MAGAZINE
Lab Manager®
Run Your Lab Like a Business

June 2010 Volume 5 • Number 5

SPECIAL GUIDE TO HPLC SYSTEMS

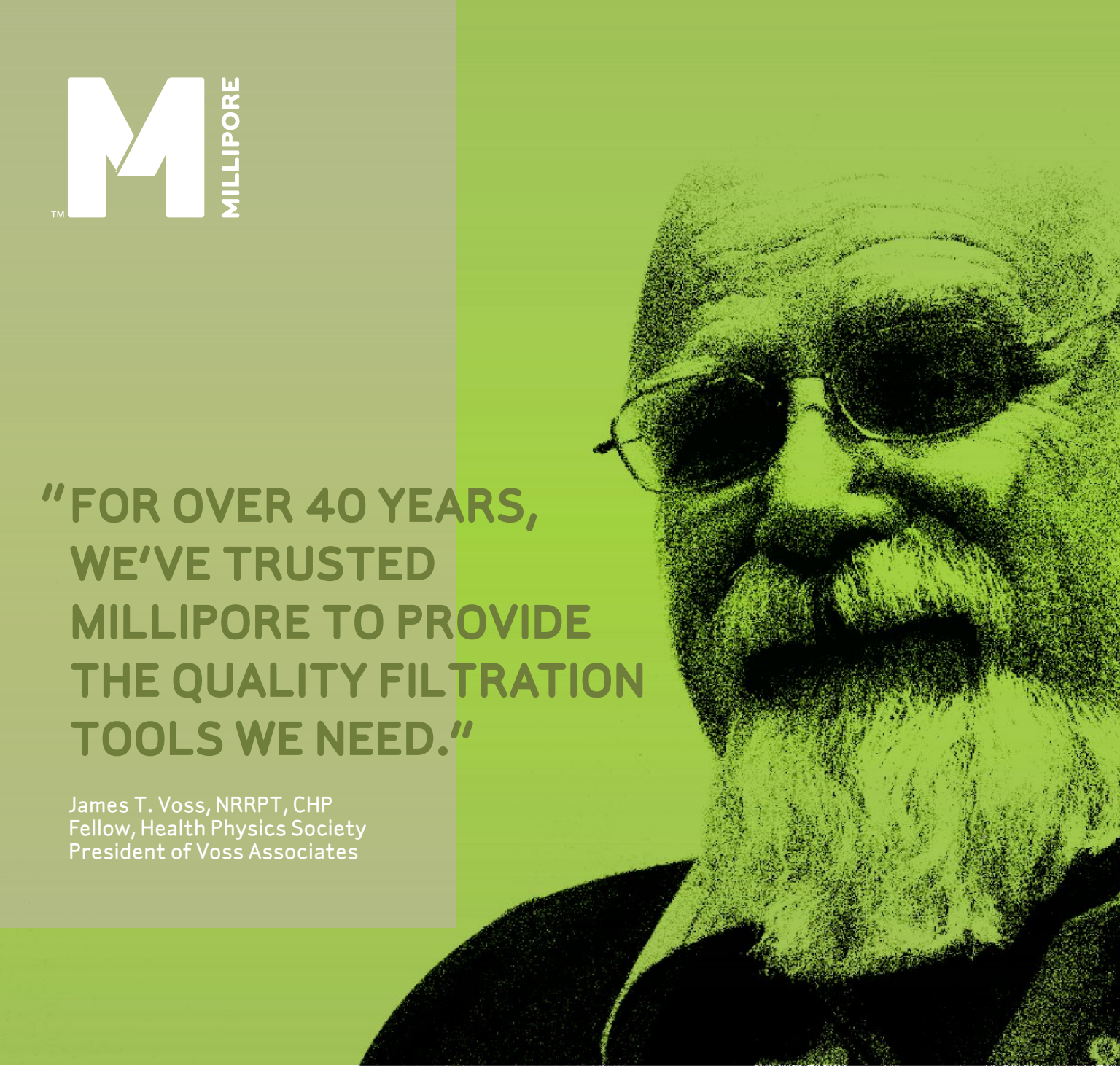
BEST AND BRIGHTEST: How good laboratory design can attract top scientific talent

PARTNERING WITH OTHER LABS

READY TO BUY:
What to consider when preparing bid specifications

INDEPENDENT GUIDE TO BUYING A MILL OR GRINDER
INSIDE!
WWW.LABMANAGER.COM

MILLIPORE™



"FOR OVER 40 YEARS, WE'VE TRUSTED MILLIPORE TO PROVIDE THE QUALITY FILTRATION TOOLS WE NEED."

James T. Voss, NRRPT, CHP
Fellow, Health Physics Society
President of Voss Associates

Millipore is the source for filters you trust.

Because our Millex® syringe filters provide unsurpassed quality and consistency, numerous customers have specified the Millex brand in developing sample preparation methods. With over 50 years of filtration expertise, Millipore continues to set the industry standard for high-performance membrane technology and its application in sample preparation.

ADVANCING LIFE SCIENCE TOGETHER®
Research. Development. Production.

Go to the source at
www.millipore.com/trustMillex1

How far would you go to protect your samples?

Researchers worldwide protect more than two billion samples inside Thermo Scientific cold storage equipment. With +4°C refrigerators to -196°C cryogenic freezers and Thermo Scientific Nalgene and Nunc consumables, you're free to concentrate on your work without worrying about your valuable samples.

Thermo Scientific Revco high-performance laboratory refrigerators and freezers are engineered for the laboratory, providing:

- **Security**–Our IntrLogic™ microprocessor-based control system manages setpoint and actual conditions, providing the highest level of security
- **Efficiency**–Advanced defrost sensors minimize frost built-up, maintaining coil efficiency
- **Versatility**–A variety of sizes from undercounter to upright models is available to meet your space requirements

So relax – and choose Thermo Scientific Revco laboratory refrigerators and freezers. Visit **www.thermoscientific.com/cold**

Thermo Scientific Revco refrigerators and freezers are available for general and specialized applications including pharmacy, blood banking and chromatography.

Moving science forward

Thermo SCIENTIFIC

Part of Thermo Fisher Scientific

MAGAZINE
Lab Manager®
Run Your Lab Like a Business

CONTENTS

www.labmanager.com June 2010

SURVEY RESULTS. Next month we will begin sharing the results of our laboratory equipment product surveys, which you and your colleagues have participated in via our web site (http://www.labmanager.com/articles.asp?ID=407). Based on a specific instrument type, you will be able to learn brand favorites, the various uses for each instrument, purchasing plans, budget allowances, and the features/benefits that matter most in the purchasing decision. If you haven't yet taken any of the surveys, please visit the link above to share your product purchasing practices.

products | applications | software | **services**

We've expanded our job description.

With Agilent Multi-Vendor Services, now you can get Agilent-quality repair, maintenance, compliance and relocation services for all the

LC, GC and MS systems in your lab regardless of the name on the instrument. Agilent Multi-Vendor Services gives you one highly qualified engineer, who understands your lab, your workflow and your goals to keep all your instruments performing at maximum capacity. That's why Agilent customers worldwide report 98% satisfaction with their Customer Engineers.*

Learn more at www.agilent.com/chem/multivendor

*Satisfaction reported in Agilent Customer Satisfaction Survey 2007

Our measure is your success.

Agilent Technologies

Lab Manager MAGAZINE®
Run Your Lab Like a Business

Lab Manager Magazine® (ISSN: 1931-3810) is published 10 times per year; monthly with combined issues in February/March and July/August, by LabX, P.O. Box 216, 478 Bay Street, Midland, ON Canada L4R 1K9. USPS 024-188 Periodical Postage Paid at Fulton, MO 65251 and at an additional mailing office. A requester publication, *Lab Manager*, is distributed to qualified subscribers. Non-qualified subscription rates in the U.S. and Canada: $120 per year. All other countries: $180 per year, payable in U.S. funds. Back issues may be purchased at a cost of $15 each in the U.S. and $20 elsewhere. While every attempt is made to ensure the accuracy of the information contained herein, the publisher and its employees cannot accept responsibility for the correctness of information supplied, advertisements or opinions expressed. POSTMASTER: Send address changes to *Lab Manager Magazine®*, P.O. Box 120, Georgetown, CT 06829.

WDS Canadian return: P.O. Box 216, 478 Bay Street, Midland, ON Canada L4R 1K9.

BPA WORLDWIDE BUSINESS
Lab Manager Magazine® is audited by BPA

Food testing is a dirty business

That's why R&D and QC labs turn to Metrohm for accurate and consistent results.

How you break down the complex matrices of food samples affects the precision and lifetime of columns, detectors and electrodes—which, in turn affect the accuracy of results. Metrohm systems handle any type of food analysis. They'll even automate your sample prep tasks, so results are accurate and stay aconsistent—always.

Metohm automates sample prep tasks:

- Weighing
- Homogenizing
- Filtering
- Diluting

And provides accurate measurements of:

- Anions/Cations
- Carbs/Sugars
- Salt
- Total Acidity
- Trace Metals
- Water Content
- Oxidative Stability of Edible Oils

www.metrohmusa.com

Metrohm

US 866-METROHM (638-7646)
Canada 866-260-6069

See us at IFT Booth 3267

Risky Business

For reasons that are hard to explain but undeniably human, we sometimes choose to take dumb chances. For example: neglecting to fasten our safety belt when "just driving around the corner," or failing to put on work gloves when "just pulling a weed or two" from that poison ivy-infested corner of the yard. In such instances of daring-do we gamble against unfortunate outcomes. When the gamble pays off—no car accident; no horrible rash spreading up our arm—we feel victorious; as though we out-foxed fate. But when Murphy's law kicks in, which it will, that innocent-seeming risk can end up costing thousands of dollars in medical care, auto repair, fines, higher insurance rates, not to mention pain and suffering. When a lab manager takes that same kind of risk regarding lab safety, the consequences to his or her lab can be devastating. And, according to author Vince McLeod in this month's cover story, the results of lab safety noncompliance and violations will be even more damaging going forward. Turn to page 10 to find out why.

In this month's Lab Design & Furnishings article, authors Jay Brotman and Robert Skolozdra discuss a less obvious but very important aspect of laboratory design—aesthetics. They argue that for institutions competing for the top scientific talent, design details such as abundant daylight, views to the outside environment, open and appealing community spaces and artwork create a "home for research" that younger researchers in particular appreciate. In addition, such design features are usually in line with "green" practices and therefore provide an added attraction to environmentally minded scientists. Such qualities in a research facility can impact that organization's reputation, both in terms of personnel satisfaction and even sources of funding, and top talent wants to work in a top lab. Turn to page 28 to learn more.

"The need for knowledge retention is greater than ever," says John Borchardt in this month's Leadership & Staffing article. Turn to page 16 to find out what lab managers can do to avoid losing valuable knowledge when key staff members announce their retirement or transfer out of R&D to other functions.

The new generation of lab managers "needs to be much more skilled at external partnerships," says Dr. J. Stewart Witzeman, chairman of the Industrial Research Institute and director of Eastman Chemical Company's Eastman research division, in this month's Business Management article, "Partnering with Other Labs." However, as author F. Key Kidder learns, leveraging relationships to achieve the cost benefits, access to better technologies, global talent pools and complementary skill sets available through partnering is not simple. Turn to page 46 to learn how managing business models such as joint ventures, in-and-out licensing agreements, material transfer agreements, corporate-sponsored research agreements and joint development alliances takes a very different skill set from what makes someone a good internal manager.

For everything you ever wanted to know about chromatography, turn to page 66 where you will find an entire section devoted entirely to that technology. From "The Evolution of HPLC Systems" to an "Independent Guide to Purchasing Liquid Chromatography Equipment," to technology highlights from the upcoming HPLC 2010 in Boston, to Angelo DePalma's product focuses on HPLC and GC systems and columns as well as chromatography data systems, we offer a wealth of information all in one spot. We hope you find it useful.

Happy reading.

Pamela Ahlberg - Editor-in-Chief

In April's "Evolution of Lab Glassware Washers," information for 2008 should have read: "In February, 2008, Miele introduced the PG 8527 with a patented integrated conductivity meter in the water circuit that introduced "contact-free sensing" to the process. In September, 2008, Miele introduced the G 7893, a compact 24-inch wide laboratory glassware washer with true forced-air HEPA-filtered drying.

Lab Manager MAGAZINE
Run Your Lab Like a Business

Publisher Mario Di Ubaldi
mariod@labmanager.com
203.227.1390

Editor-in-Chief Pamela Ahlberg
pam@labmanager.com
973.729.6538

Assistant Editor Katia Caporiccio
katiac@labmanager.com
888.781.0328 x233

Contributors John K. Borchardt, Ph.D.
John Buie
Richard Daub
Angelo DePalma, Ph.D.
Sara Goudarzi
Tanuja Koppal, Ph.D.
Vince McLeod, CIH
Gloria Metrick
Rich Pennock
Ronald B. Pickett
Bernard Tulsi

Account Managers June Kafato—International
junek@labmanager.com
705.812.2332
Ashley Munro—West Coast
ashleym@labmanager.com
888.781.0328 x228
Edward Neeb—Midatlantic
edwardn@labmanager.com
860.350.2761
Larry Frey—Midwest & Southeast
larryf@labmanager.com
845.735.5548

Art Director & Production Manager Gregory A. Brewer
gregb@labmanager.com
888.781.0328 x241

Graphic Designer Danielle Gibbons
danielleg@labmanager.com
888.781.0328 x231

List Rental Jen Felling—Statlistics
203.778.8700

Custom Article Reprints The YGS Group
labmanager@theygsgroup.com
800.290.5460
717.505.9701 x136

Subscription Customer Service info@labmanager.com

Published by LabX

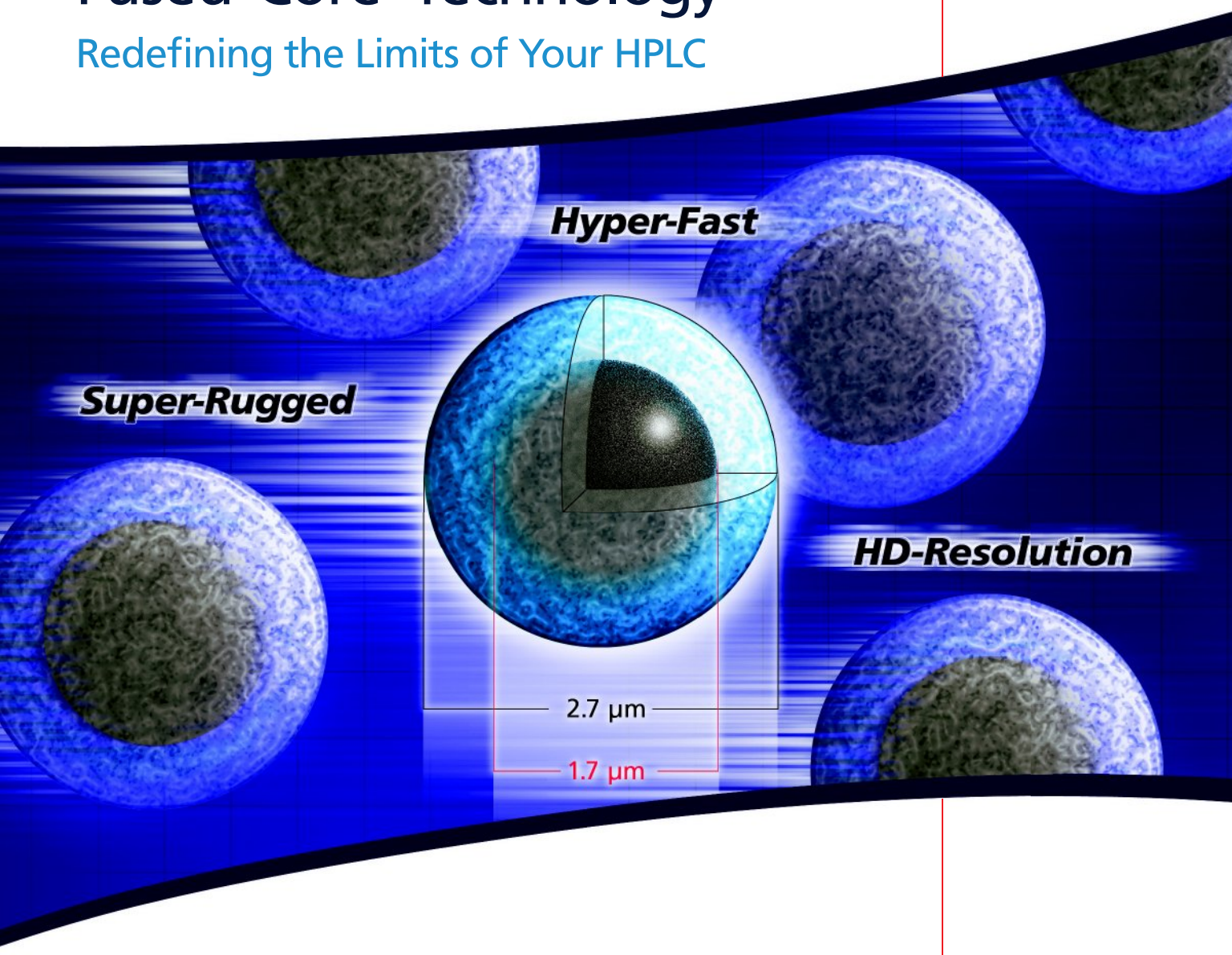
President Bob Kafato
bobk@labmanager.com
888.781.0328 x223

General Manager Ken Piech
kenp@labmanager.com
888.781.0328 x226

888.781.0328
P.O. Box 216, 478 Bay Street
Midland, ON, Canada L4R 1K9

Ascentis® Express Fused-Core™ Technology

Redefining the Limits of Your HPLC



Based on Fused-Core particle technology, Supelco's Ascentis Express columns provide a breakthrough in HPLC column performance.

- Double the efficiencies of conventional 3 µm particles
- Equal efficiencies of sub-2 µm columns at half of the backpressure
- Rugged design capable of high pressure operation

Now available — Ascentis Express Peptide ES C18 for peptides and small proteins

For additional information, call our technical experts at 800-359-3041/814-359-3041 or visit us on the web: ***sigma-aldrich.com/express***

IT PAYS TO PROTECT

THE TRUE COST OF EMPLOYEE HEALTH AND SAFETY

by Vince McLeod

Never has our title phrase rung more true than when it comes to workplace health and safety. It is a classic case of "Pay me now, or pay me later" and occurs all too frequently and with increasingly serious consequences in research laboratories. We hope to convince you that following the former instead of the latter makes more sense, for your bottom line as well as for your employees.

When we view the whole picture of employee and workplace health and safety, you can quickly see that it is very complex and involves people from many different agencies in addition to your employees. Depending on your facility focus, your location and whether your business is in the public or private sector, entities that may exert jurisdiction over you can include the Occupational Health and Safety Administration (OSHA), the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), a state fire marshal, a state environmental department, and others, right down to local environmental and emergency management officials.

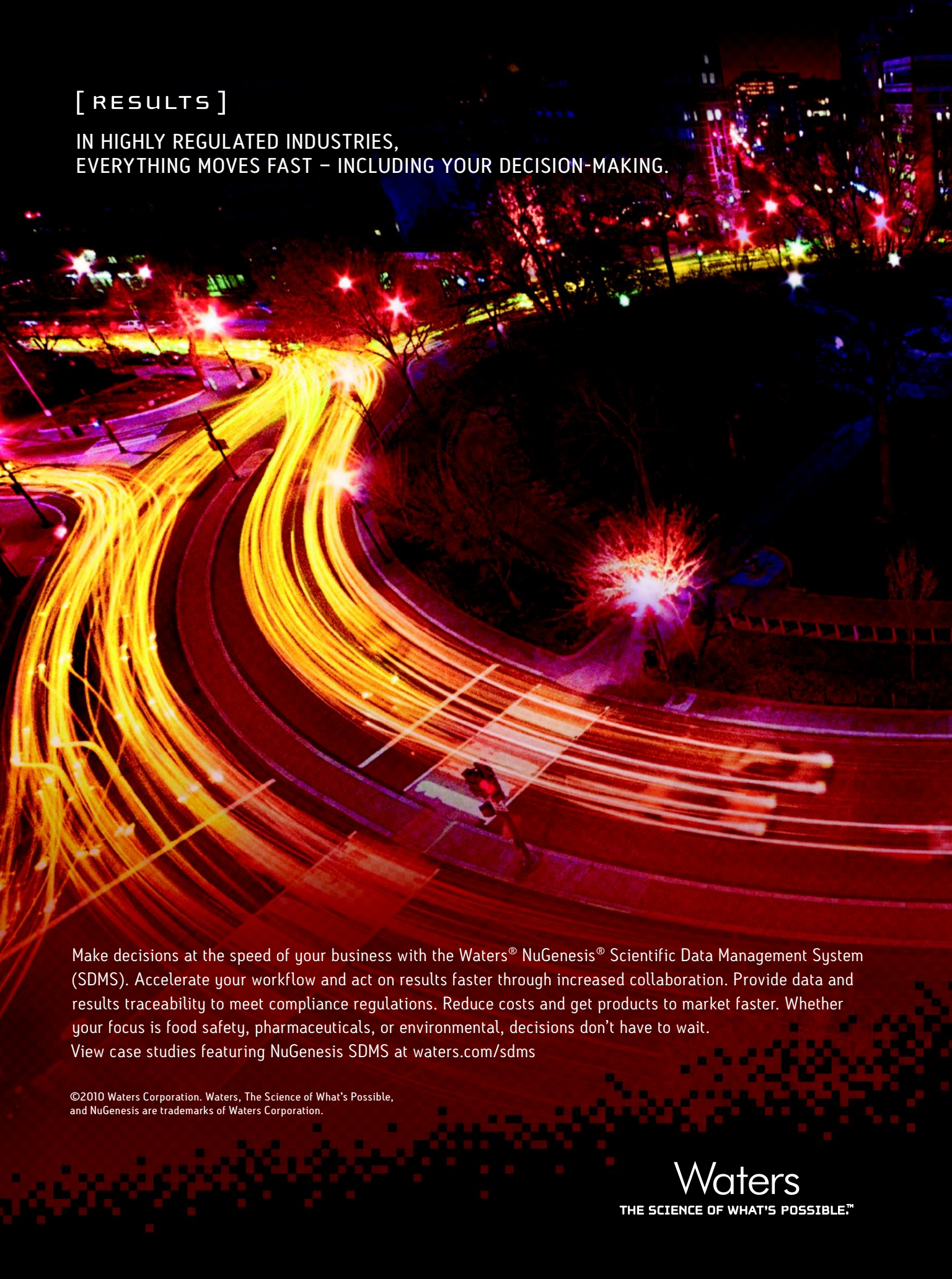
"... current OSHA penalties are not great enough to provide sufficient incentives."

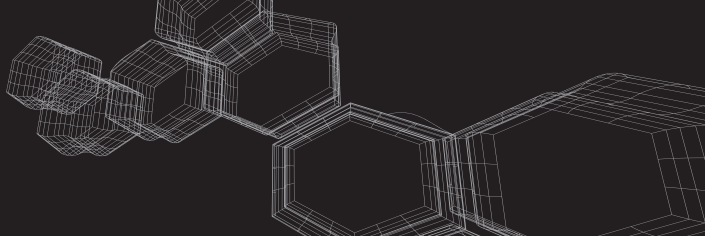
To get started, let us give you a few sobering statistics that we hope make an impression. According to the U.S. Bureau of Labor Statistics 2008 data, there are about 4 million work-related injuries per year.[1] That equates to around 11,000 injuries per day! There were 5,657 work place fatalities in 2007. That is almost sixteen deaths per day, or one every hour and a half! If we include deaths from occupational illnesses, which are about ten times the fatalities, we have one work-related death every eight minutes. It is hard to fathom these numbers when living in 2010 and considering all the information and knowledge we have compiled leading us into the 21st century. We are the first to admit these statistics are a little disheartening. But they are also motivating, pushing us to work diligently every day to bring the numbers down and reinforcing why we do what we do.

Why so many illnesses, injuries and deaths?

Recently, Charles Jeffress, the former assistant secretary of labor, commented in a Public Broadcasting Service *Frontline* interview that our current laws, particularly penalties for violations, are ineffective and that companies find it less burdensome (read more profitable) to take the risk of not having safety programs in place than to comply with the law.[2] This is disturbing, but not the only reason for those rueful statistics. There are about 30 million employers in the United States, but only about 1.5 million have to report to OSHA. In addition, the Occupational Safety and Health Act, basically unchanged since its inception in 1970, does not cover public employers in states without safety and health laws, leaving about 8 million U.S. workers with no legal protection at all.[3] The Occupational Safety and Health Administration, with an average of fewer than 2,000 inspectors, struggles to enforce the laws. And too often the penalties and fines levied for violations are trivial compared to the cost of implementing technologies and programs consistent with OSHA standards.[4] This circles back to the statement by Mr. Jeffress and explains why it is true.

In summary, our dismal statistics for workplace ill-


[RESULTS]
IN HIGHLY REGULATED INDUSTRIES,
EVERYTHING MOVES FAST – INCLUDING YOUR DECISION-MAKING.
Make decisions at the speed of your business with the Waters® NuGenesis® Scientific Data Management System (SDMS). Accelerate your workflow and act on results faster through increased collaboration. Provide data and results traceability to meet compliance regulations. Reduce costs and get products to market faster. Whether your focus is food safety, pharmaceuticals, or environmental, decisions don't have to wait.
View case studies featuring NuGenesis SDMS at waters.com/sdms
©2010 Waters Corporation. Waters, The Science of What's Possible, and NuGenesis are trademarks of Waters Corporation.
Waters
THE SCIENCE OF WHAT'S POSSIBLE.™



nesses, injuries and fatalities are due to our outdated law, millions of businesses and workers without coverage, little or weak enforcement, and insignificant penalties. This is totally unacceptable, and we need to flip the table, not just because it is "the right thing to do," but because it also makes good business sense.

The new sheriff in town—OSHA

This past March, Assistant Secretary of Labor David Michaels said he wanted to "make it clear that 5,000 preventable worker deaths and 4 million injuries recorded in our nation every year are expensive, disruptive, wasteful, and completely unnecessary."[5] The new OSHA management promises to be more aggressive in making sure everyone obeys the law. The top priority is giving emphasis to strong enforcement. Michaels admits that current OSHA penalties are not great enough to provide

> "... when someone is injured ... the chain reaction of costs and consequences has started and cannot be stopped."

sufficient incentives. For example, if you wilfully commit a workers' safety violation that results in death, you are guilty of a misdemeanor and a serious violation—those with a high chance of death or serious physical harm are subject to a maximum civil penalty of only $7,000. This could change significantly should H.R. 2067 become law.

Known as the Protecting America's Workers Act (PAWA), H.R. 2067 is designed to provide OSHA with significant new tools to improve workplace health and safety. Included are higher penalties, enhanced enforcement and expanded victims' rights. Highlights of the legislation include the following:

- Increased maximum civil penalties from $70,000 to $250,000 for willful violations and increased criminal penalty from six months' imprisonment to ten years (for willful violations resulting in death)
- Expanded OSHA coverage for millions of workers who are currently unprotected, such as state/municipal employees and airline and railroad workers
- Expanded protection for whistle-blowers to provide a 180-day statute of limitations
- Provision of additional workers' rights such as refusal to perform hazardous work and private right of action for workers and families if OSHA does not prosecute
- Prohibition of employers from discouraging the reporting of work-related injuries and illnesses by employees[6]

While the PAWA is debated, OSHA took action recently to crack down on employers that repeatedly ignore the law and endanger workers. The new Severe Violator Enforcement Program (SVEP) will focus OSHA enforcement activity on targeted worksites with histories of OSHA violations.[7] SVEP will include more intense examinations of employer practices, increased inspections and follow-up inspections as well as inspections of other worksites under the same employer where similar hazards and deficiencies exist.

In addition to SVEP, OSHA issued revised penalty policies that allow increased potential fines and expand the timeframe for an employer's history of violations from three years to five years.

The new directive puts a gravity-based penalty structure in place, but with reductions available for a clean history, number of employees and good-faith procedures. Both the SVEP and the new penalty structure take effect in the coming months.[7]

So, we can see that with the new OSHA management and potential new legislation taking the risk of noncompliance could prove very costly and a bad business decision. And this is not just for heavy industry. Recent serious lab accidents and a couple of tragic fatalities have drawn the attention of the Chemical Safety and Hazard Investigation Board.[8] CSB Chairman John Bresland stated, "I believe it is time to begin examining these accidents to see if they can be prevented through the kind of rigorous safety management systems that we and others have advocated in industrial settings." So, it would only take one serious accident to put you under the microscope.

A bigger hammer—EPA

We mentioned in the beginning that other agencies besides OSHA may regulate your activities. As it turns out, a definite connection exists in that facilities that tend to ignore worker safety violations also tend to ig-

nore environmental laws.[9,10] In many instances responsibilities for worker safety and environmental compliance are in the same hands within a company. Most of the environmental laws carry felony sanctions for criminal violations that can result in serious jail time and much heavier fines and penalties.

Mr. Uhlmann, the current director of the Environmental Law and Policy Program at the University of Michigan School of Law and former chief of the Department of Justice's Environmental Crimes Section, provides one stark example—an Idaho business with cyanide waste tanks. Workers were sent into the tank to clean it. The hazardous wastes were dumped on the ground, and one worker collapsed in the tank and suffered severe and permanent brain damage but lived. Under OSHA no crime was committed (though many OSHA violations were) because the worker lived; therefore, no OSHA sanctions were levied. Under EPA, however, improper disposal of hazardous wastes resulted in a 17-year jail sentence.

The moral here: if your worker safety record is not so hot, you had better take a close look at your compliance with the Resource Conservation and Recovery Act and its Hazardous and Solid Waste Amendments, the Clean Air Act, the Clean Water Act, and the Toxic Substances Control Act, for starters. It might seem unfair that environmental sanctions are much more severe than those for worker safety, but regulators will use the tools available to them when justified and needed.

Let us inject one more warning here. In our experience, research laboratories are more apt to run afoul of environmental regulations, as evidenced by numerous

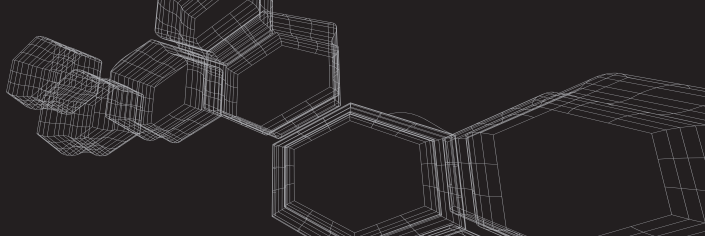
> "... money is the best change agent, especially when it comes to safety standards and enforcement."

and substantial EPA fines levied against both private and academic laboratory facilities. Since the connection flows both ways, if you have been stung by environmental compliance issues, you could be selected for a visit by OSHA.

Mr. Uhlmann states, and most would agree, that a strong enforcement program is needed to get consistent violators to toe the line. To that end the Department of Justice, EPA and OSHA started the Worker Endangerment Initiative, a cooperative effort to corral chronic and persistent violators of worker safety laws. By forming this partnership, OSHA and EPA inspectors are more knowledgeable regarding regulations that can form the basis of criminal charges and lead to convictions.

The rest of the story—when something bad happens

Perhaps the threat of serious fines and possible jail time has started us thinking and spurred us to action, beginning with a thorough review of our environmental, health and safety programs. It has been said many times, and most would agree, money is the best change agent, especially when it comes to safety standards and enforcement. But this is not the strongest argument for compliance, in our humble opinion. We believe it pays to protect because of the far-reaching and devastating effects on individuals, family and coworkers. What will be the fallout and subsequent direct and indirect costs? And will these



really be less than the costs of taking precautionary steps and having proper safety programs in place?

How many times have you heard or read these explanations? "It has never happened before." "We've been doing it that way for years." We hear them a lot, and they may be true, until you read them on the accident report. If you are a frontline lab supervisor, you may have immediate knowledge when an employee is hurt, but most managers will know only when they receive the first report of injury or a call from the workers' compensation office. And, of course, when someone is injured, that is too late and the chain reaction of costs and consequences has started and cannot be stopped.

We all know that when someone is injured on the job it is going to cost us. But, in fact, the potential regulatory fines that we have discussed above may be one of the least amounts after everything is said and done. When we look at all the various costs associated with an occupational illness or injury, we can separate them into two major categories: direct costs and indirect costs. Let's take a closer look at each of these so we have a clear picture of everything involved.

Direct costs are the easier of the two to evaluate. Each item is a defined task with a known dollar amount attached. It begins with the initial trip to the emergency room. Costs quickly add up when the bills arrive from the physicians, the hospital, the diagnostic lab and the pharmacy. All these are repeated with each follow-up visit, and we then add in the costs of independent medical exams, physical therapy, surgery and other treatments. We have seen data from workers' compensation cases where even minor injuries such as cuts or small chemical burns, two of the most common laboratory accidents, have costs that easily run into thousands of dollars. Step up the seriousness of the injury or add in a complication or two and we are into tens of thousands of dollars or much more.

"... if you have been stung by environmental compliance issues, you could be selected for a visit by OSHA."

Depending on the time away from work and the treatment outcome, other direct costs might include nurse case management, workers' compensation hearings, lost wages and attorney fees (for both employee and employer). And don't forget the replacement costs for temporary hires and/or overtime for other employees to fill in while the injured employee completes recovery and rehabilitation and returns to full work duties.

Indirect costs are a little harder to fit numbers to and are those not directly tied to the injured employee but resulting from the repercussions of the injury and lost work time. Most are associated with internal or in-house management time. The laboratory manager and safety coordinator have to investigate the accident and the workers' compensation claim and issue reports. The finance department and insurance coordinator have to track and pay bills, premiums and deductibles and adjust the payroll. Other unit or midlevel managers will deal with staffing issues, claim reporting and monitoring and other reporting as necessary. These hours add up and are usually significant.

As Assistant Labor Secretary Michaels has pointed out, all workplace injuries are extremely disruptive. Immediately we have to deal with the loss of production of the injured employee. This creates staffing issues whether we turn to temporary workers or attempt to cover with existing employees or coworkers. Specialized training may be necessary, and time on the job will be needed before they reach full capability. Dealing with this disruption will definitely affect the laboratory's function no matter if you are a research lab or production facility.

Finally, we turn to the injured employee, and indirect costs attributed here may be the most significant and long-lasting of all. Obviously, the employee first has to deal with the pain and discomfort during treatment and recovery. The severity of the injury dictates this process. Even if he or she is able to return to work in a reduced capacity, there will be follow-up visits to medical providers and treatment facilities, travel time to and from these, and time in the waiting room. It is too late for apologies. Address the root cause of the accident thoroughly and quickly. Treat the employee fairly, and ensure he or she receives all entitled benefits in a timely manner.

There are going to be definite family impacts as well, especially if the employee is unable to perform daily functions. The family's (and the employee's) quality of life will change. The effects of these changes cannot be predicted or measured. Make sure the family stays fully informed every step along the road to recovery.

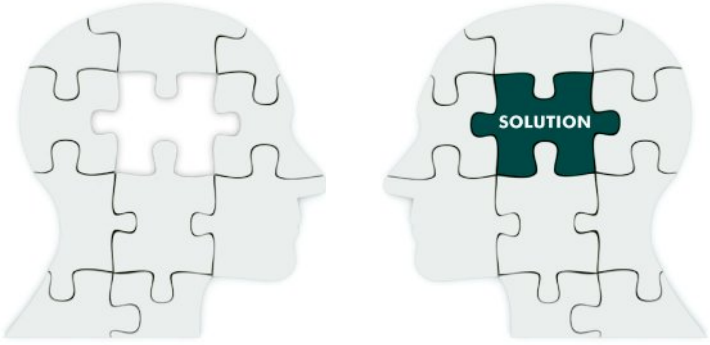
The employee's coworkers are also going to be affected. You can bet they will be watching closely how the injured

employee is treated and how the company addresses the loss and disruption. Do not try to downplay or ignore the event. Involve all coworkers in the accident investigation; their insights are invaluable. Address corrective actions as quickly as possible, whether they are safety issues, personal protective equipment needs or additional training. The last thing we want is another accident or injury.

References

1. *Injuries, Illnesses and Fatalities.* U.S. Department of Labor, Bureau of Labor Statistics. Washington, D.C. 2008 http://www.bls.gov/iif/
2. *A Dangerous Business.* Lowell Bergman & David Rummel and Linden MacIntyre. Public Broadcasting Service, *Frontline.* January 2003. http://www.pbs.org/wgbh/pages/frontline/shows/workplace/etc/script.html
3. *Sixteen Deaths per Day.* Brave New Foundation. Culver City, Calif. 2009 http://16deathsperday.com/
4. *OSHA: Beyond the Politics.* David Weil. Public Broadcasting Service, *Frontline.* January 2003. http://www.pbs.org/wgbh/pages/frontline/shows/workplace/osha/weil.html
5. *Remarks to Joint Meeting of ASSE and AIHA.* David Michaels, Assistant Secretary of Labor, OSHA. Washington, D.C. March 2010. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=SPEECHES&p_id=2143
6. *Testimony of David Michaels before the Subcommittee on Workforce Protections.* David Michaels, Assistant Secretary of Labor, OSHA. Washington, D.C. March 2010 http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=TESTIMONIES&p_id=1062
7. *News Release: U.S. Department of Labor's OSHA Takes Action to Protect America's Workers with Severe Violator Program and Increased Penalties.* U.S. Department of Labor, Occupational Safety and Health Administration. Washington, D.C. April 2010 http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=NEWS_RELEASES&p_id=17544
8. *University Lab Accident under Investigation.* Jeff Johnson. *Chemical and Engineering News*, American Chemical Society. Washington, D.C. January 2010 http://pubs.acs.org/cen/news/88/i04/8804notw1.html
9. *Prosecuting Worker Endangerment: The Need for Stronger Criminal Penalties for Violations of the Occupational Safety and Health Act.* David Uhlmann. American Constitution Society for Law and Society, Forthcoming; U of Michigan Public Law Working Paper No. 120. September 2008. http://ssrn.com/abstract=1262922
10. *A Dangerous Business Revisited: an Interview with David Uhlmann.* Public Broadcasting Service, *Frontline.* February 2008. http://www.pbs.org/wgbh/pages/frontline/mcwane/interviews/uhlmann.html

Vince McLeod *is an American Board of Industrial Hygiene–certified industrial hygienist and the senior industrial hygienist with the University of Florida's Environmental Health and Safety Division. He has 22 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 2,200-plus research laboratories.*



RETAINING KNOWLEDGE

CAPTURING AND PROTECTING DEPARTING EMPLOYEES' KNOWLEDGE

by John K. Borchardt, Ph.D.

"Knowledge loss resulting from employee turnover is becoming a critical issue that cannot be ignored," according to a 2008 report in *MIT Sloan Management Review*.[1] What can lab managers do to avoid losing valuable knowledge when key staff members announce their retirement or transfer out of R&D to other functions? This is occurring at many companies now in the wake of staff reductions, corporate acquisitions and mergers.

Laboratory reports focus on what was done and the results achieved, rather than how the work was done, which is important information that is lost when key staffers depart. Consultant Geoff Dolbear has used the term "lore" to describe this "soft" knowledge. Lore includes:

- Key contacts whose important information and input are needed to achieve project goals
- Other valuable information sources
- Key insights important to project success
- Key work habits and skills important in achieving project goals
- An understanding of future work needed to finish incomplete projects, and how this work can best be done
- How the company can improve workplace processes
- Threats to continued success in the company's lines of business

The solution to this problem is a systematic knowledge-retention program. Knowledge retention is being used increasingly by a growing number of firms. These include companies with large R&D operations such as Chevron, BP, Merck, LyondellBasell, SC Johnson & Son, Halliburton, and Dow Chemical.[2] While such programs are being used to capture knowledge in a variety of business operations, the focus of this article will be on the use of knowledge retention in R&D.

The most common approach for capturing lore is with interview-based discussions followed by preparation of a report, which is then stored in an accessible manner on the organization's intranet. The stored information represents a useful knowledge asset for the company's other employees and adds value when licensing technology, selling business units or taking part in a merger.

Need for knowledge retention

The need for knowledge retention is greater than ever. While the recession and the resulting decline in their 401(k) funds has led some older employees and baby boomers to delay their retirement, many others have been forced to retire earlier than expected because of laboratory staff reductions at many firms.[3] These individuals are often laboratory managers and key senior members of technical staffs.

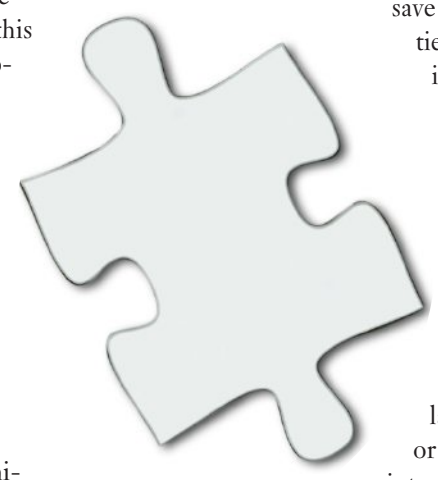
It is important to retain the knowledge of how they achieved their most important accomplishments, the status of their current projects, and how their successors can best carry on with a minimum loss of project momentum. Upon such departures, other key staff members are promoted or transferred and given new job responsibilities. These individuals seldom have much time to coach a successor in their former responsibilities.

Other occasions when knowledge-retention efforts are timely include during a project transfer from the lab bench to the pilot plant, or from the pilot plant to commercial production. In the case of drug companies, the transfer of drug development from the laboratory to

Phase II or Phase III clinical trials can be a good time to initiate knowledge retention for that project.

Sometimes, large firms with R&D centers located around the world will transfer a project, but not personnel, from one facility to another that is thousands of miles away. Important information can also be lost when projects are terminated or technology is licensed to other organizations. Conducting knowledge-retention interviews and writing reports is best done before the staff members initially associated with the project move on to other work.

Lab staff members may become involved in knowledge-retention programs at facilities other than their own laboratories. For example, oil refinery turnarounds are major refurbishment projects critical to competitive performance in the mature oil-refining industry. To help achieve this competitive performance, BP has introduced processes and tools to capture and share turnaround experience across BP plants worldwide. In-depth interviews of engineers and others involved in the turnarounds capture lessons learned following completion of the projects.[4] Reports enable these lessons to be shared with other refineries.



Laboratory managers and staff members vary in the type of key knowledge they hold. Some are technical knowledge experts in their fields. Some serve as informal internal consultants and mentors. It is often important to determine the identity of these individuals and their role in successful projects, because their names may not have appeared as authors of technical reports.

Report templates

It is usually best to develop a report template suited to the needs of a company's laboratories. This is best done by a knowledge-retention professional working with laboratory managers. Sections of the template may be left blank when appropriate for specific reports. For example, a chemist or chemical engineer working in catalyst development may have little or no interaction with a firm's catalyst customers, so the report section on customer service could be left blank.

On the other hand, the interactions a co-worker had with pilot plant personnel, manufacturing personnel, the company's sales personnel and with customers may well have been critical to the successful introduction of a new product. Who were the key contacts at various customers? What were this individual's key interactions with co-workers in other functions and with other personnel? What were the key processes or events that led to the initial sales to these customers? All this is worth recording for consideration and possible future use the next time a new catalyst is developed.

Interview-based discussions

While one could argue that the departing expert could sit down and write this report, interviews conducted by a skilled interviewer can elicit information that otherwise would not be retained. Relieving the departing expert of the responsibility for writing the report can save his or her expensive time for other activities. Besides the departing expert and the interviewer, participants in the discussion can include the departing expert's supervisor, co-workers closely associated with his/her work, and successors assuming responsibility for the departing expert's work. These individuals can also ask questions during the interview.

These interviews are much longer than traditional exit interviews. The interviews I've done have typically lasted four to 12 hours, conducted in two or more sessions. I have heard of some interviews taking 20 hours or more.

The interview is best conducted by an individual with a unique combination of skills, including meeting facilitation, interviewing and the writing prowess needed to prepare a readable report. Because these reports are stored online, search engine optimization [see sidebar] is important to ensure that desired reports appear high up in the list of "hits" when the computer files are searched. The interviewers also need a basic technical knowledge. This know-how is essential in understanding the responses of experts to their questions and being able to ask follow-up questions.

For example, at a chemical company research center, interviewers need a basic knowledge of chemistry in addition to journalistic skills. This basic knowledge gives the interviewer/writer the ability to prepare and quickly understand the basics of fields new to him or her. Sometimes knowledge beyond that of a college degree is essential, particularly in interdisciplinary fields. Industrial experience in these fields can be a tremendous aid

in achieving the basic understanding needed to conduct interviews with experts, and to write reports that are worthwhile for others working in the field to read.

The person conducting the interview is both a trained facilitator and an experienced writer. Medium-sized and smaller firms seldom can afford to keep such a person on staff full time. A full-time staff member who has received the requisite training in interviewing and meeting facilitation could conduct the interviews and write reports as part of his or her job responsibilities. Alternatively, this could be a service outsourced as needed to technical writers. As noted, the person conducting the interviews should also be a trained meeting facilitator to keep the interview on track.

Making knowledge retention programs successful

Knowledge retention will languish if it is conducted in isolation. Lab managers should align knowledge-retention efforts with key company business and R&D initiatives. They should communicate the importance of knowledge retention to their staff members. Strong support and visible involvement by upper management is essential. Making knowledge-retention interviews and reports part of the completion of an R&D project can help institutionalize the process.

Lab managers should follow the KISS principle—"Keep it simple, stupid"—in designing management-retention programs. They should be sure to keep their interviews focused on important information. Report content should be limited to this information, so that the reports are easier to identify in searches and make for quicker reads.

Using qualified individuals as interviewers and report writers is essential. As noted, journalistic skills alone are insufficient. So, too, is R&D experience. A combination of these skills is essential.

For example, I was the fourth writer to work in knowledge retention for one of my clients. The first was a freelance writer with an undergraduate science degree. She soon found she was out of her depth and quit. The next two were R&D staff members with good technical knowledge and report-writing skills. However, they did not have the interviewing and meeting facilitation skills needed. These three writers worked fewer than six months in the program.

Then I was hired, and have worked four years for this client. Despite this being a large research center with more than 1,000 employees, seldom was the workload heavy enough to require working more than 20 hours per week—another reason to outsource the work.

Skilled interviewers can conduct telephone interviews with employees at satellite research centers or production plants around the country, eliminating the need for business travel.

Program killers

Large-scale changes such as staff reductions, closure of R&D centers, divestments of businesses, and mergers and acquisitions can distract lab managers and staff members at a time when a number of key and highly experienced employees are departing and knowledge retention is most essential.

Expecting key staff members to take the initiative to set up knowledge-retention programs for themselves is usually ineffective. Lab managers need to be vocal in their support of the program and rebalance staff members' responsibilities to give them time for knowledge-management interviews.

Sometimes, information technology departments or human resources departments are assigned the responsibility to manage knowledge-retention initiatives. However, lab managers still need to play an active role. Choosing the key employees who should participate in knowledge-retention activities is essential. Neglecting this responsibility often means that interviews are not conducted on a timely basis or even at all.

Wrap-up

The soft knowledge of your most experienced staff members is a valuable asset that can be used for commercial advantage. This knowledge was gained at considerable cost and over a lengthy period of time. Allowing these staff members to leave the laboratory without capturing this knowledge means an irrecoverable loss of valuable assets. Systematic implementation of knowledge-retention programs captures this knowledge for later use or sale.

References

1. S. Parise, R. Cross and T.H. Davenport, "Strategies for Preventing a Knowledge-Loss Crisis," *MIT Sloan Management Review*, Vol. 47, No. 4, pp. 31-38 (Summer 2008).

2. Knowledge Harvesting, Inc. http://www.knowledgeharvesting.com/Clients.html.

3. D.W. DeLong, *Lost Knowledge: Confronting the Threat of an Aging Workforce*, Oxford University Press (2004).

4. M.T. Hansen and B. von Oetinger, "Introducing T-shaped Managers: Knowledge Management's Next Generation," *Harvard Business Review Online* (March-April 2001), http://hbr.org/2001/03/introducing-t-shaped-managers/ar/1.

Dr. John K. Borchardt *is a consultant and technical writer. The author of the book Career Management for Scientists and Engineers, he often writes on career-related subjects. He can be reached at jkborchardt@hotmail.com.*

SEARCH ENGINE OPTIMIZATION

By John K. Borchardt

The term "search engine optimization" (SEO) is widely used but often misunderstood. It refers to controlling the rank of an item in a list of search-engine results. SEO involves being sure the title contains keywords and relevant information about the rest of the report.

For example, the title of a report could be "John Smith: Developing Ziegler-Natta Catalysts for Propylene Polymerization." The key search terms are "John Smith," "Ziegler-Natta catalysts," and "propylene polymerization." It is then helpful to include the technical terms in the report at least several times. Related terms in the report could also aid in search engine optimization. For the example in question, these terms could include polypropylene, stereochemistry and isotactic polypropylene, among other terms.

If the report-writing process includes an abstract, it is helpful to pack the abstract with as many important keywords as possible. Often, reports include a list of keywords as a separate section. Search engines are sometimes set to search just report titles and the keyword sections. These abbreviated searches can be useful in searching the files of large companies that contain many reports, and of smaller firms that may have servers of limited power.

Search engine optimization is more complicated than this brief explanation suggests. Some books that discuss at length how to use search engine optimization include:

1. Peter Kent, *Search Engine Optimization for Dummies*, For Dummies (April 2004).

2. Bruce Clay and Susan Esperanza, *Search Engine Optimization All-in-One for Dummies*, For Dummies (April 2009).

3. Michael H. Fleischner, *SEO Made Simple: Strategies for Dominating the World's Largest Search Engine*, CreateSpace (May 2009).

PRESUMED ACCURATE

UNDERSTANDING SENSOR-BASED LAB AND STORAGE EQUIPMENT MEASUREMENT UNCERTAINTY

by Ken Appel

There are countless examples of how failing to protect stored products from environmental effects can compromise the integrity of a research laboratory's work, making it nearly impossible for other labs to reproduce research findings.

Biomaterials that are readily damaged by poorly controlled temperatures include biologics such as blood or plasma, tissues, cell cultures, or organs. Incubators, refrigerators/freezers, water baths, rooms—in all of these, monitoring of temperature primarily, as well as RH and CO_2, is critical to research integrity. In many research laboratories, temperature monitoring is even essential for safety to monitor liquid nitrogen levels, ensuring that samples remain chilled and gaseous nitrogen is not escaping in the air and asphyxiating research staff.

If there is a breakdown in lab or storage equipment—for example, if the power goes out and a freezer starts to warm up—a temperature-monitoring system *must* be in place that alerts lab managers immediately so that problems can be addressed quickly to minimize potential damage. Research laboratories that fail to have such monitoring systems in place not only waste specimens that are rare, difficult to obtain, or prohibitively costly, but they also risk their lab's reputation for research integrity when other laboratories find themselves unable to reproduce reported test findings. The ultimate cost is the blow to an organization's reputation if a problem is not fixed in a timely fashion. This means that reliable environmental-monitoring systems are a must for nearly every research facility.

> "... monitoring of temperature primarily, as well as RH and CO_2, is critical to research integrity."

It follows that when a research experiment stipulates that the materials being studied or the research environment (chamber, incubator, etc.) be at a specified temperature, the question then becomes how accurate that temperature measurement is. The notion that a temperature can be *exactly X* is erroneous, in the strictest sense of accuracy. In reality, all measurements are subject to uncertainty, and a measured value is only complete if it is accompanied by a statement of the associated uncertainty.

What accuracy is and is not

Accuracy is established through calibration so that the entire measuring system—sensors and the instrument—traces back to a known standard. The standard that one uses to calibrate an instrument (a measuring system) should be two to four times more accurate than what you are trying to calibrate; best-in-class measuring instruments will generally trace back to standards with 4x accuracy. If you are calibrating a temperature-measuring device such as a data logger with a crude thermometer that has much lower accuracy, your calibration is meaningless.

Similarly, "NIST traceable" is meaningless without knowing the accuracy of the measuring system that was used for calibration. "NIST traceable" simply means something can be traced back to a national standard—it does not begin to suggest an accuracy level. Any calibration measurement can be shown to be NIST traceable if there is a succession of standards that originates with a national standard. Therefore, being NIST traceable does not mean the same thing as being accurate.

ISO 17025 and calibration accuracy

A decade or so ago, it was somewhat difficult for laboratory managers to be sure of the accuracy of the calibration services available for the various metrology instruments in their facilities. ISO 17025 quality standards should make this a non-issue for any laboratory manager who does his or her homework when acquiring instrumentation or calibration services.

Initially introduced by the International Standards Organization (ISO) in 1999, the ISO 17025 quality standard was specifically written for calibration facilities, going beyond the ISO 9000 quality standard to compel such

laboratories to demonstrate competence (i.e., performance) by using documented quality management systems. The A2LA (American Association for Laboratory Accreditation), NVLAP (National Laboratory Voluntary Accreditation Program), Laboratory Accreditation Bureau, and similar accrediting bodies certify calibration facilities for ISO 17025 standards.

ISO 17025 accreditation certificates clearly state the calibrations that a calibration laboratory is certified as capable of performing and stipulates the "best uncertainty" for those calibrations.

"Best uncertainty" is the smallest uncertainty of measurement that a calibration laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards on nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 percent level of confidence, usually using a coverage factor of $k = 2$.

Instrument accuracy is *not* the same as "best uncertainty"

While it is useful to know the "best uncertainty" of a calibration service, it is also quite erroneous to equate measurement uncertainty with the accuracy of your measuring instrument.

For example, a calibration laboratory accredited to the standards for RH and temperature calibration accuracy could take a $10 dial thermometer that has an accuracy of +/- 1°C, and even though the laboratory has an accredited "best uncertainty" of +/- 0.02°C, it can never overcome the crudeness of the thermometer, which is 50 times less accurate than the lab's calibration capabilities. In short, you cannot make a bad device better than it is. A crude dial thermometer, in fact, will often come with a so-called lifetime guarantee. That, too, is meaningless vis-à-vis accuracy.

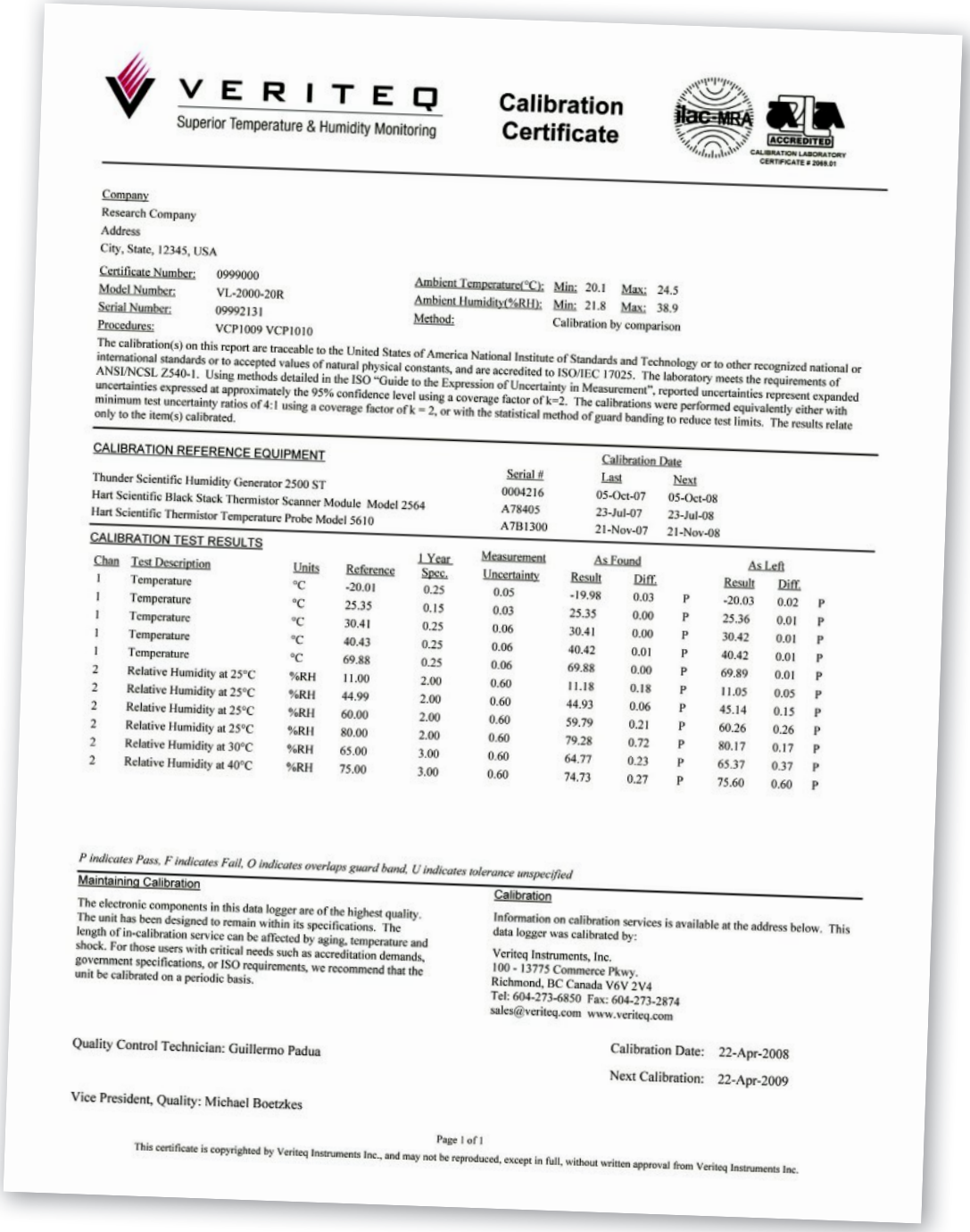
Maintaining accuracy is of paramount importance

Broadly speaking, there are two main issues when it comes to measurement accuracy. First is the actual accuracy (and measurement uncertainty) of the measuring instrument used, as discussed above. But equally, if not more, important is how that accuracy is maintained over time.

Although it is truly baffling from the perspective of an engineering organization whose sole focus is developing accurate environmental-monitoring technology, many of the environmental-monitoring instruments used in research laboratories (and indeed, in highly regulated industries such as pharmaceutical) are sold and used without any statements from those instruments' manufacturers as to what the instruments' accuracy will be after some period of time. Frankly, if a measuring device is released for use in research laboratories without stated accuracies for a predefined time period, lab managers are unwittingly introducing a wild card factor that could readily undermine research integrity.

> "... reliable environmental-monitoring systems are a must for nearly every research facility."

Calibration certificates that are consistent with ISO 17025 standards show both "as found" and "as left" calibration data, ensuring that the instrument has remained in spec in between calibrations.



VERITEQ
Superior Temperature & Humidity Monitoring

Calibration Certificate

ilac-MRA ACCREDITED CALIBRATION LABORATORY CERTIFICATE # 2069.01

Company
Research Company
Address
City, State, 12345, USA

Certificate Number: 0999000
Model Number: VL-2000-20R
Serial Number: 09992131
Procedures: VCP1009 VCP1010

Ambient Temperature(°C): Min: 20.1 Max: 24.5
Ambient Humidity(%RH): Min: 21.8 Max: 38.9
Method: Calibration by comparison

The calibration(s) on this report are traceable to the United States of America National Institute of Standards and Technology or to other recognized national or international standards or to accepted values of natural physical constants, and are accredited to ISO/IEC 17025. The laboratory meets the requirements of ANSI/NCSL Z540-1. Using methods detailed in the ISO "Guide to the Expression of Uncertainty in Measurement", reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. The calibrations were performed equivalently either with minimum test uncertainty ratios of 4:1 using a coverage factor of k = 2, or with the statistical method of guard banding to reduce test limits. The results relate only to the item(s) calibrated.

CALIBRATION REFERENCE EQUIPMENT

	Serial #	Calibration Date Last	Next
Thunder Scientific Humidity Generator 2500 ST	0004216	05-Oct-07	05-Oct-08
Hart Scientific Black Stack Thermistor Scanner Module Model 2564	A78405	23-Jul-07	23-Jul-08
Hart Scientific Thermistor Temperature Probe Model 5610	A7B1300	21-Nov-07	21-Nov-08

CALIBRATION TEST RESULTS

Chan	Test Description	Units	Reference	1 Year Spec.	Measurement Uncertainty	As Found Result	Diff.		As Left Result	Diff.	
1	Temperature	°C	-20.01	0.25	0.05	-19.98	0.03	P	-20.03	0.02	P
1	Temperature	°C	25.35	0.15	0.03	25.35	0.00	P	25.36	0.01	P
1	Temperature	°C	30.41	0.25	0.06	30.41	0.00	P	30.42	0.01	P
1	Temperature	°C	40.43	0.25	0.06	40.42	0.01	P	40.42	0.01	P
1	Temperature	°C	69.88	0.25	0.06	69.88	0.00	P	69.89	0.01	P
2	Relative Humidity at 25°C	%RH	11.00	2.00	0.60	11.18	0.18	P	11.05	0.05	P
2	Relative Humidity at 25°C	%RH	44.99	2.00	0.60	44.93	0.06	P	45.14	0.15	P
2	Relative Humidity at 25°C	%RH	60.00	2.00	0.60	59.79	0.21	P	60.26	0.26	P
2	Relative Humidity at 25°C	%RH	80.00	2.00	0.60	79.28	0.72	P	80.17	0.17	P
2	Relative Humidity at 30°C	%RH	65.00	3.00	0.60	64.77	0.23	P	65.37	0.37	P
2	Relative Humidity at 40°C	%RH	75.00	3.00	0.60	74.73	0.27	P	75.60	0.60	P

P indicates Pass, F indicates Fail, O indicates overlaps guard band, U indicates tolerance unspecified

Maintaining Calibration

The electronic components in this data logger are of the highest quality. The unit has been designed to remain within its specifications. The length of in-calibration service can be affected by aging, temperature and shock. For those users with critical needs such as accreditation demands, government specifications, or ISO requirements, we recommend that the unit be calibrated on a periodic basis.

Calibration

Information on calibration services is available at the address below. This data logger was calibrated by:

Veriteq Instruments, Inc.
100 - 13775 Commerce Pkwy.
Richmond, BC Canada V6V 2V4
Tel: 604-273-6850 Fax: 604-273-2874
sales@veriteq.com www.veriteq.com

Quality Control Technician: Guillermo Padua

Calibration Date: 22-Apr-2008

Next Calibration: 22-Apr-2009

Vice President, Quality: Michael Boetzkes

Page 1 of 1

This certificate is copyrighted by Veriteq Instruments Inc., and may not be reproduced, except in full, without written approval from Veriteq Instruments Inc.

A2LA-certified data loggers are calibrated when they are released to market, and the measurement accuracy (and measurement uncertainty) is detailed in the A2LA certificate for that particular instrument, as shown in Figure 1. However, it is an immutable law of metrology that all sensors drift. Humidity sensors are especially prone to drift because they are "air breathers," as they must be in direct contact with the environment. Not only is the air constantly changing temperature (which affects RH), but air also contains contaminants that affect sensors. Humidity sensors especially—but ALL sensors actually—have an ability to measure that degrades over time. The question then is how you manage and control this inevitable degradation.

A key difference between temperature data loggers that are released to research laboratories WITH stated accuracy at the time of next calibration (e.g., what the sensor will read one year later, or "as found" accuracy) is that they use highly stable components, including sensors and best-practice calibration methods. This is true no

matter which sensors are used—thermistors, resistance temperature detectors, and especially thermocouples.

Ideally, and it does exist, manufacturers need to stipulate the accuracy of measuring instruments such as data loggers over a specified time period (usually by the time of recommended recalibration). This means there is historical knowledge of the measuring instruments' characteristics when recalibrated.

Conclusion

The next time you look at your data, consider how much the values may have deviated from the original measurements. If the instrument manufacturer has not stated accuracy in between calibration intervals, then you are hoping the measured values are correct. Since it is a given that ALL sensors will drift over time to some degree, a sensor-based instrument released to the market whose behavior (drift) has not been characterized over time and cannot be stated is at best a presumed accuracy, not a studied and stipulated accuracy.

"In reality, all measurements are subject to uncertainty ..."

Don't mistake a specification of initial accuracy for how the instrument will perform.

For more discussions of the factors underlying stability of humidity sensors, please see http://www.veriteq.com/download/whitepaper/catching-the-drift.htm. On differentiating stable vs. unstable temperature sensors, please see http://www.veriteq.com/validation/pay-off-thermal-validation-data-logger.htm.

***Ken Appel**, manager of regulated markets at Veriteq, can be reached at kappel@veriteq.com or by phone at 800-683-8374.*

SECURING DATA

THE DEMAND FOR GREATER DATA INTEGRITY AND SECURITY DRIVES SOFTWARE DEVELOPMENT

by Gloria Metrick

A long-standing issue for the laboratory informatics industry has been managing and securing its data in order to be able to verify that the data has a high level of integrity. Reasons for this effort include the following:

- To ensure that the data researcher's reference for decision-making and calculations is correct.
- To satisfy outside stakeholders, such as regulatory agencies, that the data is properly managed and represented. In the case of medical research, this also includes managing patient privacy by limiting access to personal data and records.
- To support other efforts, such as proving patents by providing the supporting data.

Whether you're looking at a LIMS, ELN or another system, large or small, ensuring the integrity of the data is important for these reasons.

Securing data against changes

Most RFPs (request for proposals) that come from regulated companies to software vendors contain questions concerning how the system will secure the data. Potential customers want to know that the data cannot be changed by the users of the system or viewed by the wrong people. This is where a discussion of data integrity usually begins. Although data integrity requires a good process, there are often many technical issues to resolve in order to maintain the integrity of the data as well.

Most software offerings these days do allow users to protect their data from direct changes. Of course, this is one of those areas where one is also required to create good strategies and practices to support this. For example, since much of our data now sits in commercial databases, there are layers of protection. The software application itself will prevent users from changing data through the application. Even if the application can be modified by the customer, the actual software and data protection strategy should not be modified in a way that would allow unwanted changes. The customer will need to create and manage all the appropriate security measures surrounding the database, so that the application has access to read and write to the database but does not allow users to connect to the database and change it directly. There are many other factors as well, such as ensuring the clocks on the various systems providing data are kept in sync and that the date/time stamps are properly managed to ensure the highest integrity and to prove that data was entered or modified when the system claims it was done. Beyond this, there is the issue of secure data centers, which offer yet another layer of security.

"... there are often many technical issues to resolve in order to maintain the integrity of the data as well."

These are examples of the ways in which data must be protected. It is not enough to have an application that supports this type of protection; one must also have a strong overall process of security.

Proving ownership of changes

Over the years, software vendors have focused increasingly on ensuring that data entries and changes are absolutely linked to the correct person. Although many systems have done this for a number of years, stricter rules are now being applied.

In the 1990s, 21 CFR Part 11 (the U.S. governmental guidelines on electronic signatures and electronic records) became a big talking point. Everyone wanted to know if particular pieces of software were "21 CFR Part 11"–compliant. As many of you already know, software

THE BAKER COMPANY
BIOLOGICAL SAFETY CABINETS

Take it personally.

We know how much you put into your work. Because we listen to our customers carefully, we have a true appreciation of your commitment and passion. It inspires us to be better, too. That's the reason we make our safety cabinets to a higher standard of quality and safety. It's a guiding principle that motivates every Baker employee, from our engineers to our service representatives. You can always depend on our personal best.

THE BAKER COMPANY

P.O. Drawer E, Sanford, ME 04073 • (207) 324-8773 • (800) 992-2537 • Fax: (207) 324-3869 • www.bakerco.com

is not compliant. It has to be written to support compliance if you want to have a compliant installation of it, but the way in which you use the system is what actually makes it compliant or not. This is similar to the physical management of data, where part of the responsibility for securing the data lies outside the software. As with the physical security of the data, an installation can be made noncompliant by improper use and maintenance.

"...secure data centers... offer yet another layer of security."

The electronic move continues

The goal has long been to make data more electronic for many reasons, but proving ownership has been an important driver.

Even though 21 CFR Part 11 has been around for many years, we are still revising the way we handle electronic records and electronic signatures. Thus, as new technology comes about and as we learn more about the pitfalls of the technology, we are more capable of addressing these types of issues.

Electronic signatures and digital signatures are one example of this. If we look at the way we tried to manage these back when 21 CFR Part 11 came out in the 1990s, we see a vast difference from the way we handled them in early 2000. And in the past few years, we have witnessed even more changes to them.

For example, early on, some software vendors instituted electronic signatures in their software. But as standards changed, they have continued to modify the way these options work within their systems in order to best prove that the person changing the data is truly the person using the account. Additionally, when we approach the issue of digitally ensuring that the person is the person they say they are and attaching a true digital signature, we continue to wade into complex technical, procedural and legal territories. Consequently, we've seen at least one organization pull together a standard model for approaching this: the SAFE-BioPharma Association (http://www.safe-biopharma.org/). For those who think this has all become entirely straightforward after so many years, I need to point out that if it was so easy, nonprofit organizations such as SAFE-BioPharma would not have been created solely to address these standards.

But even SAFE-BioPharma's standards are far from ubiquitous. Companies pay to join this organization in order to benefit from these standards and, the last I heard, although its membership is growing, SAFE-BioPharma is still far from representing the majority of the biopharma industry.

Nor does it begin to address the issue that other industries and organizations have with this very same topic, which explains why, for example, HL7 (http://www.hl7.org/) was created specifically for handling health records.

"The goal has long been to make data more electronic for many reasons, but proving ownership has been an important driver."

Comfort level versus technology

While technology has continued to progress, if we consider how long we have been trying to make our data records and signatures electronic, one might think that our progress is extremely slow. However, corporate lawyers have become more comfortable allowing their laboratories to start moving away from manual signatures only recently, and the laboratory informatics community as a whole seems more comfortable with the idea only now as each step slowly gains acceptance. Even if technology and the understanding of it had moved along more quickly, we probably would not have been able to embrace it any more quickly, due to our general lack of comfort with and understanding of the issues.

Are we done?

As long as the topic of "electronic signatures" remains an important one, it isn't finished. Technologies and strategies that we take for granted, that are no longer "hot," are the ones that we have worked out to the point where they are probably reliable and straightforward. Considering that we have not stopped talking about electronic or digital signatures for a number of years, I predict we still have a few years to go before we can rightfully claim to have it all figured out, although that doesn't stop us from making that claim year after year.

And, as usual, there is nothing to prevent companies from having bad practices that undo what good their new and "compliance-capable" systems might provide, nor, in some cases, prevent them from modifying these systems to the point where they allow the very things they were meant to prevent.

Gloria Metrick *is the owner of GeoMetrick Enterprises (www.geometrick.com), which provides consulting services for laboratory informatics projects. She is the author of "Out on a LIMS™: The Newsletter for People Who Risk Life and LIMS™ on a Daily Basis" and "Out on a LIMS™: The Blog for People Who Risk Life and LIMS™ on a Daily Basis," as well as a contributor to TheIntegratedLab.com. Gloria can be contacted for projects, or to speak or write, at GeoMetrick Enterprises, 781-365-0180, Gloria@GeoMetrick.com.*

BEST AND BRIGHTEST

HOW NATURAL DAYLIGHT AND OTHER AMENITIES IN LAB DESIGN CONTRIBUTE TO ATTRACTING AND RETAINING TOP SCIENTIFIC TALENT

by Jay M. Brotman, AIA, and Robert B. Skolozdra, AIA

The list of fundamentals for good laboratory design is growing. Over the past decade, security and sustainability have both become higher priorities, and within each of these broad areas, best practices and special requirements have proliferated. Of late, designers and operators of laboratory spaces for a wide variety of research types are beginning to encourage clients to consider an unusual and often unconsidered aspect of research facilities: how laboratory design and amenities contribute to a research organization's ability to attract and retain top scientific talent.

The fact is people matter more than ever. What's more, the leadership of research-driven organizations understands that their most highly qualified candidates and employees will consider many aspects of their current and potential career positions. Human resources experts note that top researchers often look for a team or organization with a superior reputation. This can profoundly affect one's career, so it often supersedes salary and benefits on the list of career goals.

The quality of the lab facility itself impacts an organization's reputation significantly, both in terms of personnel satisfaction and even sources of funding. Top talent want to work in a top lab.

"The quality of the lab facility itself impacts an organization's reputation significantly."

This is partly just human nature. In a recent workplace survey of more than 2,000 respondents across eight different industries, 92 percent of respondents felt that better workplace design makes a company more competitive.[1] Moreover, a 1998 study by the Hay Group found that the workplace is a major factor in employee retention as well—specifically, employees in "high-performing companies" rated their working environments more highly than did their counterparts at other companies.

Studies in various fields have shown that daylight and outdoor views directly contribute to good health, improved productivity and elevated levels of workplace satisfaction. At Yale's Sterling Hall of Medicine in New Haven, Connecticut, a recently added wing was designed specifically to allow ample sunlight and scenery.

PHOTOGRAPH COURTESY OF OLSON PHOTOGRAPHIC

What design considerations and amenities matter most in setting one lab facility above the rest? Whether working on a newly constructed building or a renovation, lab managers should consider the following issues, which have been shown to boost a lab's reputation and, ultimately, help draw talented scientists into the fold.

Daylight and views

Of all features that contribute to desirable lab facilities, natural daylight is arguably the most important. Bringing abundant daylight into labs as well as support and corridor spaces creates an energizing, welcoming environment in what is often required to be a sterile, highly controlled setting.

What's more, sunlight produces health benefits for building occupants, dovetailing with sustainable design goals as well as productivity needs. In "Greening and the Bottom Line," the Department of Energy's Joseph Romm and William Browning of the Rocky Mountain Institute show that daylighting boosts productivity and reduces

The use of glass walls, transoms, skylights and open lab planning help bring natural light and views from a lab building's perimeter into central areas. At Yale's Sterling Hall of Medicine, a lab designed by the architecture firm Svigals + Partners employs full-height glass partitions.

PHOTOGRAPH COURTESY OF OLSON PHOTOGRAPHIC

To improve the research environment, lab modules should be situated along exterior walls to bring natural light and views for relief into the bench area. Natural finishes and light-colored surfaces help contribute to a bright, comfortable work area, as in this genetics lab.

PHOTOGRAPH COURTESY OF OLSON PHOTOGRAPHIC

Lab planning should emphasize adjacencies between bench and meeting areas, private work zones and collaborative spaces. This contributes to a more relaxing atmosphere that fosters interaction and dialogue, as seen in this informal break area at Yale's School of Medicine.

PHOTOGRAPH COURTESY OF OLSON PHOTOGRAPHIC

absenteeism in facilities like Lockheed 157, a multistory office space designed with a top-to-bottom atrium. There, absenteeism was reduced by 15 percent and employees spoke glowingly of their bright, attractive workplace.

Just as important, windows provide access to outdoor views, allowing occupants to feel connected to the world beyond the lab. Studies of workplaces have shown conclusively that the well-being and health of occupants benefit significantly from access to views, especially of natural settings. Extending this view access to interior corridors also functions as an orientation device, eliminating the mazelike effect of large research environments.

These findings are not news, of course, but few research labs are designed with these principles in mind. An exception is the Sterling Hall of Medicine C-Wing at the Yale School of Medicine's Department of Genetics in New Haven, Connecticut. Designed by the nearby architectural firm Svigals + Partners, the lab interior was developed to accept as much daylight as possible, with generous views in and out. A post-occupancy survey showed that the finished project enjoys sunlight in 86 percent of areas occupied for visual tasks—a very high portion compared to typical labs, which might have daylight in only one-third of spaces, or even less.

What are some practical ways a facility can incorporate more light? The C-Wing plan, for example, aligns spaces that can benefit from transparency—glass partitions and open areas—so that sunlight can reach from the perimeter deep into the floor plate. Lab modules are situated along the exterior walls, where exterior windows allow daylight and views into the bench area and beyond into corridors through interior glazed openings. Light-colored surfaces and transparent materials are utilized throughout, and open areas and glass-enclosed meeting

rooms are strategically located to take advantage of the daylight. High clerestory and view-height windows were combined to create a bright, inviting atmosphere.

Of course, research space is always at a premium. Yet the common practice of designing lab facilities with double-loaded corridors limits the possibility for a highly transparent interior. Standard uses along these corridors include storage and lab support zones, which may not benefit from daylight anyway. A daylight-friendly lab layout may mean balancing space efficiency with personnel gains—lose a bit of usable square footage, for example, and gain productivity and employee loyalty.

Transparency offers other benefits as well. Commercial researchers benefit as staff members can show research in process to VIPs and investors from the corridors without bringing them directly into core research zones. Some groups, Yale's genetics team included, even use the open interiors to tell the story of the science at work in the facility. What's more, should there be an emergency in the lab, colleagues on the outside will know immediately that help is needed, making response time quicker, and thus increasing lab safety.

Sustainability and LEED

Daylighting offers another bonus: it's an advantageous and often required component of sustainable design. Good use of natural light helps reduce lab power loads, from both electrical lighting and HVAC requirements, and injects health and morale benefits for occupants.

On top of that, sustainably designed lab spaces can directly influence a highly qualified applicant's view of the parent organization. From anecdotal experience, we know that many researchers in the health and science fields see green lab facilities, especially with Green Globes or U.S. Green Building Council LEED certification, as a big plus. Sustainability is often in line with their beliefs, especially among recent graduates entering the field. An internal study of RNL's LEED Gold offices, for example, found that 82 percent of its staff felt that the new space would improve recruitment and retention. Savvy candidates for lab positions may also be aware that LEED-certified labs are healthier spaces, containing elements like low-VOC materials, higher ventilation rates and better lighting systems.

It may be difficult for some laboratories to achieve LEED ratings, owing to the significant power loads and other operational issues that make them different from other commercial and institutional spaces. Currently there is no LEED program specifically geared toward laboratories. But a well-designed facility can achieve certification nevertheless.

The Yale Sterling Hall of Medicine's C-Wing and I-Wing, for example, achieved Gold ratings under the LEED for Commercial Interiors (LEED-CI) program, the first in the country for a laboratory renovation. The USGBC chose the Svigals + Partners project as a case study for developing a LEED standard for lab renovations. It may soon become commonplace to hear of LEED labs, which can only contribute to a competitive hiring environment.

Floor planning

Flexible and inviting lab organization is another element in the design of a prestige facility. These workplaces attract top talent in part because they foster collaboration and positive interaction among peers. Just as important, they can adapt to new research programs

▲ *In contrast to laboratory zones, common meeting areas such as cafés, lobbies and corridors should avoid doors and walls to encourage interaction. At Albertus Magnus College's new Center for Science, Art and Technology in New Haven, Connecticut, a dramatic open lounge fosters a sense of community within the facility.* PHOTOGRAPH COURTESY OF OLSON PHOTOGRAPHIC

and up-to-date protocols and methodologies. In fact, the workplace consultancy DEGW's Axel Praus concluded in his paper "Recruiting the Next Generation" that while salary and career prospects remain the most appealing factors, "The workplace environment and flexible approaches to working are equally important to students soon to be entering the job market."

"It is essential that employers around the world understand both the fundamental changes taking place and the expectations of this pool of future employees," Praus adds, stressing "modern workplace environments that reflect the skills and communication habits of this generation."

This new paradigm includes recasting the workplace to have a more relaxing atmosphere that fosters interaction and collaboration—a huge benefit, especially in large and multidisciplinary research projects. For large facilities, creating multiple locations with both formal and informal meeting areas, especially locations for eating, make the facility more inviting while simultaneously reducing the travel time to and from the lab.

▲ *Recognizing that research labs often serve as a home-away-from-home for scientists spending long hours on research, Svigals + Partners has worked with the Yale School of Medicine on more than 200 small and large projects with a focus on creating a home-like atmosphere. These projects included the first lab project in the United States to earn the U.S. Green Building Council's LEED rating for Commercial Interiors (LEED-CI).*

PHOTOGRAPH COURTESY OF WOODRUFF/BROWN ARCHITECTURAL PHOTOGRAPHY

Open lounges along corridors encourage greater interaction and collaboration; studies of interaction in the workplace have shown that a closed door, even one that leads to a public break area, will discourage an occupant from entering the area beyond, *especially* if there is someone already in the space. Open lounges foster a desirable sense of community within the facility, as do windowed corridors and open (doorless) daylit stairwells.

For an example of this type of strategy, consider the Yale Department of Genetics renovation: in this case, Svigals + Partners co-located a large break room, a conference room and several offices on the courtyard side of the facility. The break room itself opens directly onto the courtyard through glass doors. The effect is striking, combining daylighting, views and strategic floor planning to create a space that fosters collaboration, community and shared enjoyment.

Comfort and amenities

Everything discussed up to this point contributes to the comfort of the facility occupant, often while paying additional dividends of sustainability, efficiency and increased productivity. Yet there's more to be said on comfort: ideally, the design approach should transform the facility into a "home for research."

5 MUST-HAVES FOR BUILDING DESIGN

A few key elements are useful for lab management and their facility design teams to consider in planning a construction or renovation project. These could be make-or-break items when hiring the top talent:

1. **Adaptable Infrastructure.** Many candidates are very aware of how quickly technology is changing. Consider extra power, data, cooling and space over and above the minimum requirements. Flexible, reconfigurable casework is also now a common requirement.
2. **Networking.** Already advantageous to productivity, digital networking that makes best use of personal digital devices will attract up-to-date minds.
3. **Virtual reality.** Special visualization labs have a dramatic impact on applicants and benefactors alike. These are becoming more common, which means that their cost-effectiveness is rising.
4. **Lighting and acoustic control.** At Lockheed 157, daylighting and acoustic strategies were responsible for a 15 percent reduction in absenteeism, which the company said paid for the added design cost in the first year. The employees rave about their workplace.
5. **Art.** Art can foster pride and a prestigious atmosphere while communicating the story of the science. A butterfly research lab designed by Svigals + Partners for Yale incorporates a butterfly-themed work of glass into the doors of the main entrance. The effect on the facility is to enhance an already beautiful daylit lobby as well as the glass-enclosed spaces beyond.

Many research labs are 24-hour facilities, and their denizens spend as much—if not more—time there as they do at home. Current and prospective employees view their available amenities through this lens. Showers and locker rooms for lab employees, for example, are simple amenities that offer multiple payoffs. New recruits imagine themselves comfortably refreshing themselves without having to travel to and from home. Employees who wish to ride bikes to work are also encouraged—yet another way to earn points toward LEED certification.

Aesthetics are also important to creating the "home for research," and they may further contribute to sustainable design. The *Whole Building Design Guide*, a project of the National Institute of Building Sciences, lists several recommendations:

- Provide windows in all occupied spaces
- Design spaces around basic human needs, ancient preferences and connections to the patterns of nature and the mind
- Consciously integrate facilities into their natural and man-made contexts

When considering interior elements, consider that colorful and warm alternatives to the traditional sterile laboratory environments are crucial and not at all cost prohibitive. Metal casework can be replaced with maple,

Wood finishes on casework doors add a subtle but warm contrast to darker benchtops of more functional materials. To improve the usefulness and flexibility of the lab, managers select furniture systems that can be easily reconfigured or relocated. As at the Yale Department of Genetics' C-Wing, lab support areas are fixed, while modules and benches can be moved as needed.

PHOTOGRAPH COURTESY OF OLSON PHOTOGRAPHIC

oak or even bamboo. These can be as cost-effective as metal casework, sustainably sourced and offer pleasing natural appearances. Flooring with colors and patterns can add a contemporary dash and a dose of fun, with many sustainable materials available. Countertop workspaces, especially for bench tops, should remain neutral in color.

Easily relocatable benches and shelving are also good, cost-effective elements that contribute to the flexibility and usefulness of the space on a day-to-day, week-to-week basis. When considering lighting fixtures, the design should of course seek to reduce the power level while retaining lumen quantities. Pendant fixtures work well in this regard—the hanging lamps reflect the light to create even distribution, which in turn generates a more open feel and furnishes the space with a sophisticated, architectural look.

Workplace paradigms are already changing in nearly every field, and talented candidates consider their potential work environment in their decision making. In the research field, being so competitive, securing the best and brightest has concrete implications for the research organization's short- and long-term outlooks. Modest investments in creating a "home for research" are likely to pay for themselves, not only because they are likely to represent energy-efficient and productivity-increasing design strategies, but because they will raise esteem. In labs as elsewhere in life, a good reputation will beget a good reputation.

References

1. 2006 U.S. Workplace Study, www.gensler.com

***Jay Brotman**, AIA, is a partner and director of technical services, and **Robert Skolozdra,** AIA, LEED AP, is a partner and LEED design specialist, both with Svigals + Partners, an integrated architecture and art provider specializing in research and educational facilities. The company is based in New Haven, Connecticut.*

SURVEY REVEALS LOYALTY AND ENGAGEMENT LEVELS

In late 2009 and early 2010, more than 3,500 science professionals worldwide responded to an annual workplace survey created by Kelly Services, Inc.

Nearly 25 percent of the survey respondents indicated that the global recession has improved employee loyalty, as many science professionals continue to focus on attaining long-term careers within their current organizations and laboratories.

The survey, known as the Kelly Global Workforce Index (KGWI), revealed that managers who use strong morale boosters and open lines of communication tend to improve employee loyalty and commitment levels across many industries, including science.

As scientists focus on obtaining career success, managers can improve the morale in their organizations by providing effective training programs, positive feedback, and open and honest communication to their employees. In doing so, managers will likely retain their employees on a long-term basis and prepare them for career and organizational success well into the future.

Survey findings – Employee loyalty levels

In order to understand the ways in which employee loyalty and engagement levels compare and contrast in accordance with age and work experience, Kelly Services' KGWI obtained the views of a wide range of science professionals across three generations: Generation Y (aged 18 to 29), Generation X (aged 30 to 47), and the Baby Boomer generation (aged 48 to 65).

The following survey findings reveal the loyalty levels of science professionals of all ages and work experiences across the nation:

- Twenty-four percent of all respondents feel "more loyal" to their organizations now than they did before the recession began.
- Loyalty levels did not significantly vary across different generational groups. Twenty-five percent of Generation Y respondents are currently more loyal to their organizations, slightly higher than Generation X respondents (24 percent) and Baby Boomer respondents (22 percent).
- Positive management and company morale, as well as availability of effective training and development programs, tend to improve employee loyalty levels.

Scientists develop renewed loyalty

In addition to impacting employees around the world, the recent economic recession affected a wide range of scientific organizations and laboratories. Many companies experienced layoffs, budget cuts and organizational profit losses. Yet, in spite of these changes, many presently employed scientists have developed a strong sense of loyalty to their companies.

So, why are some scientists more loyal to their organizations? According to the survey, positive yet realistic managers tend to improve the morale of their employees by providing a clear understanding of the organization's future and identifying areas in which employees can further develop their skills.

In addition to positive management, organizations should also offer ample training opportunities to their employees, as well as pay and benefits that reflect employees' work experiences. Finally, some science professionals' on-the-job performances tend to improve when they are recognized and rewarded for their work. To recognize employees, managers can award anniversary gifts to loyal scientists in celebration of significant milestones or provide additional vacation time to high performers.

By leading in a positive yet realistic manner, training employees on a long-term basis, providing adequate pay and benefits, and recognizing employees for their dedication and service, man-

agers will likely be able to improve the loyalty levels of their employees during the coming months and years.

Survey findings – Employee engagement levels

In the meantime, the following findings were uncovered in regard to scientists' current engagement levels:

- Forty-five percent of all survey respondents within the scientific industry are "totally committed" to their current organizations and laboratories.
- Forty-eight percent of all Generation X survey respondents are totally committed to their current employers, compared to 47 percent of Baby Boomer respondents and 41 percent of Generation Y respondents.
- More interesting and challenging work—as well as higher salary and benefits, improved training programs, and enriched work/life balance—will likely improve employee engagement levels.
- Some employees' engagement levels are also impacted by the reputations of their organizations. Forty-seven percent of all Baby Boomer respondents believe that corporate reputation is important to their decision about whether to join or remain with an organization, in comparison to 37 percent of Generation X respondents and 26 percent of Generation Y respondents.

Scientists need challenging and meaningful work

As managers strive to maintain the interest, focus, and motivation of their employees, they need to realize that a variety of elements, ranging from high salary and adequate benefits to effective training programs and meaningful responsibility, seem to improve employee engagement. Yet, according to the survey, scientists must have interesting and challenging work above all else—even high salaries!

It seems that many scientists thrive when they have opportunities to live out their passions while also working to improve the lives of their fellow human beings. Without meaningful, valuable work, scientists' commitments to their positions and organizations may diminish.

Scientists desire to work for reputable organizations

Finally, 81 percent of all survey respondents believe that organizational reputation is either a "very important" or "somewhat important" factor in deciding whether to continue to work within an organization or to leave. Without a doubt, highly motivated and competitive employees are typically attracted to organizations that have their best interests in mind. As scientists work to improve the lives of others, they want to be employed by organizations that hope to do the same.

In addition, as scientists pursue employment opportunities within other organizations or promotions in their current companies, they will also be concerned with one key organizational characteristic—quality. Scientists desire to work for organizations that develop quality products and provide quality services. If organizations want not only to survive but also to thrive amidst the current realities of the global economy, they will need to hire highly qualified employees and managers.

By providing quality within and outside the confines of their company headquarters, organizations not only will become well known within the science industry as good corporate citizens, but they will also continue to attract top talent.

As organizations focus on the future, they will be able to maintain a high level of success as long as they continue to remain engaged with their workforces. In return, scientists will likely become more loyal to and engaged with their organizations in the future. As a result, such scientists will continue to perform to the best of their abilities, as they hope to not only improve the lives of others, but also to impact the well-being of the organizations in which they work.

Diane Barker *is the director of Kelly Services' Americas Products Group – Science. Kelly Services, Inc., a leader in providing workforce solutions, is headquartered in Troy, Michigan. For more information, visit www.kellyservices.com. Diane can also be followed on LinkedIn at http://www.linkedin.com/pub/diane-barker/0/631/499.*

Be on the lookout. This year's *Lab Manager Magazine* – Kelly Scientific Fourth Annual Salary and Employee satisfaction survey will be arriving in your e-mail inboxes this month. Visit www.labmanager.com/salarysurvey2010 if you would like to take the survey now. Based on your participation, we will once again provide the most up-to-date snapshot of how you and your peers are currently faring in terms of wages and job satisfaction. Results of the survey will be published in the October 2010 issue. Make sure you're represented.

RAPIDLY GROWING FORENSIC LABORATORY SYSTEM COULD USE OVERHAUL

by Bernard Tulsi

"With the exception of nuclear DNA analysis … no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or sources." This indictment encapsulates the findings of a congressionally mandated report from the National Research Council, an arm of the National Academy of Science (NAS), on the state of forensic laboratory science in the United States.

Citing fragmentation and scant evidence to support the reliability of many of the techniques used in the forensic laboratory system in the U.S., the NAS report called for comprehensive reform and new research. Upon the release of the report in early 2009, a statement from the National Research Council noted that rigorous and mandatory certification programs for forensic scientists were lacking, as were strong standards and protocols for analyzing and reporting evidence. The Council's release stated, "… there is a dearth of peer-reviewed, published studies establishing the scientific bases and reliability of many forensic methods. Moreover, many forensic science labs are underfunded, understaffed, and have no effective oversight."

> "… many forensic science labs are underfunded, understaffed, and have no effective oversight."

Seeking to put the report's findings into context, the *New York Times* noted, "Forensic evidence that has helped convict thousands of defendants for nearly a century is often the product of shoddy scientific practices that should be upgraded and standardized, according to accounts of a draft report by the nation's pre-eminent scientific research group." The newspaper dubbed the NAS report, "… a sweeping critique of many forensic methods that the police and prosecutors rely on, including fingerprinting; firearms identification; and analysis of bite marks, blood spatter, hair, and handwriting."

"*The* story right now regarding forensic labs is the February 2009 National Academy of Sciences report,"

says Thomas L. Bohan, past president, American Academy of Forensic Sciences (AAFS) and director of MTC, a forensics consultancy based in Peaks Island, Maine. "Among other things, it led immediately to the creation of a new committee in the Obama White House."

Writing in the March 2010 issue of the *Journal of Forensic Sciences*, Bohan noted, "Shortly, a bill will be introduced in the Senate Judiciary Committee addressing the problems cited by the NAS. Concurrently, the White House Subcommittee on Forensic Science, staffed and led by a number of AAFS fellows, is directly tackling key threshold tasks such as 'gap studies' to determine where the omissions in validation lie with respect to each of the questioned forensic methods."

> "... senior lab management focus less on the proper execution of projects and more on throughput."

In a letter to the editor of *Newsweek* magazine published April 12, 2010, Bohan wrote, "Based on my life as a physicist and an attorney, including 35 years of applying science to forensic questions, I believe that all of the NAS report's assertions are correct, an opinion in which I am not alone. Scientists across the country engaged in, or familiar with, forensic work agree that most of the forensic methods relied on by crime laboratories have neither been validated nor have had their error rates measured."

Reviewing the NAS report, "Strengthening Forensic Science in the United States: A Path Forward" in the *Journal of Forensic Sciences*, Bohan stated, "Make no mistake. This book [report] is a harsh indictment of forensic science as practiced by law enforcement agencies and prosecutors in the United States; it is *not* an everything-is-pretty-good-but-let's-try-to-make-it-even-better assessment, in spite of the reference to 'strengthening.'

"And it is not a pronouncement from the ivory tower, but rather the product of a multi-year study by a diverse group of legal scholars and scientists selected by the country's most respected scientific organization: the National Academy of Sciences. This group unanimously recommended 13 measures to address the problems it asserted have long plagued crime-lab forensics, recommendations that included a call for massive forensic-science research sponsored and funded by a science-based agency outside the Department of Justice, and an exhortation that all the nation's forensic laboratories be independent of law-enforcement agencies. In September 2009, the American Academy of Forensic Sciences adopted a public position statement endorsing all 13 of the recommendations."

Turning to some of the practical contributors to the woes in the forensic world, Brian Wraxall, chief forensic serologist with the Richmond, Calif.-based Serological Research Institute (SERI), a nonprofit private forensic lab, says that there has always been a series of problems—such as pressure on staff, lack of leadership, huge backlogs,

and severe financial constraints. "The backlog, particularly now with DNA, is huge. While the federal government is funding some of that work, there is still a lot that does not get done. In general, lab workers do not have the time to complete everything they have to do. If they are given 20 items of evidence to analyze, in some cases they may do only a couple of them because of time constraints."

He adds that high-volume, high-pressure working conditions are not a good scenario for forensic work. Funding is always short, and as a result there is always a shortage of qualified staff. "There is bigger staff turnover now than when I started. This means that you train someone, and before you know it they are gone, leaving you to start over," says Wraxall. Numerous additional requirements now make it difficult to prepare workers for the forensic field in a short time, he says.

"Even if you hired a worker who has accumulated some experience in another lab, it will be necessary to train him or her in your methods and procedures because there is no standardization within the scientific community of forensics. But sometimes you have to be concerned about standardization.

"The NAS report raises the question of standardization. The problem is that when you do that, it takes away the opportunity for people to use their brain, take the initiative, and make use of their full abilities," says Wraxall.

Turning to the question of leadership, Wraxall says that senior lab management focus less on the proper execution of projects and more on throughput. "That's not smart, because when you start counting numbers and counting heads, you tend to lose sight of the need to develop and put out useful evidence." One result is that far too many cases are not addressed properly because of the backlog burden and the pressure on staff, he adds.

The forensic laboratory system in the U.S. consists of both public and private labs. The most well-known public labs are those of the Federal Bureau of Investigation (FBI). Throughout the country, there are local public labs operated mostly by police departments and staffed by state employees. Private labs also play a crucial role in the delivery of forensic services, and like private labs in other fields, they are organized on the fee-for-service business model. Most of the private labs in the U.S. are classified as small, with just a few large and medium-sized operations.

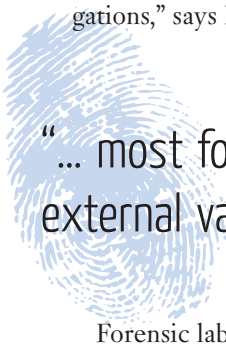
> "Both in the U.S. and around the world, forensic laboratories are on a growth trend."

"Private forensic labs get their samples mostly from public laboratories or law enforcement authorities. Upon completing the analytical work, the labs invoice the state or local government. The work itself is similar in private and public laboratories," says Karl Reich, chief scientific officer, Independent Forensics (Hillside, Ill.).

Both in the U.S. and around the world, forensic laboratories are on a growth trend, according to Reich.

He notes that there has been considerable expansion in forensic laboratory services in many states. Many more private labs were launched over the last several years as well. But there have also been a number of mergers with larger labs or outright closures. "The service model for forensic labs is tough," he says. At the moment, forensic laboratories make up less than 1 percent of the total laboratory universe in the U.S., and the whole area is tiny compared to the full span of medical or diagnostic laboratories in existence today, Reich estimates.

"The way we do DNA forensics now did not exist just 15 years ago, so that area has grown from almost zero to an impressive size." He sees continued growth overseas, as many countries still do not have forensic services. "No country can afford to be without these services, especially DNA databases for forensic investigations," says Reich.



"... most forensic labs allow others to do the external validation and publish the results."

Forensic labs are not FDA-regulated, and in comparison to regulated labs, the accreditation that forensic labs need is not very stringent, though it is fairly onerous, according to Reich. Accreditation requires an annual inspection, and external and internal audits every other year, and certain staff members have to take external proficiency examinations, usually two times a year on average.

"In general, but not 100 percent of the time, work that is admissible in court has to come from an accredited lab. There are variations in the statute from state to state. For DNA, however, all the labs have to be accredited—that is not the case for other forensic subdisciplines," says Reich.

Most private forensic labs are broadly divided into the lab portion that includes analysis, and the support portion that includes office and sometimes sales functions. The lab section is operated by analysts and supervisors who execute and monitor the work, respectively. Both groups generally report to a lab director who is responsible for the general management of the facility. Reich's lab, Independent Forensics, which focuses on DNA analyses, has roughly this structure with one key difference: it also has a section that carries out R&D, which does not have any direct DNA analysis functions.

"This is a bit unusual compared to other forensic labs. Our R&D section develops new products. In forensics investigations, there is often the need to determine if saliva, semen, blood, or urine is present. So our R&D section developed four specific lateral flow strip tests for the forensic identification of those body fluids," says Reich.

The dominant focus of most forensic labs today is DNA analysis. "The DNA sections of forensic labs receive the most funding, are allocated the most space, and receive the most attention and publicity. That's inescapable," says Reich.

Around 1995, the FBI settled on 13 genetic systems that would constitute a full profile that could be entered into a database, which could then be searched for a match. "The success of this approach has really taken hold in the U.S., and it is having an impact worldwide," says Reich. The only analytical instrumentation currently available for this is capillary electrophoresis from Applied Biosystems, and the process reagents are made only by Applied Biosystems and Promega.

Polymerase chain reaction (PCR) technology is still very important in the field, according to Wraxall. Both Reich and Wraxall agree that forensic labs do not develop or use technology as fast as other research sectors. "Crime labs in general tend not to do the research. They generally pick up research done by others, such as Applied Biosystems or Promega. Applied Biosystems is deeply involved with new technologies and is constantly at the forefront of developing new systems capable of using smaller amounts of samples and materials. We do have the capabilities to solve specific problems in the forensic area, but, by and large, we are reliant on outside research," says Wraxall.

"Another reason is the requirement to do validation. If we developed a completely new system, we would have to do all the external validation, and then all other users will have to do internal validation—external carries many more criteria than internal. So most forensic labs allow others to do the external validation and publish the results. They then do their internal validation and incorporate the system into their casework," says Wraxall. He adds that most crime labs have huge backlogs and generally have no time to engage in research.

Still, non-DNA methods still enjoy considerable application in the forensic world. The main instrumentation for ballistics testing continues to be the microscope. Toxicology analyses rely on gas chromatography and mass spectroscopy, and document analyses use microscopy and scanning techniques.

"Working in this field, you get to develop evidence that helps to convict the guilty as well as exonerate the innocent."

To be sure, the social impact of forensic work can be compelling. "Working in this field, you get to develop evidence that helps to convict the guilty as well as exonerate the innocent, and that is a unique aspect of this field of work," says Reich.

In the future, Reich perceives more consolidation because of the service model that dominates the private labs. "It is harder for smaller labs to win state contracts; the bigger labs have an inherent advantage. There will also be some severe fights over new technology, because the field has not modernized. For sure, standards will be much more regulated in the future."

Wraxall says that while some of the regulations and accreditations are fine, some can be "a waste of time." We need to develop systems for proper training, and to ensure that workers perform in an environment in which they are not under constant pressure to get results out against horrendous deadlines, he says. "The only way to do that is to employ adequate numbers of people and train them well."

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

LABX SUPPORTS CRIME LAB REGULATORY REQUIREMENTS

By Stephen Wilent, Laboratory Solutions Consultant, METTLER TOLEDO

Overview/Purpose

This article is designed to outline supporting functionality provided by METTLER TOLEDO LabX Balance software that establishes efficacy standards regarding regulatory requirements for Crime and Forensic Labs.

After defining the established regulatory requirements currently established for Crime and Forensic Labs, this article will describe how LabX Balance software fully supports compliance efforts in regard to measurement uncertainty, calibration, ISO 17025 and irrefutable acceptance of electronically generated weight data in a court of law.

Precision versus Accuracy – How Your Lab Balances Are Affected

Precision can be defined as the closeness of agreement of results of a series of repeat measurements under presumed identical conditions. These results are often expressed as a standard deviation. Precision is often mistaken as a measure of accuracy; it is distinctly different from accuracy, and the confusion can lead to significant ISO violations regarding weights and measurements. The fact is, precision between instruments or labs can be very good, but the accuracy can be off by orders of magnitude. Poorly maintained or low quality balances can provide good repeatability, while at the same time their accuracy can be very poor! Simply put—precision describes the scatter of results achieved when repeatedly measuring the same weight. Precision is not a factor of the true value of the weighed item, and should not be used to describe accuracy. It should be noted that when measuring small quantities of substance on an analytical balance, (ie. A few % of the balance's capacity), repeatability is the dominant contributing uncertainty of measurement, accounting for greater than 90% of the total uncertainty.

Accuracy can be defined as the closeness of agreement between the result of a measurement, or series of measurements, and the TRUE VALUE of a traceable, certified standard. Accuracy is establishing a relationship between values displayed on the balance and values known. Simply put—accuracy is obtained by comparing values obtained on the balance against the value of the Standard as reported on the weight's Certificate of Calibration.

Having a clear understanding of the difference between precision and accuracy will allow you to maintain your weights and measurements in an ISO compliant manner. The quality management functionality within METTLER TOLEDO LabX balance software contains all necessary components to completely support establishing measurement uncertainty (minimum weight) for determining the precision of your lab balance. LabX balance software also contains all necessary calibration and weight traceability support for determining the accuracy of your lab balance.

In a study conducted by Independent Investigator, Michael R. Bromwich, for the Houston Police Department, Crime Laboratory and Property Room, it was found that among the 1,271 cases of control substances cases—147 cases had major issues due to widespread problems related to poor laboratory practices. Most of the minor issues were attributable to a combination of analyst errors, poor documentation practices, and an informal review process, along with a quality assurance program that was not sufficiently rigorous[1]. Most of the actual analytical work performed in the Controlled Substances Section was predominantly cocaine and marijuana identification cases.

It is important that crime labs produce accurate analysis results to prevent wrongful convictions due to flawed forensic evidence and its presentation to the juries in court.

A recent Supreme Court ruling is expected to result in more Crime Lab Technicians having to testify during trials. In a 5-4 decision, the Supreme Court ruled that the confrontation clause of the US Constitution's Sixth Amendment entitles criminal defendants to confront witnesses against them. As a result, Lab Technicians performing weighing tasks during chain of custody may be cross-examined about lab reports that are submitted as evidence. Procedures for challenging weighing results and reports and compelling Lab Analyst testimonies will be implemented by the states[2]. If an analyst performs a weighing task for forensic drug analysis and subsequently retires or is no longer employed by the lab, the weight data generated by that analyst can be considered hearsay in a court of law. LabX pro balance, with its built-in quality management and Measurement Assurance functionality providing traceable and verifiable data capture, minimizes the potential of this data being questioned in court.

A Director of a Regional Forensics Laboratory and a user of LabX pro balance since 2008 verifies that, "LabX pro balance streamlines our daily balance weight verification and calibration quality management process. LabX also provides reliable and secure weight data when creating and storing weights for forensic drug analysis."

LabX – Increase Efficiency and Provide Precise Evidence Documentation

Flexible and easy to use, LabX Balance software connects all your lab balances and automatically stores your historical weight and calibration data. All weight and calibration data can be accessed within seconds. LabX software is the only software in the market that allows users to perform weighing tasks directly on a METTLER TOLEDO balance touch screen. This enables the Lab Technician to fully concentrate on the task at hand. LabX balance software is fully barcode reader compatible; scanning barcodes on the evidence, then placing the sample on the balance to be weighed, eliminates the potential for transcription errors throughout chain of custody. This also eliminates any mix up during the weighing process and ensures the correct sample is placed onto the balance.

Weighing methods can be created and tailor-made for each specific weighing task. The templates require users to always follow the same procedures according to their SOP. The user can not deviate from this SOP, providing strict SOP compliance. Written instructions can be defined in the weighing method to offer guidance to the user when the job is executed on the balance. This will minimize the time and effort required to train users, as all instructions are pre-set and users can simply follow the step-by-step instructions.

With LabX, manual transcription error is a thing of the past, as all data are automatically captured. Key metadata, which are crucial to the weighing operation such as: weighing date and time, operator name, procedure used (in the evidence weighing), balance settings, weighing status and instrument used, and also when the balance was last adjusted are all recorded. Once the job is complete, a professional report is automatically generated that contains all necessary data for total compliance.

Measurement Assurance

The dictionary defines calibration as: "to determine by measurement or comparison with a standard; the correct value for each balance reading on a device." Risk assessment is an integral aspect of each day for lab managers and technicians. But, have you considered the importance of, and the risks associated with the calibration of your balance and the accuracy that is provided? Can your calibration provider back you up in times of trouble, and supply documented evidence that the equipment was functioning within specification? Can their calibration procedures withstand independent scrutiny and be shown to be traceable to National Standards for accuracy of measurement, thus reducing the risk of failed prosecution? These are important documents that in court provide tremendous support that crime lab and weighing activities are professionally and expertly conducted.

The built-in test and adjustment scheduler for LabX ensures that balance calibrations are carried out as planned according to your SOP. Whether it's using the internal or external weight verifications, or even performing repeatability tests, lab managers have the option to configure the calibration setting according to their requirements. For example, if the user accidentally forgets to execute the test, LabX can block the weighing job from running. This ensures that all weighing jobs will and can only be executed on a well-calibrated and tested weighing instrument, once again providing strict SOP compliance to quality management objectives.

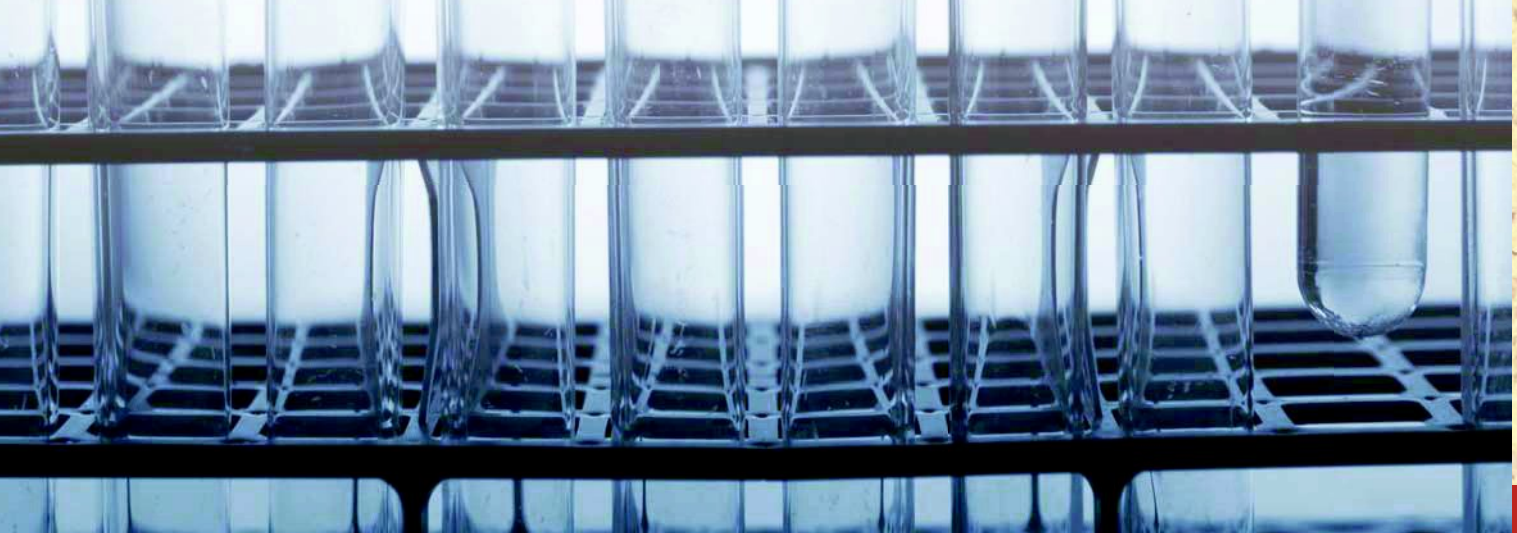
In order to support required regulation and accreditation standards (ASCLD-LAB, ISO17025, 21 CFR Part 11), it is fundamental that LabX offers full traceability of all data and information generated within the system, electronic signature and complete system security. This includes support for password policy, user rights management and role definition and control of access to specific functionality. By utilizing built-in software features, the user can easily conform to these rigorous standards.

METTLER TOLEDO

www.mt.com/forensics

[1] Final Report of the Independent Investigator for the Houston Police Department Crime Laboratory and Property Room by Michael R. Bromwhich, June 13, 2007, http://www.hpdlabinvestigation.org/reports/070613report.pdf

[2] Source: Forensic Magazine



LAB MANAGER MAGAZINE'S

INDEPENDENT GUIDE TO PURCHASING A LAB MILL OR GRINDER

www.labmanager.com

Thomas Scientific

The ORIGINAL Lab Mill

The Wiley Mill by Thomas Scientific sets the standard of quality, efficiency, and value within the sample preparation market. With over 75 years of proven technology, Wiley Mills are the **most robust, longest lasting mills on the market! We challenge you to find a better mill for the money!** The mills are suggested by the U.S. Bureau of Plant Industry for milling of samples. To find out which mill is best for your application, send a sample to Thomas Scientific to perform a free analysis and you will receive a detailed report. For details, visit **www.thomassci.com**.

Retsch®

Solutions in Milling & Sieving

Retsch is the world leader in solid material sample preparation equipment for quality control and research and development laboratories. Our expertise and devotion to providing the highest quality products for accurate sampling methods is unsurpassed. Our vast selection of mills, grinders, sieve shakers, sample dividers, and fluid bed dryers offer the industry standards for sample preparation. Retsch mills and grinders provide the most efficient and reproducible particle size reduction available for laboratory-scale grinding. Whether your field is pharmaceutical, biological, agriculture, electronics, foods or plastics, Retsch offers a mill to suit your needs! **www.retsch-us.com**

IKA® 100 years

About IKA® (www.ika.net)

IKA® Works celebrates 100 years as a global market leader for laboratory equipment, analytical and process technology. Magnetic stirrers, overhead stirrers, dispersers, shakers, mills, rotary evaporators, calorimeters, laboratory reactors and incubation shakers make up the laboratory and analytical equipment's portfolio. While the process technology section offers solutions for production scale stirring, mixing and kneading applications. The company is headquartered in Staufen, Germany with subsidiaries in USA, China, India, Malaysia and Japan.

DRY MILLING

The purchaser should next consider how finely the material needs to be ground.

A MID-RANGE GRINDING (FINAL FINENESS: ~0.01-0.1 MM)

Typically used for chemical products and pharmaceutical products, as well as minerals and ores.

The purchaser should next consider the properties of the material to be ground.

ROTOR BEATER MILL

This type of mill is ideal for free-flowing, soft to hard materials.

Size reduction is achieved by hammering, impact and shear effects. The feed material passes from the hopper into the center of the grinding chamber where it is crushed between the rotor, sieve and grinding inserts. Rotor beater mills offer the highest degree of operating safety.


Retsch
SR 300


Retsch
SK 100


Retsch
ZM 200


IKA
MF10 Basic


Hosokawa Mikro
ACM - Air Classifier Mill


Hosokawa Alpine
UPZ - Pin Mill


Hosokawa Mikro
MP - Hammer & Screen Mill


Fritsch
Variable Speed Rotor Mill
PULVERISETTE 14


Fritsch
Cross Beater Mill
PULVERISETTE 16

DISC MILL

This type of mill is ideal for hard materials.

A disc mill can be used to grind, cut, shear, shred, fiberize, pulverize, granulate, crack, rub, curl, fluff, twist, hull, blend or refine. Substances are crushed between opposing discs or plates, which may be grooved, serrated or spiked.


Retsch
DM 200


Retsch
RS 200


SPEX SamplePrep
8500 Shatterbox®


SPEX SamplePrep
Shatterbox®


Hosokawa Alpine
AFS - Attrition Mill


Fritsch
Disk Mill
PULVERISETTE 13


Fritsch
Vibrating Cup Mill
PULVERISETTE 9

MORTAR MILL

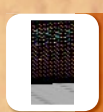
This type of mill is ideal for medium-hard-brittle to soft-brittle grinding materials.

Grinding occurs in a mortar and a grinding jar made from the same material.

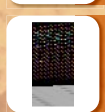

Retsch
RM 200


Herzog
HP-C/M


Herzog
HP-CS


Glen Creston
MP5


Glen Creston
MP4


Glen Creston
MP1


Fritsch
Mortar Grinder
PULVERISETTE 2

B COARSE GRINDING

Typically used for g
pharmaceutical product

The purchaser should ne

JAW CRUSHER

This device is ideal f

A jaw crusher consists o
farther apart at the top t
smaller fragments as it tr


Retsch
BB 51


Hosokawa Mikro
Crusher


Glen Creston
JC75

CUTTING MILL

This type of mill is ide

A rotor equipped with s


Retsch
SM 300


Thomas Wiley Mill
Model 4


IKA
MF10 Basic


Fritsch
Universal Cutting Mill
PULVERISETTE 19

Lab Manager MAGAZINE
Run Your Lab Like a Business

INDEPENDE
A LA

START HERE

INTRODUCTION:

In a laboratory, most mate
a small representative sam
representative and reduce

The first consideration wh

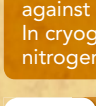
FINE GRINDING (FINAL

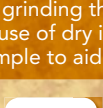
Typically used for chemical products a

A MIXER MILL

This type of mill is ideal for ambi
cryogenic grinding of biological samp
material, plastics, pharmaceuticals an

Mixer mills grind samples by impartin
the container in which grinding eleme
placed. As the container is rolled, swu
shaken, the inertia of the grinding ele
them to move independently into eac
against the container wall, grinding th
In cryogenic grinding, the use of dry i
nitrogen embrittles the sample to aid

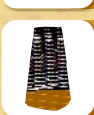

Retsch
MM 400



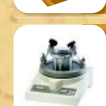

Retsch
CryoMill


SPEX SamplePrep
8000D Mixer/Mill®


SPEX SamplePrep
6770 Freezer/Mill®


IKA
M20 Universal Mill


IKA
MF10 Basic


Fritsch
Vibratory Micro Mill
PULVERISETTE 0

(FINAL FINENESS: ~0.3-20 MM)

glass, ceramics, minerals, ores and stones as well as some chemical products and
ts.

xt consider the properties of the material to be ground.

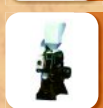
for hard materials.

f a set of vertical jaws, one of which is moved back and forth against the other. The jaws are
han at the bottom, forming a tapered chute so that the material is crushed into progressively
avels downward, until it is small enough to fall through the opening at the bottom.


Retsch
BB 200


Retsch
BB 300


IKA
MF10 Basic


Herzog
BB 100


Herzog
BB 200


Herzog
BB 300


Fritsch
Jaw Crusher
PULVERISETTE 1 - Model I


Fritsch
Jaw Crusher
PULVERISETTE 1 - Model II


Fritsch
Jaw Crusher/Disk Mill
PULVERISETTE 1/13

eal for soft to medium-hard and fibrous materials. It is often used for preliminary size reduction.
special cutting plates inside the mill revolves at high speed.


Retsch
SM 2000


Retsch
GM 300


Thomas®
Thomas Wiley Mill


Thomas Wiley Mill
ED-5


IKA
A10 Mill


IKA
M20 Universa


Hosokawa Alpine
RO - Rotoplex


Glen Creston
Micro Hammer Cutter Mill


Fritsch
Cutting Mill
PULVERISETTE 15


Fritsch
Power Cutting Mill
PULVERISETTE 25


Cole-Parmer®
Analytical Mill 04301-00

DENT GUIDE TO PURCHASING
LAB MILL OR GRINDER

N:

st materials required for sampling are, in practice, nonhomogeneous mixtures. The best method of obtaining ive sample of the nonuniform whole is to take a quantity of the material large enough to be compositionally reduce it to a fine homogeneous powder. For this purpose, a laboratory mill/grinder is usually used.

tion when purchasing a laboratory mill or grinder is to decide whether it will be used for wet or dry milling.

FINAL FINENESS: <0.005 MM)

products and pharmaceutical products. The purchaser should next consider the properties of the material to be ground.

l for ambient and gical samples, plant uticals and chemicals.

y imparting motion to ing elements have been olled, swung, vibrated or nding elements causes y into each other and grinding the sample. se of dry ice or liquid ple to aid in grinding.


Retsch
MM 200


SPEX SamplePrep
8000M Mixer/Mill®


SPEX SamplePrep
6870 Freezer/Mill®


IKA
A11 Mill


IKA
MF10 Basic


Glen Creston
McCrone Micronising Mill

B ROTOR BEATER MILL

This type of mill is ideal for free-flowing, soft to hard materials.

Size reduction is achieved by hammering, impact and shear effects. The feed material passes from the hopper into the center of the grinding chamber where it is crushed between the rotor, sieve and grinding inserts. Rotor beater mills offer the highest degree of operating safety.


Retsch
SR 300


Retsch
SK 100


Retsch
ZM 200


IKA
MF10 Basic


IKA
MF10 Basic


Fritsch
Variable Speed Rotor Mill
PULVERISETTE 14


Fritsch
Cross Beater Mill
PULVERISETTE 16

D PLANETARY BALL MILL

This type of mill is effective for most material types.

A planetary ball mill consists of at least one grinding jar arranged eccentrically on a wheel that spins in the opposite direction to the grinding jar(s). This releases high dynamic energies resulting in a fine grinding of the sample.


Retsch
PM 100


Retsch
PM 200


Retsch
PM 400


IKA
Ultra-Turrax Tube Drive


Fritsch
Planetary Micro Mill
PULVERISETTE 7 *premium line*


Fritsch
Planetary Mono Mill
PULVERISETTE 6 *classic line*


Fritsch
Planetary Mill
PULVERISETTE 5 *classic line*


Cole-Parmer®
Jar Mill 04172-50

C LABORATORY JET MILL

This type of mill is ideal for hard, brittle or abrasive materials.

The process material is driven at near sonic velocity around the perimeter of the chamber by multiple jets of air or steam. No grinding media are involved. Size reduction is the result of the high-velocity collisions between particles of the process material itself.


FPS Food and Pharma Systems Srl
PilotMill-zero


FPS Food and Pharma Systems Srl
LaboMill


Hosokawa Alpine
AFG - Fluidized Bed Jet Mill


Hosokawa Alpine
Hosokawa Alpine


Fluid Energy
"00"

WET MILLING

Wet milling is used for homogenization of suspended solids, emulsions and dispersions. Typical applications include cosmetics, soaps and some pharmaceutical products.

The purchaser should consider what capacity grinder is required.

A <600 LITERS

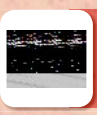
For small capacity applications, a bead mill should be considered.

BEAD MILL

These are typically used for laboratory samples that are very difficult to disrupt with standard mechanical homogenizers.

The combination of the rotational effect and the grinding beads produces a faster, more effective lysing process for biological samples. Bead mills also allow for closed-vessel and multiple-sample processing with no risk of cross-contamination. This equipment is beneficial to laboratories that process multiple small-volume samples.


IKA
Ultra-Turrax Tube Drive


Hosokawa Alpine
AHM - Ball Mill


Herzog
HSM 100P


Herzog
HPM 100


Herzog
HP-MA


Willy A. Bachofen
RL


Willy A. Bachofen
Multilab


Fritsch
Mini-Mill
PULVERISETTE "§


Fritsch
Vibratory Micro Mill
PULVERISETTE 0


BioSpec Products
BeadBeater


BioSpec Products
micro Mini-BeadBeater


BioSpec Products
Mini-BeadBeater 1


BioSpec Products
Mini-BeadBeater 16


BioSpec Products
Mini-BeadBeater 96

PLANETARY BALL MILL

This type of mill provides rapid and fine grinding of soft to very hard materials, emulsions and pastes.

A planetary ball mill consists of at least one grinding jar arranged eccentrically on a wheel that spins in the opposite direction to the grinding jar(s). This releases high dynamic energies that result in a fine grinding of the sample.


Retsch
PM 100


Retsch
PM 200


Retsch
PM 400


IKA
Ultra-Turrax Tube Drive


Fritsch
Planetary Micro Mill
PULVERISETTE 7 *premium line*


Fritsch
Planetary Mono Mill
PULVERISETTE 6 *classic line*

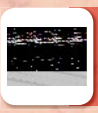

Fritsch
Planetary Mill
PULVERISETTE 5 *classic line*

B >600 LITERS

For small capacity applications, a rotor-stator homogenizer should be considered.

Industrial-scale mills are also available for larger-scale applications.


IKA
Colloid Mill


Hosokawa Alpine
AHM - Ball Mill


Hosokawa Alpine
ANR - Media Mill


Willy A. Bachofen
RL


Willy A. Bachofen
Multilab


Kinematica
Megatron

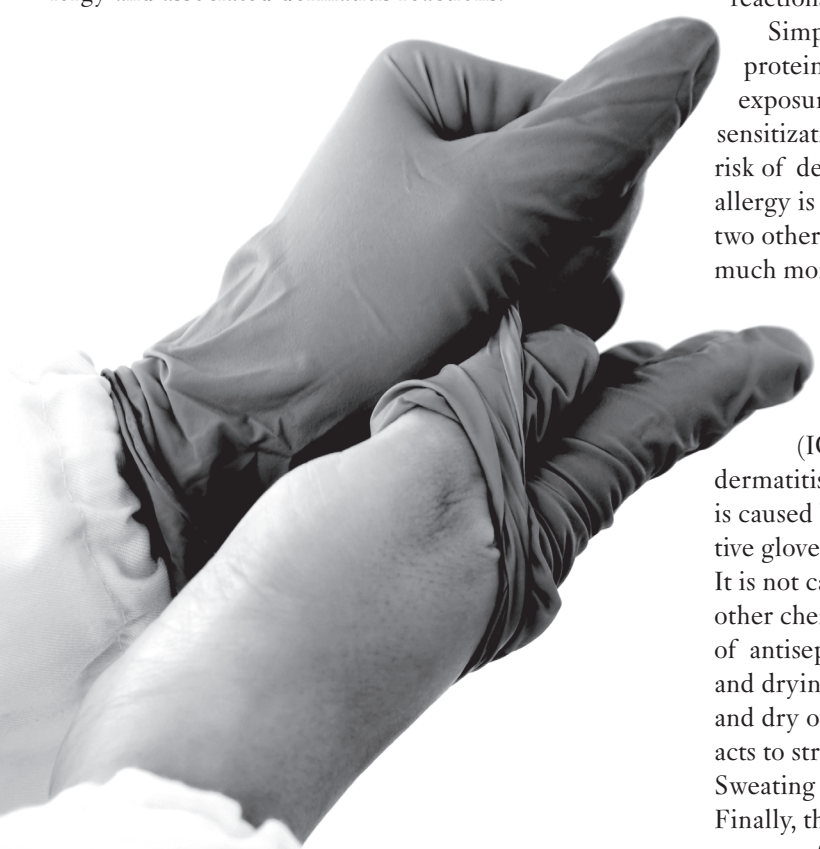
Author: John Buie

RASH DECISIONS

RECOGNIZING AND PREVENTING LATEX RUBBER GLOVE ALLERGIES

By Vince McLeod

In the research laboratory, especially where chemicals are involved, gloves are our primary defense in preventing exposure to and contact with harmful agents. Since the introduction of "universal precautions" for safeguarding against blood-borne pathogens, glove use has grown exponentially. In most laboratories, use of the latex examination glove has become the norm. But for some workers, wearing disposable latex gloves may produce allergic reactions. Reports on the prevalence of latex allergy vary greatly. Recent scientific literature indicates rates up to 11 percent for non-health care workers exposed to latex at work.[1] Read on to learn the causes, symptoms, treatment and prevention of latex allergy and associated dermatitis reactions.



What is latex and what is latex allergy?

Natural rubber latex, referred to as "latex," is the product manufactured from the milky sap extracted from the rubber tree, *Hevea Brasiliensis*, found predominately in Africa and Southeast Asia. Latex is made up of many chemicals, but the proteins found in the rubber are the culprits leading to the more serious allergic reactions. The manufacturing process can remove most of these proteins. However, due to the huge demand, many poor-quality gloves have reached the market. Additionally, the manufacturing processes use organic chemicals, including carbamates, mercaptobenzothiazole and thiurams as acceleration agents, further increasing the potential for allergic reactions for workers wearing latex gloves.

Simply stated, latex allergy is a reaction to the proteins in latex rubber. It is unknown how much exposure is needed to produce an allergic reaction or sensitization, but increasing the exposure increases the risk of developing symptoms. Fortunately, true latex allergy is rare, as you will see. Unfortunately, there are two other types of reactions that can occur and these are much more prevalent.

Different latex reactions

The single most common reaction to latex products is called *irritant contact dermatitis* (ICD), which is also known as eczema or just dermatitis. As the name indicates, this type of reaction is caused by irritation from wearing and using protective gloves and by exposure to the powders inside them. It is not caused by an allergy to the latex proteins or other chemicals contained in the latex. Frequent use of antiseptic or germicidal agents, or constant washing and drying of the hands, may deplete the natural oils and dry out the skin. The alkaline nature of many soaps acts to strip away the protective acid mantle of the skin. Sweating and rubbing also contribute to skin irritation. Finally, the powders added to gloves for easier donning are one of the leading causes of ICD.

Symptoms of ICD often include dry, itchy, cracked, scaly skin, usually on the hands. Redness, swelling and blistering may also occur. Symptoms are usually limited to the areas covered by the gloves.

Allergic contact dermatitis is sometimes called chemical sensitivity dermatitis (CSD). It is a response to the chemical accelerants in the latex mentioned above, which are referred to as contact sensitizers. Other common contact sensitizers include disinfecting agents and soaps. Technically referred to as Type IV delayed hypersensitivity, CSD appears as a rash with blisters (similar to poison ivy) and usually peaks within 48 hours. People with chronic skin damage are at increased risk, and with repeated contact progression spreads beyond the border of the gloves. Neither chemical sensitivity dermatitis nor irritant contact dermatitis is a true allergy.

Be on the lookout. This year's *Lab Manager Magazine* – Lab Health and Safety survey will be arriving in your e-mail inboxes this month. Visit www.labmanager.com/safetysurvey2010 if you would like to take the survey now. Based on your participation, we will provide the most up-to-date snapshot of current laboratory health and safety challenges, solutions and best practices. Results of the survey will be published in the September 2010 issue. Make sure you're represented.

True *latex allergy*, technically named immediate Type I hypersensitivity, can produce severe reactions in workers exposed to latex. Auspiciously, it is much less common than the dermatitis reactions. A Type 1 reaction is a systemic response caused by repeated exposure to a specific allergen (i.e., the latex proteins). Triggered by exposure to some threshold level, a flood of histamine and other factors are released, causing vasodilatation and bronchoconstriction. Symptoms usually begin within minutes of exposure in sensitized persons, but they can occur hours

later and be widely varied. Skin flushing, rashes, hives or itching are examples of mild reactions. Severe reactions include itchy swollen eyes, runny nose, sneezing, scratchy throat and asthma (difficult breathing, coughing and wheezing). Very rarely, anaphylactic shock has occurred, but this is seldom the first sign of latex allergy.

Damaged or broken skin can increase the risk for latex allergy, and in many cases, workers contract the dermatitis before developing the latex allergy. Also, a link has been demonstrated between increased susceptibility to latex protein allergy and allergic reactions to certain foods, such as avocados, kiwis, bananas, tomatoes and papayas.

Absorption through the skin, the dermal route, is not the only exposure means for latex proteins. Breathing in the particles, the inhalation route, is possible as the proteins can become attached to the powders and then dispersed when the gloves are donned or removed. This can be a concern for any sensitized individual who happens to breathe the airborne particles.

> "In most laboratories, use of the latex examination glove has become the norm."

Treatment and prevention

The key to preventing long-term health effects is detecting symptoms early. Seek proper medical attention at the first signs of trouble. Medications are available to treat the symptoms, but complete latex avoidance is the most effective strategy. Special precautions are necessary to prevent subsequent exposures once a worker develops latex allergy.

Workers are often unaware of latex allergy risk in the workplace. This can result in potentially serious health problems. Minimize risk and prevent possible health problems by following these recommendations from NIOSH:[2]

- Use non-latex gloves (such as nitrile, PVC) whenever possible (e.g., working with noninfectious materials, doing routine housekeeping, etc.).
- If latex gloves are the best choice, use powder-free gloves with reduced protein (<50 micro-

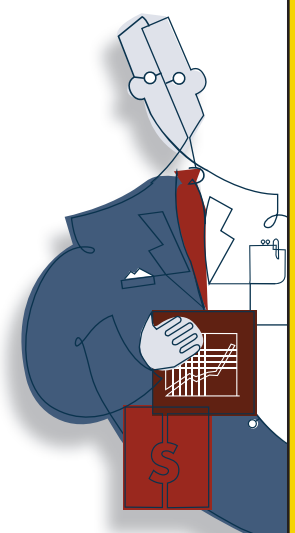
grams/gram extractable protein) and low levels of residual chemical accelerants.
- Develop and implement appropriate safe work practices to reduce chances of latex exposure.
- Develop and provide training to employees on latex allergy.
- Learn to recognize the symptoms of latex allergy.

"... a link has been demonstrated between increased susceptibility to latex protein allergy and allergic reactions to certain foods..."

References

1. *Preventing Allergic Reactions to Natural Rubber Latex in the Workplace,* NIOSH (National Institute of Occupational Safety and Health): Publication #97-135, June 1997.
2. *Latex Allergy A Prevention Guide,* NIOSH (National Institute of Occupational Safety and Health): Publication #98-113, 1998.

***Vince McLeod** is an American Board of Industrial Hygiene–certified industrial hygienist and the senior industrial hygienist with the University of Florida's Environmental Health and Safety division. He has 22 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 2,200-plus research laboratories.*



SAFETY TIP

ORGANIZE A SAFETY COMMITTEE

Your department should have a safety committee. Academic institutions and companies should all have safety committees. The committees should consist of employees, supervisors, faculty, staff, administration and students.

The committees should meet regularly to discuss safety, health and environmental concerns/problems and to seek solutions to them. The committee should help to see that the safety policy is implemented. The committee can help to promote an interest and concern for health and safety issues. It might be the group responsible for conducting regular inspections, reviewing accident reports, and developing recommended safety procedures. Better is to be a coordinating group that engages all the other employees in the organization of these activities.

One type of safety committee is the central safety committee. It is chaired by the highest ranking onsite official. The members of the committee are his or her direct reports. In this way senior management/administration is involved, providing leadership in the safety program.

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

PARTNERING WITH OTHER LABS

WHILE THE ADVANTAGES OF EXTERNAL PARTNERSHIPS ARE PLENTY, SUCCESS REQUIRES A KEEN MANAGEMENT STRATEGY by F. Key Kidder

The locals in mountainous New England dismiss vacationers as "flatlanders," but aren't we all? Globalization chronicler and oracle Thomas Friedman saw it coming, enunciating the virtues of a flat 21st-century world where "connect and collaborate" is the norm. Then A.G. Lafley, CEO of Procter & Gamble, helped reconfigure the art of innovation by declaring that henceforth P&G would outsource 50 percent of its R&D. Earnings tripled in seven years.

Corporate towers of vertical integration, the old way of doing business, tilt and topple in today's times. In the flat world, captains of industry "horizontalize" by selecting external partners who will do the job better, cheaper, quicker. Two traditional solutions to pump up corporate growth—internal or organic growth, and mergers and acquisitions—are being nudged aside by strategic external alliances seen to offer faster and surer return on investment.

Companies aggressively shop their core competencies globally, inviting in prospective external partners. Management gurus and business leaders weigh in with partnering paradigms, touting open R&D models such as "transformational growth," "transnational innovation" and "innovation 3.0." And as the linkage between national competitiveness and R&D firms up, governments around the world convene big thinkers and policy advisors to address the innovation imperative.

> "Good partnerships begin with good lab practices."

Cost benefits, access to better technologies, global talent pools, complementary skill sets—there's plenty to like about external partnerships. Scientists, says Dr. J. Stewart Witzeman, chairman of the Industrial Research Institute (IRI) and director of Eastman Chemical Company's Eastman research division, are skilled at leveraging relationships to achieve their goals, and external partnerships are a logical extension of that capability. Logical perhaps, "but not automatically simple, nor does it necessarily take the same skill set that makes someone a good internal manager."

An array of partnership business models has emerged from the slow dance and courtship between industry, academia and government. Joint ventures, in-and-out licensing agreements, material transfer agreements, corporate-sponsored research agreements and joint development alliances—these are the structures of the contractual marriages partners enter into. But the matrimonial state is fraught with uncertainty. There are risks to be managed.

R&D was once kept under lock and key as the crown jewels and doesn't necessarily travel well, but outsourcing requires lab managers to

collaborate with external partners, often sight unseen. "Good partnerships," says R&D innovation guru Dr. Gene Slowinski, "begin with good lab practices."

The partnership dynamic is interpersonal. People partner with people, not institutions, "but run-of-the-mill lab rats are not people persons. We're used to dealing with inanimate objects," says Sam Straight, a pharmaceutical industry veteran and executive-in-residence at N.C. State University's College of Management. Others echo this. "Who resists innovation sourcing?" poses Slowinski, "... technical staff and middle management.... many professional scientists want to be scientists, not project managers. Their skills sets and interests lie in making technical discoveries, not integrating external technologies."

Mentoring, says Straight, "is obviously the biggest way of acquiring these skills. Within your organization there are going to be people that handle relationships all the time. Set up a program to have them mentor those who'll run relationships with external providers. You're looking for an individual who wants to own that external relationship. That's the person you entrust with it.... And you need someone on either side to act as ombudsperson, someone to take problems as they arise and resolve them, and it's not always a win for [either partner]. But it's got to be fair, and over time you build trust."

The new generation of lab managers "needs to be much more skilled at external partnerships," says Witzeman. Many are "bandwidth limited," says Slowinski, director of Strategic Alliance Research at Rutgers University's graduate school of management, and resist taking on added administrative burdens. "If budget is redirected externally, it may decrease internal spending, disrupting teams and decreasing capabilities."

Even relatively straightforward external collaborations like outsourcing can be complex and exasperating, says Jennifer Peckham, a DPU operations manager for GlaxoSmithKline who oversees supplementary chemistry work with Chinese contract research organizations. "Although we set all the rules and priorities, I have to be very firm with the CRO about what they're working on. It's taken me a while [to have the comfort level] to say 'You're straying off onto X, Y and Z.' That's part of the reason it's so important to have someone dedicated to outsourcing. You've really got to stay on top of it."

> "IT lines of communication is the stuff that connects and facilitates external partnerships and drives collaborative behaviors."

Building the foundation for successful external alliances is an inside job. Organizational silo mentality and internal politics can poison partnerships, which are ill advised without the full support of upper management and a company culture that embraces external collaboration.

In 2001, Cisco CEO John Chambers announced that command and control management was passé and set out to network the world. Cowboys still ride herd over swaths of corporate America, but that mentality—the antithesis of collaboration—is seen ebbing as the world flattens.

New research into this cultural sea change, from command and control to a more collaborative mindset, bodes well for future partnerships. Many younger, up-and-coming team members in corporations with a prevailing command and control style are inclined to "work around" corporate policy and collaborate via social media applications. (A 2010 global "Collaboration Nation" study by Insight Express, funded by Cisco, surveyed over 3,000 IT users in 10 nations.)

"Before embarking on external partnerships, managers must vet all internal contributors to minimize risk."

According to the survey, users in the United Kingdom and France were most aggressive in taking matters into their own hands, while those in China were most compliant. Still, China and India had higher adoption rates of collaborative tools than the U.S. or U.K. did, most likely because the former are rapidly evolving competitive infrastructures with more flexible protocols about cross-functional interactions.

IT lines of communication is the stuff that connects and facilitates external partnerships and drives collaborative behaviors that "promote the mission of the research lab," says Dr. Paul Tiffany of the Haas School of Business at University of California, Berkeley. "More companies are starting to realize that [social technologies] are really powerful platforms for enhancing communication among geographically dispersed teams.

"When the question is how to build relationship partners, you want everybody in the same eco-zone, as it were, where they can informally bounce ideas off one another. Innovation often begins with 'Aha, so that's what you're doing,' and researchers can see where a certain approach has applicability to what they're working on. The point is to get them to share insights, because one person can't do it all. So the issue is really one of communication."

Bigger, faster systems to improve lines of collaborative communication are just over the horizon. Boeing's massive 787 "Dreamliner" project is a case in point: a team of global partners designs and manufactures all components, leaving Boeing to focus on overall integration. Dassault Systemes' digital 3D CAD mock-up virtually designs and models each of the plane's 10,000 parts before they are manufactured.

Partnerships are front-loaded and often require inordinate initial effort—assessments and decisions regarding IP and nondisclosure, strategic intent, technical capabilities, business development, and operational structures and systems must be finalized. It is easy to underestimate the work involved.

"Most of my challenges are at the start of partnerships," says Bem Culiat, retired senior ORNL scientist and chairman of the scientific advisory board for NellOne Therapeutics, Inc. But she uses the time to evaluate prospective partners and establish trust. "You can get a sense during these negotiations if folks are delivering and if they will reasonably compromise." As partnerships progress, she insists on face-to-face meetings at critical junctures because "so much input is nonverbal. You can't read body language by video conferencing."

Before embarking on external partnerships, managers must vet all internal contributors to minimize risk. "Every partnership is really three partnerships in one," says Witzeman. "If I strike a deal with you, that means I have to depend on somebody in my organization to fulfill my end of the bargain, as do you.

"Everybody understands that diverse teams like partnerships tend to be much better at coming to a good solution. But one of the dirty little secrets of this diversity is there's going to be conflict, because not everybody thinks the same way. Teams have people with complementary skill sets. One scientist has a more rigorous scientific approach; another has a more general applied approach. Good managers see both sides and they play the equivalent of a scientific marriage counselor. Constructive, data-driven conflict is one thing. Personality-based conflict is toxic."

At the same time, managers must take pains to communicate to internal staff the importance of the collaboration at hand. Even the best partnership agreements, notes Slowinski, are a poor substitute for enthusiastic team members who understand the potential of their R&D work to create marketplace value.

Partnerships sometimes harness teams of rivals, and they demand vigilance at every turn. "Not every partner is your friend," cautions research from IRI. "At 8 a.m. they are your partner; at 8:15 a.m. they may be your

competitor.... Partners can simultaneously be collaborators at the R&D level, competitors at the business-unit level, major suppliers to each other in the supply chain, and adversaries in court."

"Technical methods of communication have to involve significant security... not something that is easy to achieve."

Entry into external alliances is indeed governed by competitive considerations. The life sciences face an acute R&D crisis, but the industry was late to take the partnering plunge, restrained by unresolved IP issues. Industry leader Pfizer took the M&A route with mixed success before building a relationship R&D network in China using virtual technologies.

"We must make sure that confidential information remains confidential," says Jon Coffman, principal engineer in biotherapeutics research at Pfizer. "Technical methods of communication have to involve significant security… not something that is easy to achieve. Beyond the technical methods, many of us prefer to meet face to face at the beginning of a long-term relationship to establish a level of personal trust. The face-to-face meeting has positive long-term impact on the trust relationship."

The R&D universe is cluttered with partnership conferences and symposia, proof of partnership's gravitas. The Government University Industry Research Roundtable, an arm of the National Academies, is an example. Topics on the table for its summer meeting include IP, trust, cultural differences (language, standards, behaviors), responsibility and authority, research integrity, ethical standards, and safety and security.

Rigorous management of both lab notebooks and carefully defined research expectations are key best practices. Lab staff must update notebooks daily and know what confidential information can be shared and under what circumstances—a "firewall" that industry welcomes in its academic partnerships, says David Chen, director of the Coulter Foundation translational research partnership in biomedical engineering at the University of Virginia.

The fallout from the Bayh-Dole legislation still clouds industry-university research. The pace, says Witzeman, can be "maddeningly slow," driving business to overseas institutions that are "much more enlightened about how to deal with IP." But Chen sees the cultural gap between industry and academia narrowing, as universities trend toward process-oriented methodologies and demonstrate the "will to kill"—making the tough calls to pull back funding for campus labs that don't measure up.

Maryland is among the states that incubate partnerships that tap into its university and federal lab research. "As an intermediary, we bridge the culture gap between the different worlds of small business and the federal government," said Ron Kaese, director of federal programs for The Maryland Technology and Development Corporation.

F. Key Kidder *left journalism to pursue a career in government relations, politics and PR, but still likes to keep one hand in writing. He may be reached at k2@keykidder.com or 410-828-6529.*

READY TO BUY

WHAT TO CONSIDER WHEN PREPARING BID SPECIFICATIONS by R. Gerry Hall

Keep instrument bid specifications open and realistic

A longtime practice of sales representatives is to convince a prospect to include one certain bid requirement. This limitation may eliminate worthy competition from submitting bids. Bid specifications are fine, providing every line item is what is always needed—and that some variation absolutely will not do the job. Sometimes bid specs are a bluff. Some specs are not met, even by your perceived "preferred" OEM.

What if a limiting spec removes from consideration what might turn out to be a better long-term asset? Realistic specs are good. OEMs that are not competitive will not bid—or are easily eliminated from consideration.

"Don't just accept claims of superiority or of a competitor's shortcomings without fully sourcing."

The decision-making process

Sometimes you think you know who you want to do business with. This may be because neighboring facilities have the same instrument (so you are relying on word of mouth). Or someone may have "locked in" your ear. Don't just accept claims of superiority or of a competitor's shortcomings without fully sourcing. Remember that you are talking to a sales rep. The sales rep's job is to get your order. Contact references for all top candidates offering bids. You may know users of one instrument, but don't discount other options. Talk to all references—all companies. The wrong purchase may cause you to lose (or waste) precious annual budget dollars. Some budget wasters include money lost on an emotional (not objective) purchase or on more-expensive consumables, by getting less warranty or by missing some technological advancement.

Company reputation

Does one sales rep or one company have a reputation? Does this create a positive or negative prejudice? With repeat one-on-one visits, what do you really think of this company, its product and its people? Remember, your job is to find the best long-term solution for your specific application—not a friend.

Promises of "soon to be delivered" features need to be treated carefully. Does a company show itself as a leader in innovation and relevant revisions or does it only talk about what is coming? A feature "soon-to-be-released" may get off to a rocky start. Will this new feature actually perform as described? Will it meet audit requirements?

A long-term investment

Explore all options. This may take a little more time. The decision you make is the decision you will live with for years. Forget about "follow the leader." Investigate. Do any contenders include value-added features in their offering? Do you fully understand the capabilities and limitations of all features?

www.labmanagers.org

Scottsdale ARIZONA

31ST ANNUAL CONFERENCE

NOVEMBER 3 - 5, 2010

Out of Box Solutions to Managing Today's Laboratory

Location: **Hilton Scottsdale Resort** Registration Deadline: **October 1, 2010**

Program Chair: **Kelly John Mason, ExxonMobil Research and Engineering Company**

Inspiration and innovation comes from a vast variety of sources, which today's laboratory manager needs to develop and nurture. Too often laboratory staff and management are constrained by traditional strategies while the business and performance expectations are for step-out or revolutionary solutions. Through the selection of speaker topics, workshops and roundtable discussions, the 31st annual conference focuses on out-of-the-box solutions for improved laboratory performance in the three axes of laboratory management: technology, leadership and laboratory asset management. Subject matter experts will provide attendees with the game changing skills to embrace and engage innovation within their organization. This conference will challenge the attendees to explore non-traditional solutions to laboratory management problems. Your attendance at ALMA's 31st conference will help ensure continued success of your laboratory and your management career.

Conference Highlights:

- **Conference Presentations:**

  The Economic Realities of Lab Automation, Joe Liscouski, Institute for Laboratory Automation

  Getting Your Staff and Boss to Think Outside the Box, Sam Liggero, Tufts Gordon Institute

  Success Stories on Implementing LEAN to Improve Lab Output, Jan Borge Jakobsen, Algeta

  Networks and Lab Management: It's All About the Beer, Mike Neag, AkzoNobel

  Interdepartmental Laboratory Equipment Teams, Forum for Equipment Standardization, Process Optimization, Time Savings, and Cost Reduction, Mike Mathiesen, Dial Henkel

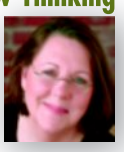
  Managing Flexible Capacity Resources, Dave Pilosof, The Clorox Company

  Keeping Capabilities Current and Running Within a Limited Capital Budget, Marina Despotopoulou, Arkema Inc. and Phil Edwards, NOVA Chemicals

- **Roundtable Discussions:**
  Out of the Box Technologies, Out of the Box Leadership, and Out of the Box Management of Assets
- **Supplier Exhibits, Presentations, and Discussions**
- **Opening Reception and Exclusive Tour** *at the Dial Henkel Corporate Laboratory*
- **Conference Banquet with Guest Speaker** *Alan Cabelly, "One Leader, Four Generations: The Four Directions of Leadership"*

Keynote Address: **Biomimicry: Using Nature's Stories to Spark New Thinking**

Dr. Mary Viola, Tufts Gordon Institute and Dr. Jeanette Eberhardy, Wiv, Inc.



Biomimicry and other fields of inquiry are studying nature's designs to help us solve human problems in a sustainable way. Remarkable discoveries and innovations have followed, for example:

- The scum produced on the surface of rainforest ponds contains a key nutrient for malnourished babies
- The study of leaves informs solar cell development
- And modeling the swarming of ants has led to breakthroughs in operational efficiencies in organizations like Southwest Airlines

Today's nature scientists and thought leaders are challenging our current definitions of resources, growth and economy. Can the study of nature's patterns lead us to new ways of thinking and allow us to re-energize our

Pre-Conference Workshops
November 2 - 3, 2010

Introduction to Lab Automation

Unlocking Your Teams Creative Potential: Improving Productivity Using Resources You Already Have

Building Business and Technology Strategies in Your Organization

Manage Your Boss: Secrets from the Best

The Best of HRMA: Hire and Retain by Motivating and Acknowledging

Making Innovation Work in Your Organization

Applying LEAN to Laboratory Operations

Visit www.labmanagers.org for details on registration, fees and workshop dates.

Special Exhibit and Sponsorship Opportunities Available

Please contact ALMA at 505.989.4683 or alma@labmanagers.org for detailed information.

Association of Laboratory Managers
2019 Galisteo St., Bldg. I-1, Santa Fe, NM 87505
505.989.4683
www.labmanagers.org

www.labmanagers.org

Why might vendor-specific specs be bad in the overall process?

1. The Cost Factor – An award based on some "excluding" spec might turn out to be more expensive than other offerings. If only one OEM can fill some specification, they can also charge more. Is that spec critical? Is it justified?
2. The Cost Factor – Compare new instrument warranties (90 days, one or two years); costs of service contracts, consumables, expendables, reagents and even waste disposal.
3. Technology – The favored supplier last year may now be left behind by various new innovations offered by vendors X, Y or Z. Evaluate everyone.

"... your job is to find the best long-term solution for your specific application—not a friend."

Where the bid process breaks down

Sales reps cover a large territory and a wide variety of accounts. They can't always know every prospect or who is getting ready to buy. They may receive an "out to bid" notification. If they are then excluded from coming in to talk or do demos, they have missed their chance to present. You have missed your chance to ensure that you have done the best job for your company. Don't you want all relevant information available to make the best decision possible for your facility?

"Look at more than basic spec requirements."

Some bid specs that rate discussion

I recently reviewed one set of bid specs for an automated chemistry analyzer and was amazed at all the ambiguous requirements.

1. The ability to program and run seven chemistries in one run. Many automated chemistry analyzers can analyze seven different analytes in one run. This depends on what chemistries are being run. One- and two-reagent tests may allow for seven-analyte runs. What happens when you want to include two or three tests that are three- and four-reagent chemistries? Some instruments then wouldn't meet the requirements used in designing this ambiguous bid spec.
2. Cooling and heating compartments. Instruments are basically configured to control the possibilities of migration, cross-contamination, absorption and evaporation. And many labs are encouraged to "extend the workday" by starting a final run before going home at the end of the shift. This is fine, but you may need to use judgment as to what analytes and reagents are partnered for the night run. Stop. Think.
3. Capacity for 60, 80 or 100 samples. This may be an arbitrary number utilized as a lockout spec. Less sample capacity is not critical—especially if you receive multiple sample carriers (trays). If two trays are required to load a full run, this may allow for greater efficiency and less analysis time. Dovetailing your work allows the operator to start a run while then pouring the second half of the run. Analysis starts while run prep and table building continues.
4. Ability to substitute larger-capacity sample trays. If sample trays allow you to double the number of samples in a run, ask the questions: What's different? What are the comparable sizes of the sample trays? Are "large capacity" sample trays a different size? Are cups half the normal size or less? Smaller sample cups mean you probably can't load a run for multiple analytes or maybe even allow for over-range dilutions. Don't assign a bid spec to a system where the fit is not well thought out.
5. Washout and carryover. I think all instruments include water reservoirs and a certain amount of washing. A point here may be to include a meaningless spec to confuse the prospect. If carryover was an issue for certain instruments, they would not enjoy their continued sales successes in a spirited and competitive marketplace. No one could sell an instrument that is subject to carryover, contamination and false data. If you are concerned, ask all reps to do demos where carryover can be evaluated.
6. NO3 must use a cadmium column. The poisonous metal cadmium has been employed as an industry

standard for nitrate analysis for more than 50 years. Used cadmium becomes poisonous cadmium waste. There are EPA- and FDA-approved nitrate analyses that don't employ cadmium. I hear that Rhode Island has banned the use of mercury in reagents. Other states are looking at this same ban. I predict that next on this list will be cadmium. Why not consider taking a step toward "greening" America now?

> "If that sales rep makes claims against another rep or instrument, investigate why."

One nefarious sales rep's trick is to reference old information. Again, keep an open mind. Talk to everyone. Ask all the questions. A sales rep makes claims for his or her instrument. If that sales rep makes claims against another rep or instrument, investigate why. Every company should be able to defend itself against another's claims.

I recommend you keep bid specs basic. Let as many vendors as possible compete. Look at more than basic spec requirements. Check for unique features of each system. Encourage demos. Then you can truly buy the best-fit and best-priced equipment and supplies for your lab.

***R. Gerry Hall**, president, TimeKeeper® America, can be reached at tka@tampabay.rr.com or by phone at 866-668-0800.*

TECHNOLOGYNEWS

The latest equipment, instrument and system introductions to the laboratory market

ANALYTICAL

Spectroscopy and Thermal Analysis Platform

nanoIR™

- Reveals the chemical composition of samples at the nanoscale
- An integrated video microscope allows users to find features of interest on sample mounted on a zinc selenide prism
- Samples can be easily exchanged without tools in less than a minute
- Integrates topographic, spectroscopic, mechanical and thermal property mapping

Anasys Instruments www.anasysinstruments.com

Diffuse Reflectance Probe

FDR-805

- Designed for the analysis of powders, slurries and other diffusely reflecting materials
- Variable offset feature allows optimum sample distances to be set anywhere between 30 and 100 nm
- Features a bifurcated 80 fiber-optic bundle for increased sensitivity and efficiency
- Proprietary optical design provides high sensitivity, low stray light and large depth-of-field

Axiom Analytical www.goaxiom.com

PRODUCT SPOTLIGHT

ICP-MS FOR ELEMENTAL ANALYSIS

TRIPLE-CONE TECHNOLOGY DELIVERS IMPROVED STABILITY

The NexION 300™ inductively coupled plasma mass spectrometer from PerkinElmer, with Universal Cell Technology, features three modes of operation—Standard, Collision and Reaction—and can be quickly switched from one mode to another, allowing users to choose the proper method for a specific sample or application.

Standard Mode is ideal for simple and routine analyses while Collision Mode—with Kinetic Energy Discrimination—is useful for semi-quantitative analyses, environmental sample monitoring and testing unfamiliar samples. Reaction Mode, featuring a scanning quadrupole, offers the ultimate detection limits for difficult elements, such as arsenic, magnesium and chromium.

"This allows the user to select the best technique for his/her needs in a good, better, best approach," said Chuck Schneider, Inorganic Business Manager at PerkinElmer. "The combination of triple cone technology and quadrupole ion deflector deliver dramatically improved stability."

In addition to the sampler cone and skimmer cone generally found on other ICP-MS systems, NexION 300 also features a hyper-skimmer cone for a tightly defined ion beam.

The device has been engineered to remove un-ionized material so that its cell does not require routine cleaning. "This allows more uptime for the lab, which translates into improved sample throughput," added Schneider.

For more information, visit www.perkinelmer.com. Chuck Schneider, Inorganic Business Manager, can be reached at charles.schneider@perkinelmer.com.

Protein Standards

Precision Plus Protein™ Dual Xtra

- Provides 12 reference bands from 2 kD to 250 kD
- 12 dual-color bands facilitate straightforward analysis of orientation of proteins in the gel and on the blot
- Allows researchers to use just one molecular weight standard
- Naturally fluorescent dyes can also be used for fluorescent multiplexing

Bio-Rad www.bio-rad.com

Amino Acid Analyzers

30+ Series

- Based on ion exchange with post column derivitization with Ninhydrin
- Identify and quantify free amino acids, as well as amino acid composition of proteins and peptides
- A combination of 5 lithium citrate buffers achieves a full amino acid profile in less than 90 minutes
- Total PC control allows 24/7 operations

Biochrom www.biochrom.co.uk

Immobilized Polysaccharide Columns

CHIRALPAK® IA, IB and IC

- Help to develop new separations and attain high levels of enantioselective recognition of chiral molecules
- All three models are based on high-efficiency 5-µm diameter spherical silica
- Offer enhanced compound solubility, greater column stability and novel column selectivity
- Available in a wide range of column dimensions

Chiral Technologies www.chiraltech.com

Acoustic Bubble Spectrometer

ABS USB

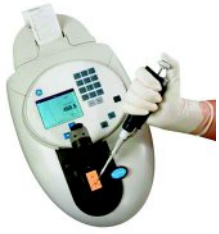
- Used to measure and monitor the distribution of bubble sizes and void fractions in liquids
- Capability for bubble sizes ranging from 10 to 500 microns
- The acoustic technique is very sensitive to bubbles and is not fooled by the presence of particulate matter
- Features two tranducers–one to transmit and one to receive a series of short frequency bursts

DYNAFLOW www.dynaflow-inc.com

Spectrophotometer

NanoVue™ Plus

- Measures volumes as low as 0.5 µl due to "drop and measure" sample plate
- Does not require cuvettes or capillaries
- Hydrophobic sample plate enables easy sample recovery and cleaning
- Features a wide wavelength range from 200 to 1,100 nm



GE Healthcare
www.gelifesciences.com

Acetonitrile

JT Baker® HPLC-9012

- Specifically designed for HPLC and LC/MS applications
- Gradient elution tested at 254 nm, meeting ACS specifications for general use, liquid chromatography suitability and UV spectrophotometry
- Interference-free, low baseline noise at 210 nm and 254 nm

Mallinckrodt-Baker www.mallbaker.com

Scientific-grade Spectrometer

QE65000

- Uses a Hamamatsu FFT-CCD detector, providing 90% quantum efficiency
- Features an onboard programmable micro-controller with 10 user-programmable digital inputs/outputs
- For full UV-Shortwave NIR coverage, an HC-1 composite grating is available
- A proprietary low-BRDF bench coating to improve stray light performance is also available

Ocean Optics www.oceanoptics.com

C18 Columns

Clarity® Oligo-MS™

- For rapid and efficient LC/MS characterization and quality control of synthetic RNA and DNA
- Impurities in complex synthetic mixtures can be separated from the peak of interest in less than 10 minutes
- Packed with either 2.6 µm or 1.7 µm particles
- Provide twice the efficiency of fully porous 3-micron columns and three times the efficiency of fully porous 5-micron columns

Phenomenex www.phenomenex.com

Ultra-High Performance LC

Nexera

- Features high-speed injection (10 second cycle time)
- Offers near-zero carryover (0.0015% without rinsing)
- Modular design enables numerous system configurations
- Features a micro-volume pre-heater to minimize band broadening in high-temperature conditions

Shimadzu www.ssi.shimadzu.com

Oil Analysis Spectrometer

Spectroil Q^{100}

- Features a CCD optical system for flexibility with even the most exotic in-service oil analysis applications
- Standard configuration analyzes 22 wear metals, contaminants and additives in 30 seconds—additional elements can be added at any time
- Conforms to ASTM Standard Test Method D6595 requirements

Spectro Inc. www.spectroinc.com

LC/MS Sample Screening

Exactive LC/MS System and Transcend Technology

- Configuration combines automated online sample prep for high throughput with dual benefits of ultra-high resolution and accurate mass
- Exactive streamlines technical steps normally requiring specialized setup and operation
- TurboFlow™ technology enables direct injection of complex matrices, eliminating upfront sample prep and delivering results in less time

Thermo Fisher Scientific www.thermofisher.com

BASIC LAB

Pressurized Microwave Digestion System

Discover SP-D

- Able to process a typical 0.5 g sample of organic material in 10 minutes or less, including cool down
- Features individual pressure and temperature control and programming for each sample
- ActiVent™ Technology automatically controls vessel pressure and removes gas produced from digestions without allowing volatile elements to escape

CEM Corporation
www.cem.com

Hygrometer/Thermometer/ Barometer/Dew Point Pen

Traceable®

- Compact design features an electronic capacitance polymer film sensor not affected by condensation
- User selectable dual display shows humidity/temperature, humidity/dew point, barometer/temperature or barometer/humidity
- Barometer measures pressure in three different units: inches of mercury (inHg), millibars (hPa) and millimeters of mercury (mmHg)

Control Company
www.control3.com

Rotary Evaporators

Hei-VAP Series

- Come with a detachable operating panel with 4-ft tethered cable for remote control
- Feature a stainless steel heat bath with two independent safety circuits
- Able to accommodate up to a 5-liter flask and reach a maximum temperature of 210°C
- Non-sticking vapor tube/clamping sleeve eliminates hassle and broken glass

Heidolph www.heidolphbrinkmann.com

PRODUCT SPOTLIGHT

BENCHTOP CO_2 INCUBATOR

SUPER FAST MOIST HEAT DECONTAMINATION CYCLE

Caron Products' Oasis™ benchtop CO_2 incubator provides a safe and accurately controlled environment for cell and tissue cultures to thrive. The 6 cu. ft. incubator maintains high relative humidity and accurately controls temperature and CO_2. Made of high-grade stainless steel, the unit features infrared sensor CO_2 control, direct heat and high relative humidity.

The exterior is powder-coated with ISOCIDE antimicrobial paint to protect the unit from contamination. In the event of contamination, the push of a button will trigger an overnight sanitization cycle to clean the unit, followed by a drying cycle which pumps in HEPA-filtered air, eliminating the need for cleanup.

"Other cycles require the end user to pump moisture out of the chamber and wipe the interior down, which is a very messy process," said Dave Figel, VP of Engineering and Operations at Caron Products. "Our [decontamination] cycle… literally dries the interior so you don't have to!"

Oasis comes with user-friendly features and optional accessories to customize the incubator to each user's needs. "Our goal… is to incorporate the safest environment in the benchtop CO_2 incubator market," added Figel. "It is also stackable, so customers can double their workspace without taking up additional lab space."

For more information, visit www.caronproducts.com. Dave Figel, VP of Engineering and Operations, can be reached at dfigel@caronproducts.com.

Fume Hood

UniFlow SE

- Features chemical resistant, flame retardant, unitized composite resin construction
- Available in 4′, 5′ 6′ and 8′ widths
- VaraFlow baffle system directs airflow through fume chamber to exhaust outlet with minimum turbulence
- Tested to comply with ASHRAE-110 fume hood performance guidelines

HEMCO www.hemcocorp.com

Single Channel Pipettes

Variable Volume

- Six sizes are available from 0.5 µl for PCR protocols to 5 ml for large sample dilutions
- Feature an ergonomic design with low plunger force to reduce the risk of repetitive stress injuries
- Tapered cone design enables users to use pipette tips from various manufacturers
- Fully autoclavable to eliminate cross contamination

Hoefer www.hoeferinc.com

High Capacity/High Speed Shakers

Lab Companion SKC Series

- Feature programmable motion control, unbalanced load sensors and a cut-off function
- Feature a maximum orbit of 2.8" (70 mm) and clamps that accommodate up to 6 liter flasks
- The "sticky pad" accessory eliminates the need for flask clamps
- Offers speeds of up to 500 rpm

Jeio Tech
www.jeiotech.com/eng

Salt Analyzer

CLD-100

- Achieves accurate determination of chloride ions by coulometric titration method
- Able to measure 20 µl or 1% NaCl standard in 20 seconds
- Features a mercury-free sleeve-type reference electrode for safety
- Reusable electrolyte can be used for several measurements

JM Science
www.jmscience.com

Mobile Cleanroom for Optical Tables

Mobile Environmental Enclosures

- Units are 8 feet high and are equipped with cleanroom curtains on all four sides
- Features multispeed blowers on the roof to maintain positive, downward, pressurized airflow, cleaned using HEPA filters
- Available in three footprint sizes: 3′ x 6′, 4′ x 8′ and 8′ x 8′

Kinetic Systems
www.kineticsystems.com

Weighing Solution

One Click™

- Complete product bundles consist of an Excellence XP/XS balance, corresponding accessories and LabX 2010 software
- One Click performs all calculations and documentation automatically, shortening the time to prepare a standard solution from 15 minutes to less than four
- The complete solution can be customized to meet individual process requirements

Mettler Toledo www.mt.com

Recirculating Evaporator

Centrifan™ AF

- Includes an Auto-Fill feature allowing unattended evaporation of samples generated by any separation or extraction system
- Functions without vacuum to prevent sample contamination risks
- Does not require external gas supplies or a heated water bath
- Eliminates hazards such as bumping, foaming, freezing and cross-contamination

Modular SFC www.modularsfc.com

Dual Input Differential Manometer

HHP886

- Features dual display and dual pressure inputs
- Pressure is displayed in one of four user-selectable units (psi, mbar, inH20 and mmH20)
- Includes a protective rubber boot
- Models are available with a USB connection or wireless interface

Omega Engineering
www.omega.com

Nitrogen Generator

NM32LA

- Removes oxygen, moisture and other gases to leave clean, dry, phthalate-free nitrogen
- The generator will detect the demand for gas from the LC/MS and will automatically start
- Includes two internal air compressors, making it independent of external air sources
- Fitted castors allow the unit to fit into tight lab spaces

Peak Scientific www.peakscientific.com

Immersion Circulator

MX

- Features a temperature range of ambient 10° to 135°C and temperature stability of ±0.07°C
- Suitable for use in baths as large as 28 liters
- Features an extra-large backlit readout, displaying both temperature and set point
- Includes a fully-integrated housing that prevents direct contact with the pump and heater

PolyScience
www.remarkablyresponsive.com

Laboratory Refrigerators and Freezers

Jewett® Collection

- Designed to store high value, critical samples, reagents, vaccines, blood and plasma
- 24 models range in size from 4.9 cu. ft. under-counter styles to 51.1 cu. ft. uprights
- Include microprocessor control, giving the user precise temperature regulation and set-point security
- Feature powerful industrial-grade compressors and positive, forced-air circulation

Thermo Fisher Scientific
www.thermoscientific.com/cold

Fume Hood Controller

FHC50

- Controls valves or dampers with a fast-acting actuator for containment during sash movements
- Integrates with Building Management Systems via BACnet®, LonWorks® or Modbus®
- Input measurement options include sash sensors, side-wall velocity sensors and flows from venturi valves, pressure- or thermal-based flow stations

TSI www.tsi.com/lab

LAB AUTOMATION

Automated Cell-based ELISA Procedures

BioCel Configuration

- Dispenses cells into microplates and performs a series of alternating incubations and reagent additions
- Features automated control of intermediate plate batches, cell medium removal and absorbance detection
- Provides unattended automation of approximately 500 plates per run in a 3-day experiment

Agilent Automation Solutions www.chem.agilent.com

Automated Cell Counter

TC10™

- Provides total cell counts in 30 seconds or less for cell concentrations between 5 x 10^4 and 1 x 10^7 cells/ml and cells within a 6 – 50 µm diameter range
- Scores each sample across multiple planes
- Cell viability can also be assessed with the use of trypan blue

Bio-Rad www.bio-rad.com

Microplate Washer Platform

ELx50™

- Uses a microprocessor-controlled syringe fluid system for precise control over multiple flow rates
- Features integrated dispense and aspirate pumps
- Biomagnetic separation offers superior micrometer and nanometer bead retention in flat-bottom, round-bottom and half area microplates

BioTek Instruments
www.biotek.com

Plate Adapter

SBS/ANSI Formatted Plate

- For use with SonicMan stand-alone instrument for high throughput sonication
- Placed on the tube plate chilling block, allows for any SBS/ANSI formatted microplate to be used with SonicMan
- Useful for re-suspension of compounds initially or after freeze/thaw, extraction of target proteins, DNA/RNA, and mixing low-volume assays

MatriCal Bioscience
www.matrical.com

LIFE SCIENCE

Cell Printer

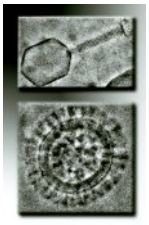
CellJet

- Designed for live cell printing for high content analysis and cell assays
- Proprietary synQUAD technology offers both on-the-fly and drop-by-drop non-contact cell printing while maintaining the viability of delicate cells
- Prints into plates or onto slides using a valve-free fluid path, greatly reducing cell damage

Digilab www.digilabglobal.com

Imaging Technique for Transmission Electron Microscopes

Thin Film Phase Plate



- Increases specimen contrast by orders of magnitude
- employs a π/2-phase plate that shifts the phase of scattered electrons, resulting in amplitude contrast rather than phase contrast as these electrons interfere with the unscattered electrons in image plane

JEOL USA www.jeolusa.com

Frozen Cells

ChemiBrite™ GPCR Frozen Cells

- Allow drug developers to expand their testing of popular G-protein coupled receptors
- Provided frozen in a convenient, Ready-To-Assay™ format, so that they can be used immediately after thawing
- Features high cellular viability and assay signal
- Contains enough cells to run either a 96- or 384-well plate

Millipore www.millipore.com

PCR Assay Portfolio for Human Identification

Investigator

- Features comprehensive and versatile coverage of current STR standards, including the new extended European Standard Set (ESS), CODIS, DAD, and ISSOL requirements
- Addresses the November 30, 2010 Council of the European Union resolution on the exchange of national DNA database information

QIAGEN www.qiagen.com

Coverslipper

ClearVue™

- Ensures coverslips are positioned correctly in relation to slides and tissue without user intervention
- Able to manage up to 11 slide racks simultaneously and automatically adjust mountant volume
- Features an enhanced gripper return plate with an extended front face, to ensure correct slide positioning
- Specially designed to ease dispensing and reduce risk of jamming caused by moisture contamination

Thermo Fisher Scientific www.thermofisher.com

Microplate and Seal Combination

Black Plate and AbsorbMax™ Sealing Film

- Combination eliminates sample degradation by exposure to light
- Black plates are supplied RNase/DNase free
- Each well accommodates a sample volume of 1 ml with round bottoms for good mixing
- Sealing films are 200 µm thick black vinyl adhesive for use with 96-well black microplates

Porvair Sciences www.porvair-sciences.com

Transilluminators

Bi-O-Vision™ Series

- Feature two workstations, producing both 312nm ultraviolet and white light
- TD-1000R model offers fixed-intensity while TVD-1000R offers variable-intensity control of UV or white light
- Units are continuously adjustable from 100% down to 50%
- Eliminate transmission of 254nm radiation, so there is minimal photobleaching, photonicking and photodimerization

Spectroline www.spectroline.com

PRODUCT SPOTLIGHT

LASER SCANNING MICROPLATE CYTOMETER

IDEAL FOR MIX-AND-READ ASSAYS

The Mirrorball™ laser scanning microplate cytometer from TTP LabTech was designed with the needs of the antibody discovery industry in mind. Performing assays in microplate format, the device offers simultaneous laser scanning for greater multiplexing and higher throughput.

Mirrorball features simultaneous, dual-laser excitation and multicolor fluorescence detection properties, and is sensitive enough to detect low abundance antigens, such as cell surface proteins, making it ideal for mix-and-read assays for hybridoma screening and cell-surface receptor expression.

Wayne Bowen, Chief Scientific Officer for TTP LabTech, based in the United Kingdom, says that Mirrorball can make a laboratory much more efficient. "Since there are two lasers in the system, you can speed up your data generation," he said. "You can scan simultaneously and correlate data across lasers."

Mirrorball achieves low autofluorescence through proprietary low loss optics and red 640 nm laser excitation, resulting in high signal to noise ratio and robust data generation. In addition to improved object recognition, Mirrorball's fluorescence detection is comparable to that of the discontinued ABI 8200 Cellular Detection system (FMAT®).

"There was a demand for this technology," said Bowen. "Mirrorball and FMAT are able to determine the activity of antibodies using a fluorescence method similar to ELISA, but don't require the wash steps, which is a benefit for the user."

For more information, visit www.the-mirrorball.com. Wayne Bowen, Chief Scientific Officer, can be reached at 044 1763 262626 or by e-mail at wayne.bowen@ttplabtech.com.

LIMS & SOFTWARE

Liquid Chromatography (LC) Software Component

Instrument Control Framework (ICF)

- Makes it easier for third-party software to enable and control Agilent LC systems in chromatographic data systems or workstations
- Available to software developers at no cost
- The third party develops an adaptor from their own software to ICF to gain full control of Agilent LCs, with no need to write additional instrument control code

Agilent Technologies www.agilent.com

Software for epMotion Automated Pipetting System

epBlue ID™

- Incorporates new barcode management functionality to provide secure sample tracking
- Complex methods can be generated in minutes with intuitive menus
- Features a tab-based structure that guides users through the software functions
- Features pipetting pattern recognition and built-in and organized liquid classes

Eppendorf North America www.eppendorfna.com

Automation Software

MICROLAB® VENUS two

- For MICROLAB^{STAR} and STARlet liquid handling workstations
- Features a touch-screen graphical user interface, streamlining method setup
- SuperSimpleMethods module facilitates easy programming of the most common lab routines
- Scheduler is four times faster than the previous version and programming requires minimal training

Hamilton Robotics www.hamiltonrobotics.com

LIMS for ADME Studies

Debra 5.7.7

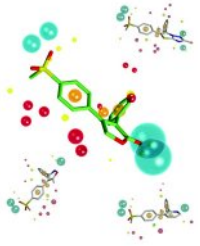
- Compound Received data can be displayed in micrograms and milligrams in Dosing Data report
- Treatment concentrations are displayed to four decimal places on all screens
- The order preferred by each user in the Pooling Splitting screen is now saved on a user-by-user basis
- Importing WBA data from MCID analysis software is much easier

LabLogic Systems www.lablogic.com

Lead Optimization Software

Medstere

- Designed specifically for medicinal chemists, suggesting novel bioisosteres for a lead compound
- Shortens lead optimization cycles by generating hundreds of non-obvious, drug-like alternatives to a known lead
- Easy-to-use interface quickly creates a range of potential lead molecules from 2D or 3D lead structures
- Comprehensive database of fragments is built from commercially available compounds



Syrris www.syrris.com

Chromatography Data System Integration Solution

For Symyx Notebook using Atlas CDS™

- Eliminates repetitious entry of information and provides live interaction of chromatography data within Notebook
- Allows chromatography users to manage methods and chromatography acquisitions from a single interface
- Users only need to enter sample information once, allowing them to easily insert standards and check injections into LC injection sequence

Thermo Fisher Scientific www.thermo.com/informatics

SUPPLIES & CONSUMABLES

Mixed-mode Weak Cation Exchanger

EVOLUTE® WCX

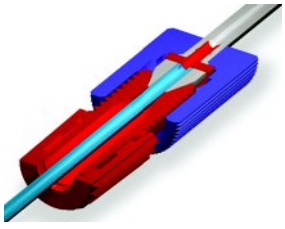
- Developed for extraction of strongly basic analytes and quaternary amines from aqueous samples
- Features a combination of hydrophobic, hydrophilic and cation exchange interactions
- Resin-based sorbent is surface modified with well-defined hydroxyl-functional oligomers
- Hydrophobic/cation exchange dual-retention mechanism permits a rigorous interference regime

Biotage www.biotage.com

Connection Fittings for Soft Tubing

MicroBarb™ Connectors

- Provide a low-carryover connection between flexible pump tubing and semi-rigid fluoropolymer tubing
- Constructed of PEEK™ plastic, the fittings are chemically inert and withstand high temperatures and pressures
- Works for any soft tubing including PVC, Silicone, Santoprene, Pharmed, Marprene, Viton, and Chemsure



Diba www.halmapr.com

Flow Cells for Chemical Analysis

Standard or Customized

- Produced to high-quality standard, the flow cells are composed of quartz or optical glass for low thermal expansion and improved chemical resistance
- Additional optical properties include homogeneity and high UV transmission
- Bespoke multi-channel flow cells feature chamber volumes of less than 10 µl

Dolomite www.dolomite-microfluidics.com

Fluid Control Components

CapTite™

- For controlling fluid in microfluidic experiments using 1/32" tubing
- Breadboard-based components snap together for fast, leak-free construction of simple and complex setups
- Compatible with tubing used for microbore LC and microbore LC/MS applications
- Designed for zero dead volume, nanoliter swept volumes and easy cleaning, ensuring long life over multiple runs

LabSmith www.labsmith.com

Microcomponents

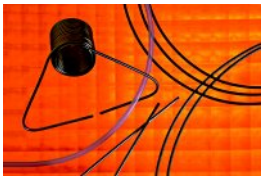
Precision Ceramic and Glass

- Standard items as well as precision-machined to customer specifications
- Product examples include ultra-thin glass microsheet for use as transparent substrates, electrical insulators, precision balls, polished sapphire bearings and sub mm bore nozzles
- Other items are available upon request

Goodfellow Cambridge www.goodfellow.com

Metal Tubing

Custom and Pre-Cut



- Materials offered are 316 stainless steel, Nickel 200, Hastelloy C, Inconel 600, Electroformed Nickel and titanium
- All metal tubing is electrolytically cut and deburred, then cleaned with high pressure, micro-filtered steam from deionized water, which removes both organic and inorganic contaminants

VICI Precision Sampling www.vici.com

Engineering Labels for the Laboratory Environment

Problem: Labeling of tubes, vials, plates, slides and other labware by hand using a "permanent" marker or a laser-printed paper label has significant drawbacks when used on labware in a laboratory environment. Exposure to chemicals, including solvents, caustics, and even water, can remove ink from surfaces, leaving an unintelligible mark. Paper labels are susceptible to physical damage, stain easily, and will become saturated when exposed to water and other liquids, leading to image distortion and adhesive failure. Adhesives used in most paper labels are not strong enough and 'winging' of labels is common. Traditional labels become brittle and fail when applied to labware exposed to cryogenic conditions. Also, most ink printed labels are incompatible with barcoding technology.

Solution: Engineered labels are specifically designed for the laboratory environment. Each label component—material, image and adhesive—is customized for the specific application and the label is then tested in that environment to ensure performance. Although there is no one universal laboratory label construction, certain labels perform successfully for a wide range of laboratory applications.

Polymer label material is commonly selected for the laboratory because of its chemical resistance as well as performance in hot, cold and wet environments. Polymer resists tearing and other physical damage. Material flexibility and thickness are important factors for labels applied to curved or irregular surfaces. Label thickness is also an important consideration for labware placed in holders or racks; sometimes containers like microtubes will not fit in their holders after labeling.

Thermal transfer imaging, using a heat-activated ribbon material in the label printer, is the best choice for engineered labels for several reasons. Thermal transfer ribbons allow users to select the image durability most suitable for their application. Images are transferred from the ribbon to the label using heat to ensure the image is durable and cannot smear after printing. Thermal transfer printing also offers up to a 600 dpi image, making the image suitable for barcode and other high-density data storage methods. In some cases, over-laminates are designed into the label to protect the image from even the strongest chemicals after printing.

The third critical label component for laboratory use is adhesives, which are designed for different surfaces, materials and environments. The rough finish often found on extruded plastics requires a thicker layer of stronger adhesive to overcome the lower surface area and sufficiently penetrate into surface irregularities. Adhesives used for plastics are often different than those used for glass, and many adhesive types exist for different types of plastics. Molded plastic can have residual chemicals used in the molding process on the surface, which is a challenge for most label adhesives. In cryogenic applications, most labels will fail when exposed to temperatures at or below -20° C, and will not stick when applied to cold or frosted surfaces, so it's important to choose a label specifically designed for cryogenic conditions.

In considering each label component, from material to image to adhesive, engineered labels are the best choice for use on labware within the laboratory environment.

For more information, visit www.computype.com/laboratory.

▼ *Engineered labels are resistant to harsh chemicals and extreme temperatures and are customized to suit any laboratory setting.*

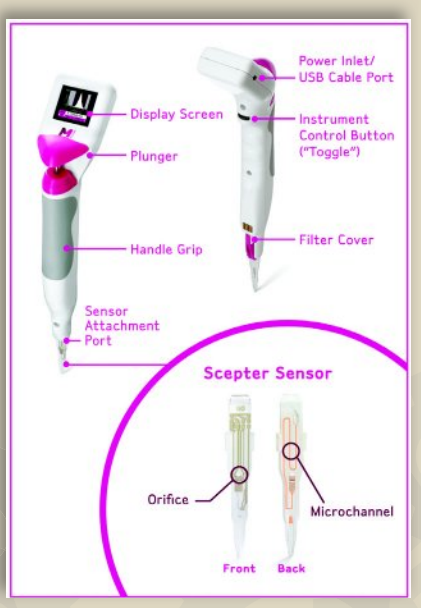
Miniaturizing Automated Cell Counting

Problem: Cell counting is necessary when seeding and passaging cells or when preparing experiments for cell-based assays. Cell counts can be used to monitor the health of cultures and rates of cell proliferation, as well as assess immortalization for transformation. Therefore, it is critical that cell counts be accurate, consistent and fast—particularly when monitoring quantitative cellular responses.

Despite the need for speed and accuracy, the vast majority of cell counting is accomplished by use of a hemocytometer—a technique first introduced in the late 1800s. While hemocytometry is inexpensive, the many steps required to complete a cell count are tedious and can result in inaccurate counts. Sources of error include uneven cell distribution in the sample; too many or too few cells in the sample; subjective judgments as to whether a given cell falls within the defined counting area; contamination of the hemocytometer; variation in how a sample is loaded; and differences in user technique.

Researchers can also count cells using automated instruments such as vision-based counters, flow cytometers, or systems that incorporate Coulter technology, though the cost of these instruments can be prohibitive.

Solution: The latest innovation in cell counting combines the ease of automated instrumentation and the accuracy of Coulter technology in an affordable, hand-held format. The Scepter™ cell counter from Millipore incorporates Coulter impedance-based particle detection in a miniaturized format. The instrument, which is the size of an automated pipette (Figure 1), incorporates analog and digital hardware for sensing, signal processing, data storage, and graphical display. The disposable sensor is engineered with a microfabricated, cell-sensing zone that enables discrimination by cell size and cell volume at sub-micron and sub-picoliter resolution. Cell population statistics are displayed as a histogram directly on the Scepter cell counter's screen. Cell counts are conducted by attaching a sensor and inserting it into the cell sample.



▲ *Scepter automated hand-held cell counter and disposable sensor with miniaturized Coulter technology.*

Depressing the plunger of the Scepter cell counter activates a pump that draws fifty microliters into the sensor's microchannel. The sample flows through a nylon mesh to break up any clumps and then passes through an orifice outfitted with an electrical field. As cells pass through the orifice, changes in resistance are recorded and translated into a cell count. At the same time, the amount of flow impeded as cells pass through the orifice is translated into cell volume. Cell diameter is then extrapolated from the volume recorded.

The Scepter cell counter detects each cell passing through the sensor's orifice and calculates cell concentration and displays a histogram of cell volume or cell diameter. The time required to perform cell counts using Scepter is generally less than twenty seconds.

In order to compare the linearity and precision of the Scepter cell counter with alternative techniques, nineteen cell types were counted using Scepter; an automated vision-based system; a full-size Coulter-based system; and a hemocytometer. Results showed that cell concentrations measured by the Scepter cell counter closely matched theoretical cell concentrations with high linearity. Counts completed with the Scepter cell counter were shown to be more precise than vision-based counting and hemocytometry, displaying smaller standard deviations and smaller average coefficients of variation.

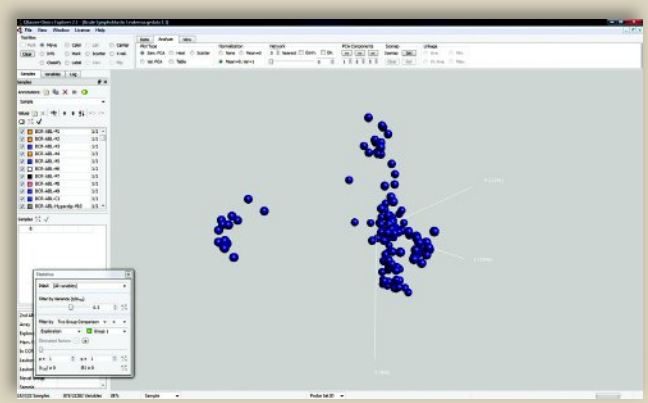
In addition to counting cells, the Scepter instrument also provides insights into the health of cell populations. For example, a researcher can compare histograms of the diameters of well-maintained cultures of to a new culture. The histograms of well-maintained cultures will show a relatively high quantity of cells with the expected diameter, whereas the histogram of a neglected culture will be dramatically shifted. Changes in the histogram can also reveal the mix of live and dead cells within a culture, as well as the diameter (and relative health) of cells in an early passage compared to a later passage.

For more information, visit www.millipore.com/scepter.

Advanced Data Analysis Using Visualization

Problem: A common problem affecting many scientists, especially those working in the area of molecular biology, is the vast amount of data that is created by their experiments. With such a large volume of data to consider, it is often impossible to derive any real biological meaning from their findings with the naked eye alone, which means that sophisticated data algorithms need to be developed in order for researchers to interpret their data effectively.

Until now, computer software designed for this purpose has focused on being able to handle increasingly vast amounts of data. As a result, the role of the scientist/researcher has partly been set aside, and a lot of data analysis is now performed by specialist bioinformaticians and biostatisticians. In most cases, however, this model has several drawbacks, since it is typically the scientist who knows the most about the specific area being studied.



The figure shows how data separates into two groups. The user can continue with the analysis. One natural step is to remove the group to the left and study the larger complex to the right in more detail.

Solution: Even though the exploration and analysis of large data sets can be challenging, the active use of visualization techniques can provide a powerful way of identifying important structures and patterns very quickly. Visualization provides the user instant feedback, and with results that present themselves as they are being generated.

We recommend a five-step method to ensure repeatable and significant results when using visualization. By applying this five-step method, it is possible to investigate large and complex data sets without being a statistics expert. The method is described below in more detail, but some basics need to be in place at the start.

First of all, the high-dimension data needs to be reduced to lower dimensions so that it can be plotted in 3D. We recommend the use of Principal Component Analysis (PCA) for this purpose. Tools to color data to enhance the information are also required, as well as filters and tools to select and deselect parts of the data set.

At this stage, researchers can begin the five-step visualization process by detecting and removing the strongest signal present in the active dataset. Once this signal is identified, it can be removed in order to see whether there are any obscured (but still detectable) signals present. Removing a strong signal will usually result in the reduction of both the number of active samples and/or variables.

Step two of the visualization process is to assess the signal-to-noise ratio in the data by using PCA and randomization. The strength of a visually detected signal or pattern is measured by examining the amount of variance captured in the 3D PCA-plot. This captured variance is compared with what the researcher would expect to capture if the real variables were all replaced by random variables, and will therefore give a clear indication of the reliability of the identified pattern.

Step three is to remove any "noise" by variance filtering. If researchers can see a significant signal-to-noise ratio in their active dataset, they should try to remove some of the active variables that are likely contributing to the noise.

Step four offers the option of performing statistical tests that can be applied to any/all of the other stages of the five-step process: either during the initial analysis, when a step is repeated, at the end of a step, or not at all.

The final step uses graphs to refine the search for subgroups or clusters. Connecting samples in networks or graphs, for example, makes it possible to move into higher dimensions (i.e. more than three), since the graph created in a sample plot is based on the distances in the space of all active variables, and can therefore provide more insight into the structure of the data. These five steps are then repeated until there are no more structures to be found. When used in this way, visualization can be a powerful tool for researchers. If data can be visualized in a clear way, scientists can identify results easily, on their own, without having to rely on specialist bioinformaticians and biostatisticians.

For more information, visit www.qlucore.com.

NEW Proprietary Technology

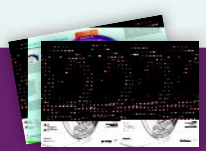
Do more with what you have.

You're a problem solver. To make your methods faster and increase your lab's throughput, you find ways to get the most out of every instrument in your lab. So, we made **new Agilent Poroshell 120 columns** as resourceful as you. Poroshell 120 helps you make every HPLC in your lab work harder. Agilent's unique process for superficially porous particles gives you the speed and resolution like a sub-2 µm column with up to 50% less back pressure – typically less than 400 bar – so **it works on any HPLC**.

Poroshell 120 performance, combined with column qualities of consistent reliability and long lifetime, plus worldwide Agilent support, give you the assurance you need to solve problems at every step.

Learn more.

Go to **www.agilent.com/chem/discoverporoshell** and **request your Agilent HPLC Column Navigator poster.**



Our measure is your success.

Agilent Technologies

EVOLUTION OF HPLC SYSTEMS

BY JOHN BUIE

High performance liquid chromatography (HPLC) is, for many scientists, an essential piece of apparatus for the separation, identification, purification and quantification of various compounds. Users of HPLC work in a variety of fields including biomedical research, and the cosmetics, energy, food and environmental industries.

As outlined below, the origins of HPLC date back to the invention of chromatography in the early 20th century, through the introduction of partition and paper chromatography in the 1940s, to the introduction of liquid chromatography in the early 1960s. Shortly thereafter, the need for better resolution and high-speed analyses of nonvolatile samples led to the development of HPLC.

In **1903**, the Russian botanist Mikhail Tsvet is considered to have 'invented' the chromatographic technique when he reported separations of different plant pigments into a series of colored bands on a packed column. He called this technique 'chromatography'.

1940

In the **1940s**, Martin and Synge developed the theory of partition chromatography and used mathematics to describe the separation process resulting from the use of a liquid-coated solid phase and a moving liquid phase.

In **1944**, the technique of paper chromatography was developed by Consden, Gordon and Martin. This technique was originally used for the identification of amino acids.

During the **1970s**, most chemical separations were carried out using a combination of open-column chromatography, paper chromatography and thin-layer chromatography. However, these chromatographic techniques were inadequate for the quantification of compounds and for resolution between similar compounds. During this time, high pressure liquid chromatography gained popularity, due to decreased flow-through time, thus reducing purification times of compounds being isolated by column chromatography. This technique later came to be known as 'high performance liquid chromatography' (HPLC) and the technique quickly improved with the development of column packing materials and the convenience of on-line detectors. However, flow rates were inconsistent, and the issue of whether it was better to have constant flow rate or constant pressure was debated.

Also during the **1970s**, syringe pumps were used to create the pressure required to drive the mobile phase through the column. Syringe pumps were, in effect, large stainless steel motor-driven hypodermic syringes that provided a very constant and virtually pulseless flow rate, but required a frequent, lengthy and involved refilling process. Early examples of the syringe pump were marketed by Dionex.

1960

In **1964**, J.C. Moore of the Dow Chemical Company was the first to investigate the technique of gel permeation chromatography.

In **1969**, The first commercial HPLC was manufactured by Waters Corporation, and was known as the ALC100 HPLC.

In **1971**, Dionex Corp. launched the first commercial ion-exchange chromatography system for the separation of ions and polar molecules based on their charge. The first Dionex ion-exchange columns benefited from enhanced ion detection capabilities through the use of revolutionary suppression technology that reduced background conductivity.

Also in **1971**, Cecil Tarbet (the founder of Cecil Instruments) introduced the world's first commercially available variable wavelength monitor for HPLC.

In **1972**, the first stopped flow LC-mass spectrometry (LC-MS) system was described, in which a fraction of the column eluent was collected in a tube and fed directly into a mass spectrometer.

THE FUTURE OF HPLC SYSTEMS

High performance liquid chromatography has been one of the defining separation techniques of the last 40 years, and its importance and range of uses will likely increase in the coming years.

Within biochemistry, fast and microbore columns will be developed for analytical and mass-scale preparative applications for biologicals and heterologously expressed gene products. Affinity and immunoaffinity techniques will be utilized more frequently for the production of biotechnological pharmaceuticals because of the need for ultrapurification in order to remove all unwanted material from the host cell. More accurate and higher capacity chiral separation columns will be needed by pharmaceutical companies in order to optimize efficiency in mass production of "active" enantiomeric compounds. HPLC will also have an important role in the monitoring of environmental pollutants.

Organic resins may become more widely used in the future. Multiple detectors may become standard per system, and computer-generated optimization of HPLC conditions will undoubtedly advance at the rate of computer technology. Use of robots may even eventually be used to handle and load hazardous items such as AIDS samples, viral/bacterial samples, radioisotopes, or environmental contaminants.

Whatever applications are developed, and no matter how HPLC continues to evolve, the technique looks certain to continue to be one of the most important laboratory separation techniques for analytical and preparative purposes in the future.

In **1979**, Agilent Technologies, Inc. introduced a new diode array detector, which provided a rapid optical method for chemical analysis.

In **1982**, ESA Biosciences, Inc. filed a patent for a new type of electrochemical detector known as the Coulochem.

Also in **1982**, Pharmacia (now GE Healthcare) developed the system of fast protein liquid chromatography (FPLC), a powerful chromatographic method that relies on pressures lower than those used in HPLC, making the technique more suitable for the separation of sensitive proteins.

HPLC gradually developed over the years, more by evolution than revolution. Incremental improvements combined to generate an extremely powerful tool capable of high precision and reproducibility. Some of the developments of the last 15 years are described below.

In **2004**, Waters unveiled a new category of LC technology known as Ultra Performance LC (UPLC) that would take the science of separation to a new level. This liquid chromatography system was the first of its kind, and designed to provide chromatographic run times up to ten times shorter than those of the fastest existing HPLC systems, with up to two times better peak capacity or resolution, and three times better routine sensitivity. For laboratories, these performance characteristics translated into more and higher-quality information per unit of time as well as greater productivity. A particle size of around 1.7 µm as used in UPLC allows greater speed and peak capacity, but also requires the use of a higher pressure to help move the eluent through the column.

Also in **2004**, Whatman, Inc. launched a faster and easier way to remove particulates from samples being prepared for HPLC through its Mini-UniPrep™ Syringeless Filter family. Mini-UniPrep was able to decrease sample batch processing time by one third for enhanced lab productivity, reducing the need for sample prep consumables, such as syringes, sample cups, and transfer containers.

In **2004**, Pickering Laboratories launched its sensitive method for identifying hard-to-detect chemical compounds, significantly advancing the science of analyte detection. At the heart of this development was the pulse-free syringe pump.

In **1999**, Waters introduced the revolutionary XTerra® Column brand for drug development applications. XTerra Columns offered a new standard for high performance by giving pharmaceutical scientists greater speed, definable peak shapes and a usable pH range.

In **2009**, Agilent introduced the 1290 Infinity Liquid Chromatography System, designed to deliver significantly greater power, speed and sensitivity for enhanced performance in the high-end UHPLC market. Later the same year, Agilent also introduced the 1290 Infinity LC System sample injection system, offering superior performance in speed, ultra-low carryover and robustness for customers requiring high throughput. This injector extended sample capacity to 24 cooled microwell plates or 648 cooled 2-mL vials, for high-throughput usage.

In **2008**, IDEX Health & Science launched a line of Ultra High Performance (UHP) fittings and connectors that increased the ability of a separation system to handle the demands of modern techniques. Used in applications requiring greater efficiency, speed and resolution, these UHP fittings and connectors effectively handled the stresses of higher temperatures and greater column pressures.

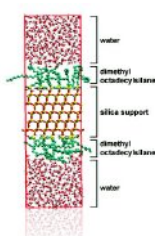
1980

By the **1980s**, HPLC was commonly used for the separation of chemical compounds. New techniques improved separation, identification, purification and quantification far beyond previous techniques, while computers and automation provided convenience. Improvements in reproducibility were made as techniques such as micro-columns, affinity columns, and fast HPLC emerged.

In **1996**, Waters introduced the Alliance® HPLC system. Targeted mainly at pharmaceutical scientists concerned with the quality of their test results, the Alliance system was positioned as a product that raised the bar of performance by which HPLC would be measured. Alliance was subsequently named as "one of the most successful products in the history of analytical instruments" and one which "has been an important influence in fundamentally transforming the industry."

2000

In **2002**, JASCO Corporation introduced the first ultra-high pressure HPLC pump, installed at Imperial College, London.



By the late **1970s**, new methods in HPLC, including reversed-phase liquid chromatography, allowed for improved separation between very similar compounds.

In **2005**, ESA Biosciences, Inc. launched the first new HPLC detection technology in 20 years, known as the 'Corona Charged Aerosol Detector.' In this system, the HPLC column eluent is nebulized and the resulting droplets are evaporated at ambient temperature producing analyte particles. A second stream of gas is positively charged as it passes a high-voltage, platinum corona wire. The charged gas collides with and transfers charges to the opposing stream of analyte particles. A negatively charged, low-voltage ion trap removes high-mobility ions while analyte particles transfer their charge to a collector. The charge transferred to the collector is in direct proportion to analyte mass. This system offers performance benefits that refractive index, low wavelength, evaporative light scattering, and chemiluminescence nitrogen detector methods lack.

In **2005**, JASCO launched the X-LC Xtreme HPLC system for use with sub-2 µm particles.

In **2006** Agilent introduced a liquid chromatography system that removed the seven most abundant proteins in human plasma, unmasking previously undetectable proteins that are potential biological markers of drug toxicity or disease.

In **2010**, Phenomenex introduced a unique way of achieving UHPLC performance from existing HPLC system hardware in certain applications with the Kinetex core-shell HPLC columns. Core-shell particles can be used with high mobile phase flow rates to further reduce analysis time without significant losses in separation efficiency, whereas the performance of fully porous particles begins to drop off sharply at high flow rates.

« EXPERT: David Ji

ASK THE EXPERT

HOW TO OVERCOME CHALLENGES WITH MASS SPECTROMETRY

by Tanuja Koppal, Ph.D.

David Ji, Laboratory Director at Analytical Laboratories in Anaheim, Inc., talks to Tanuja Koppal, Ph.D., contributing editor to* Lab Manager Magazine *about the different ways in which his service laboratory uses chromatography techniques to analyze complex sample mixtures for various clients. They are often asked to analyze and quantify trace components in samples such as nutraceuticals, botanicals, cosmetics and others. Ji and his team of chemists develop new chromatography methods and modify existing ones to get the best possible results in the least amount of time.

Q: Do you use a lot of chromatography techniques in your work?

A: Yes, we routinely use liquid chromatography (LC), mainly high performance liquid chromatography (HPLC), ion chromatography (IC) and gas chromatography (GC). We analyze a lot of natural herbs, dietary supplements like vitamins and minerals, and we have to do a lot of separation work, since our sample matrix tends to be very complex. We have to separate and quantify individual components using different instruments and columns. Most of our work is done using LC. We use IC to separate and quantify all kinds of sugars, such as sucrose, fructose, glucose, ribose, inositol, etc. using a conducting electrochemical detector. We also use an IC/conductivity detector to test organic and inorganic ions and some organic acids. We use GC with a flame ionization detector (FID) to test all kinds of fatty acids, including phytosterols and ginkgoterpenoids.

Q: What are some of the challenges you face using techniques like HPLC?

A: For our analysis we have to separate individual components. Traditional HPLC can do the job, but it takes a long time for achieving good separation. We have to slow down the gradient and that consumes a lot of solvent. To overcome this challenge we have now shifted to using Ultra Performance Liquid Chromatography (UPLC), where the packing particles in the column have much smaller size and that increases column efficiency. The column efficiencies increase three to five times compared to traditional HPLC. With the larger particle size in a traditional HPLC we can't increase the solvent velocity too much, as the back pressure in the column can increase too.

Q: Are there any disadvantages to using UPLC?

A: There are no disadvantages, but since particle size is small the back pressure is high, around 10,000 psi. The cost of the UPLC columns is not much different compared to the traditional HPLC. The lifetimes of the columns are also quite similar. We typically replace columns after about 5,000 injections, but that depends on the sample type. All HPLC instruments last at least ten years.

> "We typically replace columns after about 5,000 injections, but that depends on the sample type."

Q: Do you have to deal with sample preparation problems?

A: Our sample matrix is very complex. We can use solid phase extraction (SPE), but detecting trace amounts of ingredients is not possible with SPE and we would also need to do a lot of validation. The best way is for us to inject the sample directly into the HPLC after dissolving it in water or some other solvent. By doing this no sample preparation or pre-column clean-up is needed. However, we do need to increase the detection sensitivity in order to dilute the sample and increase the life of the column. We also need to wash the column regularly and perform routine maintenance.

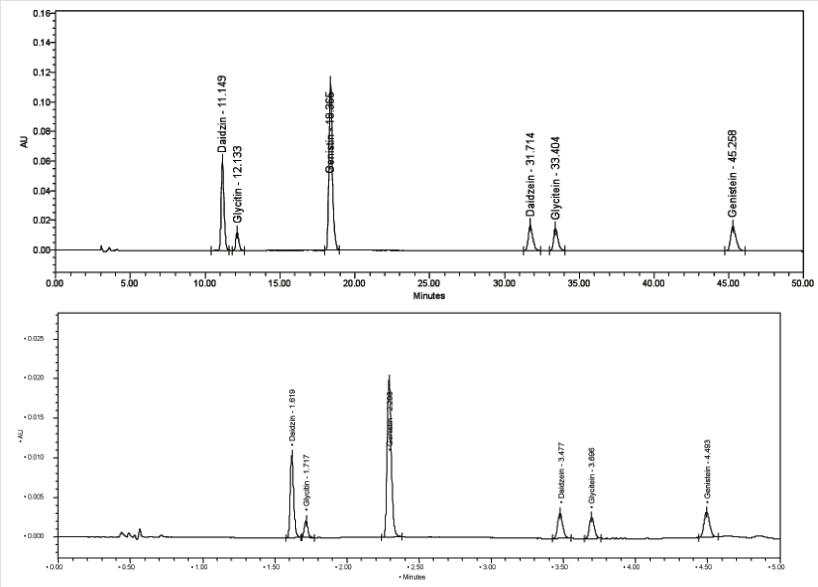
David Ji is the laboratory director at Analytical Laboratories in Anaheim, Inc., a FDA registered testing laboratory that specializes in the chemical analyses of vitamins, botanicals, nutritional supplements and cosmetics. Their services include testing of raw materials and finished products, stability testing, method development and validation and consultation for new product development. Ji and his team of chemists routinely employ various types of separation techniques to develop analytical procedures that are quality controlled, GMP-compliant and fully documented. As a part of their consultation services, they troubleshoot problems, improve upon existing protocols or recommend new ones. As the director, Ji is responsible for development and validation of analytical test methods, for laboratory troubleshooting and technical support, for customer service and technical consulting. Ji has a M.S. in chemistry from the University of North Carolina-Greensboro and has held similar managerial positions at other laboratories for more than a decade.

Q. What do you look for in terms of features when investing in an HPLC?

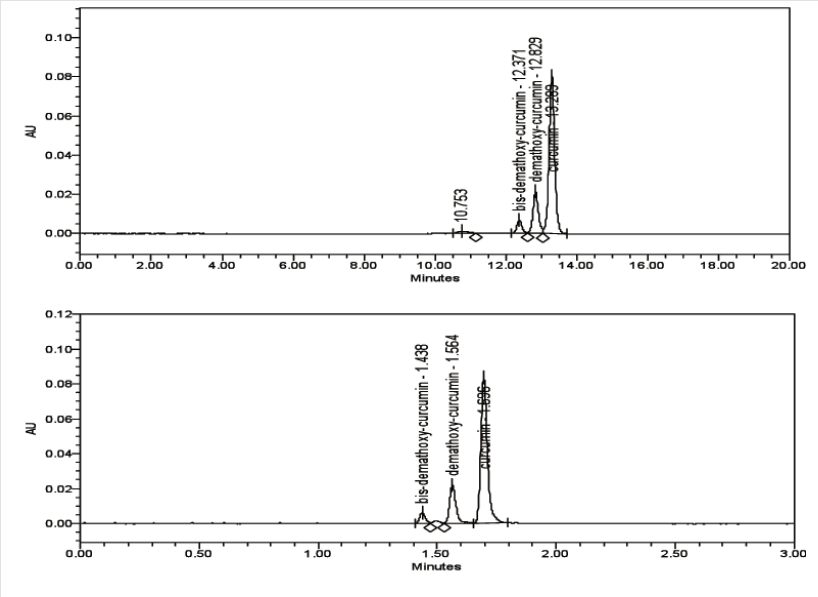
A. First of all, because we work with very complex samples, I look for an instrument or column that would give us a high efficiency for separation. Next, I consider the time taken for separation and finally, I also consider the type of solvent used, particularly since some solvents tend to be very expensive these days. Everything else, including the software, tends to be fairly standard and often not an issue.

The images shown are chromatograms comparing the separation of components in a mixture using HPLC and UPLC. For a complex matrix, such as dietary supplements, UPLC is at least three times faster than HPLC and shows better separation. For a single ingredient UPLC can perform even faster. For method development UPLC significantly increases the efficiency by saving time and costs. It also helps save solvent and waste storage cost. In our lab, each UPLC saves ~300ml of acetonitrile every day. Every year we also save about $400 to $600 waste treatment fee. When compared with HPLC, UPLC doesn't have additional cost for column and instrument maintenance. (Source: David Ji)

Chromatograms of soyisoflavonese, UPLC VS HPLC



Matograms of curcumin, HPLC VS UPLC



USERS DEMAND PRODUCTIVITY, QUALITY

by Angelo DePalma

Conceived as a separations tool for biomolecules, high-performance liquid chromatography (HPLC) has expanded its scope significantly into chemistry, pharmaceuticals, forensics, and organic chemical analysis. The introduction of integrated mass detectors in HPLC-MS (mass spectrometry) systems has strengthened HPLC as a confirmatory analysis technique, while the introduction of automation systems has greatly improved system throughput.

HPLC's evolution has been one of constant improvement in productivity and quality of results, says Terry Adams, life science business manager at Shimadzu Scientific Instruments (Columbia, MD).

Constant improvement

The need for speed and quality has led to faster, more efficient HPLC separations. But as the time between injection and elution shrinks to less than one minute for high-pressure UHPLC (ultra high-performance LC), cycle time becomes the principal bottleneck.

Adams cites several areas of improvement—both inside and outside the narrow analysis loop—that have made a difference in throughput and quality:

- Autosamplers that are easier to clean reduce the time between samples.
- Fused-core or "core shell" columns and media from Supelco, Phenomenex, Advanced Materials, Hichrom, Agilent, and others perform like sub-2-micron systems but at much lower pressures.
- Multiplexing two or more HPLC systems to a single mass detector utilizes detector downtime.
- Walk-up access allows any lab worker to queue samples onto a communal instrument and walk away.
- Networked instruments e-mail chromatograms or instrument service reports to scientists and technical personnel.
- Multidimensional HPLC, which diverts eluted peaks to an orthogonal LC system (e.g., reverse phase followed by ion exchange), provides peak capacity that is the product of the capacities of both columns.
- Increased use of derivitization for fluorescence and mass detection produces extremely clean fluorescence and mass signals, respectively, even from "dirty" mixtures that do not resolve well on the column.

The controversy over UHPLC and columns employing conventional particle size stationary phases is mostly over. The last major-vendor holdout for the traditionalists, Shimadzu, introduced a high-pressure sub-2-micron-based system at Pittcon 2010. Shimadzu had for years advocated for lower-pressure systems, compiling a mass of data suggesting that throughput and quality improvements were not as easily achievable as Shimadzu's competitors claimed, or that when they were, the benefits were more than offset by the costs of new systems and time involved in porting methods to lower particle sizes.

What's interesting here is that Shimadzu introduced the first fast LC system in the 1970s—but soon stopped offering it, due to lack of interest. "Demand was low because the complex, high-throughput applications so common today did not exist back then and computerization was in its infancy," says Adams. Despite his company's recent entry into the sub-2-micron fold, Adams believes that most applications do just fine on 2.2-micron columns that are optimized for throughput by optimizing cycle times instead of focusing on the narrower window of analysis time. Adams is also a fan of fused-core columns. However, he acknowledges the lure of high-pressure systems and recognizes that their flexibility will make them popular even among customers who don't need them—yet.

Hedging their bets

Although traditional HPLC still dominates methods and new system sales, customers increasingly opt for high-pressure UHPLC systems, says Phil

Lab Manager Magazine supplier lists are generated from manufacturer lists posted on LabX. To include your company on this list, please contact assistant editor Katia Caporiccio at katiac@labmanager.com.

DeLand, pharmaceutical market manager at Dionex (Sunnyvale, CA). "Many are still using 3- or 5-micron columns, but they're hedging a bet that they may want or need the speed or resolving capabilities of UHPLC down the road."

Pharmaceutical industry analysts, for example, will stick with existing HPLC methods for products or pipeline molecules because those have likely already been validated on low-pressure instruments. "They probably would not switch to UHPLC until a new compound comes along that has already been validated with newer methods," DeLand tells *Lab Manager Magazine.*

DeLand believes that UHPLC has reached a point of diminishing returns in terms of speed since cycle time often takes substantially longer than a chromatography run. Increasing pressure from 1000 to 1200 psi, which is substantial, may reduce elution time from two minutes to one minute forty seconds, a gain of twenty seconds. "How much time does that really save you within the context of sample prep and data analysis?" DeLand asks. "Not much." Still, other experts feel that for very high-throughput situations, such as HPLC service labs, every second counts.

Yet many users are eager to upgrade, which brings cost issues to the forefront. At one time, conventional wisdom dictated that purchasers budget 10 percent of system cost per year for maintenance. Users are now challenging that idea, says DeLand. Twenty years ago laboratory personnel took a hands-on approach to instrumentation. This was followed by a period when soup-to-nuts service contracts dominated. "During the last five years, as sample loads have increased and staff has been cut, interest in training for in-house troubleshooting has risen, and with that, demand for more reliable HPLC systems. We have come full circle."

Angelo DePalma *holds a Ph.D. in organic chemistry and has worked in the pharmaceutical industry. You can reach him at angelo@adepalma.com.*

HPLC SYSTEMS

AB SCIEX	Foster City, CA	650-638-5884	www.absciex.com
Agilent Technologies	Santa Clara, CA	302-633-8266	www.agilent.com
Applied Biosystems	Carlsbad, CA	800-327-3002	www.appliedbiosystems.com
Beckman Coulter	Fullerton, CA	800-233-4685	www.beckman.com
Bio-Rad Life Science	Hercules, CA	800-4-BIORAD	www.bio-rad.com
Buck Scientific	East Norwalk, CT	800-562-5566	www.bucksci.com
Cecil Instruments	Cambridge, UK	011-44-122-342-0821	www.cecilinstruments.com
Dionex	Sunnyvale, CA	1-800-DIONEX-0	www.dionex.com
D-Star Instruments	Manassas, VA	800-378-2712	www.d-star.com
Eksigent Technologies	Dublin, CA	925-560-2600	www.eksigent.com
ESA - A Dionex Company	Chelmsford, MA	888-642-6534	www.esainc.com
Gilson	Middleton, WI	800-445-7661	www.gilson.com
Hitachi High Technologies America	San Jose, CA	800-548-9001	www.hitachi-hta.com
Jasco	Easton, MD	800-333-5272	www.jascoinc.com
Jordi Associates	Bellingham, MA	508-966-1301	www.jordiassoc.com
PerkinElmer	Waltham, MA	617-225-0400	www.perkinelmer.com
Shimadzu	Columbia, MD	800-477-1227	www.ssi.shimadzu.com
Thermo Fisher Scientific	Waltham, MA	781-622-1000	www.thermo.com
Varian	Palo Alto, CA	650-213-8000	www.varianinc.com
Waters	Milford, MA	508-478-2000	www.waters.com

FOR HPLC, WHERE THE ACTION IS

by Angelo DePalma

High-performance liquid chromatography (HPLC) columns are rightly considered the "heart" of the instrument because that is where the separations occur. Columns consist of stainless steel tubes with inlet and outlet openings. Plastic or glass may also be used, but steel supplies the highest mechanical strength. Conventional columns are filled with porous particles coated with a polymeric material that interacts with the injected sample. In contrast to gas chromatography columns, HPLC has a true stationary phase: column "chemistries" are bonded tightly to the base material and do not bleed off.

Go with the flow

Understanding trends in HPLC column technology requires some background on liquid flow through tightly packed particles, which is a feature of all HPLC columns. All other things being equal, the smaller the particles, the more efficient the separation. But as particles decrease in size from conventional 10-, 7-, 5-, and 3-micron nominal diameters, the backpressure buildup increases exponentially. Thus, a column using 3-micron particles is about twice as efficient as a 5-micron column, but attendant pressures are three times as high. While additional separation efficiencies are possible by reducing particle size even more, to below 2 microns, more expensive hardware is required to handle the extremely high pressures. Such systems are generically referred to as UHPLC (ultra-HPLC), which represents one of the most significant trends in HPLC column technology. Note that the many vendors of UHPLC columns and systems use unique, proprietary names for their products.

Accompanying UHPLC has been the move from first-generation stationary phases toward ultra-low metal content, high-performance, spherical particles and a general trend toward lower particle size columns, even for instruments operating at conventional pressures. Together, these changes and others related to column dimensions and instrument pressure ratings have brought about tenfold improvements in HPLC performance, according to some experts. As a result, users can expect shorter run times, cleaner separations, sharper/taller peaks, and improved detection limits.

Yet UHPLC is not without its drawbacks. Users bristle at the higher cost, and methods developed with conventional-sized particle columns do not transfer to sub-2-micron or UHPLC format. For these reasons, hints Michael McGinley, bioseparations product manager at Phenomenex (Torrance, CA), pharmaceutical companies with hundreds of instruments running validated methods have been somewhat reluctant to jump onto the sub-2-micron bandwagon.

Biggest thing in column technology?

Recently, several vendors have introduced fused-core column technology that advocates claim provides all the performance of sub-2-micron particles but at normal pressures. Vendors name their fused-core columns uniquely, but the technology remains the same. Instead of a porous particle, fused core employs a solid silica particle covered with a layer of porous silica, which is then infused with the bonded phase. This has the effect of shortening the path length of solutes into and out of the particles and decreasing backpressure relative to UHPLC while providing, according to McGinley (and other vendor firms), performance equivalent in many cases to UHPLC.

Fused core has caused potential purchasers to rethink their need for a new HPLC, McGinley says. "Now they can

Lab Manager Magazine supplier lists are generated from manufacturer lists posted on LabX. To include your company on this list, please contact assistant editor Katia Caporiccio at katiac@labmanager.com.

HPLC Columns: Are you using HPLC columns in your lab? Are you considering purchasing HPLC columns soon? *Lab Manager Magazine*'s online surveys help improve the purchasing process and provide you with greater confidence in your final purchasing decision. To take the survey, please visit www.labmanager.com/surveys/columns.

use the same instrument they've had for ten years and not rock the boat." But users who are planning to purchase a new system anyway are probably better off purchasing one that can handle higher-pressure columns, because "the distinction between UHPLC and HPLC has been blurring."

Since high-pressure instruments work with both conventional and UHPLC columns, users might prefer the instrument with greater capability even if they don't yet need its higher-end performance. Some vendors, he adds, have discontinued older HPLC systems in favor of those that can handle both conventional columns and ones that generate very high backpressures. "Everyone will soon have higher backpressure capability," McGinley says, although not all will absolutely need it at the time of purchase.

Wayne Way, marketing manager at Sigma-Aldrich (Bellefonte, PA), calls fused-core particles the "biggest trend" in HPLC column technology. "Users were skeptical at first, but today they view this technology quite positively." According to Way (and my own independent research), review articles supporting performance claims for fused core abound in the literature.

Fused-core particles, Way tells *Lab Manager Magazine*, produce more rugged columns, particularly when compared with sub-2-micron technology. "They're great for open-access instruments that take a lot of abuse, and provide an easy transfer of methods." Way is referring to the fact that methods developed on UHPLC or conventional HPLC cannot be transferred unless the two labs have the same instrument. With fused-core particle columns, different labs need only have the same column.

***Angelo DePalma** holds a Ph.D. in organic chemistry and has worked in the pharmaceutical industry. You can reach him at angelo@adepalma.com.*

HPLC COLUMNS

Agilent Technologies	Santa Clara, CA	302-633-8266	www.agilent.com
Analtech	Newark, DE	800-441-7540	www.analtech.com
Applied Biosystems	Carlsbad, CA	800-327-3002	www.appliedbiosystems.com
Beckman Coulter	Fullerton, CA	800-233-4685	www.beckman.com
BioChrom Labs	Terre Haute, IN	812-234-2558	www.biochrom.com
Bio-Rad Life Science	Hercules, CA	800-424-6723	www.bio-rad.com
Chiral Technologies	West Chester, PA	800-624-4725	www.chiraltech.com
Dionex	Sunnyvale, CA	1-800-DIONEX-0	www.dionex.com
ES Industries	West Berlin, NJ	800-356-6140	www.esind.com
Fluid Management Systems	Watertown, MA	617-393-2396	www.fms-inc.com
GE Healthcare Life Sciences	Piscataway, NJ	732-457-8000	www.gelifesciences.com
GL Sciences	Torrance, CA	310-265-4424	www.inertsil.com
Grace Davison Discovery Sciences	Deerfield, IL	800-255-8324	www.discoverysciences.com
Hamilton	Reno, NV	800-648-5950	www.hamiltoncompany.com
Metrohm USA	Riverview, FL	800-727-6768	www.metrohmusa.com
Pall Corporation	East Hills, NY	800-521-1520	www.pall.com
PerkinElmer	Waltham, MA	617-225-0400	www.perkinelmer.com
Phenomenex	Torrance, CA	310-212-0555	www.phenomenex.com
Restek	Bellefonte, PA	800-356-1688	www.restek.com
SGE Analytical	Austin, TX	800-945-6154	www.sge.com
Supelco/Sigma Aldrich	Bellefonte, PA	814-359-5452	www.sial.com
Thermo Fisher Scientific	Madison, WI	800-642-6538	www.thermo.com
Tosoh Bioscience	Montgomeryville, PA	215-283-5009	www.tosohbioscience.com
Varian	Palo Alto, CA	650-213-8000	www.varianinc.com
Waters	Milford, MA	508-478-2000	www.waters.com

For additional HPLC column manufacturers, please visit www.labmanager.com/columns

MAINSTAY OF ORGANIC CHEMICAL ANALYSIS

by Angelo DePalma

Gas chromatography (GC) has long been the backbone of organic chemical analysis. Most labs involved in organic synthesis or the quantitation of nonpolar organics from food, pharmaceutical, environmental, or forensics samples employ GC as their primary analyzer.

GC was at one time commonly called "GLC," where the "L" stands for liquid. Inside GC columns are particles of a ceramic or inert material coated with an extremely viscous liquid stationary phase that interacts with the analyte. By contrast, HPLC stationary phases are bonded to the base material. New GCs are sold with software that integrates peaks, stores methods, assists in report writing, and controls instrument functions.

GC detectors have been evolving rapidly to provide greater sensitivity. Flame ionization detectors (FIDs) have been the most widely used, as they detect any molecule containing carbon. FIDs work by burning the sample in a hydrogen flame, ionizing the combustion products, and measuring the resulting current. Numerous other detector types have been introduced over the years, but the most interesting is the mass detector, which is essentially a miniaturized mass spectrometer. Mass detectors provide unequivocal identification of peaks emerging from the chromatograph based on the molecules' molecular weights and fragmentation patterns.

High-throughput analysis was once associated with commercial labs, but today even academic groups value productivity, says Jim Edwards, business development manager at Thermo Fisher Scientific (Austin, TX). Vendors have done their best to supply instruments that perform faster separations, but this has in turn introduced a detection bottleneck. "Vendors who place a premium on accelerating chromatography should similarly speed up detection to acquire data at a speed appropriate to good precision and performance." Thermo Scientific accomplishes this by using narrower-bore columns, for example 0.25 mm or 0.18 mm internal diameter, and better managing the sample injection size and thereby the quantity of injected analyte. Less easily achieved is the design of instruments that do not suffer from "fatigue effects," that is, show signs of slowing down or requiring maintenance after one or two thousand cycles. Maintenance downtime, Edwards observes, is a productivity killer that easily negates the benefits of more rapid analysis or cycling.

Vendors have put a lot of effort over the last decade into GC column technology, particularly to prevent liquid stationary phases from bleeding off the column. Column bleed degrades separation capability and adds to the chemical "noise" detected as both drifting baseline and ghost peaks. Column developers have introduced more cross-linking into the stationary phase, connecting it more intimately with coated particles and the column itself (similar to HPLC column materials). "Every vendor, across the board, has focused efforts on columns with very low bleed," Edwards says, "in addition to more unique and proprietary coatings to provide a broad array of separations."

Removing the bottlenecks

As with HPLC, GC systems have become faster and more selective, to the point where analysts now look to dead times during analytical runs to eliminate inefficiencies. Alessandro Baldi, business manager for chromatography software at PerkinElmer (Waltham, MA), cautions that this is best achieved by avoiding changes that will disrupt workflows or force analysts to alter established methods.

Oven equilibration is one obvious bottleneck. PerkinElmer tackled equilibration by designing an oven with very low mass that is cooled down rapidly and uniformly by fast-moving, nonrecirculated air. It is also possible to achieve efficiencies in heating.

Next the company went after autosampling by implementing look-ahead functions. "It takes time to

Lab Manager Magazine supplier lists are generated from manufacturer lists posted on LabX. To include your company on this list, please contact assistant editor Katia Caporiccio at katiac@labmanager.com.

GC Systems: Are you using a gas chromatography system in your lab? Are you considering purchasing a gas chromatography system soon? *Lab Manager Magazine*'s online surveys help improve the purchasing process and provide you with greater confidence in your final purchasing decision. To take the survey, please visit www.labmanager.com/surveys/gcsystems.

inject, clean the needle, and load and unload the sample," Baldi says. In an optimal configuration, the autosampler engages not at the precise moment it is needed, but when the oven is almost at the right temperature. "With these two ideas one can minimize, as much as possible, oven equilibration and dead time."

A third approach is to integrate the GC with sample prep devices in ways that provide greater flexibility and less of a hardwired configuration. PerkinElmer has its own systems for head space analysis and desorption but has recently collaborated with Tekmar (Mason, OH) on purge-and-trap

"GC detectors have been evolving rapidly to provide greater sensitivity."

sample concentration and with CTC (Zwingen, Switzerland) on solid-phase microextraction. "The goal," Baldi tells *Lab Manager Magazine*, is to minimize sample preparation.

Huge reductions in per-injection cycle times may be achieved through the use of flow-splitting techniques that divert eluent to multiple columns or post column to one of several detectors. Agilent, Shimadzu, and PerkinElmer have all introduced their own products in this area. Splitting allows analysts to switch columns or detectors on the fly without having to turn off the instrument, allow components to cool down, and swap them out. In essence, splitting creates "multiple" chromatographs from one instrument.

***Angelo DePalma** holds a Ph.D. in organic chemistry and has worked in the pharmaceutical industry. You can reach him at angelo@adepalma.com.*

GC SYSTEMS

Agilent Technologies	Santa Clara, CA	877-424-4536	www.agilent.com
Buck Scientific	East Norwalk, CT	800-562-5566	www.bucksci.com
Dionex	Sunnyvale, CA	1-800-DIONEX-0	www.dionex.com
EST Analytical	Fairfield, OH	800-283-3510	www.estanalytical.com
GOW-MAC	Bethlehem, PA	610-954-9000	www.gow-mac.com
JEOL USA	Peabody, MA	978-535-5900	www.jeol.com
LECO	St. Joseph, MI	800-292-6141	www.leco.com
OI Analytical	College Station, TX	800-653-1711	www.oico.com
PerkinElmer	Waltham, MA	617-225-0400	www.perkinelmer.com
Shimadzu	Columbia, MD	800-477-1227	www.ssi.shimadzu.com
SRI Instruments	Torrance, CA	310-214-5092	www.srigc.com
Teledyne ISCO	Lincoln, NB	800-228-4250	www.isco.com
Thermo Fisher Scientific	Waltham, MA	781-622-1000	www.thermo.com
TORION Technologies	American Fork, UT	801-705-6600	www.torion.com
Varian	Palo Alto, CA	650-213-8000	www.varianinc.com
Waters	Milford, MA	508-478-2000	www.waters.com
Zoex	Houston, TX	866-904-2942	www.zoex.com

THE "BRAINS" OF ANALYTICAL INSTRUMENTS

by Angelo DePalma

The advent of inexpensive, powerful, personal computers has been a boon for chromatography data systems. Today, all instruments ship with software packages that control instrumentation, acquire data, prepare reports, manipulate spectra and chromatograms, store methods, perform calibrations, and interface with lab- or organization-wide computer systems. This was not always so. Before PCs were commonly available, chromatographs shipped with integrators and, before that, strip chart recorders.

Yet the fundamental task of data systems remains the same. "Their basic function," says Hugh Goldsmith, president of GC systems manufacturer SRI (Torrance, CA), "is to strip-chart the data, integrate the peaks, and calibrate them so your answer appears in meaningful units." Goldsmith recalls that in the "old days" users integrated peaks by physically cutting out traces and weighing them on a balance. Shoulders and overlapping peaks were dealt with by hand-drawing, or by extrapolating the peak of interest to baseline. "Now you can dice and slice the chromatogram electronically because you can always call up the original digital representation. You don't even need paper."

Division of labor

According to Jim Edwards, business development manager at Thermo Fisher Scientific (Austin, TX), chromatography data systems are becoming more versatile and less instrument-centric. "We increasingly find that as labs grow and acquire GCs from different vendors, more software systems are capable of controlling third-party instruments. Several software-only firms, for example, establish relationships with companies such as ours to develop drivers and controls for our instruments that operate natively within their software. Years ago that would have been difficult to do because of the costs of computer systems."

Improvements in chromatography data systems have for the most part tracked advances in hardware—a very desirable development given the tremendous strides in chromatographic methods and instruments. "If all vendors did was focus on improving hardware to make it more productive and less noisy, we'd simply have a bottleneck on the software side," notes Edwards.

Data system designers have quite efficiently exploited the doubling of computing power every few years and falling prices of computer systems. Software now guides users through routine operations, method development, and basic report generation, leaving scientists and technicians—the real "CPUs" of a chromatography system—to focus on designing experiments, manipulating and reducing data, and reviewing results. "It's been a productive division of labor," Edwards says.

It's all in the interface

Chromatography data systems have had to adapt to the slowly evolving demographic of laboratory personnel, from specialist to generalist. "We have observed a shift from users who were chromatographers and analytical chemists to a new group composed of process manager, quality manager, statistician, biologist, and so on," observes Alessandro Baldi, business manager for MS and chromatography software at PerkinElmer (Waltham, MA). The change does not necessarily represent diminishing expertise, although that is certainly one component of it. But it does reflect the prevailing sentiment among both analysts and equipment suppliers that instruments are tools for

Lab Manager Magazine supplier lists are generated from manufacturer lists posted on LabX. To include your company on this list, please contact assistant editor Katia Caporiccio at katiac@labmanager.com.

Chromatography Data Systems: Are you using a chromatography data system in your lab? Are you considering purchasing a chromatography data system soon? *Lab Manager Magazine*'s online surveys help improve the purchasing process and provide you with greater confidence in your final purchasing decision. To take the survey, please visit www.labmanager.com/surveys/cds.

rather than objects of laboratory work. Chromatographs need to be intuitive and easy to use, and a key component of usability is the interface. Baldi cites popular gadgets and software whose interfaces have become simple to the point where individuals can operate them with no training.

Can this be achieved with analytical instruments, and if so, is it desirable? Baldi answers "yes" to both questions. PerkinElmer has put a lot of effort into its graphical user interface, to provide simplicity and ease of use that Baldi says have become his company's mantras. Software developers, he argues, should exploit the familiarity of icons and visual components from consumer-grade software, for example, to initiate or end a run, and structure the navigation in their data systems similarly to common e-mail clients. "Data systems these days resemble iTunes or Outlook more than they do the chromatography system of 20 years ago."

While achieving this level of user-friendliness, data system designers must somehow cope with the ever-increasing intricacy of analysis. Many validated methods, particularly those supporting regulated industries or law enforcement, involve the use of multiple columns and detectors, which generate outputs in multiple dimensions. PerkinElmer deals with this complexity by creating layers similar to those in popular software. "You don't see everything at once, but instead have intuitive navigation from one environment to another, just as you would within programs that bundle e-mail, contacts, and calendar functions. After you navigate to the different layers, it becomes horizontal and easier to visualize. This is the kind of architecture we have been trying to mimic."

Another strategy for improving the user experience is to improve the data product continually. PerkinElmer's Chromera software package, released at Pittcon 2009, undergoes new releases quarterly. Like most instrument vendor packages, which work only with the respective vendor's instruments, Chromera works only with PerkinElmer instruments, but the eventual goal is interoperability with third-party instruments.

***Angelo DePalma** holds a Ph.D. in organic chemistry and has worked in the pharmaceutical industry. You can reach him at angelo@adepalma.com.*

CHROMATOGRAPHY DATA SYSTEMS

Agilent Technologies	Santa Clara, CA	877-424-4536	www.agilent.com
Baseline Chromtech	Toronto, Ontario	416-512-6418	www.qiuhuan.com
Bio-Rad Life Science	Hercules, CA	800-424-6723	www.bio-rad.com
Dionex	Sunnyvale, CA	800-DIONEX-0	www.dionex.com
ESA Biosciences	Chelmsford, MA	888-642-6534	www.esainc.com
H&A Scientific	Greenville, NC	252-752-4315	www.hascientific.com
Hitachi High Technologies America	San Jose, CA	800-548-9001	www.hitachi-hta.com
PerkinElmer	Waltham, MA	617-225-0400	www.perkinelmer.com
SRI Instruments	Torrance, CA	310-214-5092	www.srigc.com
Thermo Fisher Scientific	Waltham, MA	781-622-1000	www.thermo.com
Varian	Palo Alto, CA	650-213-8000	www.varianinc.com
Waters	Milford, MA	508-478-2000	www.waters.com
Zoex	Houston, TX	866-904-2942	www.zoex.com

HPLC TECHNOLOGYNEWS

The latest equipment, instrument and system introductions to the laboratory market

HPLC 2010, the 35th International Symposium on High Performance Liquid Phase Separations and Related Techniques, runs from June 19 to June 24, 2010 at the Hynes Convention Center & Sheraton Boston Hotel in Boston, MA. For more details, visit www.hplc2010.com.

Here's a sneak peek at some of the new products that will be showcased at HPLC 2010.

HPLC Columns

VisionHT™

Booth 310

- Available in 1.5, 3, 5 and 10 µm particle sizes in six different phase selectives spanning the full polarity spectrum
- 12,000psi pressure rating is compatible with all ultra high-pressure LC systems
- Offer increased polar interactions to make neutral, non-polar compounds elute faster and retain polar compounds longer
- Instead of frits, thin screens retain media in the column, minimizing dead volume

Grace Davison Discovery Sciences www.discoverysciences.com

Non-Porous ODS Column

Presto FF-C18

Booth 513

- Compatible with polymers up to 30 MDa
- Separates almost any polymer including bio-polymers and synthetic polymers
- Achieves twice as many peaks as conventional ODS columns
- Also able to separate and analyze polysaccharides

Imtakt USA www.imtaktusa.com

Evaporative Light Scattering Detectors

ELS-2040/2041

Booth 410

- Suitable for a wide range of applications, including HPLC, LC/MS and SFC
- Patented gas flow control system removes the mobile phase using a short evaporation tube
- This gas flow technology reduces the evaporation time of the mobile phase at low temperatures by adding dry gas during evaporation, maintaining sharp peaks

JASCO
www.jascoinc.com

UHPLC Columns

HALO® Peptide ES-C18

Booth 411

- Delivers fast and high resolution separations with either UHPLC or conventional HPLC equipment
- Provides speed and resolution comparable to columns packed with sub-2µ particles
- Fused-Core® particle technology provides excellent reliability when separating peptides
- Available in various lengths, as short as 30 mm or as long as 150 mm

MAC-MOD www.mac-mod.com

HPLC Columns

ACE® C-18-AR

Booth 411

- Provide extra resolving power for a wide variety of sample mixtures
- Exceptional bonded phase stability and ultra-low bleed characteristics make them suitable for LC/MS
- Achieves baseline resolution of all compounds in a sample when other C18 columns fail
- Bonded to the silica is a proprietary phase consisting of a C18 chain with integral phenyl functionality

MAC-MOD www.mac-mod.com

PRE-OWNED HPLC EQUIPMENT & SERVICE MARKETPLACE

GUIDE TO HPLC SYSTEMS

High-purity Silica Phase for Preparative HPLC

NUCLEODUR® C18 HTec

Booth 710

- Low bleed characteristics make it suitable for LC/MS
- Features a long lifetime in acidic (pH 1) as well as basic (pH 10) mobile phases
- Delivers exceptional transferability from analytical to preparative scale
- Available in particle sizes 5 µm, 7 µm and 10 µm

Macherey-Nagel www.mn-net.com

Automated Powder Dosing

Quantos QB1

Booth 914

- Designed for sample prep for analytical methods such as HPLC
- Automates dosing of small quantities of free-flowing substances
- Radio frequency identification (RFID) in the dosing head saves all information
- Doses to 0.5 mg—with 0.005 mg readout accuracy

Mettler Toledo www.mt.com

Reversed-Phase Columns

HYDROCELL RP 5D and RP 10D

Booth 111

- Produced from macroporous PS-DVB beads with particle size 5 µm and 10 µm
- Offer advantages such as lower back pressure and high permeability
- Provide optimum pore volume and large pore size with high separating efficiency for large proteins, polypeptides, oligonucleotides and other macromolecules

BioChrom Labs www.biochrom.com

Micro-LC System

ExpressLC-ultra®

Booth 308

- Designed to run 0.5 mm ID micro-columns at pressures up to 10,000 psi
- Allows for the use of separation columns packed with <2 µm particles
- CCD-based detector offers higher UV sensitivity with full spectral capability
- Features a binary gradient pump (flow rate range 1-50 µl/min) with solvent selection

Eksigent
www.eksigent.com

ADVERTISER INDEX

Marketplace

PARTING POINTS

Takeaways from this month's issue:

IT PAYS TO PROTECT

When someone is injured on the job, the potential regulatory fines could be substantially higher than those associated with implementing proper safety programs. The new OSHA management promises to be more aggressive in making sure everyone obeys the law. The Protecting America's Workers Act, H.R. 2067, includes:

- ncreased maximum civil penalties from $70,000 to $250,000 for willful violations
- ncreased jail time from six months to 10 years for willful violations resulting in death
- Expanded OSHA coverage for millions of workers who are currently unprotected
- Provision of additional workers' rights (refusal to perform dangerous work, etc.)

10

16

RETAINING KNOWLEDGE

Allowing staff members to leave the laboratory without capturing their knowledge means an irrecoverable loss of valuable assets. Knowledge retention is being used by a growing number of firms. Here are some ways to go about capturing exiting employees' knowledge:

- Report templates: suited to the needs of the company's lab
- Interview-based discussions: to elicit information that might not otherwise be retained
- Managers should align knowledge-retention efforts with key company initiatives
- Interviewers should have basic journalistic skills, as well as R&D experience

20

PRESUMED ACCURATE

Consider how much the values in your data may have deviated from the original measurements. If the manufacturer has not stated accuracy in between calibration intervals, then you are hoping the measured values are correct. All measurements are subject to uncertainty.

- The standard used to calibrate an instrument (a measuring system) should be two to four times more accurate than what is being calibrated
- Best-in-class measuring instruments will generally trace back to standards with 4x accuracy
- "NIST traceable" means something can be traced back to a national standard—it does not dictate an accuracy level

28

BEST AND BRIGHTEST

Designers and operators of laboratory spaces for various research types are encouraging clients to consider how laboratory design and amenities contribute to an organization's ability to attract and retain top scientific talent. Here are some of those amenities:

- Daylight: abundant daylight creates an energizing, welcoming environment
- Windows: they provide access to outdoor views, letting occupants feel connected to the outside world
- Sustainability: workers see "green" labs, such as with LEED certification, as a big plus
- Floor planning: a relaxing atmosphere fosters interaction and collaboration
- Comfort and amenities: showers and lockers, for example, can be beneficial to workers

46

PARTNERING WITH OTHER LABS

Outsourcing requires lab managers to collaborate with external partners. These partnerships bring many benefits, such as access to better technology, global talent pools and reduced costs. However, there exist many obstacles to overcome, as follows:

- Externally redirected budgets may decrease internal spending, disrupting teams
- Organizational silo mentality and internal politics can damage partnerships
- Managers must vet all internal contributors to minimize risk
- Not all sides think the same way; conflict is bound to arise

Laboratory

CONTAINMENT SOLUTIONS

Ductless Polypropylene Hoods

AirClean® Systems polypropylene ductless hoods provide excellent operator protection for a wide range of common laboratory applications.

Features:

- NO RUST — Polypropylene construction for excellent chemical resistance, allowing longer service compared to standard metal enclosures.
- Wide range of activated bonded carbon, impregnated chemisorptive, and HEPA filters for containment of virtually any toxic vapor, fume, gas or particulate.
- AirZone™ baffling establishes a proper horizontal airflow pattern directing toxins away from the operator in a predictable pattern.

Options:

- Vented and unvented polypropylene base cabinets
- Slip hatch electrical access ports
- Polypropylene sink and water fixture
- Sturdy mobile cart

FREE Application Assessment
Call Toll Free: 800-849-0472
Visit us at:
www.aircleansystems.com/assess

Protecting the Operator or Process from Chemical Fumes, Vapors, and Particulate since 1992

Visit our website at www.aircleansystems.com/labmanager

AirClean® Systems
"THE FUME CONTROL EXPERTS"

3248 Lake Woodard Drive, Raleigh, North Carolina 27604
Telephone: (919) 255-3220 • Toll Free: (800) 849-0472
www.aircleansystems.com • info@aircleansystems.com

Vibration Isolation

Vibration-Free Platform provides a portable isolation system wherever you need it.
Starting at $2,166

Vibration-Free Workstations come in many standard sizes and top materials.
Starting at $1,704

Lab & Cleanroom Storage

Cleanroom supplies storage cabinets are available in several shelf and garment rod configurations, with HEPA filter module for optimal cleanliness of stored materials.
Starting at $1,388

Vacuum Chambers

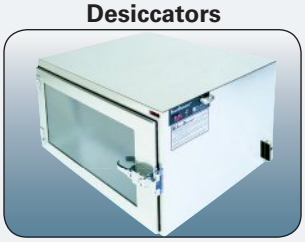
Many standard sizes and materials.
Starting at $1,255

Low-Cost Solutions for High-Tech Industries

TERRA UNIVERSAL.COM
Critical Environment Solutions

To order, call 714-578-6000 • Fax: 714-578-6020 Fullerton, CA

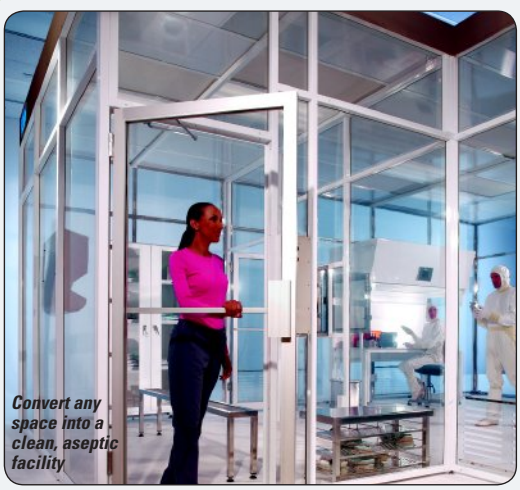
Desiccators



SmartDesiccator automates N_2 flow to maintain setpoint humidity level (ambient to 0%RH). Seconds to set up and program!
Starting at $821

Vacuum Cleaners

Many standard models, including the portable ULPA-filtered MicroVac above.
$955



Convert any space into a clean, aseptic facility

BioSafe™ Aseptic Cleanroom

Modular Cleanrooms

- Total Cleanroom Solutions—Terra designs, builds and equips to your specs!
- Cleanliness to Class 10 (ISO 3), BioSafe™ all-steel designs with antimicrobial surfaces for aseptic processing
- Free-standing structures require no external bracing
- Any size or floor plan, with pass-throughs and internal partitions
- A/C, temperature and humidity control, special lighting

Pass-Throughs

BioSafe™ Pass-Through Chambers feature no-lip, no-seam design for easy sterilization.
Starting at $8,578

Garb & Parts Dispensers

Stainless steel dispenser is ideal for loose gloves, hair nets, shoe covers.
Starting at $295

Three-bay acrylic wall-mount glove dispenser accommodates multiple glove sizes or materials.
Starting at $235

Laminar Flow Hoods

Vertical Laminar Flow Station includes PLC control over motorized shield, FFU and lighting to meet Class 100 standards.
Starting at $4,937

Laboratory Ovens

Dozens of models available. Large-capacity forced-air oven (shown) provides stable heating to 220°C.
Starting at $5,017