sample?

ICKES: To analyze unknown protein content in a food sample, Kjeldahl would be the most appropriate method initially because it directly measures the nitrogen content of the amino acids. Two things to consider when analyzing a sample for unknown protein amount are the correction factor for the specific sample type, which is determined by empirical data from amino acid analysis, and any contribution from nonprotein nitrogen, which can be determined by Kjeldahl after the precipitation of the protein with trichloroacetic acid followed by filtration.

What are some of the trends and improvisations taking place in protein analysis?

ICKES: The trend for Kjeldahl analysis of protein is that the technique is still widely used due to its robustness, ability to cope with virtually any sample matrix, and compliance with official methods. There is also a trend toward increasing the use of alternative techniques such as Dumas and NIR spectroscopy, which use less chemicals and have a faster analysis time. With the evolution of the hardware and software of NIR spectroscopy, it continues to be a growing trend for the analysis of protein in food.

What are the challenges associated with sample preparation for NIR spectroscopy?

SCHOENFUSS: NIR spectroscopy is actually a very flexible system—you don't have to have liquids or have to dilute a sample. The challenge is that you need the samples for NIR spectroscopy to

be consistent. You don't want the temperature or particle size to vary. You don't want the thickness of the material in a petri dish or how much you have compressed a paste into the dish to vary. So developing a standard operating procedure for how the sample will be prepared, before you start your calibration work, is very important. You also have to decide on the presentation method, because this can't change either.

What is the effect of particle size and sample color when using NIR spectroscopy for protein analysis?

SCHOENFUSS: In our work, we did not find particle size differences due to the fat in fluid milk to be an issue for quantification of components, which is contrary to what is seen in mid-IR analysis. But for dry ingredients such as flour and grains, it can be very important. Calibrations can even be developed to estimate the particle size of powders using NIR spectroscopy.

Can we determine amino acid profiles or protein ratings using NIR spectroscopy?

SCHOENFUSS: NIR spectroscopy has been used to identify and quantify amino acids, and it is also possible to determine protein ratings.

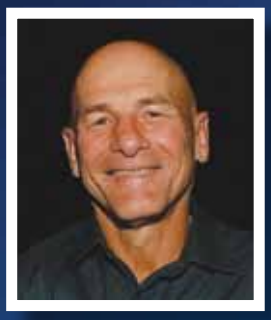
How important is it to use the right standards and calibration methods for protein analysis?

SCHOENFUSS: The quality of a calibration is directly dependent on the quality of your wet chemistry data for protein analysis. So if that data is inaccurate, the calibration will be inaccurate as well.

FOR MORE INFORMATION ON PROTEIN DETERMINATION, VISIT WWW.BUCHI.COM/EN/CONTENT/SOLUTIONS-PROTEIN-DETERMINATION-0 OR WWW.LABMANAGER.COM/PROTEINSPOTLIGHT

William H. Ickes *is currently the product specialist for Kjeldahl and Dumas at BUCHI Corporation in the USA. He is a graduate of Millersville University and has a Bachelor of Science in chemistry and biology. He formerly worked as a pharmaceutical raw materials chemist at Lancaster Laboratories as well as a technical support specialist and service specialist at BUCHI Corporation.*

Dr. Tonya Schoenfuss *is a professor in the Department of Food Science and Nutrition at the University of Minnesota and conducts research on dairy products and ingredients; she also teaches food quality, product development, and dairy product technology classes. She has a BS in dairy science from Cal Poly San Luis Obispo, an MS in food science from Virginia Tech, and a PhD in dairy science from Louisiana State University.*



David Patterson, PhD

ASK THE EXPERT

GETTING YOUR HEAD AROUND BIG DATA

by Tanuja Koppal, PhD

David Patterson, PhD, professor of computer science at the University of California at Berkeley, talks to contributing editor Tanuja Koppal, PhD, about big data—what it is, where it applies, and what lab managers can expect to gain by investing in it. He also provides guidance on where people can get more information about (and help with) big data and the possible concerns they need to be aware of.

Q: What is big data?

A: From a computer science perspective, it's more accurate to call it "unstructured data." Big data is not the pristine data usually found in tables. Unstructured data is the messy, dirty, incomplete data that is collected from a lot of different sources. So the idea is that, rather than throwing away this messy data that does not fit into any relational database, it will be useful to keep it and process the data in nontraditional ways. Big data can often be large databases with terabytes or petabytes of information, but it can also refer to small amounts of information that is hard to process with traditional software tools and relational databases. Big data is often complex, but that has to do with the incompleteness and inconsistency in the data rather than its size.

Q: Why should lab managers care about big data? Does big data impact all labs?

A: Presumably all labs get information from various data sources that they then have to store. So the question is, are they then able to analyze, compare, and correlate those datasets and results, possibly over time, to gain useful insights? The fundamental argument underlying big data is that, if only we have the right tools to process and analyze all the data that we have, then we can get "gold" (from the data) to drive future discoveries.

Q: What can we truly expect to gain if we make all the right investments in big data?

A: It depends on the type of lab. If it's a research lab and you are able to pore through all the data, then big data promises to uncover some behaviors and patterns that would be the indicator of some new phenomenon. If it's a production-oriented lab, then the potential benefit of big data would be to find ways to improve the lab processes by monitoring data from several different processes and machines.

Q: How have you exploited big data in your lab?

A: The work that we do involves processing genetic information for looking at cancer. As computer scientists we are building tools, particularly open source software, that people can use to process the data more accurately and faster. If people suspect that they need to process their unstructured data in new ways to make discoveries, then open source software like MapReduce from Hadoop can help those with no extensive computer science background pore through their data to make interesting insights. The MapReduce framework handles some tasks well, but not others. So to complement it we have built another open source software here at UC Berkeley, called Spark. MapReduce is good for going through all the data in one pass, while Spark is better at iterative processes where you tend to go through the data several times to process it. That's a good way to separate the two programming frameworks.

Q: Is the data processing done in real time, or does the data have to be stored and available in certain formats?

A: There are two approaches here. One is based on processing stored data, while the other is a streaming version. Spark has a standard version for processing stored data, and there is another one for streaming data. But this industry has phenomenal amounts of storage capacity, and it's getting cheaper to store the data. So the hope is that people will store their data and compare it over time, to gain the insights I was alluding to earlier.

Q: Do the users need to be technically proficient, or will some amount of training suffice?

A: It would depend on what they are doing and using now to process their data. The original MapReduce was created by Google to be used by new employees to pore through tons of data, so it was designed to be easy to use. These days there are free online courses available that include tutorials on how to use programs like MapReduce. I would encourage lab managers to review those courses to see if the lab personnel can handle the data processing or if they need to bring in experts. There are also many companies that are now offering commercial support for MapReduce, Spark, and other software.

David Patterson joined the University of California at Berkeley in 1977 after receiving all his degrees from the University of California at Los Angeles. His most successful projects have been Reduced Instruction Set Computers (RISC), Redundant Arrays of Inexpensive Disks (RAID), and Network of Workstations (NOW). All three projects helped lead to multibillion-dollar industries. This research led to many papers and six books, with the best-known book being *Computer Architecture: A Quantitative Approach*, co-authored by John Hennessy, and the most recent book being Engineering Software as a Service, co-authored by Armando Fox. His current research is centered on cancer genomics for UC Berkeley's AMP and ASPIRE Labs. In the past, he served as director of the Parallel Computing Lab (Par Lab), director of the Reliable And Distributed Systems Lab (RAD Lab), chair of UC Berkeley's CS Division, chair of the Computing Research Association (CRA), and president of the Association for Computing Machinery (ACM). This work resulted in 35 honors, some shared with colleagues. His research awards include election to the National Academy of Engineering, the National Academy of Sciences, and the Silicon Valley Engineering Hall of Fame along with being named Fellow of ACM, the Computer History Museum, IEEE, and both AAAS organizations. His teaching honors include the ACM Karlstrom Outstanding Educator Award, the IEEE Mulligan Education Medal, and the UC Berkeley Distinguished Teaching Award. He has also received Distinguished Service Awards from ACM, CRA, and SIGARCH.

Q: What changes need to be implemented in the lab for the correct use of big data?

A: The first thing is to be able to figure out how to correctly and affordably store the data obtained from the various instruments and sources. Then you need to ask how likely you are to go back and do a time series analysis of the data to find new insights. There is no point storing the data if you are not going to be processing it. Next, you need to find out if there are people in your lab who would enjoy writing some programs in these easier programming frameworks to answer some of these questions. The third step would be to try machine-learning algorithms that are intended to go through lots of data and find interesting insights. For instance, it can classify data into different buckets based on its characteristics. So in this way you are increasing the level of sophistication in your data and gaining valuable insights, which will start a positive feedback loop to get you to collect, store, and process more data.

Q: What are some of the concerns associated with big data?

A: Let's talk about data security first. It's one thing to put the data on the Internet as opposed to collecting it in your lab. If you put your data sources out on the Internet, people are likely to discover it, and hence it's usually a good idea to have it all encrypted. You also want to limit the number of people who have access to it. In terms of putting patient information or other types of private data on the Internet, there are strong legal and ethical rules put in place by organizations like HIPAA [the Health Insurance Portability and Accountability Act] and others. Another thing to consider would be storing the data in the cloud rather than on servers in your organization. Companies like Amazon, Google, and Microsoft offer cloud-based computing services, and as a part of that offering they have in place best practices for keeping the data secure. People should always have a back-up plan to store their data in place in case there is an operator accident or a failure of the equipment.

Q: Any advice for lab managers based on your experiences and expertise?

A: Talking to other lab managers and people who are at the cutting edge of the technology to find out what's worked for them would be good for everyone trying something new. In the IT industry there is a lot of enthusiasm around big data because there is the belief that if we mine the data, we can find gold. Many companies, like Walmart, are able to change the way that they are doing business based on the data that they are collecting. So it seems like common sense to be collecting the data that you are generating and mining it to improve your position in the marketplace.

Q: When and how do you come to the realization that big data is not working for you?

A: It's a learning curve. It's not something that you can do in three months and declare that it was a failure. You would need to give yourself at least 18 months to get people trained and get the data collected and processed. There are courses and resources out there to help you learn about the tools and technologies. There are also consultants who can tell you what you need to do. You can start small and relatively cheap. Get a storage system that is relatively cheap or use the cloud, and then look into processing the data. Another idea is to reach out to some students at universities who have the necessary skill sets in computer science or statistics and hire them for the summer to work in your lab, which is a low-risk, low-cost option to get this done.

Hadoop MapReduce is a software framework for easily writing applications that process vast amounts of data (multi-terabyte datasets) in parallel on large clusters (thousands of nodes) of commodity hardware in a reliable, fault-tolerant manner. (Source: Hadoop)

More on MapReduce at http://hadoop.apache.org/docs/stable1/mapred_tutorial.html

Spark is an open source cluster computing system that aims to make data analytics *fast*—both fast to run and fast to write. To run programs faster, Spark provides primitives for in-memory cluster computing: your job can load data into memory and query it repeatedly much quicker than with disk-based systems like Hadoop MapReduce. (Source: AMP Lab, UC, Berkeley)

More on Spark at http://spark.incubator.apache.org/research.html

PREVENTING HPV EXPOSURE

BEGIN BY FOLLOWING DECONTAMINATION SYSTEM MANUFACTURERS' SAFETY PROTOCOLS

by Vince McLeod

In the July 2012 issue of *Lab Manager*, we wrote about hydrogen peroxide vapor systems and basic safety concerns with using this chemical for decontamination. The proliferation of research facilities, particularly healthcare, life sciences and animal care centers, points out the need for environments that are sterile in terms of unwanted diseases and vectors. We have recognized a trend toward using the HPV systems for large-scale decontamination. *VHP Safety Basics*, our initial article, addressed basic operation cycles of hydrogen peroxide vapor systems and discussed the hazards associated with their use, including symptoms of exposure and basic safety precautions. We opened the article with a fictional scenario of an over-exposed technician. This scenario and the article drew the attention of one manufacturer of HPV decontamination systems.[1] Based on the excellent feedback, we decided to issue a second article clarifying a couple of points and providing more discussion and detail on HPV system safety protocols.

Let's start at the beginning. The hydrogen peroxide used in HPV systems is much more concentrated than is the common drugstore product purchased over the counter. Typically, commercially available 30 to 35 percent concentration (w/w) hydrogen peroxide solution is flash evaporated by the HPV equipment and distributed into the area targeted for decontamination. Recommended personal protective equipment (PPE) will depend on whether you are handling the liquid concentrated source chemical, preparing to run the HPV system, or readying the area for re-entry. Follow the manufacturer's recommendations or the safety data sheet for the specific material you are dealing with.[2] In general, handling the concentrated liquid chemical will require specific PPE, to protect against potential splashes, skin contact and inhalation, while re-entering a decontaminated room that has been properly purged might require only standard lab wear such as a lab coat and eye protection. If you have questions, ask to review the safety data sheets, speak with a supervisor or safety professional, and follow the specific safety protocols provided by the manufacturer.

> "Handling the concentrated liquid chemical will require specific PPE, to protect against potential splashes, skin contact and inhalation."

If you will be handling the concentrated form or working in an area recently decontaminated, it is important to know the symptoms of exposure.[3] We mentioned in the first article that hydrogen peroxide is irritating, especially to the mucous membranes of the eyes, nose, throat and pulmonary system. This is what industrial hygienists refer to as warning properties of the chemical or agent. In other words, we can perceive the exposure occurring with our senses. The trouble with hydrogen peroxide is that this "detectable" threshold may vary from person to person, and the personal exposure limit (PEL)—the limit to which a worker can be exposed on

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SAFETY TIP

FORBID SMOKING, EATING AND DRINKING IN THE LABORATORY

By James. A. Kaufman

The practice of forbidding smoking, eating, and drinking in laboratories is one of the basic good hygiene practices. Unfortunately, it is often one of the most frequently disregarded. Too many people seem to have a "good reason" for continuing these bad habits. None of these reasons are good enough.

These practices protect people in laboratories from ingesting toxic chemicals or infectious materials. The stuff that's on your hands ends up in your mouth.

I've watched science department heads drink coffee while supervising the lab. I've seen teachers make stir-fried vegetables in a wok in the lab between classes for lunch. Don't do it. Set a good example yourself and enforce the rules.

Set up a separate area that can be used for taking breaks, making coffee, and consuming food. Don't allow it in the lab. And that includes applying cosmetics, too.

It's not only a bad practice but it is also against the law. Two OSHA regulations speak specifically to this unfortunately widespread practice. One is the bloodborne pathogens standard, 29CFR1910.1030. The other is the sanitation standard, 29CFR1910.141(g)2/4.

There are many worthwhile experiments that involve eating something. For example, teaching colligative properties by making ice cream. Take your students to the cafeteria, use paper plates and plastic utensils and teach your students about safe practices at the same time. Remember, safety is a teachable moment.

Also remember, Pierce College in Tacoma, Washington was sued for 2.5 million dollars following the death of a young woman. She drank a saline solution as part of an A&P class. It contained sodium azide as a preservative. She died four days later.

Many laboratory have ice machines. They should be clearly labeled: "This Ice Is Not for Human Consumption".

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

average during working hours—as specified by OSHA, is a very low one part per million (1ppm) calculated as an eight-hour time-weighted average (TWA). The bottom line is that if you don't have a hydrogen peroxide sensor, and if your nose is tingling or your eyes or throat are feeling funny, something is not right and you should leave the area and investigate further.

And this leads us to our exposure scenario. As we have already stated, the opening scenario of our original article was fictional, but let's look a little closer at what can go wrong and the safety precautions that can minimize or eliminate possible exposures and subsequent injuries. As a quick review, there are four phases of decontamination using HPV systems: preconditioning, gassing, dwell period and aeration. The initial phase, preconditioning, does not present an exposure hazard, as no hydrogen peroxide has been introduced. The second phase, gassing, presents the most potential for danger, as this is when the hydrogen peroxide is rapidly distributed to build to the target level for effective decontamination. The third phase, dwell period, does just that: The concentration level of the hydrogen peroxide gas is maintained (it "dwells") during the required or recommended contact time—thus, exposure is possible. The final phase, aeration, removes the hydrogen peroxide vapor from the enclosure or area to safe working levels, and exposure concerns gradually decrease to the end of this phase.

> "If your nose is tingling or your eyes or throat are feeling funny, something is not right and you should leave the area and investigate further."

So, how could an employee become exposed to hydrogen peroxide using HPV systems? And what do we do to prevent this from happening? As we mentioned in the first article, HPV decontamination systems have been in use for more than 10 years. Manufacturers have developed and refined safe operating protocols over the years. Most offer on-site, multi-day training on proper setup, operation and safeguards. First and foremost, an employee, in order to become exposed,

would have to ignore the safety protocols and/or breach the containment area. This should never happen. Unfortunately, no matter how thorough the safety procedures and training or how foolproof the system, we see employees disregard or defeat them too often. Sometimes it is out of ignorance—perhaps a new employee or one from a different department was unaware of the process. Other times it might be a hardworking, conscientious employee pressured with a deadline or shortcutting to get more done in a day.

The only other potential for employee exposure would be a malfunctioning system, such as a leak or a faulty reading from a sensor. HPV systems usually incorporate sensors to monitor the levels of hydrogen peroxide during the conditioning and maintenance phases and to indicate the end of the purge cycle. In addition, there are personal monitors and instruments that must be used to check areas prior to re-entry or use.

So, how do we prevent exposures from occurring? Looking at the first situation, we want to ensure that all employees who will operate the HPV system receive the recommended training from the manufacturer. Then provide awareness training (to the appropriate level of detail) for employees that may work in the enclosure(s) or area(s) under decontamination. Finally, make sure the area is secured, well marked or otherwise clearly designated as a "No Entry" area until decontamination is complete and the purge verified. For the second scenario, potentially malfunctioning equipment, the operators must thoroughly inspect the equipment before use. Check seals, sensors and controls according to manufacturer's instructions. Know how to calibrate and operate the monitoring equipment and have spare sensors on hand. Most important, make sure the monitors are used for each decontamination project and that areas or enclosures are cleared before re-entry or use.

In summary, HPV systems have many advantages over systems that use other agents, especially for large rooms or areas. Hydrogen peroxide is a very effective decontamination agent. Manufacturers have spent more than 10 years developing the technology and refining safe operating procedures. Safe use of HPV systems is a matter of training employees in following the manufacturer's procedures and proper use of available monitoring sensors. Knowledge of the HPV cycle and understanding the application equipment and the monitoring instruments can prevent unwanted employee exposures and possible injuries.

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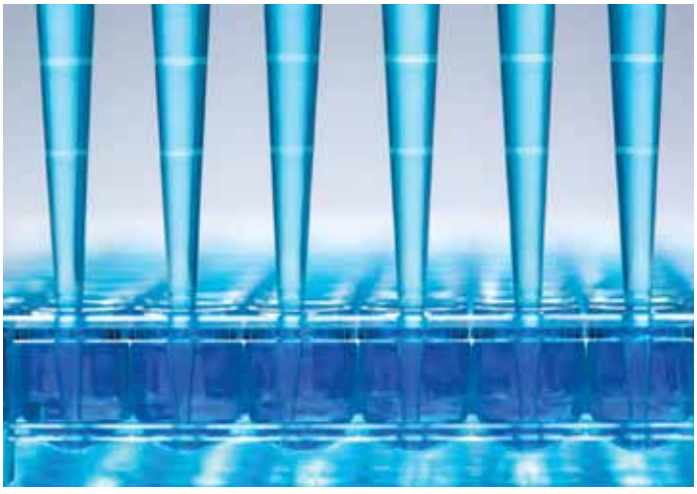
Vince McLeod *is an industrial hygienist certified by the American Board of Industrial Hygiene, and the senior industrial hygienist in the University of Florida's Environmental Health and Safety Division. He has 25 years of occupational health and safety experience at the University of Florida, and he specializes in conducting exposure assessments and health hazard evaluations for the university's 3,000-plus research laboratories.*

AUTOMATED LIQUID HANDLERS

USERS DECIDE BETWEEN DEDICATED AND MULTIPURPOSE SYSTEMS

by Angelo DePalma, PhD



Demand for automated liquid-handling systems parallels the larger automation marketplace. Generally, the need for automation is based on speed or throughput, consistency of results, and the value of a lab worker's time. Within this multidimensional demand space, requirements range from simple automated pipetting through midrange systems to multiuse, general-purpose automation systems costing hundreds of thousands of dollars, and liquid handling is just one component in demand.

Users continue to specify high-end liquid-handling systems that serve "workflow automation" needs rather than single-liquid dispensing operations, says Jason Greene, senior product marketing manager at BioTek Instruments (Winooski, VT). Greene mentions Agilent's SLAS 2013 launch of its Encore Multispan liquid handler, which broadens liquid-handling capabilities through the addition of a robotic arm. An Agilent press release notes that users will be "able to easily automate a larger portion of their workflow" and "significantly expand walkaway time."

"This ability to reach off the deck wasn't new, but it was a novelty for Agilent," Greene adds. "It allows users to integrate other components, like many of our products, into a liquid-handling workflow. In the past, users were able to snug instruments up to the deck, and if they were lucky, the gripper they had on board could just barely reach off, but that capability was really limited."

Purpose-built systems

Lab managers must ultimately decide if their liquid-handling needs are based on one or two processes or if they prefer flexibility—and with it greater complexity and higher costs. "Some organizations still have automation teams in-house tasked to handle the complexities of automated liquid-handling systems," Greene says, "but a majority want a 'solution,' a turnkey system that does what it's expected to do. They know they'll need some in-house support, but they prefer to have experts configure and optimize systems for their workflows."

Keith W. Roby, tactical marketing manager at Beckman Coulter Life Sciences (Indianapolis, IN), agrees that purpose-built automation is catching on, but only in certain select markets. "From our perspective, flexible workstations are still in very high demand."

Academic research labs, he explains, usually have more than one project going, and within each project there are several workflows that could benefit from automation. "Research labs shift priorities and even projects. Unless they're coming in at a very low price point where labs can purchase multiple systems, dedicated workstations are not a viable option." By contrast, flexible automation platforms, which evolve with workflows, ensure that instrumentation will not become obsolete.

This raises the question of who will carry out programming and repurposing of liquid-handling

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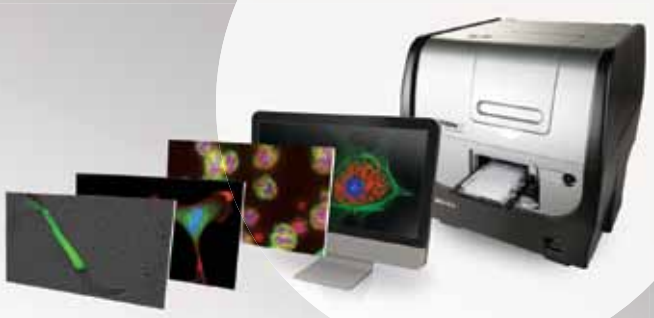

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systems because, as Roby admits, "the more flexibility you build in, the more complicated these platforms become."

Beckman Coulter believes it has significantly reduced the flexibility-complexity conundrum by providing a graphical user interface (GUI) for method development. "For many routine applications, individuals do not need to learn software to create applications," Roby says. "They can open up an old method and go through a series of questions related to sample number, dispensing volumes, washes, and other parameters." The GUI will "ask" more questions for complex workflows than for simple ones.

> "Users continue to specify high-end liquid-handling systems that serve 'workflow automation.'"

Markets where purpose-built automation makes the most sense, according to Roby, are clinical testing and pharmaceuticals. The former usually rely on very large, expensive platforms that perform the same tests over and over. The latter can justify the expense of an application-specific platform for new or ongoing projects based on consistency of results and reduced human resource utilization.

Dedicated but flexible

Bobby Chavli, associate director for marketing and customer service at Hamilton Robotics (Reno, NV), believes that purpose-built or application-specific workstations are the wave of the future. "In the past, if [people were] doing ELISA assays, they'd purchase a robot with ELISA capabilities. Today they're probably looking for an automated ELISA workstation rather than an all-purpose robot."

The impetus for specialization amounts to the division of labor between scientists who do science and the vendor's engineers who specialize in automation. "People don't want to spend a lot of time learning the intricacies of laboratory robotics," Chavli says. "Application-specific workstations save them from that learning curve, setting up the system, optimizing and tweaking it. Users want vendors to figure that stuff out for them."

This raises issues of personalized versus core facility utilization and of instrument proliferation. Top-of-the-line automated liquid handlers, as part of larger, sophisticated automation systems, remain expensive and may still be more appropriately utilized within core facilities. But as prices for automation have fallen across the board, many more labs can now justify the expense of application-specific liquid handlers that sit on individual desktops. If configured with the user and application in mind, routine operations may be conducted without expert input.

Personalization and task-specificity are ideal for lab groups with minimal liquid-handling needs, for example polymerase chain reaction or simple extraction. For those, Chavli says, systems capable of little more than automated pipetting may be the answer. Even for higher-end lab work, full-blown, application-specific systems satisfy a growing desire on the part of operators to run their own experiments on their own time and terms.

As Chavli notes, application specificity is not the dead end its name suggests. True, such systems come ready to use out of the box, but many with built-in mechanical flexibility can provide access to new workflows through programming. Software and method writing are two areas where vendors can provide substantial value, even for systems originally designed for a single major application.

"The initial workflow is why you buy the instrument," Chavli explains. "The additional ones you acquire later on are icing on the cake. And if [your] needs change again in six months, [you] can call the vendor again."

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

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REFRACTOMETERS

VERSATILE ANALYZERS, FROM QC TO LC

by Angelo DePalma, PhD

Refractometry is thought to be a limited analytical technique that works best with binary solutions—for example, salt or sugar solutions—where it excels at precise concentration measurements. "With multicomponent solutions, refractometry provides more of a fingerprint for quality control and final product checks," says Alex White, product specialist at OptoTec (Ashland, VA). "But the technique is limited in what it can tell you about multicomponent solutions."

Modularity to the rescue

Although refractometry is a mature technique, instrument developers continue to expand the method's horizons in terms of utility and applications. Users obtain a lot more information by employing refractometry modularly in combination with add-on analyzers such as densitometers, polarimeters, turbidometers, colorimeters, viscometers, and titrators for pH and other determinations. "Modularity allows users to take multiparameter measurements on small sample volumes at high throughput," White says. By connecting multiple instruments, users can quantify seven or more parameters and thus significantly upgrade the value of the analytical "fingerprint" for foods, pharmaceuticals, beverages, and other products. Automation—for example, plate handling and dispensing within the 96-well microplate format—further enhances throughput and walkaway time.

White calls systems that employ modularity "future proof." The only restrictions are sample size and laboratory budgets.

RI as a detector

Another example of expanding refractometry horizons is the application of differential refractometry as a detection mode in ultrahigh-performance liquid chromatography (UHPLC).

UHPLC promises much faster analysis time, but that advantage comes at the cost of short column life and an intolerance for "dead volumes" outside the column. Dead volumes cause peaks to broaden, which flies against the whole point of UHPLC.

"Traditional refractometer detectors broaden peaks by twenty microliters or more," says Michael Larkin, PhD, director of advanced projects at Wyatt Technology (Santa Barbara, CA). "That was acceptable when peaks were a hundred microliters wide or more, but with UHPLC's twenty-microliter-wide peaks, with a conventional diffractometer you've just lost all your resolution."

Wyatt's release of a UHPLC-capable differential refractometer (DRI) with a three-microliter mixing volume has added refractometry to the ultrasensitive detection arsenal of modern chromatographers. "Before, UHPLC was practical only if your analytes possessed an ultraviolet chromophore," Larkin says. "Now anything exhibiting a refractive index will do."

Waters also sells a DRI suitable for UHPLC.

While UV is more sensitive than DRI, UV traces are not very useful unless the analyst knows the UV extinction coefficient, which is impossible for unknowns. Due to the unique way proteins and long peptides refract, the DRI response is almost completely independent of protein structure, while providing useful concentration data.

It comes down to a value known as dn/dc, a measure of protein refractive index as a function of concentration. "Amino acids have unique dn/dc values, but in proteins they fortuitously average, so every protein has about the same dn/dc value, plus or minus a few percent," Larkin explains.

Purchase decisions

Customers value refractometry for its simplicity, says White. There are no moving parts, and instrumentation from all reputable vendors tends to be accurate and robust.

Differentiating characteristics include add-ons such as presses for solid samples and flow cells. Temperature control is essential, White says, because it influences the RI measurement. "Potential buyers should also put a premium on accuracy, stability, and traceability, whether they plan to use the instrument in stand-alone or modular mode." Systems should have the capability of providing electronic signatures and a full audit trail as well as documenting who took measurements on what samples and any adjustments to the instrument configuration.

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

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STIRRERS

CONTROLLING THE ENVIRONMENT AND THE OPERATION DETERMINES MUCH OF THE ACCURACY

by Mike May, PhD

A glass rod swirled in a beaker worked fine for laboratory stirring for years, decades, and more, but that won't do today in most cases. As Oliver Vogelsang, product manager for stirrers at IKA in Staufen, Germany, explains, "Stirrers are being more and more integrated into automated processes." Such advanced uses of stirrers require updated technology. In addition, stirring in general often depends on far more sophisticated features than rhythmic hand power.

Some of the technological needs arise from using stirrers in so many ways. "Stirrers are used in very diverse lab settings, from beakers and round-bottom boiling flasks to 200-liter pilot project reactors," says Jim Jacso, director of sales and engineering at Glas-Col in Terre Haute, IN. "Mixing is a key to lots of work done in research as well as in production environments." As examples, he points out bacterial resuspension, polymer research, and larger systems that need multiple paddles to keep everything thoroughly mixed. Even these disparate examples, though, provide only a glimpse into the overall application space for stirrers.

Turning up the technology

One key element to stirring comes from the motor. Joseph Novotny, senior engineer at Eberbach Labtools in Ann Arbor, MI, says, "There is a shift by many manufacturers, including us, from brush-DC motors to the brushless style, which provides an advantage in size and torque."

The technology inside a stirrer must not only mix a sample but also do so in a specific way. That often requires a specific motor and paddle combination. A stirrer must even keep track of changes in what it is mixing. As Vogelsang says, "Another important factor is the measurability of changes in the fluidity of the probe, which is provided by a torque-trend measurement."

> "Everybody is always looking for high speed and high torque, and often they have to sacrifice one for the other. You can't have both worlds."

Tracking this characteristic of a sample, its viscosity, is common enough that other experts also mention it. For example, Jacso says, "Lots of people want to know when viscosity is changing in their samples, and getting that data requires monitoring the current draw of the motor and then interpolating that into the data that the user needs." With this capability in a stirrer, a researcher can keep track of changes in a sample over time.

Beyond information on a sample's viscosity, users want other data. Consequently, says Jacso, "People like nice user interfaces as well as being able to connect the output of a stirrer to a PC so they can gather data." He adds, "They want to make sure that the device is doing what they want and that it provides information on what they're researching."

Going the distance

In some experiments, a researcher wants some distance between the control of an experiment and the actual process. "The newest technology," says Vogelsang, "allows for the control element to be removed from the stirrer. This feature enables tests to be controlled through the protective cover of an extractor hood." He adds, "One of the benefits is increased user safety."

That separation can also improve performance. As Jacso says, "The key is to try to keep the stirrer's control away from solvents as much as possible, but that's kind of hard because the motor and control are often in one package. Vapors can get inside and impact the electronics in the controls." He adds, "We keep the motor and controls separated."

Beyond providing control across a physical distance, a good stirrer should last a long time. Vogelsang says, "Stirrers are very robust, and they generally withstand

the demanding laboratory routine." To ensure that long performance, though, he reminds users that it is important that the "devices are handled with care" but "if all directions in the manual are followed, the stirrers will enjoy a very long life." To make sure that the directions get followed, Vogelsang says, "It is mandatory that a laboratory manager properly trains the staff in handling the lab devices."

Stirrer selection

Getting the right stirrer depends completely on how it will be used. As Vogelsang says, "Any new stirrer would have to fulfill the requirements of the application. That could be a high-torque or -rpm range, a USB interface, a timer, a reverse-rotation function, and much more." When shopping for a new stirrer, Vogelsang says, "It's better to have too many functions than not enough."

Many users hope to put stirrers to use in various ways. For example, Susan Campbell, associate professor of biochemistry at Georgetown College in Kentucky, says, "We use stirrers during titrations and some enzymatically catalyzed reactions and, of course, making simple solutions." In terms of function, she says, "The stirrer needs to operate smoothly at multiple speeds with different-sized stir bars—from 'fleas' to much larger bars." So she needs a stirrer that provides a range of stir bar options.

> "There is a shift by many manufacturers … from brush-DC motors to the brushless style, which provides an advantage in size and torque."

In many cases, though, a user can't get everything in a single stirrer. As Jacso explains, "Everybody is always looking for high speed and high torque, and often they have to sacrifice one for the other. You can't have both worlds."

Sometimes, though, simple is enough. As Novotny says, "The majority of people just want to dissolve something. In those cases, a simple stirrer with analog controls works just fine. I've used that kind of stirrer to mix many batches of photographic developer and stop bath and fixative—yes, in the *old days* of film photography."

Ultimately, though, a customer needs a stirrer that meets the needs of the lab. If you need more stirring control or power, keep that in mind. "Some people buy cheaper systems, and they won't work," says Jacso. "They burn up in the labs if, say, the mixing viscosity is too high." He adds, "Higher-quality stirrers tend to keep users satisfied." Only you know just what you need.

Mike May *is a freelance writer and editor living in Ohio. You may reach him at mike@techtyper.com.*

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ANALYTICAL BALANCES

CONTROLLING THE ENVIRONMENT AND THE OPERATION DETERMINES MUCH OF THE ACCURACY

by Mike May, PhD

Everyone from a science student to an internationally known researcher needs an accurate and dependable analytical balance. Engineers keep advancing the fundamental weighing technology. As Tom Delano, vice president of business development at Adam Equipment in Danbury, CT, says, "There are always some small changes or advances in the way things are weighed, the weighing mechanisms."

Beyond the changes inside balances themselves, the external market drives the evolution of this technology. Ian Ciesniewski, technical director at Mettler Toledo in Columbus, OH, describes two key market trends. "One is customers pushing for smaller and smaller errors and smaller limits on the sample size," he says. "This is driven by pharmaceutical and biotechnology companies." Ciesniewski says that economics explains the second driver. "Customers need to control costs and increase productivity," he says. "Part of that falls on the balances."

Human interactions

Users expect better interfaces. In fact, Delano calls this the "big area of change." He adds, "Today's balances can include very sophisticated software and even touch-screen displays."

Some of the electronic advances might go unnoticed but not unappreciated. As Jennifer Camarda, sales specialist for premium weighing at Sartorius Lab Products & Services, headquartered in Goettingen, Germany, says, "Having a leveled balance is critical for proper weighing results, as even the slightest incline can cause inaccurate results." She adds, "At the push of a button, the Cubis Q-Level will automatically level within seconds to ensure accurate weighing."

Users also seek other forms of lab efficiency from an analytical balance. "There's an ever-increasing move toward automation on the data-handling side," says Ciesniewski. "This includes a critical need to control calibration processes."

Consequently, many users look for an analytical balance with onboard, durable storage and communication ability, or both. "In many applications," says Ciesniewski, "you can't just have a user creating weigh data, as this creates traceability issues."

Keeping weights consistent

To ensure that an analytical balance provides a reliable, accurate output, it must be adequately serviced. Ciesniewski says that this requires service by a manufacturer-certified vendor twice a year. When asked what features of an analytical balance matter most, Guy Grundwell, professor of chemistry and biochemistry at Central Connecticut State University in New Britain says, "Durability and accuracy."

Overall, the accuracy of a balance's output depends critically on the operation and the surroundings. For one thing, Ciesniewski says, "Choose a balance with an estimated error that is never more than one-third of the expected tolerance for the weighing task. This ensures that the balance's measurement uncertainty—error—remains relatively insignificant." He adds, "The degree of error in an average weighing is much smaller than it was twenty or twenty-five years ago, and most of the uncertainty is external to the balance." Understanding and controlling the external conditions—including the environment and user- or sample-related variables—will help minimize weighing errors.

The environment can create problems that few users consider. As Camarda says, "Static is one of the most common issues that affect weighing measurements, especially during cold months when humidity is low. To minimize the effects from electrostatic charges, Sartorius designed Cubis Q-Stat, an analytical draft shield within the Cubis portfolio that contains an integrated 4-jet ionizer without disruptive air streams to quickly dissipate electrostatic charges built up on sample vessels and substances directly inside the weighing chamber."

Controlling an analytical balance's environment and use produces more accurate results.

***Mike May** is a freelance writer and editor living in Ohio. You may reach him at mike@techtyper.com.*

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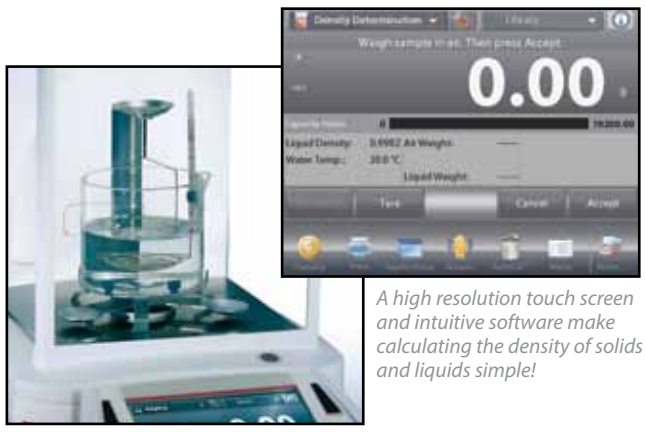

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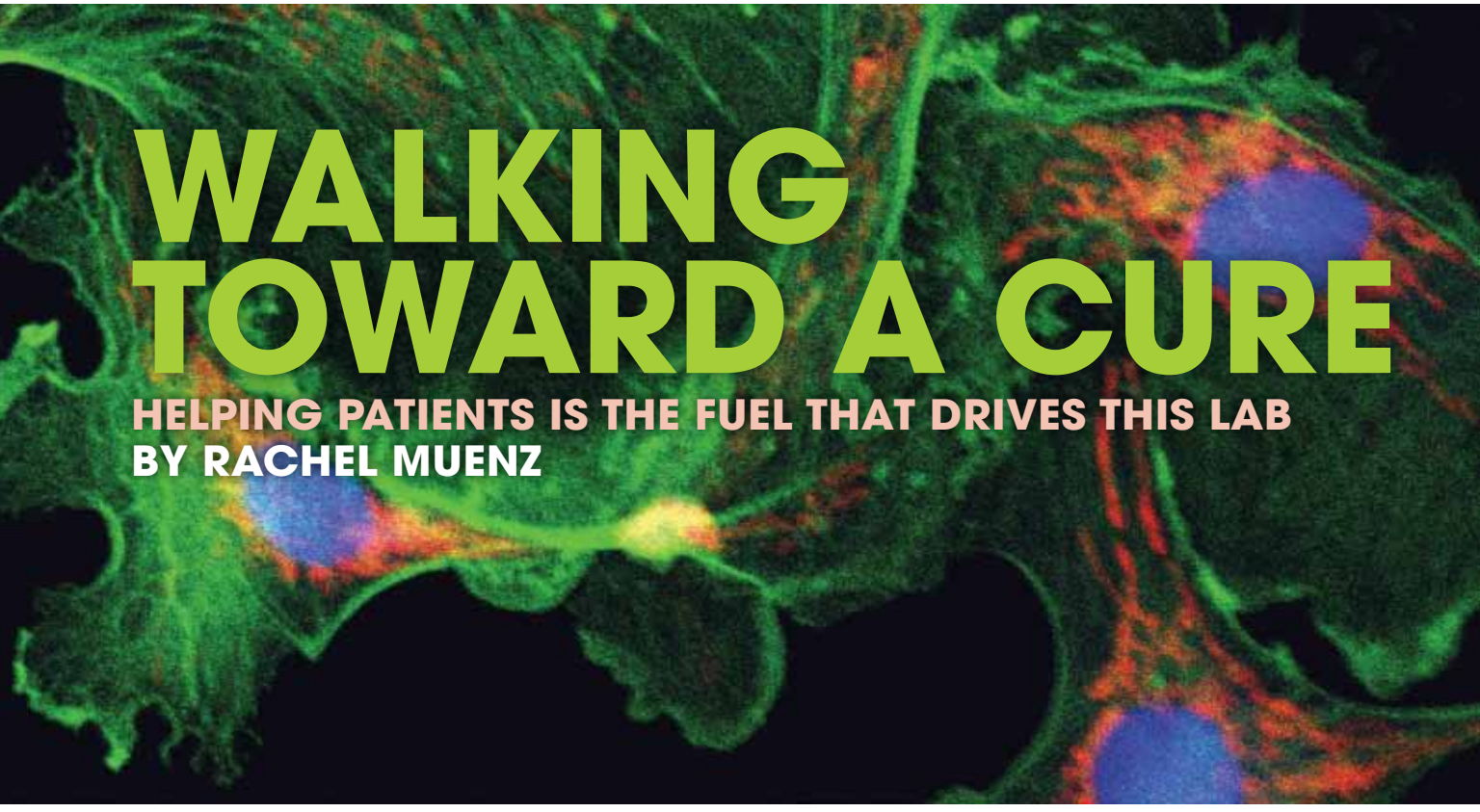


WALKING TOWARD A CURE

HELPING PATIENTS IS THE FUEL THAT DRIVES THIS LAB

BY RACHEL MUENZ

For lab manager Mark Lloyd, finding the motivation to come to work every day isn't difficult. All it takes is an extra-long walk—a routine that started when he was a master's student working at a shared resource facility at Georgetown University.

"They [university staff] had asked me—when I came in through the campus—to walk through the hospital and the cancer center so that I could have exposure to patients. That way, as I got to the lab, I would have a very poignant reminder of why we were doing this kind of work," he explains.

Now manager of the Analytic Microscopy Core (AMC) facility at the H. Lee Moffitt Cancer Center & Research Institute in Tampa, Florida, Lloyd continues to "park in the most inconvenient parking lot possible" so that he has "the opportunity to walk through the clinical areas on a daily basis, twice a day minimum" to remind himself why his work matters. "Because I feel this work is so very important, I encourage my staff to do the same," he says.

That work involves imaging anything that requires a microscope to see as well as analyzing those images.

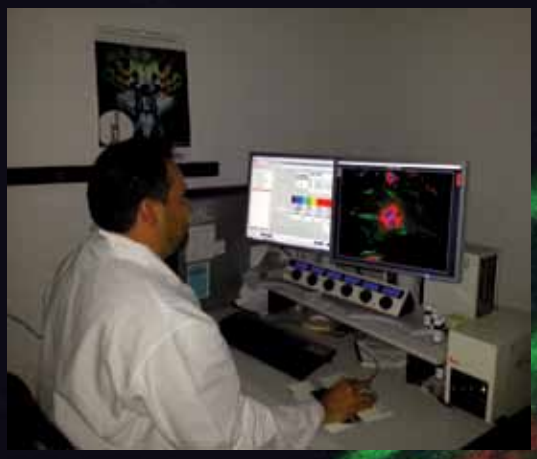
"It used to be that a picture was worth a thousand words and taking that picture would be substantial for publication and so on, but now a number is worth a thousand pictures," says Lloyd, who has worked in cancer research for 13 years, ten of those at Moffitt. "We are not only responsible for the image acquisition, but we also do very extensive and customized image analysis to be able to provide Moffitt and other researchers the opportunity to interrogate and understand their biological processes at the microscopy level of resolution."

The AMC is broken into three segments: cell imaging and analysis, digital pathology— which deals with tissues imaging and analysis—and the vivarium area, which covers live imaging of animals.

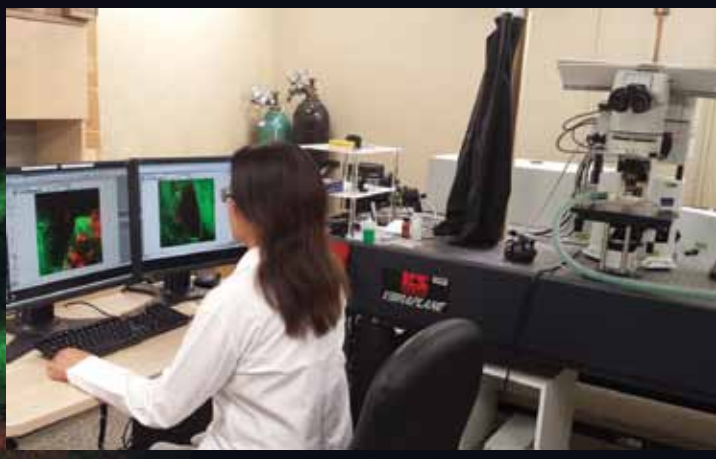
The Analytic Microscopy Lab team, right to left: Tingan Chen, MD, PhD; Mark Lloyd, MS; Marilyn Bui, MD, PhD; and Joseph Johnson, MS. Not pictured: Agnieszka Kasprzak, MS.

Lloyd reports to a scientific director, and the lab also has three full-time research specialists I, II, and III.

"We also have a number of interns who come and go throughout our calendar



▲ *Joseph Johnson uses a confocal microscope to image the mitochondria (red) and microtubules (green) in cancer cells.*



▲ *Dr. Tingan Chen uses a multiphoton excitation microscope to image tumors in animals under anesthesia.*

year," Lloyd adds.

Those staff members have a range of education levels, including MD, PhD, and master's degrees—education that is key to working with those using the AMC.

"Level of education is very important for scientists in a shared resource setting to be able to have a conversation with principal investigators to assist them in their experimental design and in suggesting or discussing the kinds of image analysis that would best meet that investigator's needs," he explains.

However, he adds employees don't necessarily need to be experts in the investigators' areas of research, and the training they receive when they start at the facility is just as crucial.

"We need to be trained in what is available in terms of the technology to be able to answer the questions that they [principal investigators (PIs)] bring to us," he says. "In that regard, I find in many cases the training that these employees receive is more important to them than the education that they come with. I would prefer to have a 'blank slate' than necessarily go to the market with a fine-tooth comb trying to find the perfect candidate."

That training involves a course module designed especially for the AMC, which gives new staff exposure to all areas of the lab and allows them to both meet the facility's needs and pursue the area of microscopy they enjoy most. In their first year, employees are sent to at least two different external training programs, which they get to choose with management's help.

"Those programs vary a great deal depending upon which areas of interest those individuals have identified … and where they feel comfortable and where we really need them," Lloyd says. Programs can range from intense weeklong training sessions to weekend or two-day overnight programs focused on a specific technique.

For Lloyd himself, a business background is also important to his job. "My training is in both tumor biology and optical microscopy, but I also have an MBA to help me with the kinds of financial and management decisions that need to be made for the laboratory," he says.

Workload and roles

The knowledge of Lloyd and his staff stands them in good stead, as they can get as many as 20 projects a day, though the average is usually half that.

"We are a volume-driven facility, and so we receive about ten different projects a day from individuals who are coming in for image acquisition, coming in with their samples to take some pictures," he says.

The AMC staff also act as teachers, training the researchers who utilize the facility how to use the instrumentation to a point where they are comfortable and can come in 24/7 to work unassisted on projects that require a lot of time.

As lab director/manager, Lloyd is responsible for many tasks, reporting to a scientific director and advisory council to ensure that the techniques and expertise the AMC offers are those required by the Moffitt faculty. He looks after employee satisfaction, designation of longer projects, personnel management, and experimental design. And he's taken on the added task of obtaining and managing his own government-funded grant projects for the development of new tools to be used within the AMC.

"I try to work as a kind of hybrid of a PI lab and a core research/shared facility," he says. "I've been here a decade, and I really enjoy what I do as a staff scientist in the core facility, which is really the right role for me. I really enjoy being in a [microscopy] core facility."

He adds that, in particular, working with the microscope to meet researchers' needs and designing experiments is a lot of fun for him.

"I enjoy being a scientist," Lloyd says. "I like being able to think critically about the kinds of problems that arise. I think even more satisfying for me, personally, is the ability to design that experiment. I will bring the whole team together for something that's really challenging and we'll brainstorm through it and begin to map it out."

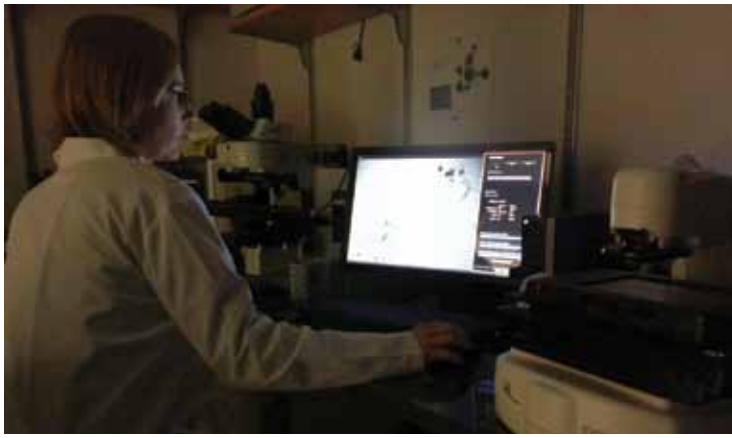
An average day in the lab always begins with a team discussion, when they figure out what will be done that day and go over anything important from the previous day or week that hasn't been addressed yet. The AMC's online scheduling system notifies the staff of their roles and responsibilities for the day, which are dictated by the investigators making the requests. Throughout the day, staff perform the listed functions to ensure projects are completed, reported on, and communicated back to the investigators.

"We kick off at 9 o'clock all knowing, basically, what our schedule is going to be for the day," Lloyd says. "By the time we leave at 5:30, we have the next day's schedule already available so we can mentally prepare for the tasks that will be at hand the next day."

To motivate staff to power through those days, the AMC has a lot of small rewards, based on the personal preferences of the staff member being rewarded, which are put in writing during year-end evaluations.

"I motivate my staff in the ways that are best for them individually," Lloyd explains. "As you can imagine, microscopists who spend a lot of their time in a dark room may have different kinds of preferences for how they are acknowledged and so on."

▼ *Agnieszka Kasprzak evaluates a time-lapse experiment in a live-cell incubation chamber.*



Those rewards can be anything from going out to lunch together to fun, inside-joke type gifts. "These types of team-building exercises, when appropriate, can be very impactful for the individual, and so that's the way we like to motivate each other."

Lloyd himself spends a lot of time in meetings but prefers the lab, despite the challenges.

"My greatest challenge is being able to satisfy the myriad of different kinds of ideas that come through the lab," he explains. "An investigator's imagination is the limit of what could be requested of us, and this is a challenge intellectually, but it's probably the most fun part of this job."

Technology and the training and research it involves, because technology is always changing, are a big part of meeting that challenge, Lloyd says.

"We try not to let an investigator come to us with some kind of novel technology that we don't already have some understanding of—how it works and what it does," he says. "This gives us an opportunity to think as scientists about how we can solve these kinds of problems. Preparation is what leads to success."

The AMC uses a variety of microscope and image analysis technologies, both from big brands and smaller vendors, in order to stay flexible for the variety of requests they receive from PIs. A LIMS also helps keep things organized.

"Each one of these companies has its strengths and weaknesses, and we very much understand what each of those is, so we like to not pigeonhole ourselves into one specific brand or model but to be as versatile as possible with each of these systems," Lloyd says.

Super-resolution has been one major development in microscopy.

▼ *Mark Lloyd uses a multiphoton microscope to investigate tumor growth in an animal under anesthesia.*

"In the past few years, techniques have emerged that defeat the laws of physics computationally and enable what is called in the field 'super-resolution,' which just innately changes how well we can see really small things," Lloyd explains. "This is very exciting for us and for the investigators at Moffitt [who] require that kind of technique."

More broadly, there's been a big increase in lab automation in the cancer research field, in making instruments easier to use, and in the need for objective quantification. Lloyd says these changes mean the AMC is focusing more on image analysis than ever before. Whereas it once took up around ten percent of their time, image analysis now consumes about 60 percent of it.

"It's been very exciting to be able to move with the technologies and be able to take advantage of them, because they certainly are beneficial for the investigators and the kinds of questions that can be asked and answered," Lloyd says.

Technology, as one would expect, features prominently in the facility's future plans, with the aim to continue to acquire state-of-the-art instruments. However, with the challenging funding environment of the past several years, finding the capital to purchase that equipment has meant the lab has had to try new strategies.

"We have taken some creative approaches to defining partnerships with outside institutions that have functionality that we do not and, vice versa, offering functionalities that they may not that we have," he says.

One of the most interesting things going on at the AMC now involves a new business venture. "I recently started a business, a start-up out of Moffitt, which takes advantage of the intellectual property that has been created in our laboratory," Lloyd says. "We are being funded significantly right now and we're trying to take it to the next level, so this is a very interesting opportunity for us to be able to venture out into something a little bit different."

Lloyd sees commercialization as key to helping the patients he sees every day on his walk. "I've been able to envision ways that microscopy and the kinds of work that we do in the core facility can be immediately translatable to the clinic," he says. "Some of the kinds of patents that have come out of our lab are being commercialized to actually impact the patients."

"Research papers and grants are important, but commercialization is also important to be able to have a real impact on our patients."

Rachel Muenz, *assistant editor for* Lab Manager, *can be reached at rachelm@labmanager.com or by phone at 888-781-0328 x 233.*

MAIN MICROSCOPY AND IMAGE ANALYSIS TOOLS IN THE AMC:

Leica, Nikon, Olympus, Zeiss, Life Technologies EVOS, CRI, Definiens, Visiopharm, Media Cybernetics Image Pro Plus

TECHNOLOGYNEWS INTERPHEX

In this month's Tech News section, we highlight exhibitors for two tradeshows—**INTERPHEX 2014**, which takes place March 18-19 in New York City and the **105th Annual Meeting of the American Association for Cancer Research (AACR)**, which will be held April 5-9, 2014, in San Diego, California. INTERPHEX (International Pharmaceutical Expo) showcases complete biopharmaceutical and pharmaceutical manufacturing solutions to process all dosage forms for life-enhancing drugs, while the AACR meeting will highlight the latest and most exciting discoveries in every area of cancer research. Please note that the products shown here may not necessarily be at these shows, but the highlighted companies will be there to answer any questions you may have.

ANALYTICAL

Compact Mass Spectrometer

expression S

- New enhancements include polarity switching during a single analysis to ensure detection of the greatest range of compounds
- Also includes fast mass scanning (10,000 u/s) for compatibility with UPLC, SFC and where multiple compounds need to be monitored simultaneously with SIM, as well as higher flow rates of 1-2 ml/min for simpler interfacing with standard chromatographic conditions

Advion www.advion.com

Hydrogen Sensor for GC System

BOOTH 1812

- For the 7890B Gas Chromatography system
- Helps GC users move away from costly helium carrier gas by providing the additional level of security many organizations require in order to use hydrogen
- Self-calibrating sensor automatically executes a safe sequence for the shutdown of the GC system if even a small hydrogen leak is detected, preventing potentially hazardous situations

Agilent www.agilent.com

External Valve Oven for GC

LVO

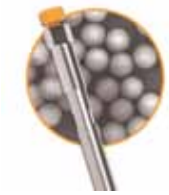
BOOTH 1812

- For the 7890B gas chromatograph (GC) system
- Can be configured to support complex, multi-valve ASTM International and EN (European Standard) GC applications
- Precisely engineered for thermal isolation from the GC oven
- Provides a homogeneous isothermal environment for up to six positions for columns and valves
- Vertical design orientation allows for convenient maintenance

Agilent www.agilent.com

HPLC Columns

Flare



- Expand the existing range of analytical capabilities in separation science by providing diamond-based HPLC columns and TLC plates that allow for the exploration of novel chemistries
- Offer expanded pH range capability (1-13), elevated temperature ranges, increased longevity and novel selectivity, without compromising efficiency

Diamond Analytics www.diamond-analytics.com

Handheld Raman Spectrometer

RaPort®

- Brings qualities of laboratory molecular analysis to the field
- Provides precise material identification with excellent mobility
- Works on Android & Windows software, empowering tablets and smartphones
- Includes built-in battery (up to 6 hours of off-line operation) and wireless data transfer
- Acquires spectra of prohibited and hazardous materials and their compounds even through their packaging

Enhanced Spectrometry www.enspectr.com

OEM FTIR Spectrometer

Monolith 20™

- Provides infrared spectra with high signal to noise ratio, high baseline stability and extremely low maintenance requirements
- Has no mechanical adjustments and uses a lateral transfer moving corner cube that is insensitive to all angular perturbations during scan
- Achieves a signal-to-noise ratio better than 45,000, based on one minute of data acquisition

FTRX www.ftrx-llc.com

CCD Spectrometer

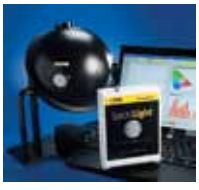
VS7000-CCD-HSE

- Ultra-fast back-thinned CCD Spectrometer outperforms most front-illuminated and low-cost back-illuminated CCDs, in stray light, dynamic range, and speed performance
- New electronic shutter CCDs and electronics now available for the VS7000 and other UV-VIS-NIR mini spectrometers
- Features a readout speed of 1 msec and e-shuttering speed of a few microseconds
- Also features 2048 pixels and a sensitive area height of 1mm

HORIBA Scientific www.horiba.com/scientific

Portable Spectroradiometers

ILT950UV & ILT950



- The ILT950UV provides a range of 200-450 nm while the improved version of the ILT950 features a range of 250-1050 nm
- ILT950 now includes a machined optical bench for reduced stray light and improved thermal stability
- Both instruments now use the new higher pixel SONY CCD array for improved performance including nearly 50% more sensitivity over the entire spectral region

International Light Technologies www.intl-lighttech.com

www.labx.com

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Trace Gas Analyzer

PTR-TOF 1000

- Extremely sensitive (down to pptv-levels), this instrument is designed for super-fast air analysis, in particular for flux measurements where milliseconds count
- Features dimensions, weight and price usually to be expected from a high-end quadrupole PTR-MS, but with all advantages of a more powerful TOF-based solution
- Provides whole mass range in split-seconds and higher resolution for better separation and identification

IONICON www.ionicon.com

X-ray Fluorescence Spectrometers

EDX-7000/8000

- Offer excellent sensitivity, resolution, and throughput for an array of applications, from general screening analysis to advanced materials research
- Incorporate a new high-performance semiconductor detector that offers a high fluorescent X-ray count per unit time
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Shimadzu www.ssi.shimadzu.com

Bubble Trap for Chromatography

- Designed to be crevice-free and self-draining, efficiently removing unwanted gas or air bubbles in process fluids without providing areas where harmful bacteria could accumulate
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- Includes full traceability on all wetted components
- Available in sizes ranging from four to ten inches and in custom designs

L.J. Star www.ljstar.com

Headspace Samplers

HS-20 Series

- Provides a reliable and robust headspace solution for any application analyzing volatile components in a difficult matrix
- Consists of two models: a Loop model and a Trap model
- Gives users excellent repeatability through precise control of gas flow rates, and a mechanism that allows a sample vial to enter the oven from the bottom

Shimadzu www.ssi.shimadzu.com

NMR Spectroscopy System

Spinsolve Carbon

- World's first Carbon-13 capable benchtop NMR spectroscopy system
- Provides the power of a 1D and 2D proton-carbon NMR in a benchtop instrument that can be safely used in the laboratory
- Offers users 1D ^{1}H, ^{19}F and ^{13}C experiments that use standard 5 mm NMR tubes
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Magritek www.magritek.com

Isotope Ratio Infrared Spectrometer

Delta Ray

BOOTH 3544 (at INTERPHEX)
BOOTH 1107 (at AACR)

- Measures thermal expansion in electronic materials and other products
- Can detect potentially harmful materials to ensure all electronic products are safe
- Specifically designed for the accurate measurement of the coefficient of thermal expansion to ensure optimal manufacturing processes and to avoid unnecessary expenses as a result of wasted material

Thermo Fisher Scientific www.thermoscientific.com

Thermomechanical Analysis System

TMA 4000

BOOTH 2117, 2217

- Measures thermal expansion in electronic materials and other products
- Can detect potentially harmful materials to ensure all electronic products are safe
- Specifically designed for the accurate measurement of the coefficient of thermal expansion to ensure optimal manufacturing processes and to avoid unnecessary expenses as a result of wasted material

PerkinElmer www.perkinelmer.com

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BOOTH 1107 (at AACR)

- Now include Instant Connect Helium Saver module, designed to reduce helium consumption an average of 80 percent
- High-capacity TRACE 1310 auxiliary oven, with multi-valve, multi-column capacity enables use of up to four conventional detectors simultaneously
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High-Temp Gel Permeation Chromatography Columns

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- Recommended for the analysis of organic-soluble polymers and are packed with spherical particles composed of polystyrene cross-linked with divinylbenzene
- TSKgel HT columns are for high temperature applications up to 140°C, while the TSKgel HT2 columns are used in ultra-high temperature applications up to 220°C

Tosoh Bioscience www.tosohbioscience.com

SEC-MALS Detector for UHPLC

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- Can be coupled to any UHPLC system in order to determine absolute molecular weights and sizes of polymers, peptides, and proteins or other biopolymers directly, without resorting to column calibration or reference standards
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Wyatt www.wyatt.com

PRODUCT SPOTLIGHT

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Those working with LC-MS now have an industry-first tool to help them achieve greater sensitivity and separations efficiency. Waters recently launched the first nano- to microscale UltraPerformance LC® (UPLC®) system rated for 15,000 psi operation at January's WCBP 2014 Symposium.

The ACQUITY UPLC® M-Class System is suited for a broad range of applications including proteomics, metabolic profiling, metabolite identification and pharmacokinetic studies.

"When scientists doing proteomics or investigating new biopharmaceuticals talk to us about the work they do, they often speak of protein coverage or being able to quantify and identify incredibly small amounts of key molecules usually in the presence of much higher amounts of other molecules. This is difficult work without the appropriate tools. With the ACQUITY UPLC M-Class System, they will have the capability to peer into the unseen and achieve their research goals," said Art Caputo, president of the Waters division. "As an LC inlet to mass spectrometers, the ACQUITY UPLC M-Class System empowers more scientists to reliably employ microscale chromatography in order to solve their most complex analytical challenges."

In addition, the system's new 5k psi-capable ACQUITY UPLC M-Class Columns use the potential of sub-2-μm particle technology to yield faster separations, greater peak capacities and increased levels of sensitivity. Waters is also launching five new chromatographic columns with internal diameters ranging from 75 μm to 1.0 mm.

The system's design will help minimize dispersive and adsorptive losses during a chromatographic separation, among a number of other benefits. It is expected to begin shipping in the current fiscal quarter.

For more information, visit www.waters.com/mclass

BASIC LAB

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- Features a hermetic, isolated design
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Agilent www.agilent.com

ASTM Class 6 Weight Sets

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- Available in nine calibration variations including 50g x 10mg, 500g x 1g, 2000g x 1g, and several other sizes in between
- Made from stainless steel, are lead-free and clean

Alliance Scale www.alliancescale.com

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- Offers a user-friendly alternative to carbon and DI exchange tanks without sacrificing capacity
- Boasts a composite tank with easy access openings for quick change filter access reducing onsite service time
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Aries FilterWorks www.ariesfilterworks.com

Cooled Scientific Cameras

VS Range

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- Aimed at Original Equipment Manufacturers (OEMs) of integrated imaging systems as well as low light microscopy users
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- Now includes a version designed to allow scientists to perform safe, productive heating and stirring experiments with pear shaped flasks commonly used with rotary evaporators
- Allows chemists to eliminate the need for sample transfers between reaction flask and an evaporator (pear-shaped) flask, allowing the same flask to be used for both synthesis and evaporation

Asynt www.asynt.com

Glass Refractive Standards Set

- Used to calibrate instruments that are designed to measure the refractive index of microscopic fragments of glass and glass-like materials
- Consists of both calibrated glass samples and immersion liquids calibrated for refractive index versus temperature
- Glass materials consist of optical glass in sizes suitable for crushing and use with rIQ™ and other automated glass refractive index measurement systems

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- Dispenses via the user's choice of program, including constant flow rate, stepped flow, ramped flow, and pulsed flow
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- Suits many industrial sectors, from pharmaceuticals to bulk powders
- Delivers data that support process and product understanding and the optimization of powder processes
- Particularly suited to applications where traditional powder testing techniques have limitations
- Measures a range of bulk, shear and dynamic powder properties under conditions that reflect a diverse range of process environments

Freeman Technology www.freemantech.co.uk

Pipette Automation Device

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- In combination with a VIAFLO II electronic handheld pipette, enables the pipette's protocols to be performed automatically
- Reduces the need for traditional handheld pipetting to a minimum, relieving lab personnel from activities that may cause repetitive stress injuries
- Ensures tip immersion depth and pipetting angle are always the same, resulting in increased reproducibility and thus better results

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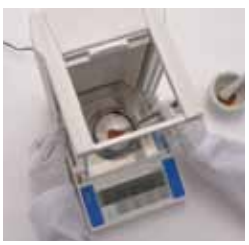

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UniMax

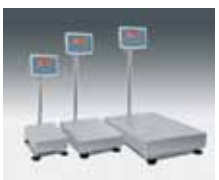
- This series of hoods has been expanded to include wide selection of models that feature greater interior working dimensions
- Standard models range from 6 feet to 24 feet wide, 4 feet to 8 feet deep, and 7 feet to 16 feet high
- Easily accommodate tall apparatus / distillation processes, roll-in reactors, or long integrated instrumentation systems

HEMCO www.hemcocorp.com

Laboratory Bench Scale

Miras® 2

- Capable of weighing to laboratory accuracy with 15,000 and even 30,000 divisions
- Designed to provide superior accuracy and performance for today's contemporary laboratories and industrial settings
- Fitted with RS232 output as standard
- Includes a parts counting program, portability with six "D" Cell operation, check- weighing program, Net/Gross display, filters and kg/lb display



Intelligent Weighing www.intelligentwt.com

Scanning Electron Microscope

JSM-iT300LV

- Fingertip control allows the user to enlarge, rotate, and navigate high resolution images on screen
- Features smart analytical port geometry that is ideal for multiple configurations and simultaneous analysis
- Designed for a multitude of sample types and has a wide range of accelerating voltages from 300v-30kV, a vacuum pressure range of 10-650 Pa, and magnification range of 5-300,000X

JEOL www.jeolusa.com

AFM System

NanoWizard ULTRA Speed

- Delivers fast-scanning and super-resolution on an inverted microscope
- Enables the tracking of changes in samples in real time whether the sample be imaged in air or liquid
- Scanning at speeds of greater than 100Hz line rate with excellent, true atomic resolution in closed-loop mode is enabled by the enhanced low noise of scanner, position sensor and detection system

JPK Instruments www.jpk.com

PRODUCT SPOTLIGHT

THE X FACTOR

NEW MICROSCOPY SOLUTION AIMS TO REVOLUTIONIZE IMAGING IN LABS WORLDWIDE BOOTH 2426

Researchers requiring heavy-duty nanoscale imaging have a new weapon. Introduced at the 2013 Microscopy and Microanalysis conference in Indianapolis, ZEISS's Xradia 810 Ultra system is now available to order. This X-ray microscopy (XRM) solution increases throughput for three-dimensional imaging at the nanoscale by up to 10 times and uses a number of technical innovations to achieve better contrast, and in turn faster acquisition.

The new instrument operates at 5.4 keV, a lower X-ray energy that delivers better contrast and image quality for many materials.

"Contrast improves significantly as these lower-energy X-rays are absorbed more strongly, enabling high-quality tomographies to be completed at vastly reduced imaging times," stated the company in a recent news release. The company designed the Xradia around that new source energy, using specialized optics to extend the capabilities of the Xradia Ultra family.

With nanoscale X-ray imaging speed an order of magnitude faster, both industry and science can see a number of benefits such as quicker measurements in oil and gas feasibility studies, and better contrast.

The system's higher absorption contrast at 5.4 keV in addition to Zernike phase contrast also makes high-resolution X-ray imaging viable for a variety of low Z and bio materials such as polymers and tissue samples.

"With the study of medium and low Z materials a major focus throughout the research world, Xradia 810 Ultra makes it more cost-effective and efficient to image a variety of polymers, oxides, composites, some fuel cells, and other materials of interest," says Dr. Kevin Fahey, Chief Materials Scientist at Carl Zeiss X-ray Microscopy.

For more information, please visit http://www.xradia.com/zeiss-xradia-810-ultra/

Fine Dosing/Metering Pump

SIMDOS® 02

- Delivers 0.03 – 999 ml dosing volumes, and a flow rate ranging from 0.03 – 20 ml/min
- Adaptable to fluid characteristics, making it ideal for a variety of liquid applications
- Splashproof IP65-rated housing protects the pump from water and dust intrusion, contributing to its excellent long-term stability and consistent reliability
- Following calibration, repeatability is +/- 1 percent (full range)

KNF Neuberger www.KNFusa.com

Fiber-optical Switches

FiberSwitch® eol and mol series

- For high-performance applications from the VIS to the IR
- Fiber core diameters start at 3μm (eol-VIS) and go up to 800μm multi-mode (mol-series)
- Feature switching times starting from 2ms and the FiberSwitch series life time spans more than 100 Mio cycles
- Boasts low electrical power consumption of less than 0,45W

LEONI Fiber Optics www.leonifo.com

Moisture Analyzers

Professional

- Feature USB, Ethernet and WLAN connectivity for easy data transfer, and now can send measurement reports in A4 or letter format direct to a networked page printer
- Built-in instrument tests are easy to perform and ensure accurate results
- Five-click guided procedure allows users to qualify the performance of all the instruments together thanks to the certified reference substance SmartCal™

METTLER TOLEDO www.mt.com

Heating and Chilling System

Full Range

- Integrates a circulating water temperature control system with a portable chiller to provide heating and chilling from a single, compact self-supporting unit
- Features a temperature range of -20°F to 300°F (-29°C to 149°C)
- Systems are available in air or water-cooled condensing, up to 96 kW of heating, pumping capacities up to 120 GPM, and up to 40 ton chilling capacities

Mokon www.mokon.com

Digital Wireless Platform for Lab Apps

Moticam X

- MoticamX camera series frees the viewer from traditional wired connections
- Using standard "free" downloadable viewers to any Android or iOS platform, real-time images can be shared from any microscope simultaneously for educational to consultative dialogues to up to 6 viewers—more if a MoticHub is set up
- Moticam can be connected to any microscope

Motic www.motic.com

Thermoelectric Temperature Controller

5C7-195

- Features an internal power supply, full H bridge and is capable of load currents up to 4A in H bridge mode
- Can control resistive heaters or thermoelectric modules with load currents up to 5A utilizing the unidirectional output and internal supply
- Can be programmed with a P via the RS232 com port, which has 1500VAC isolation

Oven Industries www.ovenind.com

Embedded Temperature Controller

5R7-388

- Features a RS232 port
- Bi-directional controller is designed for independent thermoelectric modules or in conjunction with auxiliary or supplemental resistive heaters
- Used for both cooling and heating of many different applications
- "H" bridge configuration of the solid state MOSFET output devices allows for the bi-directional flow of current through the thermoelectric modules

Oven Industries www.ovenind.com

Handheld Temperature Measurement System

PalmSense²

- Suited to measurement in high temperature RF environments or EMI applications in labs and field service
- Gives users the freedom to move around critical sensing points with the system's 24 hour battery life in continuous use
- Features a wide temperature range 0 to +450°C, high accuracy of +/- 0.05°C,(probe dependent) and resolution of +/- 0.01°C

Photon Control www.Photon-Control.com

Autoclaves

- New to the US market
- Specifically designed and built for lab applications (pharmaceutical, food and chemical industries, laboratory, microbiology)
- Provide good performance, durability and reliability
- Range includes vertical and horizontal autoclaves from 8 to 150 liters

RAYPA www.raypa.com

Benchtop Supercritical Fluid Extractor

SFT-110

- Redesigned restrictor valve with integrated micrometer allows for very precise flow control
- Removable oven lid and large side panel allow the user easy access to the high pressure vessel
- An indicator light on the SFT-10 pump module alerts the user to proper operation of the Peltier pre-cooler, ensuring CO_2 is maintained in the liquid state

Supercritical Fluid Technologies www.supercriticalfluids.com

UV Viewing Systems

CC-80 and CC-81

- Provide excellent fluorescence analysis of research findings
- Suited for use in chromatography, electrophoresis, genetic research, photoresist coating inspection, forensic science and much more
- Researchers can custom design their own fluorescence analysis systems by choosing from a wide range of Spectroline UV lamps that are available in 254, 312 and 365 nm wavelengths

Spectroline www.spectroline.com

Image Analysis System

G:BOX Chemi XRQ

- Suited to scientists needing a cost-efficient system for quickly and easily imaging a range of gel or blot types
- Features a new generation, high resolution, high quantum efficiency and low noise CCD camera with 4 megapixel imaging capabilities inside a light tight darkroom
- Can accurately visualize and separate faint and bright bands on one gel or blot with ease

Syngene www.syngene.com

High-Temperature Cold/Hot Plates

- TECA introduces high temperature versions of several cold/hot plate models
- A cascade system can boast a range of -50C to +150C (Model AHP-1200C31) while single stage systems AHP-1200CPV and AHP-301CPV can reach -15C to +120C
- Also include features such as integral temperature controller, data logging software, internal-to-external temperature switching and RS-232 communications

TECA www.thermoelectric.com

Digital Heaters

Dri-block®

- Users can now select two, three and four-block models for high throughput applications, as well as a twin control unit for more complex experiments
- Offers updated electronics, a brighter, larger LED display, and an innovative count-down timer function with audible alarm, ensuring timely and precise heating of test-tubes, microcentrifuge tubes, cuvettes, microliter plates and more

Techne www.techne.com

Raman Imaging Microscope

DXRxi

BOOTH 3544 (at INTERPHEX)

BOOTH 1107 (at AACR)

- New Thermo Scientific OMNICxi image-centric software provides visually driven data acquisition and intuitive sample targeting and parameter optimization
- Automated alignment and calibration saves time and frustration
- Near-instant visual chemical profiling requires no spectroscopic expertise to interpret
- Provides the ability to analyze large samples quickly

Thermo Fisher Scientific www.thermoscientific.com

Pulsed Discharge Detector

miniPDD

- Uses about one fifth (20%) the amount of helium as the VICI Valco D-3 and D-4 versions, giving up only a bit of sensitivity and dynamic range in return
- Approximately one half the size of the D-4, but has nearly the same sensitivity—about 100 ppb for fixed gases
- Suited to portable applications, and more

VICI www.vici.com

Ultra High Speed Cameras

Phantom v2010

- Almost 40 percent faster than the Phantom v1610, with the ability to capture more than 22,000 frames-per-second (fps) at full resolution
- Features high definition and widescreen 1280 x 800 CMOS sensors
- Offers high speeds and larger 28-micron pixels that allow for superior sensitivity when shooting in low light, which is often a problem with high-speed imaging

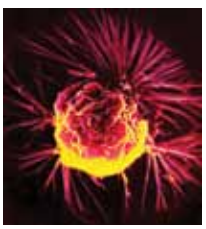
Vision Research www.visionresearch.com

CELL CULTURE

Cell Culture Plates

Alvetex®Scaffold

BOOTH 1544



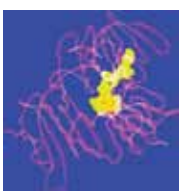
- Now available in a 384-well version
- Provide biopharmaceutical companies with a new tool to improve the predictive accuracy, productivity and biological relevance of their cell-based high throughput testing
- Give users simple workflow and ease of analysis
- Also available in a 12-well culture plate, 24-well culture plate, 96-well plate, 6-well and 12-well inserts

AMSBIO www.amsbio.com

Aptamer Kits for Cell Isolation & Flow Cytometry

AptoPrep™

BOOTH 1544

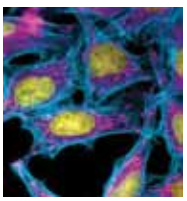


- Combine the advantage of the specificity of aptamer to target cell with the convenience of isolation/elution of a particular cell from complex cell samples
- Deliver positive isolation in as little as 30 min
- Mild and unique cell releasing technology allows users to isolate bead- and aptamer-free cells in as little as 1 hour

AMSBIO www.amsbio.com

Stable Cell Lines

BOOTH 1544



- New cell lines express endogenous or recombinant proteins and are available in a ready-to-use format to facilitate users' research efforts
- Provides an optimized solution for manufacture of therapeutic and diagnostic protein, but also for applications in drug screening, pharmacological research and toxicological studies
- Extensive portfolio available

AMSBIO www.amsbio.com

Single-use, Rocking Bioreactor System

ReadyToProcess WAVE™ 25

BOOTH 3141 (at INTERPHEX)

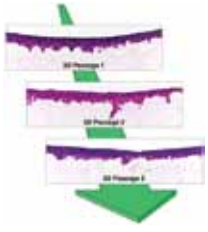
BOOTH 927 (at AACR)

- Designed to meet the evolving needs of bioprocessing
- Allows precise, automated, and intelligent control of numerous process parameters through a user-friendly graphical operator interface, which provides real-time control and many data analysis and reporting options
- Comprises a rocker, gas mixer, and pump, all operated by UNICORN™ control software
- Features quick set-up

GE Healthcare www.gehealthcare.com

Platform for Passaging Stem Cells

Alvetex®Strata



- Novel platform for passaging stem cells in 3D using Reinnervate's new Alvetex®Strata technology
- Allows pluripotent stem cells to retain their natural 3D structure during passaging, which offers an advance over traditional 2D culture methods
- Provides improved expression of markers of pluripotency and enhanced cellular differentiation
- Alvetex®Strata products are currently available in a 6-well hanging insert format

Reinnervate www.reinnervate.com

CHEMICALS, KITS & REAGENTS

Antifungal Certified Spiking Solutions®

- Include fluconazole, itraconazole, voriconazole, posaconazole, 5-fluorocytosine and ketoconazole at a 2.0 mg/mL concentration
- Suitable as Snap-N-Spike® starting materials in preparation of calibrators, controls, or linearity standards for LC-MS/MS testing of antifungals in therapeutic drug monitoring (TDM) or other critical clinical and diagnostic testing applications
- Prepared and certified to the highest industry standards

Cerilliant www.cerilliant.com

Internal Standards of Nicotine Metabolites

Snap-N-Spike®

- Now include two new solutions of nicotine metabolites anabasine-D4 HCl and trans-3′-Hydroxycotinine-D3 at concentrations of 100 µg/mL in methanol
- Can be used as internal standards spiked into patient samples or in isotope dilution methods for quantification of anabasine and 3-hydroxycotinine levels in nicotine screening and other clinical or diagnostic testing applications by GC/MS, LC/MS, or LC-MS/MS

Cerilliant www.cerilliant.com

Rare Cell Enrichment (Streptavidin) Kit

IsoFlux

- Designed to provide more options for circulating tumor cell (CTC) and other rare cell capture from biological samples
- Incorporates streptavidin-coated magnetic beads that can bind with one or more biotinylated antibodies targeted towards cell-surface markers on the cells of interest
- Facilitates capture of targeted rare cell populations that can include CTC and a variety of other cells

Fluxion Biosciences www.fluxionbio.com

Protein Purification System

ÄKTA™ start

BOOTH 3141 (at INTERPHEX)

BOOTH 927 (at AACR)

- Ready-to-go straight from the box
- Compact, affordable system represents a quick and reliable solution that removes the hassles of manual approaches and provides automated control of the purification procedure
- Controlled via a touchscreen, which displays the UV curve and other run data in real-time
- Allows the implementation of all common purification techniques

GE Healthcare www.gelifesciences.com

Transfection Reagent

Lipofectamine® 3000

BOOTH 1415

- For nucleic acid delivery in a broad spectrum of cell lines
- Increases efficiency up to 10-fold in difficult-to-transfect cells
- Reduces cytotoxicity-associated cell alteration
- Provides consistent results and more significant experiments
- Designed to optimize every step in the transfection process and deliver superior performance and improved cell viability in hard-to-transfect cells

Life Technologies www.lifetech.com

Enzymatic Shearing Kit

Chromatrap

- Contains all the necessary reagents and buffers for up to 10 chromatin preparations
- Allows users to determine optimal shearing conditions for their chromatin preparations and can supply them with enough chromatin to perform up to 24 ChIPs if using standard Chromatrap® ChIP spin column kit or up to 96 IP's if using Chromatrap® ChIP 96 high throughput microplate

Porvair Sciences www.porvair-sciences.com

qPCR Master Mix

rEVAlution

- Environmentally-safe, ready to use hot-start qPCR mixture offers superior safety, speed, and signaling capabilities
- Uses EvaGreen® dye, which is safe for aquatic life, safe for handling, can be directly disposed of down the drain, and produces stronger signals than SYBR® green dyes
- Requires less mixture for greater yield and has fewer contamination issues

Empirical Bioscience (formerly Syzygy Biotech) www.empiricalbioscience.com

LAB AUTOMATION

Compact Pipetting Workstation

NIMBUS384

BOOTH 3465 (Hamilton Company)

- Quickly handles most applications and accommodates multiple pipetting plate formats
- Unique 384 50 µL, air-displacement, multi-probe heads add even more flexibility by allowing users to pipette in 384, 96, quadrant, column, row and single-tip formats
- Features an ultra-flat deck with 11- and 12- positions, which allows for tip stacking and 1,536 pipetting automation

Hamilton Robotics www.hamiltonrobotics.com

PCR Workstation

NIMBUS

BOOTH 3465 (Hamilton Company)

- Enables fast and flexible assay setup for endpoint, real-time, qPCR or multiplex PCR
- Is PCR-kit-neutral, has an easy-to-use software wizard and suits a wide range of applications such as gene expression, genotyping, sequencing and pathogen detection
- Offers a variety of tip and labware types and can accommodate six master mixes and 192 PCRs

Hamilton Robotics www.hamiltonrobotics.com

Autosamplers

InMotion™

- This automated sample changer is designed for titrators, density meters and refractometers
- Offers excellent productivity in minimal space with flexible solutions for analyses
- Only 42 centimeters wide, the Flex and Pro series offer professional automation in minimal bench space
- The Max series can handle more than 300 samples on one 57 centimeters wide sample rack

METTLER TOLEDO www.mt.com

Air Displacement Pipettor Module

Cavro®

- Designed for Tecan's Cavro Omni Robot
- Integrated and optimized for use with the Cavro Omni Robot's Universal Z arm
- Gives users an alternative to the existing liquid displacement pipetting for any application using the Cavro Omni Robot
- Validated, maintenance-free design simplifies system integration, with onboard pressure-based liquid level detection (pLLD) and diagnostics to monitor correct operation

Tecan www.tecan.com

Online Automation System Configuration Tool

iAutomate™

BOOTH 3544 (at INTERPHEX)

BOOTH 1107 (at AACR)

- Self-serve, free-to-use tool
- Allows users to quickly and easily build their own system to meet application or process requirements, or modify an existing system around the Orbitor or Orbitor BenchTrak plate movers, a fully customizable plate mover
- Enables lab- or office-based access for automation optimization and efficient online estimating

Thermo Fisher Scientific www.thermoscientific.com

Automation Scheduling Software

Momentum™ 3.3

BOOTH 3544 (at INTERPHEX)

BOOTH 1107 (at AACR)

- Offers new features to facilitate set-up and streamline workflows
- Incorporates graphical system layout and an instrument integration suite within the runtime environment
- Users can accommodate quick system and instrument changes by configuring their system directly in Momentum 3.3
- Communication settings for all instruments on the system can be tested at the click of a button for rapid integration

Thermo Fisher Scientific www.thermoscientific.com

LIFE SCIENCE

Lentivirus for miRNA Expression and Inhibition

BOOTH 1544

- New range includes ready-to-use human and mouse lentivirus products for miRNA and anti-miRNA expression (miRNA inhibition)
- Lentiviral expression vectors are the most effective vehicles for delivering genetic material to almost any mammalian cell—including non-dividing cells and whole model organisms
- Produced from the optimally designed anti miRNA lentivectors

AMSBIO www.amsbio.com

Disease Panels for Real-Time PCR

PrimePCR
BOOTH 1118

- Now include 700 new PrimePCR human and mouse disease panels and 71 new pathway panels for real-time PCR (qPCR)
- Allow researchers to thoroughly and efficiently investigate genes known to be differentially expressed in a specified pathology or biological pathway
- More than 1,100 panels with nearly 6,700 predesigned plate configurations are now offered

Bio-Rad www.bio-rad.com

Cell Imaging Multi-Mode Reader

Cytation™ 3

- Now offers more new features to drive workflow efficiencies and data collection
- 40x and 60x objectives are now available options for any Cytation 3 application requiring increased magnification
- Higher magnifications allow easy imaging of bacteria, yeast, and sub-cellular structures such as mitochondria
- 35 mm, 60 mm and 100 mm Petri dishes are now compatible, for expanded sample vessel convenience

BioTek www.biotek.com

Pressure Monitor & Limiter

- Designed for any small animal volume controlled ventilator
- Protects rodent lungs, including mice, from typical barotrauma caused by mechanical ventilation
- Pressure monitoring features an analog output of the ventilation pressure signal allowing researchers to collect system pressure and make corrections to optimize the ventilation of their animals
- Features a peak inspiratory pressure range of 10-50cmH_2O

Harvard Apparatus-Hugo Sachs Electronik
www.harvardapparatus.com

Universal Blocking Oligos

xGen®
BOOTH 2514

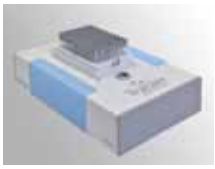
- By incorporating these oligos into target capture experiments, users can decrease the complexity and increase throughput of their target capture experiment without degradation of performance
- Able to bind to all indexed adapters using a single oligonucleotide sequence, removing the need for multiple oligos
- Allow users to more readily multiplex their experiments for cost-effective enrichment of thousands of samples

Integrated DNA Technologies www.idtdna.com

Code Reader for Frozen Samples

Tracxer RD235 CRYO

- Offers a high-end solution for scanning whole racks with 2D Data-Matrix or TraXis coded tubes
- Provides high resolution image quality, ensuring high-accuracy 2D code reading
- Features an anti-frost system which minimizes condensation on the scanner plate
- Allows users to easily scan a complete rack of 2D coded tubes in 7 seconds and a single tube in less than 2 seconds



Micronic www.micronic.com

Protein Precipitation Sample Preparation Kit

Combipack™

- Includes five color-coded Porvair P3 protein precipitation plates and five 1ml deep well collection plates
- Contains all the elements required to accelerate the traditionally troublesome procedure at a budget price
- P3 plate uses the CRASH method, in which the protein is denatured with acetronitrile and the flocculant filtered out, allowing 96 samples to be handled at one time

Porvair Sciences www.porvair-sciences.com

LIMS & SOFTWARE

Software for Chemometric Profiling Workflows

MassHunter Profinder
BOOTH 1812

- Designed for batch processing of complex mass spectrometric data
- Transforms chemometric peak-finding workflows with enhanced batch processing, robust re-mining and alignment capabilities
- Provides researchers with a tool for simultaneously processing multiple, large-volume data sets with minimal intervention, maximum flexibility, and excellent results
- Reduces the noise associated with data profiling

Agilent www.agilent.com

FDA 21 CFR Part 11 Software

WinASPECT® PLUS

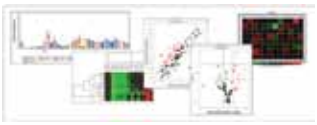
- For the Analytik Jena SPECORD® PLUS series
- Offers an excellent tool needed for efficient analysis in all fields, from R&D to production, from quality control to lab routine
- Provides a comprehensive user management to comply with all requirements of FDA conforming analysis, e.g. individual access rights for different users, electronic signatures, etc.

Analytik Jena www.analytik-jena.com

Software for Real-Time PCR

CFX Manager™ Version 3.1

BOOTH 1118



- Allows users to quickly and easily set up a real-time PCR experiment, assess data quality, and interpret results
- Includes new features for allelic discrimination, including automatic genotype call assignments based on a proprietary clustering algorithm, the option to change calls directly in the allelic discrimination chart, and a feature that allows users to view a map of the calls directly on the plate view

Bio-Rad www.bio-rad.com

Algorithm for Bioinformatics Suite

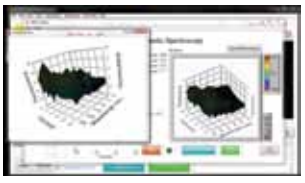
PacBioToCA

- Facilitates the assembly of genomes sequenced with Pacific Biosciences® long-read technology
- Optimized to take advantage of the highly parallel processing architecture of the Convey hybrid-core (HC) server
- Delivers six to 15 times acceleration
- Allows researchers to test more parameters
- Enables users to achieve results in a matter of days instead of weeks

Convey Computer www.conveycomputer.com

Kinetic Spectroscopy Software

TimePro™



- Designed to be used with CRAIC Technology's microspectrophotometers and their controlling Lambdafire™ software
- Allows the user to monitor changes in the spectra over time
- Also allows users to measure the time dependent changes in full UV-visible-NIR range reflectance, absorbance and even emission spectra of microscopic samples
- Is a plug-in module for CRAIC Technologies Lambdafire™ software

CRAIC www.microspectra.com

Management Software for Academic Researchers

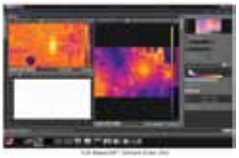
Projects

- Provides a simple, structured and safe way for scientific researchers to organize their research outputs
- Helps researchers to keep track of experiments, save time and get ahead with research
- Lets users view a unique chronological visual timeline of their research activity and more easily find important files, and much more

Digital Science www.digital-science.com

Thermal Research Analysis Software

ResearchIR™



- Aimed at R&D and Science users of thermal imaging cameras with a cooled or uncooled detector
- Available in 20 languages
- Provides a comprehensive set of acquisition, diagnostic and data sharing tools, and features customizable, savable workspaces that allow users to arrange how images, data, charts and plots are displayed
- Features zoom and pan capabilities and much more

FLIR Systems www.flir.com

Data Management Software

ActivityBase XE 7.7

- Now includes enhanced screening and analysis functionality
- Addresses growing assay volumes for high content and multiparametric datasets by processing information up to 50 times faster than the previous version
- New visualizations and third-party integrations support image-based screening capabilities and faster analysis to support decision-making
- A 64-bit version for data volume scale-up is also offered

IDBS www.idbs.com

Chemistry Functionality for ELN

E-WorkBook 9.4

- New chemical drawing features enable users to capture a wider variety of molecular types and streamlines chemistry data input
- Users can also now define organometallic structures with simplicity and efficiency
- A customizable chemical data lookup functionality speeds collaboration and data retrieval from external repositories
- Supports direct addition of data to experiments at point-of-use

IDBS www.idbs.com

Chemometric Interpretation Software

Pirouette®

- Can help the users achieve excellent chromatograph based control when integrated along with alignment technology, like InfoMetrix LineUp™, in the software bundle
- With LineUp alignment technology bundled into the method, GCs will generate very consistent results with retention time shifts automatically corrected, as long as mechanical problems, severe column degradation or a process upset don't intervene

InfoMetrix www.infometrix.com

Web-based Proteomics Software

ProteinCenter

BOOTH 3544 (at INTERPHEX)

BOOTH 1107 (at AACR)

- Now available as cloud-based version and can be accessed by multiple workstations in a laboratory
- Regularly updated from all major protein databases
- Contains a consolidated, biologically annotated, protein sequence database that enables filtering, clustering and statistical bioinformatic analysis from single, combined or comparison data sets
- Enables scientists to compare and interpret proteomics data sets in minutes instead of months

Thermo Fisher Scientific www.thermoscientific.com

MOBILE APPS

App for Monitoring of PCR Instrument Data

Download on the App Store

PCR Essentials

- Enables researchers and technicians equipped with iOS and Android-based mobile devices to obtain real-time performance data from Life Technologies' ProFlex™ PCR System
- Frees scientists and technicians to remotely monitor, review data and perform other tasks without being captive to the immediate vicinity of the instrument
- Available for free on the Apple App Store and Google Play

Grand Interactive www.grandinteractive.com

SUPPLIES & CONSUMABLES

Silicone Tubing for Peristaltic Pumps

IPX APSPG
BOOTH 3055

- Specially formulated to withstand the repeated compression and release actions of peristaltic pumps
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- 313" I.D. x .500" O.D. size tubing now available
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- Particularly suitable for storing active ingredients
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Greiner Bio-One www.greinerbioone.com

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- Accommodate a wider range of application requirements

Thermo Fisher Scientific www.thermoscientific.com

INSIGHTS ON CENTRIFUGES

PURCHASING AND CARING FOR A LAB ESSENTIAL

by Angelo DePalma, PhD

Air-cooled Benchtop Centrifuge / Allegra X-5 Beckman Coulter / www.beckmancoulter.com

Superspeed Centrifuge / Sorvall LYNX Thermo Fisher Scientific / www.thermoscientific.com

Cell Culture Centrifuge Value Package Hettich / www.hettweb.com

Centrifuges work on the principle of sedimentation facilitated by an apparent angular force that draws components of a rotating sample away from the center of rotation. Although centrifugation theory is straightforward, its engineering literature is voluminous due to the number of industries and research operations that depend on the operation.

What's important here is that centrifugation efficiency is proportional to the spinning radius and to the square of the angular velocity (radians per second, generally referred to as speed in revolutions per minute, rpm).

Thus, for a given rpm value a centrifuge with a 12-inch radius will be twice as efficient as one with a six-inch radius, and for a constant radius a device spinning at 1,000 rpm is four times as effective as one rotating at 500 rpm.

Centrifuges may be broken down by size, speed, or application. Size may be further differentiated by unit size, rotor capacity, or sample size. Speed (or g-force) refers to the centripetal force applied to the sample and varies significantly depending on the sample. At the very highest end are ultracentrifuges capable of separating molecules, cellular components, even isotopes. As rotational speed increases, samples and analytes tend to get smaller and separations more difficult.

Speed in rpms is the most common way to classify a centrifuge, although RCF (relative centrifugal force, or g) is more precise. Rpms are also the most common feature users ask for, according to Peter Will, product manager at Labnet International (a Corning Life Sciences company; Edison, NJ). "But g-force is the more critical number."

Rotational speed is no indication of an application's "sophistication." Scientists employ relatively low-speed centrifugation (around 300 g) to isolate highly stress-sensitive stem cells and spinning rates of 1 million g to fractionate DNA, RNA, viral particles, and proteins.

Numerous rotor types are available for laboratory centrifugation. The two most common designs are fixed angle and swinging bucket. In the former, sample tubes remain in a fixed position on the rotor within x-y-z space; separations progress along the side of the tube and into a pellet at the bottom, depending on the actual angle.

In swinging bucket designs, as the centrifuge reaches terminal speed, samples swing out from a vertical position to where they become parallel to the floor or workbench; pellets collect neatly at the bottom of the tube.

Within these two basic designs, centrifuges accommodate a wide range of sample holders, including microtubes (1-2 mL in size); conical tubes (50-500

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Push-button security and application flexibility

Auto-ID Instant Rotor Identification
Immediate rotor detection and programming

Fiberlite® Carbon Fiber Rotors
Improved ergonomics and performance

mL); larger containers for blood, plasma, and industrial processes; and even microplates. Agilent's (Santa Clara, CA) microplate centrifuges integrate with plate handlers and other components to automate complex workflows.

Vendors strive to address as many centrifugation tasks and container options as possible within specific centrifuge designs. Hence the capability overlap among various models. "There is quite a range of options within different markets," says Hugh Tansey, global commercial director for centrifugation at Thermo Fisher Scientific (Waltham, MA).

"Centrifuges may be broken down by size, speed, or application."

CARE AND MAINTENANCE

Centrifugation lore includes tales of violent malfunctions resulting in total destruction of the unit and much of the surrounding lab space. While these stories are unfortunately true, advanced centrifuge designs significantly reduce many potential safety issues through automatic rotor identification and inertia checks that shut the unit down if samples are improperly balanced. "Quality centrifuges will detect a mass imbalance quickly and both shut down and alert the user, usually through an audible or visual signal," says Peter Will.

Much more common than catastrophic failure are errors or breakdowns that lead to an unusable centrifuge or, perhaps as bad, lost samples. "Everyone in labs works so hard to get their samples to the point where they're ready for spinning down," Tansey says. "You don't want to have them locked into the system or damaged or lost."

Rotor acceleration and deceleration are critical for balancing the needs of sample preservation and rapid run time. Deceleration that is too rapid may cause disruption of the sample pellet, while rotor slowdown that is too deliberate can add considerably to run time. "Ideally, you want a rapid but soft stop," Will says. "Quality centrifuges control this through electronics and programming that come standard with the device, where users can specify acceleration and deceleration rates."

Another aspect of safe centrifugation is protecting operators from hazardous materials. Of concern are toxic chemicals and pathogenic bacteria and viruses. "Users working with these types of samples should look for models that offer rotors with aerosol-tight lids," says Will.

CLEANING

Centrifuges are generally quite impervious to abuse. Still, manufacturers recommend regular cleaning, to the point of marketing their own detergents and specialized cleaning products.

Randall Lockner, marketing manager at Beckman Coulter Life Sciences (Indianapolis, IN), recommends wiping out the inside of the centrifuge "can" (main chamber) at least every few cycles or runs. This not only maintains an appearance of cleanliness but also prevents more serious fouling and cross-contamination. "Check all the lid and rotor O-rings for wear, cracking, and material buildup, and make this part of your maintenance routine."

Many life science workflows still use radioactivity. Depending on the isotope, centrifuges can become quite "hot" unless users check and/or clean the unit and rotors regularly. Equally serious is the potential for cross-contamination, which can skew results based on imaging, radiation scanning, or scintillation counting. Users should make swabbing with an appropriate solution that sequesters inorganic or organic materials, followed by counting, part of their routine whenever isotopes are used. Labs should take appropriate measures to protect workers from high-level spills and/or potentially dangerous swabs.

Most common maintenance problems involve rotors. "Many life science applications employ salt buffers, and these can aerosolize or otherwise remain on the rotor after samples are removed," says Matt Lieber, product manager at Eppendorf (Hauppauge, NY). Anodized aluminum and carbon fiber rotors are less susceptible to salt damage than conventional metal rotors, but these should still be cleaned regularly. Lieber suggests a non-charged detergent or a 70% ethanol solution applied with an absorbent paper towel.

▲ *Bleach Towelettes for Centrifuges and Glucometers / HYPE-WIPE® and MINI HYPE-WIPE® / Current Technologies / www.currtechinc.com*

Users should regularly check pivots on swing-out rotors for proper lubrication and apply silicone-based pivot grease regularly. Improper lubrication will not cause a disaster, but it may affect swing-out rate and skew results, particularly with phase separations (e.g., phenol-chloroform extractions).

END-USER MAINTENANCE

Regardless of their materials of construction, rotors need checking for wear and tear, which will degrade performance and potentially cause safety issues. Users should look for indications of wear, scratches, gouges, or effects of chemical exposure.

Regular maintenance visits should include inspection of all rotors to ensure that they are in service-worthy condition. Beckman-provided service personnel perform these inspections and leave behind a "report card" on rotor status. Keeping track of rotors near the end of their service lives can help lab managers prepare and budget for eventual replacement.

▲ *Centrifuge Tubes / ExtraGene / www.extragene-web.com*

"The simplest preventive step for extending the life of a centrifuge is to keep it well lubricated," advises Jeff Antonucci, Northeast regional territory manager for Hettich Instruments (Beverly, MA). "Users should regularly check seals around the housing, as a ripped or broken seal can create a slew of problems. With refrigerated units, compromised seals can cause condensation and freezing within the chamber."

Antonucci suggests that users "listen and feel" the centrifuge. "If you notice any vibration, shaking, grinding, or anything that doesn't seem or sound right, stop the unit right away, inspect it, and if you can't see the problem, call the manufacturer."

Hazardous materials likely to be encountered during centrifugation include toxic chemicals, biohazards, and radioisotopes. No matter how careful the operator, spills, contamination, and cross-contamination are facts of life. Vendors are happy to advise users on preferred, noncorrosive cleanup techniques and products. Keep in mind, however, that what works for pathogenic viruses may provide insufficient decontamination for radioactive contamination spills.

> "As rotational speed increases, samples and analytes tend to get smaller and separations more difficult."

SERVICE

While vendors have relegated catastrophic centrifuge failures to the bad memory department, today's users should be aware of the potential for bad results or loss of sample, which are almost always the result of substandard maintenance bred through adoption of poor centrifugation practices.

"All labs that depend on centrifuges should ensure that a professionally trained service engineer looks over the instrument at least once a year," advises Randall Lockner. "Bottom line: Get a service agreement. Centrifuges are substantial investments, and if they go down, so does your laboratory."

All service agreements should include some level of preventive maintenance by trained technicians. Beckman offers tiered service packages that may include additional

▲ *Centrifuge Rotors / FA-45-6-30 & A-2-DWP-AT*
Eppendorf / www.eppendorfna.com

coverage for mechanical repairs or replacements. Absent a service agreement, the cost of maintenance can add up, especially when parts, travel, and labor are factored in.

The service engineer, whether an employee of the vendor, a third-party service organization, or an independent, is the primary resource for non-routine centrifuge care and maintenance. Top vendors will provide a technician at the time of acquisition to ensure that the instrument is installed and balanced properly and to provide training for users who need it. "The engineer will also determine whether the power supply and ventilation are appropriate for that unit and that users understand the basics of balancing samples, replacing rotors, and other basic functions," Lockner notes.

PURCHASE DECISIONS—WHAT TO CONSIDER

Centrifugation is a mature technology, but given its essential role in most laboratories, managers should take purchase decisions seriously. "Customers look for high-quality centrifuges and a strong brand reputation," says Thermo Fisher's Hugh Tansey. Users want results faster, so spin rate and rotor capacity should be at the top of a lab's wish list.

Applications are the primary driver, says Randall Lockner, of which centrifuge category or model to acquire. "Are you separating nanomaterials? Are you doing mostly simple pelleting? Cell culture or cell fractionation? Consider what you need to retain and what you'll be discarding in your samples and what feeds into that selection process."

These considerations are where vendor interaction is most helpful, because a good deal of capability overlap exists among centrifuge models. "This becomes a challenge for new labs or new purchasers," Lockner says. "It's up to the vendor to explain differences among models based on the end user's needs. For many labs, a general purpose tabletop model with the proper accessories will handle every conceivable workflow."

Vendors foster this functional overlap by designing greater flexibility within each centrifuge product category. According to Tansey, rather than purchasing several systems or even a general-purpose floor model, labs can acquire one benchtop unit that's easier to use and offers greater performance in a smaller footprint. These centrifuges sport intuitive displays and motorized, automated lids and latches. "We've replaced several platforms with future-ready centrifuge platforms with improved safety and rotor installation and greater usability," Tansey says.

Labs that centrifuge large samples of three or four liters or more or many samples at once are probably destined for a floor-model centrifuge. Both tabletop and floor units are capable of sedimentation of nanoparticles and cell components, depending on throughput and capacity requirements. In fact, many labs have both types of centrifuge. "But expensive lab real estate leads to the drive to reduce not only the number of instruments but also instrument sizes," Lockner says.

Managers should not discount lab environment in their purchase. Large centrifuges take up a lot of space and make a good deal of noise. Many organizations have begun to include centrifuges in core facilities, which are usually some distance (even several floors) away from where operators generally work. Luckily, the software capabilities of today's centrifuges enable multiuser environments while maintaining traceability and safety. Some vendors now provide apps that allow users to monitor centrifuge operation remotely, for example when a run is completed or if the user ahead of you is not quite ready to give up the instrument.

Many labs still rely on older centrifuges that lack the capacity, capabilities, and user-friendliness of today's units. They tend, says Tansey, to focus on today's applications without regard to how projects and workflows might change. Modern designs can, through introduction of a new rotor or adapter, provide labs with great flexibility and performance. "Don't be too grounded in what you think a typical centrifuge might bring you," Tansey advises.

Purchasers should also focus on consumables. "Customers are not always cognizant of the tube type they work with," says Lieber. While adapters exist for using major tube types with most microcentrifuge rotors, cryovials and HPLC tubes may require special adapters. "Tube types become even more challenging with large rotors, due to the wide variety of large tube formats."

Lieber also suggests considering noise level, unit size, and physical profile. Users whose "office" consists of a few square feet of space on their workbench or at a

nearby table may suffer hearing problems or become distracted by the noise from an often-used centrifuge. "Make sure you know where centrifuges will be located and how they will fit on the bench or floor."

TUBES AND ROTORS

Labnet's Peter Will narrows down a customer's centrifuge needs by first asking what size tubes they intend to spin, if they require a fixed-angle or swing-out rotor, the number of tubes they need to spin per run, whether they require refrigeration, and finally the g-force or rpms required to get the job done.

"Tubes per run is critical and a factor that I believe differentiates us from some of the competition," Will says. Generally, the more tubes that fit within a given rotor footprint, the better, especially for larger, high-throughput labs. Analogously with speed/rpms, higher-capacity rotors accommodate fewer tubes, but smaller-capacity rotors are more limited.

Will agrees with the other experts interviewed for this article that ease of swapping out rotors is a critical attribute for centrifuges. Purchasers should be wary of units requiring more than about 30 seconds to switch rotors. Swapping

▲ *Centrifuge Tubes / Tube® 5.0 mL / Eppendorf / www.eppendorfna.com*

difficulty and extended switch-out times are often indicative of poor ergonomics, heavier materials of construction, and sometimes potential sources of operating error.

Intuitive control panels are a factor that readers of *Lab Manager* are familiar with for more operator-intensive instrumentation (e.g., HPLC, MS), but that applies just as aptly to centrifuges. Labnet and Hermle units, for example, have simple control panels that do not require cross-training as operators move from one instrument to another.

▲ *Black Screw-Top Centrifuge Tubes / Asynt / www.asynt.com*

"Purchasers should not limit themselves to today's workflows," Will advises. "They should therefore select models that provide flexibility, both for current applications and potential future applications." Flexibility relates to spinning speed as well as to the ability to accept rotors that hold larger or specialty tubes or even microplates.

Purchasers should also consider ease of use. "Customers don't want to think too much about centrifuges," Tansey says, "They just want them to work, especially in labs with high turnover or with multiple common users."

Changing rotors, especially larger ones, used to be challenging for many lab workers. Large metal rotors used in floor-model centrifuges are particularly difficult to manipulate. "Historically this required the use of tools and physical strength," Tansey says. Rotor changes were a significant source of damage to the unit, particularly when attempted by untrained operators.

Top vendors have significantly reduced rotor change headaches by making rotors lighter and easier to engage and disengage from the centrifuge. Managers investing in new large centrifuges should therefore consider carbon fiber rotors, which are up to 60% lighter than equivalent metal rotors. Carbon fiber rotors are resistant to many chemicals that damage metal so may even last longer than their heavier counterparts. Thermo Fisher's Auto-Lock system enables rotor changes through push-button control with no tools required.

Another consideration, particularly with swinging bucket rotors, is some sort of containment lid that protects users from materials that aerosolize from centrifuged samples. Biocontainment becomes the operative term with centrifugation of biohazardous cells and organisms, but in effect the lids will protect the lab from any hazardous material capable of volatizing.

As with rotors, installing biocontainment lids requires some skill and care. Thermo Fisher's ClickSeal technology makes removing and applying the protective lids much easier, according to the company.

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... LABORATORY GLASSWARE WASHER?

Whether to employ central washing stations or point-of-use washers located under a lab bench or in a corner is also something that has to be addressed with regards to laboratory glassware washers. The former provide an economy of scale and are popular with lab workers who, almost universally, hate to "wash the dishes." The downside for central washing stations is that glassware tends to disappear over time, due to breakage and operator error.

Frequency of lab washer usage by survey respondents

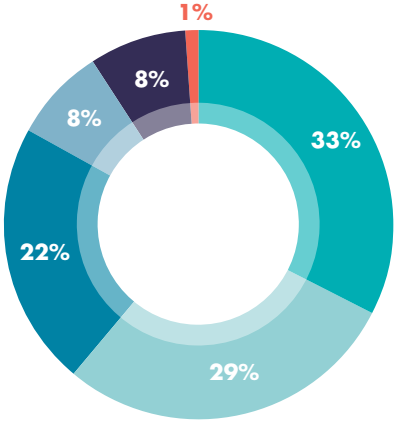
Several times daily	31%
Once a day	18%
Several times each week	28%
Once a week	10%
Two to three times a month	7%
Once a month	1%
Less than once a month	4%

Amount of time per day spent hand-washing glassware in their lab as reported by survey respondents.

Less than 1 hour	41%
1 - 2 hours	40%
2 - 3 hours	17%
over 3 hours	3%

Nearly 36% of respondents plan on purchasing a glassware washer in the next year. The reasons for these purchases are as follows

- Replacement of aging lab washer
- Moving from hand washing of glassware to a lab washer
- Addition to existing systems, increase capacity
- Setting up a new lab
- Changing from the current type of lab washer
- Other



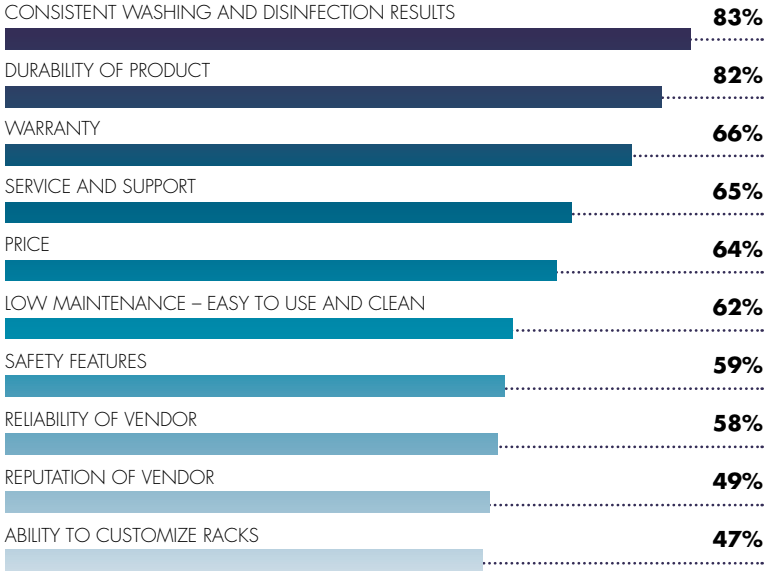
TOP 6 QUESTIONS

You Should Ask When Buying a Lab Glassware Washer

1. How is the product manufactured? Ask about the quality of the materials used and the product life expectation based on manufacturing testing. Also find out about the product's warranty.
2. What differentiates the lab washer from others offered in terms of performance?
3. Does the company offer application support and technical phone support before and after product installation?
4. How sustainable is the product? Ask the company to provide details on energy and water consumption as well as the recycle ability of the product.
5. If the product is discontinued, for how many years does the company provide accessories and parts for the washer?
6. Finally, ask about the cost of the purchase—not just the price of the product being installed but the total cost of ownership, which includes price, service expectations, warranty, etc.

TOP 10 FEATURES/FACTORS

respondents look for when purchasing a glassware washer.



Completed Surveys: 266

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

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

Gas chromatography (GC) is a common technique used in analytical chemistry for separating and analyzing compounds that can be vaporized without decomposition. GC is typically used for separating the different components of a mixture, improving the purity of a particular substance, or identifying a particular compound. GC is a ubiquitous technique, and the various GC instruments available are designed to achieve every requirement of the technique.

Types of GC Detectors used by survey respondents

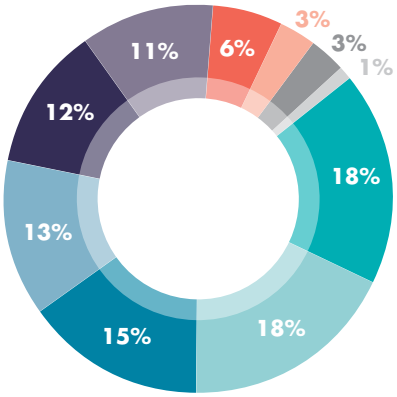
Flame ionization (FID)	32%
Thermal conductivity (TCD)	14%
Electron capture (ECD)	15%
Nitrogen-phosphorus	4%
Flame photometric (FPD)	5%
Photo-ionization (PID)	3%
Hall electrolytic conductivity	1%
Mass spectrometer	24%
Don't know	1%
Other	1%

GC-related components used by survey respondents.

Autosampler	24%
Data system	24%
Purge & trap	11%
Gas generator	9%
Headspace sampler	11%
Regulators, valves, fittings	21%

Nearly 44% of respondents plan on purchasing a GC system in the next year. The reasons for these purchases are as follows

- Addition to existing systems, increase capacity
- Upgrading existing GC-MS system
- Require more sensitivity
- Require shorter run times/increased lab throughput
- Setting up a new lab
- Require higher quality data
- Trying to reduce operating costs
- Require greater mass stability
- Other
- Require Retention-Time Locking (RLT) ready



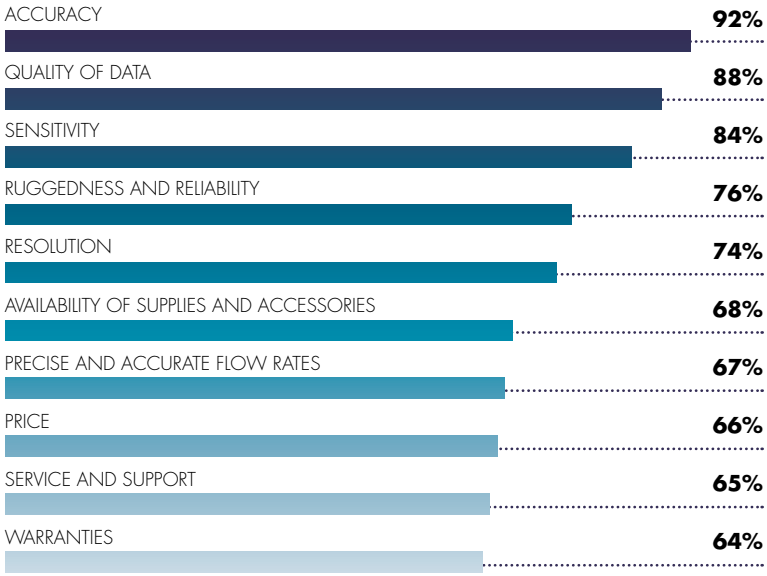
TOP 6 QUESTIONS

You Should Ask When Buying a GC System

1. What factors come into play when determining the GC system specifications you require in terms of cycle time, enhanced operator benefits, increased productivity and flexibility for specific applications?
2. What differentiates the vendor's GC system from others offered, in terms of performance?
3. How do you validate the specification claims presented by the vendor?
4. Has the data processing software been designed for enhanced analytics, with workflow in mind and does it support critical compliance requirements?
5. What are important price points to keep in mind when selecting a GC system?
6. Laboratories need fast and effective services, including an effective distribution of instruments, spare parts, education, and service personnel. How does the company serve these needs worldwide?

TOP 10 FEATURES/FACTORS

respondents look for when purchasing a GC system



Completed Surveys: 260

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

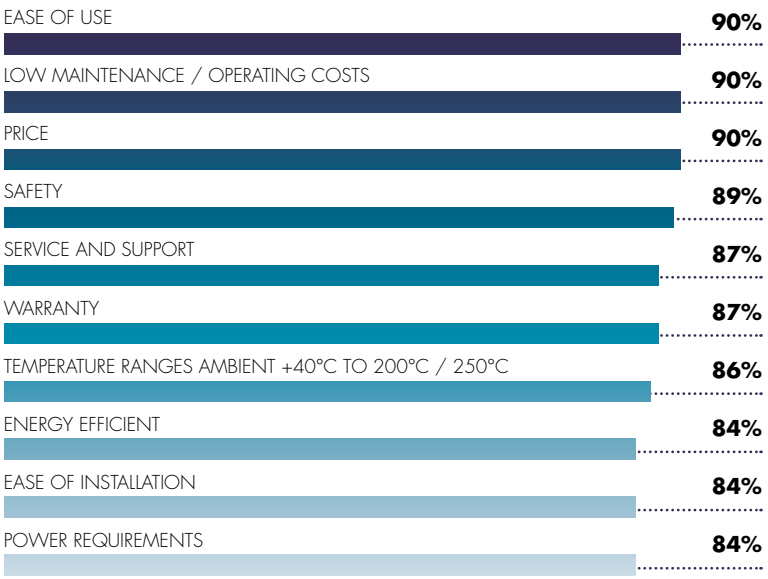
ARE YOU IN THE MARKET FOR A...
LABORATORY OVEN?

Common laboratory ovens maintain temperatures ranging from just above ambient to about 300°C and are ubiquitous in chemistry, biology, pharmaceutical, forensics, and environmental labs. Units operating at temperatures above 300°C are normally dedicated to specialized applications in physics, engineering, electronics, and materials processing. Typical lab ovens use four to six cubic feet of space and are located on benchtops or stacked atop another oven; other units may be much larger.

TOP 5 QUESTIONS
You Should Ask When Buying a Lab Oven

1. What temperature range do you require? (Does the product have reserve temperature capacity?)
2. What accuracy and uniformity does the product have? (Will my sample be damaged or will my experiment only function in one "sweet spot"?)
3. Are interior chamber space / weight of my sample and floor space in the lab a match to application and lab?
4. Do I need any computer interfaces, alarms or safety devices on my oven?
5. Are accessories like data loggers, viewing windows and modifications like access ports available from the manufacturer to suit my specific needs?

TOP 10 FEATURES/FACTORS
respondents look for when purchasing a lab oven



Completed Surveys: 264

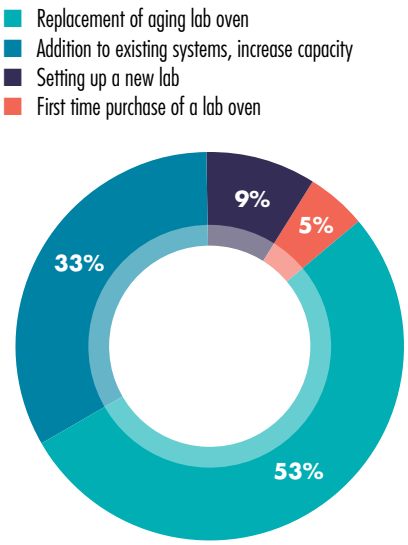
Types of lab ovens used by survey respondents

General Purpose Oven	41%
Microwave Oven	17%
Mechanical Convection Oven	16%
Vacuum Oven	10%
Gravity Convection Oven	8%
Other	4%
Safety Oven	3%

Oven-related applications performed by survey respondents.

Heating and drying	56%
Temperature-linked experiments	18%
Evaporating	12%
Sterilization	5%
Other	5%
Baking	3%

Nearly 30% of respondents plan on purchasing a lab oven in the next year. The reasons for these purchases are as follows



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

VACUUM PUMPS

CHECK FOR WEAR AND TEAR ON A REGULAR BASIS

by Rachel Muenz

Keeping your vacuum pump happy all comes down to regular maintenance.

"Regularly maintaining your vacuum pump will help minimize downtime and ensure a long, trouble-free life," says Roland Anderson, laboratory products manager at KNF Neuberger (Trenton, NJ). "Wearing parts should be monitored and replaced based on both their time in service and the specifics of the application. It's important to identify maintenance issues before they lead to unexpected downtime."

Jim Ramsden, scroll pump product manager at Agilent Technologies (Santa Clara, CA) agrees that simply doing the maintenance is the most important thing.

"A lot of customers just see it [vacuum pump] as a black box that things go into and vacuum is created, but the vast majority of vacuum pumps do have some level of maintenance that needs to be done," he says, adding that most vendors are making it easier for that initial vacuum pump maintenance to be done by users themselves.

"Vacuum pump manufacturers are trying to move in a general direction of keeping the service intervals as long as they can," Ramsden says. "There's a great desire to make sure that service intervals are longer than a year for the basic maintenance and moving towards two years for the basic when you can."

How often you should perform maintenance on your pump comes down to the type of pump and the applications you're using it for.

"Most vacuum pumps, for the first basic maintenance, it is about a one-year timeframe," Ramsden says. "Some pumps, some types of pumping mechanisms, can go to a two-year maintenance cycle."

▲ KNF's LABOPORT and LABOPORT Mini vacuum pumps.

Anderson says there are many clues that it's probably time to do maintenance on your pump, including: elevated operating noise, elevated surface temperature, reduced vacuum and/or flow performance, difficulty starting, and contamination in the pumped media.

"With medium mechanical pumps, you'll see the lowest pressure it can achieve slowly rise over time," Ramsden adds of signs to watch for. "That's usually an indication that it's time to perform basic maintenance."

He says such signs are harder to see with high vacuum pumps, so most users will do proactive maintenance.

SERVICE PROGRAMS:

- KNF offers a free repair evaluation program for all their vacuum pumps and systems
- For more difficult maintenance, most companies offer field engineers to go onsite to look after pumps, an exchange program where users can exchange their pump in need of maintenance for one that's good to go, or a factory maintenance program where users send their pumps in for repairs

Vendors are making it easier for users to do the first initial maintenance on their vacuum pumps themselves, but more advanced tune-ups should be performed by the manufacturer unless the user has the right tools and experience.

"That'll be dependent very much on the application of the pump," Ramsden says, adding that creating a maintenance plan based on those applications is important for all pump types.

As for things to be careful of when looking after your pump, Anderson mentions: over-tightening screws, not properly installing replacement parts, misplacing shims or spacers and incorrectly reassembling the pump components. Ramsden adds that users often buy a maintenance kit to do initial maintenance but won't read the manual.

"They won't do everything that's recommended in the manual, including just cleaning the inside of the pump out," Ramsden explains. "They'll attack the big thing…but they won't pay attention to the little things which are actually contributing to wearing down other parts of the pump."

Some users will take on more maintenance they can handle or outsource that maintenance to third-party companies, which, while most provide excellent service for basic issues, aren't always equipped to look after more advanced problems, Ramsden says.

Of course the biggest thing is just to remember your pump, Anderson says.

"Often, pumps are located out of sight (and out of mind). For this reason, as long as they work, they remain an afterthought," he says. "It's important to occasionally inspect your vacuum pump for signs of wear. The goal is to catch issues before they become problems. This way you can avoid unexpected downtime and costly repairs."

ADDITIONAL RESOURCES TO CONSULT:

- User's/service manual
- Vendor's technical support
- Contact the manufacturer for added guidance, reach out to the sales rep
- Instructional videos and online resources
- Word of mouth—colleagues, maintenance technicians, or knowledge leaders
- Vendor training programs and seminars

For more information about vacuum pump maintenance check out the How it Works article from the folks at VACUUBRAND on page 86. Also be sure to look for Labconco's How it Works in our upcoming April issue.

OPTIMUM VACUUM PUMP MAINTENANCE

Problem: Vacuum pumps are laboratory workhorses, providing the conditions needed to run many lab applications. Unfortunately, pumps are also exposed to acid or organic chemical vapors that can cause some real maintenance issues. Particularly with oil-sealed, rotary vane pumps, the exposure of the oil to the chemical vapors can cause the oil to become corrosive, or to break down and no longer serve its vital lubricating function. Regular oil changes are needed to protect the pump.

Beyond regular oil changes, what can you do to keep your lab vacuum pump operating reliably for years? Using oil-free pumps whenever possible is a good starting point. Most lab applications—filtration, aspiration, rotary evaporators, ovens, concentrators, gel dryers—are actually better served with chemical-resistant, oil-free diaphragm pumps, which provide vacuum at an appropriate level and require less maintenance. Some applications need the deeper vacuum that only an oil-sealed rotary vane pump (belt- or direct-drive) can supply, however. For these applications—most commonly freeze dryers, molecular distillation and Schlenk lines—oil-sealed pumps may be your only option.

Solution: Follow the Seven Golden Rules of Vacuum Pump Maintenance, and you can reduce service interruptions and help your pump last a long time.

Rule 1. Read your manual and check the oil regularly.

Can't find the manual? Most manufacturers' manuals are available online. Download the manual and review it for operating and service recommendations. Then change the oil according to the manufacturer's schedule or if it looks dirty or smells bad.

Rule 2. Warm up the pump with the inlet blocked.

By running the pump for 20 – 30 minutes with the inlet blocked before connecting to your vacuum application, fewer vapors will condense in pump oil. Consider installing a manual valve in-line to simplify warm-up.

Rule 3. Never block a pump outlet.

Blocking the pump outlet, at best, will cause the pump to stop. At worst, the overpressure condition in the pump may loosen the seal around the oil sight-glass, causing it to leak and need repair.

Rule 4. Use an inlet cold trap to protect the pump from corrosive vapors.

A cold trap at the inlet both protects the pump from corrosive vapors and reduces the vapor load on the pump, so it operates more effectively. Make sure it is cold enough for your solvents, using liquid nitrogen, for example, for very volatile solvents.

Rule 5. Use gas ballast (continuous purge) when working with condensable vapors.

Gas ballast on a vacuum pump uses air to boost condensates through the pump to the outlet, purging some of them from the oil. For applications with high vapor loads and corrosive gases, a hybrid pump (combination rotary vane/diaphragm pump) will keep the oil reservoir under vacuum, continuously distilling vapors and aggressive gases out of the pump oil, reducing corrosion and greatly extending oil-change intervals.

▲ *VACUUBRAND RC6 Chemistry-HYBRID pump. Hybrid vacuum pumps, combining rotary vane and diaphragm technology, provide deep vacuum levels with greatly reduced service.*

◀ *VACUUBRAND, INC. offers a free pump tag with a concise summary of the Seven Golden Rules for rotary vane vacuum pump maintenance.*

Rule 6. Protect the pump from particulates with an inlet filter.

Use an inlet separator to keep abrasive particulates out of the pump oil and rotating mechanism. Test for particulates by rubbing a little oil between your fingers. Consider an in-line oil filter to extend oil lifetime.

Rule 7. Run the pump after use to purge solvents from the oil.

After the application is complete, block the pump inlet, open the gas ballast and run the pump for a few minutes before shutting it off. By operating the pump near its ultimate vacuum level but with good air flow, many solvents dissolved in the oil can be purged, reducing internal corrosion during shutdown.

For more information, contact info@vacuubrand.net

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FLEXIBLE GAS CONTROL EQUIPMENT

Problem: In almost any laboratory or scientific research facility today, there are numerous devices, instruments or processes that require cryogenic fluids or gases supplied from cryogenic sources. The past quarter-century has seen cryogenic liquid cylinders expand from a rarity in laboratories with relatively few applications, to become the dominant mode of supplying high-purity gas and cryogenic fluids.

Inductively Coupled Plasma analyzers (ICP) would not be in such wide use without the storage and cost-savings of high-purity argon gas supplied from portable cryogenic or microbulk installations. They are now at every petroleum refinery, metal or ore process facility, water treatment plant, major food processor, and pharmaceutical manufacturer. The growth of industrial CO_2 lasers can be directly linked to the ability to supply large quantities of nitrogen or oxygen gas vaporized from cryogenic sources.

Solution: Gas control equipment allowing these vastly different applications to optimize the economic benefits of gas derived from cryogenic sources satisfies this burgeoning need.

Such gas delivery systems handling the required flow at lower inlet pressures common to portable cryogenic cylinders or microbulk must be properly designed, sized, and located. A case in point is CONCOA's second-generation IntelliSwitch II 538 gas delivery system (see image) utilizing Internet technology that expands to real time the control and monitoring of any cryogenic supply system.

In the medical field, mapping the human genome, stem cell research and advances in biopharmaceuticals might have been impossible without the exponential growth in cryogenic storage of biological samples. From cryoablation surgery to remove abnormal growths and harmful substances to *in vitro* fertilization, the advances in cryogenics are changing and saving lives. The shortage of helium can be directly linked to the increase in MRI installations at hospitals and the increasing demand for liquid helium.

The growth and diversity of applications now using cryogenic fluids for their thermal properties have gone beyond the laboratory setting and the futuristic world of cryonics. Industrial uses include shrinking turbine bearings, cryogenic CO_2 cleaning of metals, electronics, and clothing, to environmental applications that include lead paint removal, plastic and rubber recycling. Cryogenics and food have evolved from flash-freezing meats to using liquid nitrogen in the kitchens of many restaurants.

Superconductors or liquefied natural gas (LNG) have not yet been mentioned here, begging the question: Where will cryogenics be used and applied next?

Companies such as CONCOA are actively engaged in developing the next level and generation of control for cryogenics, gas or liquid in what now appears to indeed be the cryogenic century.

Sustained and consistent supply, whether in gas phase at room temperature or cryogenic fluids at -196° C (77°K) and precision control of pressure and temperature are critical to further growth of cryogenic applications.

For more information, please contact Larry Gallagher, specialty gas products manager, CONCOA, Virginia Beach, VA 23454, at 800-225-0473 or lgallagher@concoa.com

▲ *CONCOA's IntelliSwitch II controls and monitors cryogenic supply systems.*

WIRELESS REMOTE TEMPERATURE MONITORING

Problem: For a lab manager, these scenarios are all too familiar:

- **A medical research lab has a -20°C freezer where the door is frequently left ajar and there is no door alarm.**
- **In an academic biology lab, a -20°C freezer is accessed on average 20 times an hour and also has a -80°C freezer that warms to -55°C routinely due to new lab students and sustained door openings, thinking "hmmm, what did I come here for again?"**
- **As a lab manager, you receive a phone call at 3 a.m. saying a freezer has alarmed which forces you to go into the lab in the middle of the night.**
- **Any of these scenarios may resonate if you work in the lab environment. Most Building Automation Systems (BAS) do not send details of an alarm event; usually they only place a phone call stating something is in alarm. These situations are frustrating to labs requiring a higher level of monitoring, alerting, and control of their research samples.**

Minus80's Mobile App showing real-time temperatures and door status. (Available for both iPhone and Android operating systems).

Solution: Building Automation Systems often serve as the central platform for HVAC, fire alarm, and emergency notification systems. In some cases, emergency notifications include freezer alarms. Most in the lab have learned BAS provides limited information. Labs with freezers, refrigerators, incubators, and LN_2 storage need to have defined monitoring solutions that are customizable, stand-alone systems to protect samples. They need to be cloud-based wireless systems with built-in redundancy, offer an intuitive web portal and mobile app to see real-time data from anywhere, and most importantly, increase awareness *in advance* of a failure to allow lab staff to take proactive measures and prevent loss.

Duke Medical's Fanny Ripple Transplantation Lab in Durham, North Carolina studies issues relating to chronic rejection of pulmonary allografts including GERD, as well as gut immunity and biome depletion. The lab has utilized Duke Medical's BAS since 1992 for monitoring and transitioned to Minus80 Monitoring in November 2013 for their -80°C, -20°C, and -140°C freezers. While fortunate to have any monitoring at all previously, it was limited. The research analyst for the lab, Zoie Holzknecht states, "If a freezer went into alarm (temperature only) I would get a call stating that an alarm had gone off in a particular "zone." There was no information on which freezer or what the current temperature was."

The new cloud-based wireless system allows Zoie to have higher level monitoring. This gives the ability to customize both internal and ambient temperature parameters, recovery times, door settings, and create unique 'Action Lists' utilizing text, email, and voice for one or multiple people. All data is archived for later use and PDF reports are readily available. Automated reporting makes it easy to stay in compliance with facility regulations. Minus80's Mobile App also allows Zoie and lab staff to see real-time temps and door status. Zoie states: "Door events are important. Sometimes the temperature alarm will go off when there is no real maintenance issue, just higher volume use. This feature saves me a trip back into the lab to check the freezer when a student or co-worker is just working late in the lab."

These features help Duke Medical's lab have a more accurate view of their storage units while away from the lab, and have helped strengthen lab protocols, identify units at risk of failure, and help enhance sustainability initiatives. Wireless temperature and door monitoring provides tremendous insight and collectively helps guard against system failure and sample loss. While it is often tempting to use a building system already in place, it may not be the best solution for research monitoring where control is critical.

For more information, visit www.minus80monitoring.com

A COMBINED METHOD FOR QUANTITATIVE AND QUALITATIVE CELL-BASED RESEARCH

Biochemical and cell based assays using a microplate reader provide quantitative data on ex vivo cell behavior, while viewing cells with a microscope allows researchers to see cellular and intra-cellular processes via fixed cells or with live cell imaging. Both methods are equally important to life science research and the drug discovery process. Together, these methods provide valuable, content rich data that otherwise requires the expense of multiple instrumentation. The Cytation™3 Cell Imaging Multi-Mode Reader from BioTek Instruments, Inc., combines both methods in one compact, affordable instrument. With this unique combination, BioTek brings microplate detection analysis and automated digital microscopy to researchers without the need for separate, expensive and complex imaging systems. Additionally, cells may be grown directly in Cytation3 to reduce environmental variation due to manual intervention. Now, researchers can culture cells and subsequently glean almost simultaneous quantitative and qualitative data. Cytation3's combination of technologies also helps to streamline cell biology research for improved lab efficiency and increased throughput.

Cytation3 is modular, so labs can select only the modes that they need, and can upgrade at any time as their needs evolve. Microplates from 6 to 384 wells, and microscope slides may be used, for a variety of throughput needs. Optional dual reagent dispensers may be used for inject-and-read assays, and the optional BioStack3™ Microplate Stacker has a plate transfer time of about 8 seconds per microplate, for increased throughput and walk-away automation of up to 50 microplates.

CELL-BASED ASSAYS

Patented Hybrid Technology™, incorporated in Cytation3 or available as an upgradeable option, combines filter- and monochromator-based fluorescence optics in one compact unit for power and flexibility in assay choice. The filter optics use direct, fiber-free light paths to maximize light delivery to the sample and detector, and dedicated filter optics are optimized for live cell assays. Monochromator optics use quadruple diffraction gratings to concentrate and purify the selected wavelength, thus optimizing spectral discrimination. User-selectable monochromator optics also allow for wavelength scanning and kinetic measurements. Multiple parallel detectors decrease measuring time, and both optical systems may be read from the top or bottom of a microplate for increased assay versatility.

CELL MICROSCOPY

Cytation3 automates cell microscopy throughput compared to manual fluorescence microscopy, and also allows simple assay validation before moving to high-content screening. An inverted fluorescence microscope with brightfield capability and autofocus is integrated in Cytation3 or available as an upgradeable option. Fluorescence microscopy and color switching are available through red (Texas red), green (GFP) and blue (DAPI) LED filter cubes, and brightfield images are taken with a simple white light. Additionally, 2.5x and 4x objectives allow researchers to view and read entire microplate wells, while 10x and 20x objectives allow viewing and reading of intracellular details.

CELL PROPAGATION

Cytation3 offers uniform temperature control up to 45°C across the culture chamber, and variable orbital shaking to keep cells in suspension, even during long experiments. An optional gas control module regulates CO2 and O2 concentrations for optimal physiological conditions and pH buffering. Adding these environmental variables directly to the reading and imaging chamber reduces cell culture exposure to unregulated lab atmospheres and fluctuating temperatures that may adversely impact results.

The combination of multi-detection reading and microscopy, along with integrated cell incubation, allows for endpoint, time-lapse and montage information to simplify research and assay development, and increase throughput in cell biology research.

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PURELAB®Chorus

The **PURELAB® Chorus** range of laboratory water systems offers customers the ability to customize a system to fully optimize to best fit their application, budget and the configuration of their laboratory – all without compromising on water quality or the visual appeal of the unit. PURELAB® Chorus systems are well suited in laboratories with limited laboratory space and that must retain precise control over dispensing methods and storage options.

The PURELAB® Chorus range includes three water purification systems specifically designed to deliver the necessary water quality at the required through-flow – Chorus 1 for ultrapure Type I+/I, Chorus 2 for pure Type II, and Chorus 3 for general pure grade Type III water.

PURELAB® Chorus 1 produces the highest inorganic water purity available by applying advanced PureSure® deionization, which removes even trace amounts of those ions that could otherwise interfere with ultrasensitive analysis methods such as HPLC, Inductively Coupled Plasma (ICP) Atomic Emission Spectrometry or ICP Mass Spectrometry. Constant real-time total organic carbon monitoring provides complete confidence in the organic purity of the water. In addition, the employment of integrated ultrafiltration/microfiltration, full spectrum UV treatment and full recirculation guarantees the highest organic purity of the water at the point of use, with complete removal of endotoxins, proteins, nucleases and particulates. This makes it ideal for even the most sensitive of applications.

PURELAB® Chorus 2 is the optimal fit for those applications requiring reliable, high purity water with good organic, inorganic and microbial control, but where ultrapure water is not essential. These include electrophysiology, histology and general chemistry.

The PURELAB® Chorus 3, offers the lowest cost of ownership and provides high flow rates of up to 120 liters per hour, all while being simple to operate and easy to maintain. The smart system has an auto rinse function to maintain purity during periods of low use, offers the option of CO2 removal and is designed to allow flow rate to be easily upgraded to meet future demands. As such, it is optimized for all the workhorse applications of the lab, where purity must be effectively balanced against speed to provide the most effective water supply for general use.

Flexibility extending to dispensing and storage

The PURELAB® Chorus systems work seamlessly with ELGA's Halo dispensing solutions, all of which can be positioned independently from the water purification system for maximal flexibility and ensure that valuable laboratory space is used effectively. The flow is adjustable from drop-by-drop up to two liters per minute, allowing users to fill their containers as slowly or as fast as is needed. ELGA's unique portfolio of storage reservoirs completes the range, offering 15, 30 and 60 liters of compact storage, all designed to reduce the risk of downtime during periods of heavy use, without impacting on water quality.

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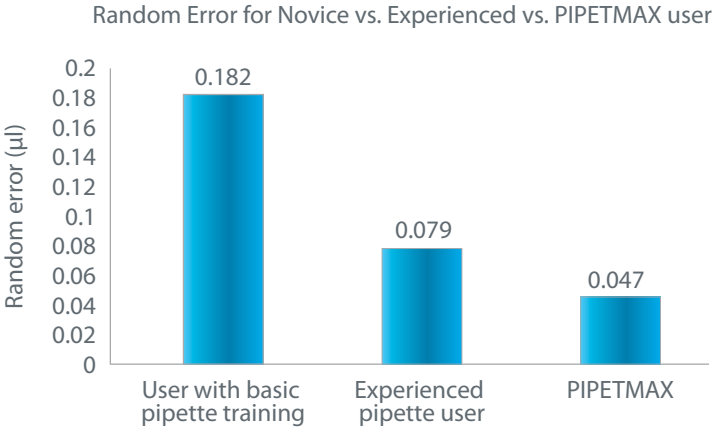
IS PIPETTING TECHNIQUE GETTING IN THE WAY OF YOUR REPRODUCIBLE RESULTS?



10 dispenses from three different technicians were measured gravimetrically.

When preparing biological samples, you need a lab assistant you can trust, one that is focused on consistency and reproducible results across 10's and 100's of samples. Advancing your science and increasing the pace of your experiments is your job! Being tied to the bench for routine pipetting tasks doesn't have to be!

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Numerous technical replicates are often included in the experimental design in order to compensate for user inconsistencies; however, that wastes samples, time and reagents. PIPETMAX prepares every assay with proven consistency, delivering high precision and accuracy in routine pipetting tasks.

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Better Oil and Grease (Extractable Hydrocarbons) Measurements

Regulatory methods such as USEPA 1664, Rev B, Standard Methods 5520 and ISO 11349:2010 can be performed more reliably with the market-leading automated system from Horizon Technology

The use of solid phase extraction (SPE) has been developed and improved over the years since its introduction into organic extraction and has been included in US EPA Method 1664 since its start in the 1990's. In addition, the automation of the method is facilitated by the use of SPE. Automation can reduce the variability that comes from human intervention and error. Table 1 compares the results of SPE with automation (SPE-DEX® 3000 Extractor or SPE-DEX 4790 and SpeedVap® IV, Horizon Technology) to conventional liquid-liquid extraction (LLE) without automation for simple distilled water samples spiked with standards, an initial demonstration of capability. It can be seen that the recoveries are better and the standard deviations more tightly controlled using the automated process for hexane extractable material (HEM) and silica gel treated HEM (SGT-HEM).

▲ *SPE-DEX 3000 Oil and Grease Extractor*

▼ *Table 1. Comparison of Recoveries, LLE and Automated SPE*

Effluent Replicate	LLE Recovery (%)	SPE Recovery (47-mm disks) (%)
HEM		
1	96.3	100.5
2	97.5	100.3
3	96.5	100.3
4	99.8	99.3
Average	97.5	100.1
Standard deviation	1.6	0.6
SGT-HEM		
1	98.0	104.0
2	93.5	99.5
3	84.5	99.5
4	94.0	95.5
Average	92.5	99.6
Standard Deviation	5.7	3.5

Additional benefits of using the SPE-DEX extractor are that it uses less solvent than LLE, it is an automated procedure, and sample process times are more rapid relative to LLE. In this case, SPE methods average 50 minutes per sample versus 2.5 hours for the LLE methods on a collected treatment plant sample. Since labor costs are often the most expensive part of an analysis this can significantly reduce the labor required and improve turnaround time.

The SpeedVap® IV is a newly updated, CE- marked evaporator that provides optimal evaporation for oil & grease extracted from water or soil or food fat extracts. It is decoupled from the extraction process to provide additional flexibility. Samples will often evaporate differently and this allows them to be easily removed for observation when approaching dryness.

Please contact Horizon Technology for more information on modern oil and grease analysis.

▲ *Speed-Vap IV Evaporator*

PANASONIC'S LABALERT SYSTEM

Protecting your lite's work with a proper monitoring system has become increasingly important in research. A study conducted by Stanford University revealed that more than $2 billion worth of samples were stored within their freezers. Furthermore, many biorepositories and biobanks have hundreds of freezers storing priceless samples.

With the rise in the use of mobile technology, it has become even easier to watch over your lab whenever you are away from it. Panasonic's LabAlert system is at the forefront of advanced laboratory monitoring systems, offering an easy setup, affordable pricing, infinite scalability, and an intuitive user interface. It allows you to instantly monitor sensitive parameters, such as your freezer's temperature or your incubator's CO2 levels.

Setup is quick and simple. A small battery-operated, wireless sensor is attached to every unit you want to monitor. These probes communicate through receivers which relay data through a single receiver connected to your internet, either via Ethernet or WiFi connection. Your account data is then transmitted continuously to a secure hosted platform. No software or computer is required to set up or run the app-based system. A locally-hosted, software-based solution is also available.

There are many lab monitoring solutions, but what makes LabAlert unique are the several advantages it brings over its competitors. LabAlert features customizable alerts, local and remote platforms, secure data storage, and visibility from any location.

With customizable alerts, find out exactly when something goes wrong with real-time notifications sent right to your phone, laptop or tablet. Alerts are easily customizable to meet the demands of your lab. Adjust alert triggers based on specific temperature ranges, humidity levels, CO2 concentrations and more. Alert recipients and delivery methods can be adjusted as well. Customizations are done within the user interface and can be adjusted at any time.

LabAlert's flexibility also allows for infinite scalability. Acquire a setup package of any size and add additional sensors to your setup at any time depending on your needs. Furthermore, keep watch over units from multiple locations at once. LabAlert can be easily configured in different locations to synchronize together under one account, so you're able to easily monitor all your equipment together. Whether you need to cover multiple floors, buildings, or states, LabAlert has you covered.

In addition, all remotely hosted data is securely transmitted and stored at all times, using encrypted communications. The servers are continuously archived and backed up to alternate remote locations, so your data is secured and protected at all times. LabAlert also lets you collect all FDA required data in a simple 21 CFR Part 11 package, allowing you to cut down on cumbersome manual data recording processes, and neatly store your data so that it's accessible at any time.

Panasonic

www.panasonic.com/biomedical

New Generation Handheld Raman

From the evolution of handheld spectroscopy arrives Progeny™ - the first handheld Raman analyzer designed to be customizable for seamless integration into any work environment. Constructed for flexibility, this device adapts to evolving workflows, laboratory processes, and new personnel. Progeny raises the standard on what a portable Raman device should provide to lab managers, chemists, scientists, and other lab personnel needing fast and accurate materials analysis.

Benchtop or Handheld: How about both?

Today's laboratories are being built and redesigned to promote workflow efficiency and not constrain workers and their activities. Ideal for use in your laboratory and with a small footprint, Progeny provides dual operation as a mini-benchtop system (optional docking station) and/or a portable handheld analyzer at a price that is less than half of the average laboratory instrument.

Unlike current handheld devices on the market today, Progeny's open architecture software and data security features adapt to your requirements and allow you to customize testing parameters to obtain the most accurate analysis of your specific materials and includes the ability to perform advanced quantitative assessment on-board the instrument. Other key benefits include:

- 1064nm high power excitation laser optimizes speed and sensitivity of analysis, minimizes fluorescence interferences known to plague 785nm systems, providing you with the capacity to analyze the widest range of measurable materials when compared to other handhelds available today.
- Patent-pending Wavelets Algorithm, Quad-core processor, InGaAs Detector, and new VPG™ provide the highest efficiency of spectral match speed and can handle the most demanding search and quantification algorithms with no need for desktop-remote work.

Contamination or cross-contamination concerns?

In today's laboratory environments, contamination from materials, other lab equipment, and even people is inevitable. Fortunately, Progeny's sealed aluminum body is IP-68 rated; total dust tight and protected against moisture. You can have peace of mind knowing that the instrument is not damaged by decontamination and that you are able to prevent potential cross-contamination when analyzing a variety of types of materials.

Modern User Interface

Inspired by modern smart-phone technology, Progeny's user interface allows for a short learning curve for rapid implementation. Because of laboratory instrumentation advancements, researchers and technicians often spend more time than before in front of their computer screen. Progeny can be remotely operated by a PC or tablet via Bluetooth and wireless.

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New and advanced ergonomics deliver comfort and ease of use with single-handed operation, large buttons and touch screen interface. When analyzing materials in confined spaces like barrels, your users can view the screen while the instrument is facing downward which reduces neck and shoulder strain and creates a more efficient work process.

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RST TOUCH RHEOMETER

The new RST Touch Rheometer offers the best that technology can provide when making rheological measurements. With touch screen interface, users can quickly set up tests to measure viscoelastic behavior, yield stress, viscosity flow curve, temperature profile, and creep/recovery performance. The cone/plate model shown here also comes with automatic gap adjustment and auto spindle recognition.

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PRE-OWNED EQUIPMENT MARKETPLACE

PARTING POINTS

Takeaways from this month's issue:

SIXTH ANNUAL INVESTMENT CONFIDENCE REPORT

Our sixth annual confidence report reveals whether survey participants—ranging from technicians to corporate management—believe their research organizations will be better off financially in 2014. It found:

- Slightly fewer respondents in 2013 than in 2012 were optimistic about their lab's outlook
- A new question about sequestration may partly account for the more negative responses
- Repercussions from the financial meltdown of 2007-2008 have not yet fully abated
- A stronger sense of optimism isn't likely to return until the US economy rebounds

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STRATEGIC SOURCING

For a typical pharmaceutical or life science company, procurement is about 25 percent of total revenue, making the savings opportunity for cost containment in this area potentially significant. Some ways to save:

- Outsourcing
- Using a Request for Proposal (RFP) process
- Lab managers taking an active role in leading steering committees, etc.
- Project management and Six Sigma certification becoming important skills in the future

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CUSTOMIZED TRAINING

Successful laboratory professionals contribute to their disciplines by keeping up with methodology and technology through regular training and education. Training is important because:

- It creates an overall culture of safety and compliance
- In spite of time and monetary challenges, training is a necessary ingredient for growth
- It is also key for certain labs to meet government regulations
- Training helps employees stay on top of new technology and innovation

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ASK THE EXPERT – GETTING YOUR HEAD AROUND BIG DATA

David Patterson, PhD, professor of computer science at the University of California at Berkeley, discusses everything you need to know about big data, including:

- What big data is
- Why lab managers should care about it
- How he uses big data in his lab
- The kind of knowledge and training lab managers need to work with big data

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PERSPECTIVE ON: A CANCER RESEARCH LAB

Mark Lloyd, manager of the Analytic Microscopy Core facility at the H. Lee Moffitt Cancer Center & Research Institute in Tampa, FL, shares the challenges and rewards of working in a shared resource facility. Those include:

- Meeting the needs of the principal investigators who use the facility
- Working with the microscopes and designing experiments
- Changing technology
- Commercializing patents to help cancer patients

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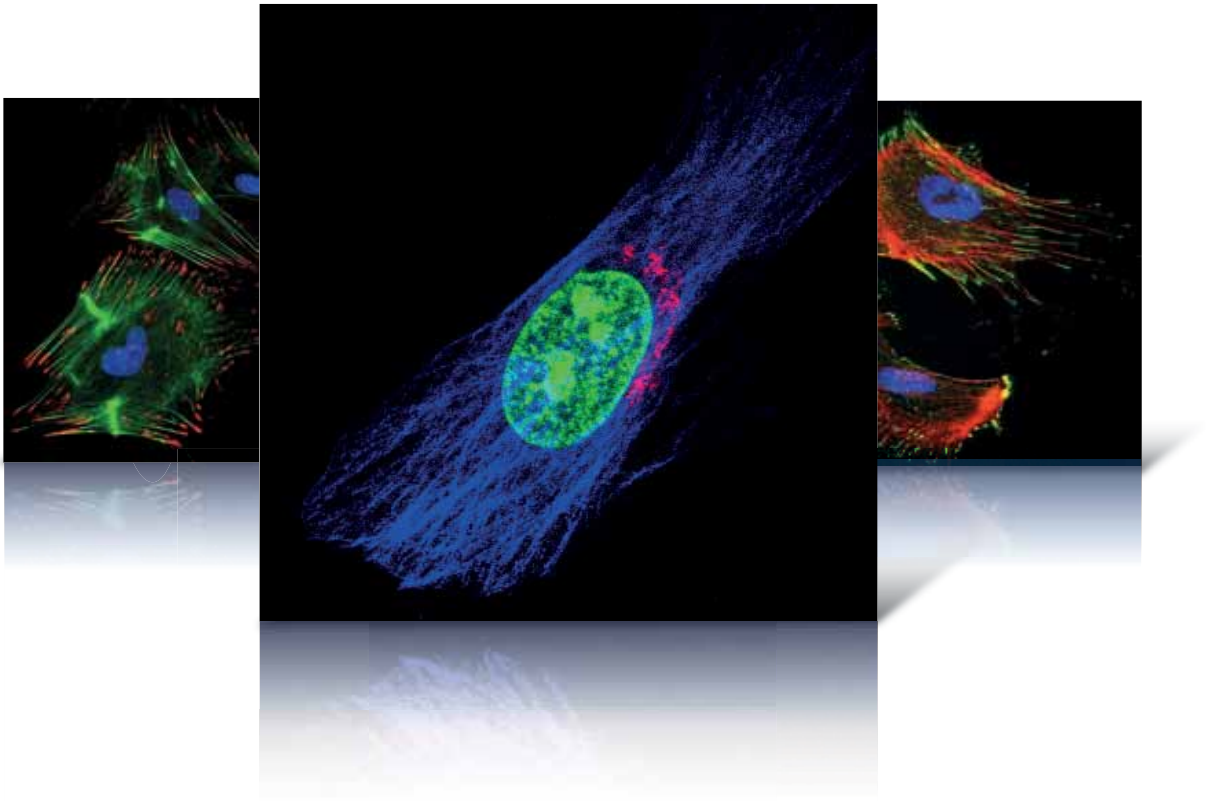

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