MAGAZINE
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Run Your Lab Like a Business

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SCIENTISTS & THE SOCIAL MEDIA

ARE LABORATORY PROFESSIONALS READY TO TAKE ADVANTAGE OF THESE NEW COMMUNICATION TOOLS?

INDEPENDENT GUIDE TO GC SYSTEMS INSIDE!
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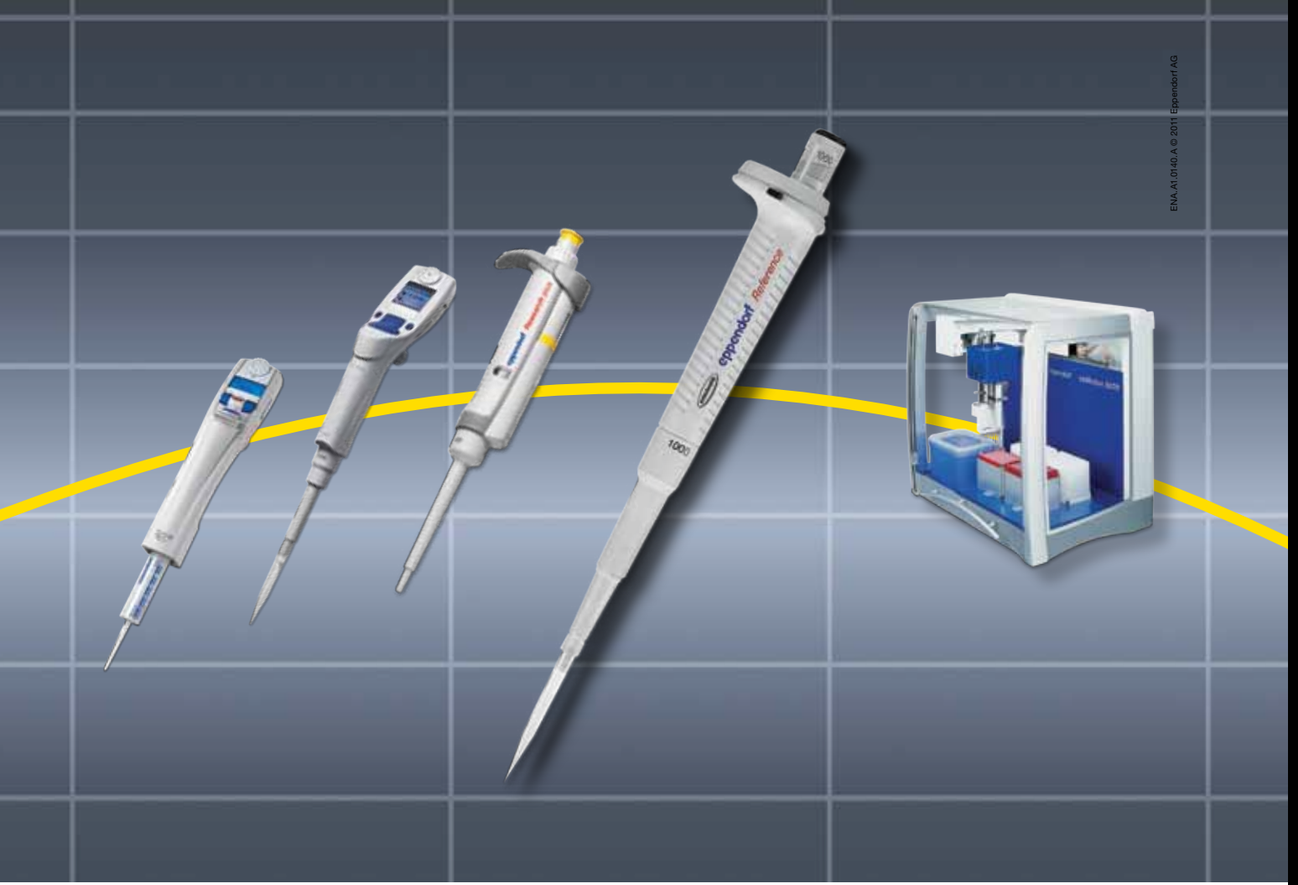

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Lab Manager MAGAZINE
Run Your Lab Like a Business

CONTENTS

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COMING NEXT MONTH:

Everything you ever wanted to know about LAB ETIQUETTE

Based on the tremendous response to our recent Lab Manager Academy webcast, "Lab Etiquette - Maintaining High Professional Standards in the Lab," *Lab Manager Magazine* will feature a follow up article on that same topic in May. In addition to practical advice on how to manage such lab etiquette problems as leaving the lab area messy, taking the last supply, or overusing one's cell phone, next month's feature story will look at some possible causes for the current problems many labs seem to be facing with regard to courtesy and respect in the lab. Do generational and cultural differences, invasive communication devices, and a more open lab space contribute to the problem? What sorts of guidelines can be put in place to resolve it? How can fixing these etiquette mistakes improve lab morale and the careers of you and your team? Find out in next month's cover story.

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If You Can't Beat Them ...

Two weeks ago I didn't text, I didn't Skype, and my Facebook page was a sad, unrevealing shell of a thing because, at the time, I had no interest in sharing either my deeds or my thoughts with my "friends." But all that changed when my daughter-in-law went into labor and the only way to track events was via text messages. News of her delivery came in the form of a four-word message from my son that read: "Ta Da. She's here." Since her birth, the texting has continued fast and furious. And, in addition to buying a camera for the computer in order to Skype little Olivia, I suddenly cannot resist telling my Facebook friends all about her.

My point is, regardless of one's reluctance to share information or communicate via these new mediums, their availability and obvious usefulness cannot be ignored. And if you have yet to be seduced in one way or another by "social media," you're stronger than I.

This month's cover story examines the shifting attitudes among lab professionals regarding Facebook, Twitter, LinkedIn and the like. Bit by bit, it seems we're all coming around.

This being the April issue, the month in which the U.S. has celebrated Earth Day (April 22) for the past 41 years, we have devoted a good amount of our editorial to "green" laboratory matters. Our Design & Furnishings article looks at ways older laboratories are being retrofitted to meet current energy consumption and green building standards. Turn to page 32 to learn a variety of strategies to reduce energy consumption, ranging from major mechanical retrofits, to recommissioning existing HVAC systems, to installing exterior insulation and new lighting. Our Technology & Operations article on page 26 describes several approaches for ensuring that the automated equipment in your lab is designed for and operating at maximum efficiency. "With lab equipment that's properly designed from the beginning—in other words, optimized for a given application—it's possible to achieve substantial energy savings." And if that's not enough, turn to this month's Mind Map on page 70 to learn a number of different steps you can take to further reduce your lab's environmental impact.

Not related to energy efficiency but equally important is this month's Ask the Expert column on laboratory water purification systems. Turn to page 52 to share University of Pennsylvania lab manager Emily Anna Bridges' rather harrowing experience when the aged water purification system supplying water to her research building which, after months of leaking and contamination problems, stopped functioning entirely. And if you're interested in knowing what your colleagues are looking for when it comes to their own lab water purification needs, turn to page 49 for the results of this month's survey, "Are You in the Market for a Water Purification System?"

For anyone who attended last month's Lab Manager Boot Camp at Pittcon in Atlanta, please let me know your thoughts regarding its usefulness. We were very pleased by the 150 plus attendance number and hope you all came away with some good leadership information and inspiration. If there was anything about this year's Pittcon that was especially interesting or useful, please share that as well.

Lastly, I would be remiss without mentioning the disaster in Japan: first the earthquake and tsunami and then the release of radiation due to the damaged nuclear power plants. Our heartfelt condolences go out to those affected by these catastrophic events.

Pamela Ahlberg
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SCIENTISTS & THE SOCIAL MEDIA

ARE LABORATORY PROFESSIONALS AT LAST READY TO EMBRACE THIS UBIQUITOUS AND INFLUENTIAL COMMUNICATION TOOL?

by Hans Buskes

Laboratories are at the forefront of research and analysis. But when it comes to communication, they are followers rather than leaders and can be very slow to adopt innovations. The use of social media is a case in point, as a recent survey of nearly 200 lab managers revealed. There are six good reasons for labs to explore the opportunities offered by the social media (see sidebar on page 14).

Imagine the following situation: An analyst has grave doubts about the accuracy of GC results and suspects a technical fault. She quickly composes a short message describing the problem, accompanied by a spectrum chart of the characteristic peaks, which she produced on her mobile phone. She adds a hashtag such as #labpros and "tweets" it into the ether. Within a minute, she receives the first response, quickly followed by six more. Two make the same suggestion: "Check that the injector isn't clogged with septum particles." Bingo! Problem solved within ten minutes.

> "It is very easy to invent reasons for not using Facebook, Twitter or LinkedIn."

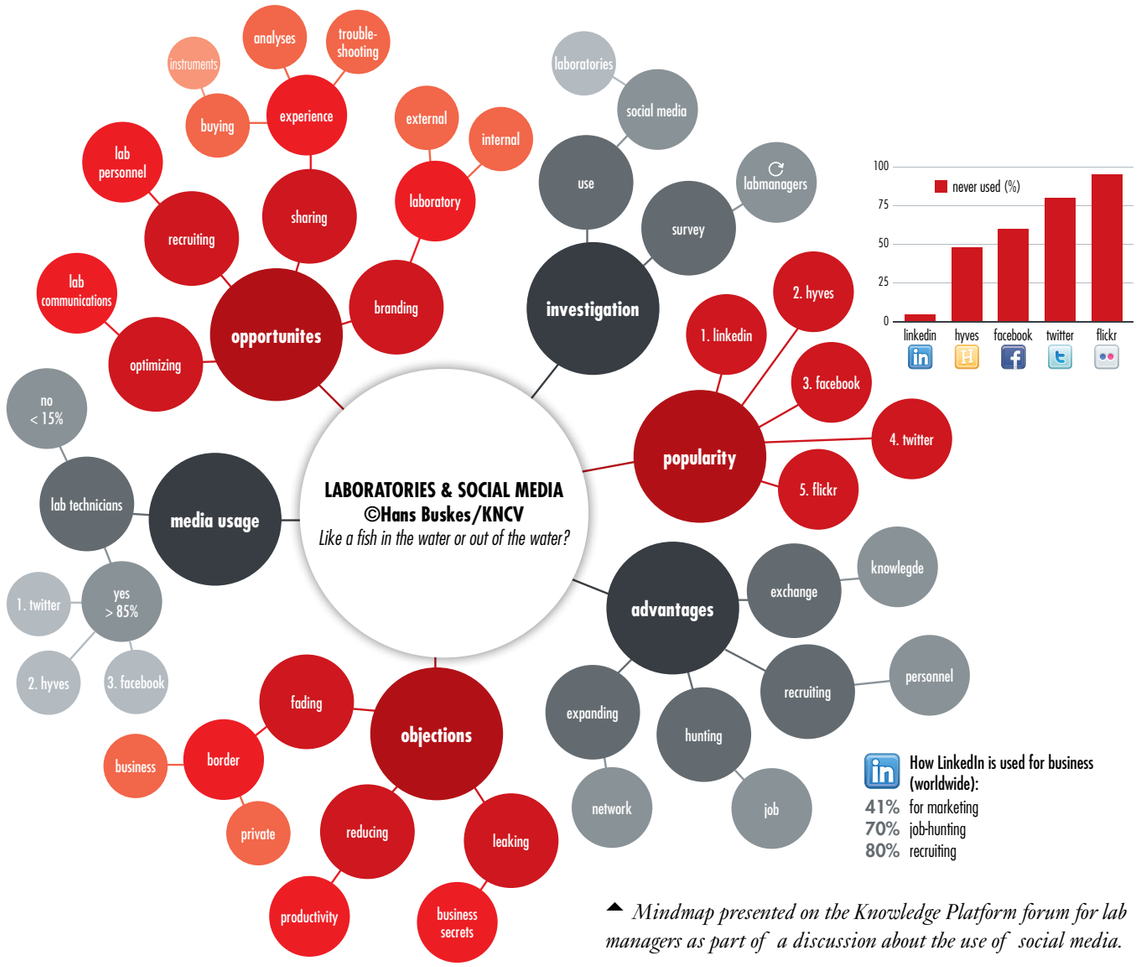
Experienced GC users will know that this is not the first time that output has been distorted by a contaminated injector or column. And experienced Twitter users know the power of the hashtag! Your message reaches thousands, possibly millions of other users within seconds, and it would be a very esoteric problem that didn't attract countless useful suggestions. So, Twitter is part and parcel of lab practice, right? Wrong.

A matter of time

Many professionals have an aversion to social media. This even applies to those working in the field of communication itself, so what hope is there for lab professionals? In his book, *Tweeting at Work (Twitteren op je werk)*, Dutch communication expert Huib Koeleman laments, "It is still all too common for communications people to consider the social media so much nonsense, even though they have never bothered exploring the possibilities in any detail." These are the very people who should be grasping the opportunities presented by new communication tools with both hands. Yet the skepticism with which they view any innovation is par for the course. Exactly the same fate befell the office telephone and, much later, the Internet. Their reticence is due to the fear of lost productivity, excessive personal use and the difficulty of managing usage effectively. "It is very easy to invent reasons for not using Facebook, Twitter or LinkedIn, and to build a case against the social media based on unfounded allegations," states Peggy McKee, who recruits laboratory personnel in the U.S. Nevertheless, the future is not difficult to predict. The telephone and the Internet are now taken for granted; it is only a matter of time before the social media will also take their rightful place in the office and the laboratory.

Fear

Lab managers are not the most social of creatures, or so the results of the survey would have us believe. Asked how often they use various social media, almost 100 percent admit to never having used flickr and over 80 percent had yet to open a Facebook account. Twitter is virgin territory to over 60 percent of respondents, while



▲ *Mindmap presented on the Knowledge Platform forum for lab managers as part of a discussion about the use of social media.*

around half have never used Hyves.[1] Only LinkedIn achieved a more creditable rating by being unfamiliar to only 4 percent. Clearly, managers feel most at home with this more business-oriented resource. Its high score, as well as the low scores achieved by the other social media, can be attributed to the lab managers' main objection to social media: they fear that the dividing line between business and private usage will be lost. This misgiving applies somewhat less to Hyves since it is intended almost entirely for private use anyway. According to the survey, the reasons that lab managers have thus far resisted adoption of the social media are, in order of importance:

1. Blurring of the boundaries between private and business use
2. Loss of productivity
3. Security: the danger of confidential information being leaked

The survey also asked lab managers to assess how often other lab professionals use social media. Their responses paint a very different picture. They believe that around 85 percent of analysts are frequent users, particularly of Twitter, Hyves or Facebook. Contributions to an online knowledge forum suggest that managers are not keen to allow the use of social media during working hours. A few lab managers from commercial organizations state that they might turn a blind eye during the night shift, when there is little else to do, but not during the daytime. However, as the WikiLeaks controversy illustrates, outright prohibition is an admission of weakness. Governments that ban WikiLeaks or put pressure on companies whose servers host the site are coming to realize that the Internet genie is now well and truly out of the bottle and it can't be put back. Managers must manage and, hence, they must manage the use of social media in the workplace.

SCIENTISTS & THE SOCIAL MEDIA

"It is only a matter of time before the social media will also take their rightful place in the office and the laboratory."

Managing social media

As the old saying goes, "If you can't beat them, join them." Take a leaf out of the Dutch government's book. Do not apply a blanket ban, but rather encourage the use of social media, making it subject to clear rules and guidelines. In a policy document on online communication, the Dutch Ministry of Foreign Affairs cites seven reasons for government staff to become actively involved in the social media. At the same time, it offers advice on how to tread the narrow dividing line between official responsibilities and private interests, and how to prevent sensitive information from being leaked. Let us remember that these issues have little or nothing to do with the resources; they have to do with the people who use them. The opinions expressed by an individual can reflect badly on the organization but this risk is not confined to Twitter or Facebook; it applies equally to e-mail correspondence, phone calls, conversations at social events, and so forth. To paraphrase, it is not the gun that kills, but the person who pulls the trigger. We must step into the social media world and embrace the opportunities, but we must also manage the risks.

What precisely are "social media"?

The danger of frequently used terms such as "social media" is that nobody actually knows what they entail. Avid users associate the term with the new media and a large number of fellow converts. Nonusers think more about the social aspect and the exchange of personal messages. Neither view is complete, for a number of reasons.

In the social media era, the traditional consumers of information have become the producers of information. In his book *Content Nation*, John Blossom offers a definition of the social media based on four key criteria: scalability, accessibility, equality and influence. Social media enable users to reach a precisely defined target group (scalability). Merely collecting as many followers as possible is pointless (other than as a boost to the ego), especially if the people you actually wish to contact are not among them. The social media are usually free to use, at least in their basic form, which makes them extremely accessible. The publisher or distributor of a traditional medium derives a certain power or status from the control he can exert. In the social media, all users are equal. Moreover, the social media enable users to exert influence. The examples are many and varied (e.g., the recent uprising in Egypt, the public outrage sparked by an advertising campaign for Pretzel Crisps, the hijacking of Nestlé's Facebook fan page by Greenpeace activists).

Dr. Hans Buskes, *general manager, Communicabus, can be reached at hbuskes@me.com.*

References:

1. Hyves is the most popular social networking site in the Netherlands, after Facebook. It is exclusively for private use.

SIX REASONS WHY LABORATORIES SHOULD EMBRACE THE SOCIAL MEDIA

1. EXPERIENCE. The social media bring the lab into direct contact with a huge international network of people whose expertise is based on experience. Their input can be very useful in problem solving as well as in matters such as the purchase of new equipment.

2. RECRUITMENT. The social media turn traditional recruitment methods on their head. Everything is faster, less expensive and more effective.

3. BRANDING. Twitter, Facebook, YouTube and, to a lesser extent, LinkedIn are excellent channels for strengthening the organization's name and reputation. Over 70 percent of Fortune 100 companies now have their own Twitter channel, and an increasing number of companies have appointed a dedicated social media manager.

4. INTERNAL COMMUNICATION. In many organizations, mistakes and failure to achieve goals can be attributed, at least in part, to poor communication and poor knowledge sharing. Yammer, the business equivalent of Twitter, can do much to resolve this problem. A major advantage is that everyone within the organization can see the Yammer messages, which are archived for future reference. Yammer provides an ideal channel through which knowledge and information can be shared.

5. NEW CLIENTS. The traditional communication tools are often restricted to an existing network. Social media open up new networks and opportunities to introduce the organization to new clients. This is clearly of interest to commercial labs.

6. ALERTNESS. Although laboratories are less susceptible than commercial companies, negative publicity based on incorrect information can have a serious impact. In communication, a slow response results in loss of control. A presence in the social media can help to put the record straight, quickly and effectively.

THE INFORMATION BELOW IS BASED ON A *LAB MANAGER MAGAZINE* SURVEY CONDUCTED IN FEBRUARY 2011 OF OVER 300 OF OUR READERS.

A SAMPLING OF COMMENTS FROM THE LAB PROFESSIONALS WHO PARTICIPATED IN THE *LAB MANAGER MAGAZINE* SURVEY:

PROS

"My usage of social media has increased a lot in the past 12 months. I see it getting more and more useful as more people familiarize themselves with it."

"I know many scientists who collaborate or speak with other colleagues in the field to troubleshoot problems."

"New users are joining in increasing numbers and existing users are developing more interest and skill in use of the platform. There's consequently more and more useful material and interactions available."

"I am making more contact with people I knew years ago, that can now assist me in sourcing used equipment. Funding for new instrumentation is becoming more and more difficult."

CONS

"I have noticed a big increase in spam-like content on sites."

"It is hard to keep separate the professional conversations from the personal, and I can't waste time with the personal conversations while at work."

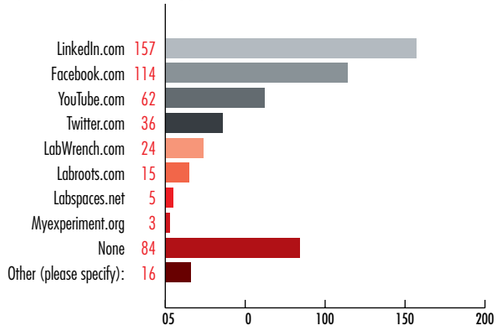
"Social media is being abused by vendors as a "free advertising" conduit: if someone asks a question in a forum, they immediately get jumped on by vendors trying to sell them something."

"I don't trust the internet security-wise for social media."

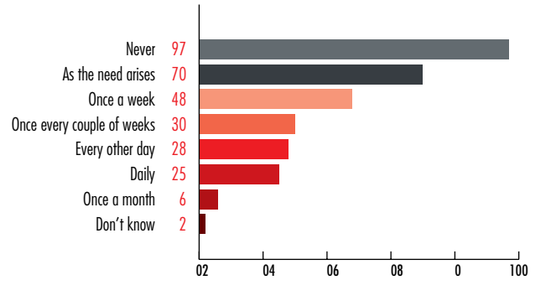
"Social media serves no purpose for work since email provides the means to communicate with researchers, faculty, staff and students."

"I use it at home but not at work."

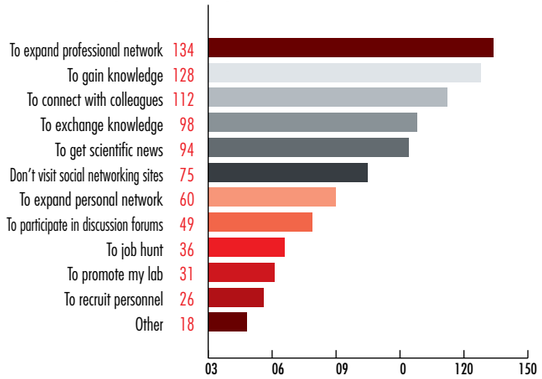
1. If you use social media sites professionally, please identify the social media sites you visit (check all that apply):



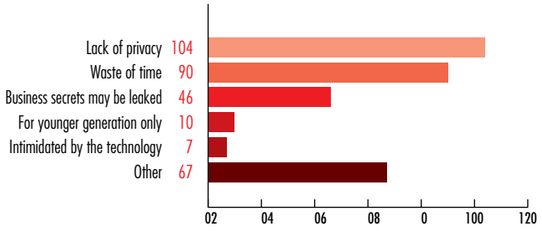
2. How often do you visit a social media site for work-related purposes?



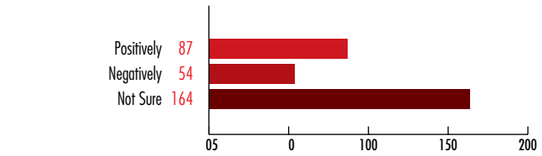
3. Please identify all the reasons you visit a social media site:



4. Reasons for not visiting social media sites:



5. How has your opinion of social media changed in the past 12 months?



PERSONAL ACCOUNTABILITY

TRIED AND TRUE TECHNIQUES FOR DEVELOPING A RESPONSIBLE AND SELF-MOTIVATED STAFF by Ron Pickett

You have a wonderful staff. You have given all the assignments and now it's time to sit back and wait for the results to roll in. Sadly, not in my world. There is a lot more to getting things done than assigning tasks. Personal accountability is one vital, necessary ingredient. But it's not your job to follow your staff around, checking to see that tasks are accomplished. So what can you do to enhance the level of accountability of your staff? (There are two lists of easy steps in the References.)

Managing the accountability of individuals

One fact you will have observed is that each member of your staff demonstrates a different level of maturity or responsibility. A good definition of an adult is someone who takes full responsibility for his or her actions, which can be very difficult! Therefore, as a manager, you need to assess the maturity level of each member of your staff and provide the appropriate degree of direction, coaching and guidance. This does not imply a detailed, formal assessment, but more of an observation of what works and what each person wants and needs to be effective on the job. For new staff members it may be necessary to provide very specific direction on what has to be done, how to do it, and to monitor the results with frequent coaching. This is the entry level of maturity. With time and experience, the employee will be able to take on additional responsibility and will require less specific direction. Your role shifts during this development process from providing specific guidance and close monitoring to ultimately describing the desired outcomes and providing an environment in which the employee can select the best way to achieve those outcomes. There are intermediate steps as the person assumes greater responsibility. The manager's role is to be less directive and more participative, seeking more input from the person as he or she assumes increased responsibility. This process may sound complicated, but it quickly becomes second nature and is the essence of what managing people is all about.

▲ *This model is used for coaching, but it is also useful in building accountability.*

> "Effective leaders need to be flexible and must adapt themselves to the situation."

An employee's maturity level is a combination of ability or skill and willingness or motivation. He or she can have a high level of ability, but lack a willingness to actually do the work. Additional training would be useless in this situation.

Maturity levels are also task specific. A person could be generally skillful, confident and motivated in most aspects of their job but would have a low level of maturity when asked to perform a task requiring skills they don't possess. Understanding this concept is especially important in the transition process when one of your staff is given

additional responsibilities. It does little good to provide training when the person already has the skills but lacks the motivation to do the job—able, but not willing! High levels of maturity guarantee personal accountability.

Developing people and self-motivation

A good leader develops the competence and commitment of their people so they're self-motivated rather than dependent on others for direction and guidance. A leader's high but realistic expectations lead to high performance of followers. A leader's low expectations lead to low performance. Think about how often that statement has been borne out in your personal experience.

In order to develop an effective staff, a manager needs to motivate followers and to do that the management style and the rewards must be individualized and appropriate. Not understanding and using the concept of variable levels of maturity is one of the major contributors to poor personal accountability and low morale. Effective leaders need to be flexible and must adapt themselves to the individual situation and personality of each staff member.

(For another look at Situational Leadership see "Good Leaders, Good Actors," Froschheiser, Lee, *Lab Manager Magazine*, Leadership & Staffing, January 2011.)

The role of performance appraisals

The best and first tool for developing and enhancing accountability is the performance appraisal. Set and agree on high standards that can and will be monitored jointly. This may seem like a primitive method, but all the necessary elements are there—expectations jointly arrived at, monitoring measures and consequences.

"The best and first tool for developing and enhancing accountability is the performance appraisal."

Simple steps to take:

- Schedule periodic update meetings.
- Provide the appropriate level of detail.
- Ask "What do you need from me to be successful?"
- Become less involved in specifics, or the "how to," and more involved in the "what if."
- Set objective, "self-measuring" standards or metrics. Assist staff with incorporating measurements that will help them get on track and stay on track to achieve their goals.

(See "Performance Appraisals," Pickett, Ronald B., *Lab Manager Magazine*, Leadership & Staffing, October 2010.)

Recently we arrived at a muffin shop five minutes after closing. When you are in this situation, you know that if the door is opened, it is likely that you have attracted the attention of the owner! If it is a staff member who opens the door, you have the best of all situations—a shop where the staff acts as if they are the owner! What happens at your lab door five minutes after closing?

Things you can do

Here are some more mature, longer-range steps you can take to achieve a climate of accountability:

- Move toward a more participative climate.
- Get input from your staff frequently and openly.
- Nurture involvement in decision making, goal setting and performance monitoring.
- Lead through collaboration.
- Spot and reward individual initiative.

Personal accountability vs. team accountability

An important issue to resolve is whether to focus on the accountability of teams or individuals. The answer to this question will change depending on the projects you are working on. When that is established, set accountability standards that recognize and reward the appropriate achievements.

So if your lab has large projects and success is dependent on the aggregate outcome of the work of several contributors, ensure that your monitoring and reward systems shape team contributions, not individual ones.

In one of my jobs there were three peers. While each of us wanted to stand out from the others, we wanted to be highly effective as a team. It was the only time I recall that if you didn't do something, it would be done for you! This was a great environment: competitive, and yet mutually supportive—not a cutthroat setting, simply everyone dedicated to getting the job done quickly and efficiently. How did that climate evolve? Each of us had a strong personal commitment to an important and challenging goal!

"Set accountability standards that recognize and reward the appropriate achievements."

CHECKLIST FOR ASSESSING PERSONAL ACCOUNTABILITY:

1. Do your staff feel like they have a positive role in the management of the organization?
2. Are things that need to be done identified and resolved on the spot?
3. Is your staff given the appropriate, individualized level of responsibility and support?
4. Does a climate of mutual support and teamwork exist?
5. Is there clarity and focus on the organization's goals?
6. Do people focus on team outcomes rather than individual contribution (assuming you need a team focus)?

What will you gain as a result of an environment with enhanced accountability?

- High morale
- Greater productivity
- Staff maturity
- Excellent retention
- Easy access to new staff

Ronald B. Pickett *is an organizational effectiveness consultant based in Escondido, Calif. He can be reached by e-mail at RonP70000@aol.com or by phone at 760-738-8638.*

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BETTER TECHNOLOGY, BETTER LIFE?

Nanotechnology is still early in its commercial development, but many scientists agree it could become a part of everyone's daily life in the not-too-distant future. In one example of how it could affect the way the scientific industry operates, nanotechnology makes it possible that a single microchip containing an entire medical history and biological sample results is all it will take to analyze and determine a person's overall health. Currently, it takes an entire lab operating in several different capacities to produce those same results.

Even if nanotechnology never goes that far and the all-encompassing biological microchip never comes to fruition, the trend toward more compact—and more efficient—best practices is firmly under way.

It is already possible, for example, to broadcast test results in mere seconds across the globe through "cloud" technology in which information is stored virtually, not within the bricks and mortar of a traditional lab.

No, this particular column is not about the science labs of the future; it is about understanding that how they might look one day is key to understanding another critical consequence of such rapidly evolving technology.

Nanotechnology and other innovations will make it even easier for scientists to be mobile, working wherever they choose. Many of them already do, following the general trend of employers starting to recognize that employees don't necessarily have to spend their workday in a particular physical location in order to be productive. Working an eight-hour day within a traditional time frame also is no longer a prerequisite to employment, since virtual work spaces where information is easily accessible make it just as convenient to work in the middle of the night—or whatever time is convenient for the employee.

> "Employees don't necessarily have to spend their workday in a particular physical location in order to be productive."

Lab managers of tomorrow, as well as today, must therefore learn how to foster and maintain the personal fulfillment of their employees outside of work, as new technologies are making it extremely easy to work practically anywhere and anytime.

Although there have always been issues through the years regarding how to balance your professional life with your personal one, scientific lab work understandably encompassed a pretty typical day before the introduction of game-changing innovations in the industry. The business of running a lab was time dependent, with the manual nature of experiments and other processes dictating that scientists needed to be in certain places at certain times. You always knew that if an experiment started in the morning, chances were good you'd need to be there in the afternoon.

As history has shown, suppliers developed automated instruments, revolutionizing lab work so significantly that practically every process now is done with automation. You can start an experiment and walk away. You can get results through the interconnectivity of the Internet, which enables scientists to dial in from anywhere in the world to see the resolution of their work.

All these advances are much more beneficial to the customer—results are fast and accurate—but it is already causing strains on the work/life balance, because now there is so much more available time to introduce a new level of workload and constantly push for innovation. The technology of the future will only make this dilemma more pronounced.

Lab managers must ultimately recognize how the world of work has changed. Because scientific professionals have so many more choices for employment, those who manage them must deliberately build plans for enabling their staff to have every opportunity for a fair work/life balance reflective of the virtual nature of their workplace as well as their home.

Adaptability is the most crucial component. No employee can attain personal fulfillment outside work without being able to adapt to the rapidly changing technologies of the scientific world. Lab managers can facilitate this process by recognizing the new mobility of today's scientific professionals and recruiting specifically for the skill sets required to work in a particular environment. This can often be done by harnessing the power of a contingent labor workforce plan, a strong trend in the scientific industry that allows labs to employ the most competent professionals only when they are needed for a particular job or project.

Lab managers must also learn how to prepare their employees for the culture of a particular lab and develop an onboarding process that will allow them to flourish, no matter what the requirements, location, or time element.

Preparing a lab's workforce in such a way that they are able to optimally handle the technological changes that are coming down the pipeline will, in the end, ensure happy employees. The employees may ultimately become more committed to their work if they know they have a life outside of it, too.

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LEADERSHIP *IS* COMMUNICATION

IGNORING ITS IMPORTANCE CAN DERAIL THE BEST MANAGEMENT EFFORTS

by Tim Hayes

Leadership is communication, yet too many business leaders do not understand or appreciate this very basic truth. It may not be entirely their fault, though. In a review of the top MBA programs across the nation, communications courses are missing from every one of their core curricula. When communication is viewed as an elective, is it any wonder that it receives the same level of contempt and dismissal in real-time business dealings?

The importance of communication in business—as in every other area of life—cannot be treated so lightly without suffering the consequences later. Consequences such as employees merely working for a paycheck, not pulling together for a shared and commonly held cause; customers purchasing on a commodity basis, not on a belief in a brand promise that represents value to them; and investors who abandon their shares in exchange for investing in an organization that promotes and lives according to its clearly stated raison d'être.

The best leaders know that solid communication makes achieving their vision and goals easier, smoother, and faster. But assuming that communications can be successfully handled as an afterthought is a mistake too many business leaders make. The message, how it fits with the overall strategy and business plan, how it dovetails with the current level of understanding among key constituencies, and how best to convey it to those varied audiences with authentic power and passion—all these factors need to be understood, respected, and valued as early in the decision-making process as possible.

Leaders who know this and live it as part of their regular business dealings enjoy the benefits and rewards that follow. Those who don't? Well, they are left open to abuse, misunderstanding, rumor, and just plain wrong ideas that can siphon away important resources in time, effort, and money to correct. Those leaders are left like a jackass in a hailstorm—they just have to stand there and take it, because they've set themselves up that way.

The good news? Leading with a solid communications approach is not difficult. It only takes an appreciation and execution of a simple strategy that has been proven virtually foolproof. It's based on four key ideas:

1. Leaders must accept the responsibility to communicate.
2. Leaders must align their communications strategy with their business strategy.
3. Leaders must amass meaningful messages that flow from and support the strategy.
4. And leaders must announce those messages with power and passion.

Climbing the ladder of organizational success isn't easy. For those who make it to the top, or close to the top, much is expected. Make your numbers each quarter, keep expenses controlled, manage to maximum productivity and profitability. That's what makes the world of business go 'round, and there's nothing wrong with any of it.

At the same time, though, having the big title doesn't necessarily make one a true leader. Employees, staff members, direct reports—whatever label you prefer—may listen to the person out front, but that doesn't mean they are true followers. Yet to be a true leader, one must have true followers.

For any leader to effectively lead and be perceived as a true leader, communications must be part of the management mix. No, strike that—communications shouldn't be just one part of the mix; it must be the underpinning, the foundation, the bedrock supporting every single part of the mix.

Everything begins and ends with a simple notion that makes all the difference in whether leaders and their businesses thrive: Leadership is communication.

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LABCAST If you missed Tim Hayes' Lab Manager Academy webinar "Becoming a Better Leader to Achieve Better Results," originally broadcast Wednesday, April 6th, **visit www.labmanager.com/leadership to watch the archived video.**

TECHNOLOGY & OPERATIONS

OPTIMIZING ENERGY EFFICIENCY

CHOSEN CAREFULLY, AUTOMATED LAB EQUIPMENT CAN DELIVER SIGNIFICANT ENERGY SAVINGS by Danielle Collins

Most laboratory managers recognize that they can improve the energy efficiency of their labs by implementing commonsense tactics such as turning off equipment that's not in use, installing lighting sensors that dim lights automatically when natural ambient light increases, and making sure freezers and chillers are sized appropriately for the samples stored inside.

Collectively, these practices can make a noticeable impact on your laboratory's energy bill and environmental footprint. This same concept—namely, evaluating the lab's needs and making simple choices that can lead to a substantial collective impact—also holds true when choosing automated lab equipment.

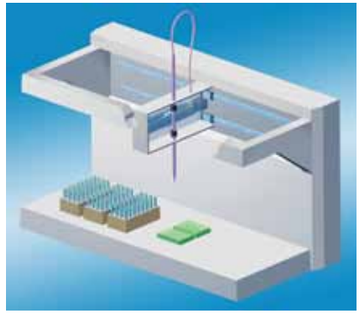
There are several approaches that can be taken to ensure that the automated equipment in your lab is designed for and operating at its maximum efficiency. One approach is to consider the energy efficiency of individual components within the machine, such as the electromechanical actuators and pneumatic valves that control processes such as liquid dispensing and microplate handling. A more systematic approach, however, is to examine the overall machine design and look at how the components work together to achieve energy efficiency. With lab equipment that's properly designed from the beginning—in other words, optimized for a given application—it's possible to achieve substantial energy savings. We'll get started by looking at a few of the most beneficial guidelines for improving energy savings and reducing your lab's impact on the environment.

Machine design and selection: Small details can have a big impact

Liquid handling workstations, microplate handlers, and automated storage and retrieval systems (AS/RS) are all examples of laboratory equipment that involve motion controlled by an electric motor (electromechanical) or by air (pneumatic). These motions are typically in one, two or three axes, such as a three-axis liquid-dispensing system that moves the pipettes up and down to the microplate, left and right from plate to plate, and front to back across each plate.

When choosing automated equipment, many lab managers focus primarily on throughput and ease of use. Although these are important factors that help maximize productivity and output, in order to determine the environmental impact of the equipment, lab managers should also ask the supplier how the machine as a whole has been optimized for energy efficiency. Significant energy savings can result if the equipment builder has properly sized and selected the electrical, mechanical and pneumatic components inside the machine. Conversely, if the components are sourced from multiple vendors and are not optimized to work together, or they are not designed with features that decrease energy consumption, then energy efficiency will inevitably be compromised.

One of the most important factors contributing to energy efficiency is the size of the components used inside automated lab equipment. When linear guides, ball screws or pneumatic cylinders are oversized for the application, they require more energy than should be necessary for the application. If the process includes multi-axis motion—for example, a pipetting application that includes both horizontal and vertical movements—the weight of the components themselves is another factor in energy consumption. Since each axis must carry the weight of the next axis that is mounted to it (in the pipetting example, the Z-axis carries the pipette, and the X-axis carries the Z-axis with the pipettes), optimizing the size and weight of the Z-axis subsequently allows the machine builder to use the smallest components possible for the X-axis. The net results are lower mass and reduced inertia for the complete X-Z system, which translates into reduced forces needed to move the system and, ultimately, lower energy consumption.



If a process includes both horizontal and vertical motion, for example in a pipetting application, the weight of the mechanical components becomes a factor in energy consumption.

Another factor that lab managers should examine in new automated equipment is whether electrical components such as motors, mechanical components such as linear guides and ball screws, and pneumatic components such as cylinders have all been optimized to work together; for example, in a liquid dispensing system. Many automation vendors now provide online tools for designing systems that incorporate these various types of components and have optimized their products to work together for ease of assembly and lowest energy consumption. If a machine builder has sourced multiple components from the same vendor, the system more likely to have optimal performance and better energy efficiency than is one that is built from components from different sources.

Energy-efficient electric motors—and the proper sizing of drives that control them—are also a factor in how much energy a laboratory machine consumes. Simply put, the fewer electrical components in the machine, the lower the energy consumption. Hardware such as integrated drives and controls that can command multiple axes and feedback inputs—servo, stepper, linear motor, etc.—can reduce complexity in the machine and energy losses that are seen when multiple drives and controls are used.

Energy efficiency and air consumption

When considering how to increase energy efficiency, most people think of how to reduce electricity consumption directly, such as turning off electronics and equipment when not in use. Air-driven, or pneumatic, components also contribute to energy usage, since air pressure must be generated, regulated and delivered from the source to the point of need. For pneumatic components, three factors contribute to lower energy consumption and reduced environmental impact: reducing pneumatic system volume, reducing air pressure and minimizing leaks.

Since air losses can occur at distances as short as three feet, mounting pneumatic valves close to the actuators that they control will reduce the energy needed to deliver the air. Manufacturers of pneumatic

Since air losses can occur at distances as short as three feet, mounting pneumatic valves close to the actuators they control will reduce the energy needed to deliver the air.

components now offer smaller, lighter, chemical-resistant valves that can be mounted directly on the machine instead of in a control cabinet, resulting in an energy savings of up to 35 percent. Air volume and pressure can also be reduced by using pneumatic cylinders that are the appropriate size and diameter for the application. Moving microplates and pipettes, which are typical applications for pneumatic cylinders, involves relatively light loads, so lab managers should look for equipment with pneumatic components that are not oversized for the application.

Pneumatic component manufacturers now offer smaller, lighter chemical-resistant valves that can be mounted directly on the machine instead of in a control cabinet, resulting in significant energy savings.

With pneumatics, energy is frequently wasted when too much pressure is applied for tasks that do not need it. This can be overcome by using pressure regulators to control exactly when energy is exerted and conserved. By applying the exact amount of air pressure needed for each task, machines can realize energy savings of up to 40 percent in many cases. It is common for operators to increase air supply pressure on regulators in the hope of improving performance, but this can end up wasting energy if the components are not sized correctly. It is important to monitor machine system pressure to ensure that it is within both a minimum and a maximum value to avoid energy waste. And although one might think of this energy as just air, an energy audit might reveal the annual savings to be tens of thousands of dollars, by simply eliminating leaks in the pneumatic system.

Cleanliness vs. energy efficiency

If cleanroom compatibility is required, lab managers should examine what the real needs of the lab are, especially considering the cleanliness that is required of laboratory automation systems. Although cleanroom class 1 and 10 specifications are common in the semiconductor and electronics industries, most laboratory environments require class 100 to class 1000 ratings, at most. In some cases, the components inside automated laboratory equipment are classified for use in a more stringent cleanroom than what is required in most laboratory environments. Additionally, the equipment may include unnecessary fans or other devices to remove particles generated by the moving components, resulting in more complexity and increased energy consumption. By examining the true cleanliness requirements of the equipment, lab managers can avoid systems that have been over-engineered for cleanroom compatibility and consume more energy than is necessary.

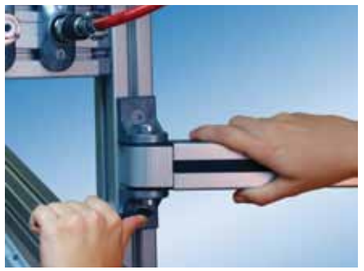
For electrical and pneumatic components that provide linear motion, friction is one of the most significant factors that contribute to the force and energy required during movement, such as loading and unloading microplates in an AS/RS system. Friction also contributes to particle generation: The more contact between two surfaces, the higher the friction between those surfaces, and the more particles that will be generated during motion. Although some friction is inevitable in any moving system, low-friction seals can eliminate the additional friction that is typically caused by the seal and reduce the force and energy required to move the actuator while still protecting it from contamination.

Machine maintenance also affects efficiency

Machine maintenance is often associated with downtime and lost productivity, but it can also affect the efficiency and environmental impact of the equipment and the lab. For mechanical components, lubrication is the primary cause for maintenance. Some linear guides and ball screws are supplied with initial lubrication that can sustain the components for the lifetime of the machine. These pre-lubricated components reduce or eliminate downtime for lubrication and ensure that the proper type and amount of lubrication is present: Too much or too little lubrication can reduce the efficiency of the components. Pre-lubri-

cated components also eliminate the need for lab personnel to handle and dispose of lubrication, which has safety and environmental consequences for the lab. Maintenance time and effort can also be reduced by choosing a system with easy-to-access lube ports or the capability to use an automatic lube system. Lab managers should consider the maintenance requirements when evaluating new lab equipment and their efficiency and environmental impact.

If lab equipment frequently needs to be repositioned or reconfigured, it also makes sense to look for workstations, work benches and other structures within the lab that can allow for that. T-slotted, extruded aluminum structures are now widely available in simple bolt-together designs that allow for speedy reconfiguration of individual processes or even entire labs. Welded or stainless steel structures are often-used alternatives, but welded frames can't be reconfigured and must be discarded—ending up in a landfill, along with the original investment. Aluminum extrusion-based workstations can also form the basis of a lean work environment, as the T-slots in the aluminum framing allow work instructions, parts bins, tools, shelves and fixtures to be positioned in optimum locations for efficient work.



▲ *If lab equipment frequently needs to be re-positioned or re-configured, look for T-slotted extruded aluminum structures with simple bolt-together designs that allow for speedy reconfiguration of individual processes or even entire labs.*

Opportunities for energy and cost savings can be found everywhere in the lab, and a few smart choices in lab design can result not only in reduced environmental impact but also in considerable cost savings. By implementing some of the suggestions noted above, you can ensure that your automated laboratory equipment will run efficiently—and generate significant energy savings at the same time.

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GREENING OLDER LABORATORIES

RETROFITTING TO REDUCE ENERGY CONSUMPTION

by Mitchell Goldman and Lisa Reindorf

How does a research facility or biotech company with older laboratories update existing facilities to current energy conservation standards?

When building a new facility, incorporating green strategies is fairly straightforward, but the goal for most institutions is to update existing structures. Essentially, how can an older laboratory be improved to meet better energy consumption and green building standards?

Why older laboratories consume so much energy

Laboratories and other science facilities are among the most energy consuming of building types. In particular, these facilities are large consumers of heating and cooling energy, mainly because air that is heated or cooled cannot be recycled, due to the potentially hazardous nature of some of the materials used. The typical older research laboratory that uses chemicals or biological materials is designed to provide generally between 10 and 20 air changes per hour, compared to about three changes per hour for a typical office space. Heating and cooling this amount of fresh air can be wasteful and costly. There are significant savings to be gained if you can find ways to reduce this waste.

Balancing safety and energy usage

Creating green labs means selecting a method that achieves the desired balance between safety and reduced energy usage. Building codes and good practice mandate that the heating, ventilation, and air-conditioning (HVAC) unit provides 100 percent of makeup air (new air) to ensure safe conditions for occupants. The most efficient means of energy conservation entails reducing the amount of air used and recovering heating and cooling energy while maintaining indoor air quality.

Most efficient green methods

Retrofitting labs and science facilities to be more energy efficient involves a number of strategies to reduce energy consumption. The most effective incorporate reduction of unnecessarily high air change rates (ventilation), airflow reduction strategies for hoods, updating mechanical systems with better controls, and heat recovery for the supply and exhaust air systems.

Reduce airflow rate

One source of major energy draw in laboratories is the various types of air hoods, which are devices critical to protecting the health and safety of lab workers while they work with chemicals and/or biological materials. Hoods create a sufficient airflow and a contained pathway to protect the personnel working within them. It requires a substantial amount of air to dilute the hazardous materials enough to create safe working conditions. Unfortunately, reconditioning this air can add thousands of dollars per hood to an institution's yearly energy bill.

▲ *VAV fume hoods - organic laboratory - Pearson Michael Chemistry Building, Tufts University. Goldman Reindorf Architects, Inc.*

Reducing air requirements involves several methods, but the most effective is through hood sash management air reduction. Others include replacing outdated fume hoods with either low-flow hoods or variable air volume (VAV) hood controls. Each of these reduces the amount of air exhausted from fume hoods. Sash management techniques include installing fume hood sash restrictors and occupancy and proximity sensors. The VAV control reduces airflow in relation to the fume hood's open sash area. Existing auxiliary fume hoods can also be retrofitted with controls that limit the airflow while still protecting the hood workers.

Mechanical systems for older laboratories and other science facilities have outdoor air changes of up to 10 to 20 times per hour. From a safety perspective, there are many cases in which the mechanical systems and ventilation rates are overdesigned. Check current codes and update master specifications that may be outdated. Often the amount of ventilation can be reduced, resulting in energy savings.

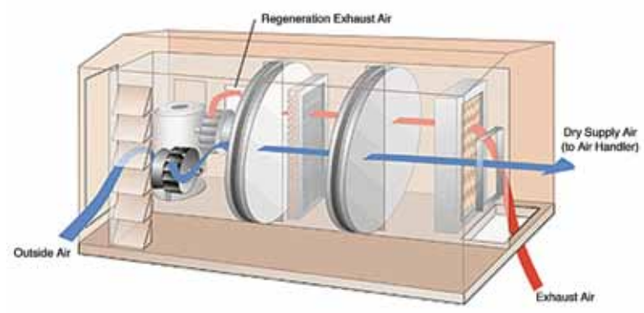
"Installing energy recovery systems can substantially reduce the cost and use of energy in laboratories."

Energy recovery systems

Heating and cooling the large amount of air utilized through frequent air changes consumes enormous amounts of energy. Installing energy recovery systems can substantially reduce the cost and use of energy in laboratories. These systems recycle thermal energy from exhaust air by recovering heat and cooling from the hood and general exhaust and transferring it back into the air intake system for redistribution into the building. Thus a portion of the exhaust heat and cooling is recovered and used again in the building, consequently saving significant energy and money.

There are many types of heat recovery systems that can be utilized in building retrofits. A heat recovery system is essentially a heat exchanger. It obtains ambient heat or cooling from the exhaust before it is discharged. This heat is then transferred to the intake or makeup air side of the building's HVAC system. As a result, the amount of energy needed to preheat or cool the air is reduced considerably.

Popular heat air-to-air recovery systems include the rotary enthalpy wheel, fixed plate, heat pipe, and run around loop. With the right application, these systems can be cost-effective. The systems described below can both preheat ventilation air in the winter and pre-cool ventilation air in the summer.



▲ *Rotary enthalpy wheel diagram*

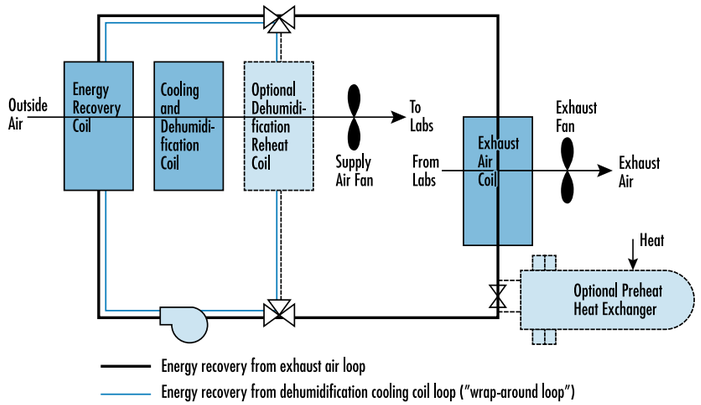
Choosing the right system depends on a variety of factors, including the building's existing mechanical system, location of fresh air and exhaust, and climate.

For laboratories with a significant amount of exhaust that is separated from the actual hood exhaust, the enthalpy wheel may be an option on the general exhaust side. Today, however, more and more owners are using enthalpy exhaust recovery on hood systems as well. Enthalpy wheels transfer energy between the exhaust air and the incoming outside air. The supply and exhaust streams must be located next to each other. The installation cost is reasonably low. In colder climates, the enthalpy wheel is the most efficient heat recovery method, but it can be the most difficult to retrofit into an existing lab building, because it is a large component that requires space (height) and proximity to the fresh air supply and the exhaust air.

For laboratories with fume hood and biosafety cabinet exhaust, the heat pipe and run around loop are good systems to consider. The heat pipe energy recovery system is an efficient and safe method for fume hood exhausts. This system, similar to the enthalpy wheel, requires proximity to the fresh and exhaust air streams and can be challenging in some existing facilities. While not requiring quite the space of an enthalpy wheel for energy recovery, the heat pipe does add some sizable components to a likely already crowded existing mechanical space.

A very popular energy recovery system for many existing lab buildings is the run around loop. Run around loops circulate a fluid between two streams of air, and retrofits involve additional coils and pumps. Although it is less efficient than some of the other measures, doing this still saves

significant energy. This is the most likely system for fume hood exhaust–intensive buildings that have exhaust systems and makeup air systems at opposite ends of the building or side by side. The run around loop requires that a coil be added to the air handling supply side and another coil be added to the exhaust manifold. Selecting the appropriate heat recovery system, designing the system correctly, meeting the applicable codes, and commissioning are all essential to a successful retrofit.



Recommissioning

If replacing an existing mechanical system in a laboratory facility is not feasible, then recommissioning the mechanical system will save energy. As the laboratory building ages, the mechanical systems degrade in operation. Recommissioning focuses on optimizing the HVAC system operation and control for the existing building conditions. Studies have shown that the average measured utility savings are about 20 percent, with simple paybacks often occurring in less than two years. Monitoring of energy consumption and optimizing system operation improves system reliability and building comfort as well as energy savings.

Indoor air quality

Retrofitted mechanical systems need to provide a high standard of safety, good indoor air quality, and low noise levels, as well as energy savings. Maintaining consistent indoor air quality is essential for "green" laboratories and can be challenging due to the varying lab types and usage. Design strategies include VAV fume hoods, carbon dioxide sensors for larger occupancies, and usage of materials with low pollutant emissions (low VOC).

VAV fume hoods - BL3 biocontainment laboratories, UMass Medical School. Goldman Reindorf Architects, Inc.

Insulation

The building envelope is a major contributor to the heating and cooling load. Heat moves through the windows and walls, into the building in the summer and out of it in the winter. Better insulation reduces the flow of heat through the building envelope. This is true of any building type, including labs and science facilities. Upgrading the exterior insulation and/or windows in retrofits is an effective way to lower energy consumption.

New exterior metal insulation panels - Renovation of Enseco, Inc. corporate headquarters, laboratory and office building. Goldman Reindorf Architects, Inc.

Lighting controls

Retrofits for laboratories should include "smart lighting" systems that incorporate daylight-responsive and occupancy-sensor lighting. These lighting systems save on energy because less lighting is used and the air-conditioning loads are reduced. Payback in energy savings for installing new lighting controls can be as quick as one year, especially when reinforced by utility incentives. The most basic and cost-effective measure for reducing lighting energy costs is to simply use high-efficiency fixtures, lighting schedule control, and occupancy sensors. Lighting reduction is also a strategy. If the amount of light needed can be reduced, removing unnecessary fixtures can achieve electrical energy savings.

Equipment

In comparison to other institutional and commercial buildings, laboratories have unusually high plug loads, which is the energy required to run equipment such as servers, centrifuges, or other unusual devices. Unplugging equipment that is not in use and utilizing the energy savings settings can go a long way in reducing energy demand.

It is not unusual for laboratory equipment to be continuously running even though it might be needed for only a short period of time. Laboratory personnel should shut off lab equipment when it is not in use, or automatic shutoff features can be installed. Simply ensuring that lab users are aware of energy saving practices can contribute to energy reduction. Energy-inefficient equipment such as old refrigerators should be replaced with Energy Star–rated equipment. Often a percentage of this cost is covered by utility rebates.

Water use reduction

When renovating laboratory facilities, auxiliary spaces should also be designed for energy conservation. Water use reduction can be obtained by installing low-flow plumbing fixtures and other means such as occupancy sensors and controls.

LAB DESIGN & FURNISHINGS

Cost and payback considerations

Obviously replacing an entire HVAC system for a laboratory facility is a significant investment, and building owners and managers would want significant energy savings and concomitant cost savings as a result of their investment. For installing a new highly efficient HVAC system, paybacks of five to seven years are not unfeasible. If the systems are already in need of repair or replacement to begin with, paybacks on energy measures become even more attractive.

Retrofits to fume hoods to reduce airflow can cost up to several thousand dollars per fume hood. This is approximately 10 to 20 percent of the price of buying new energy-efficient fume hoods, resulting in paybacks of only a few years.

Installing heat recovery systems will provide significant energy savings and environmental benefits. The enthalpy wheel can save around 50 percent of gas used, with even higher savings in colder climates. Heat pipes and run around loops can achieve between 35 and 40 percent of gas savings, which translates into considerable monetary savings, estimated to be $1 to $1.50/CFM annually, again depending on climate and utility rates.

Some green building initiatives for laboratories can be implemented for minimal cost and produce an almost immediate payback. Utility companies are anxious to support such energy savings initiatives with significant rebate incentives.

For instance, in Massachusetts, institutions that upgrade to energy-efficient technologies such as water heaters, lighting, lighting controls/sensors, chillers, furnaces, boilers, heat pumps, central air conditioners, and energy management systems/building controls can obtain a variety of rebates through their local utility providers. Rebates are much greater than those offered even five years ago and can approach significant mid-six-figure sums for aggressive energy reduction.

Design for daylight

Along with the evaluation of the mechanical systems it can involve, greening the older lab can incorporate rethinking the organization of spaces to bring in daylight and allow for flexibility. Integrating daylight into lab spaces is an important goal for reducing energy requirements (both electrical and heating) as well as improving aesthetics and ambience. Daylight has also been shown to improve employee performance and productivity.

Bringing daylight into laboratories can be challenging when retrofitting existing facilities, but there are design methods to achieve this goal. The design trend toward open laboratories facilitates better 'day-lit' spaces. For

▲ *Design for daylight - Building 54 - Massachusetts Institute of Technology. Goldman Reindorf Architects, Inc.*

major retrofits, an organized layout should locate laboratories along the building exterior to provide natural light and views. Research support spaces and offices can be located along a central corridor, with windows providing visual access into the laboratory space. For interior laboratories that cannot be reconfigured, or for enclosed laboratories, existing walls can be retrofitted with glass openings wherever possible to bring in light.

Space utilization

There has been a change in teaching and research methods over the past few decades to an increasingly team-oriented and interdisciplinary approach. Reconfiguring individual labs to combined larger rooms with multiple modules can be incorporated in design retrofits to reduce the amount of space required.

Often wet lab areas can be decreased, classroom space in academic facilities concentrated, laboratories combined, and new types of workstations designed to allow for ancillary spaces such as break rooms, conference rooms, or informal gathering areas where people can interact outside their labs. This flexible use of space and sharing of resources contributes to energy efficiency.

▶ *Tsai Laboratories - ancillary space. Massachusetts Institute of Technology, Picower Institute.*

Design for flexibility

Now that they are prevalent, multipurpose laboratories and those used for different types of research require systems that can adapt to changing requirements.

The lab and desk furniture systems should be able to accommodate simple and cost-effective changes in services throughout the life cycle of the laboratory. Some strategies are to use the mobile components a furniture system offers, such as under-bench units and modular benches and desk units, fume cupboards, and sinks.

Flexible engineering services allow less expensive changes. There are many types of services frequently provided for in laboratories; these include gas, water, electricity, supply and exhaust air, data and electronic systems, etc.

Labs can have easy connects/disconnects to allow for fast, affordable hookups of equipment and still maintain safety. Current lab design separates services from the benches to overhead service carriers, thus allowing easier changes.

> "Rebates ... can approach significant mid-six-figure sums for aggressive energy reduction."

Materials

Green your laboratory with materials that contain recycled content, as well as materials that are recyclable when they are no longer needed. Sustainable materials could include FSC-certified wood doors and casework, carpet with recycled content, concrete with reclaimed fly ash, rubber tiles, and epoxy counters. Also, to maintain high indoor air quality, specify materials that have low pollutant emissions.

Conclusion

Laboratory facilities are among the most energy consuming of building types, and older facilities are particularly wasteful of energy. There are several strategies building owners or facility managers can employ to reduce energy consumption; they range from small to major retrofits.

While major mechanical retrofits that reduce heating and cooling energy consumption are costly, they have a payback of typically between five and seven years, and as energy costs go up, the payback period will be shorter. Recommissioning to optimize the function of existing HVAC systems can often save a considerable percentage of energy consumption. There are a number of less costly methods to reduce energy consumption, such as installing exterior insulation, retrofitting fume hoods to reduce airflow, installing new lighting, educating tenants and users about energy conservation practices, and taking advantage of rebates offered by utility companies to support such energy savings.

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Mitchell Goldman *received his MA from Washington University. He is a renowned laboratory designer, recognized for his technical expertise and project management skills.* ***Lisa Reindorf*** *is a graduate of UPenn and Columbia University. She is an instructor of Architecture at RISD and known for her ability to create designs that entail reasonable construction costs.*

SURVEY SAYS: ARE YOU IN THE MARKET FOR A CENTRIFUGE?

As one of the earliest scientific instruments, the centrifuge is one of the true workhorse pieces of equipment in today's laboratories. Core centrifuge applications (blood separation, sediment analysis, removal of particles from fluids, biological separations) remain vibrant, but new ones have emerged, particularly from molecular biology and biochemistry.

If one trend stands out in these markets, it is that sample sizes are shrinking; flasks have given way to ever smaller tubes, vials and microplates.

Centrifugation has come a long way since the process was first commercialized for laboratory use in the 1940s. Today, materials such as aluminum alloys and titanium are used in order to withstand high centrifugal forces. Standard features now include processes for cooling, programming, automatic imbalance detection, noise reduction and changeable rotor systems.

Vacuum systems have also been added to modern centrifuges to reduce friction and maintain temperature control. The development of other tools, such as electron microscopes, has allowed researchers to better examine and investigate the particles being centrifuged.

With research into proteins and cell nucleic matter becoming more important and gaining pace all the time, the centrifuge will continue to be a vital piece of laboratory equipment for the foreseeable future.

Eighty-six percent of respondents are currently using a centrifuge in their labs and another five percent are planning to purchase a centrifuge.

Yes (currently using)	**86%**
No, but planning to purchase	**5%**
No, and no plans to purchase	**9%**

More and more applications are moving from floor to bench—the same performance associated with floor models can now be found in benchtop units, including microprocessor control, energy efficient motors, and the use of composite materials. One out of five respondents currently use a benchtop centrifuge and another 23 percent are planning to purchase a benchtop centrifuge.

	Currently using	Purchasing
Benchtop centrifuge	**22%**	**23%**
Microcentrifuge	**20%**	**7%**
Benchtop refrigerated centrifuge	**17%**	**12%**
Benchtop clinical centrifuge	**14%**	**15%**
Floor refrigerated centrifuge	**8%**	**8%**
Benchtop ultracentrifuge	**7%**	**11%**
Floor ultracentrifuge	**6%**	**14%**
Floor centrifuge	**5%**	**7%**
Other	**2%**	**3%**

Samples will either spin at a fixed angle relative to the rotating axis or "swing out" to perpendicular under centripetal force as the rotor speed increases. Forces generated as the rotor spins cause components in the sample to migrate toward the bottom of the sample tube, according to weight or density. Most survey respondents are using, or are planning to purchase, centrifuges with RPMs of 7,500 or less.

	Currently using	Purchasing
0 – 7,500 RPM	**39%**	**38%**
7,500 – 10,000 RPM	**20%**	**10%**
10,000 – 15,000 RPM	**22%**	**21%**
15,000 – 20,000 RPM	**10%**	**11%**
20,000+ RPM	**8%**	**21%**

Swinging-bucket rotors and fixed-angle rotors are the two most preferred centrifuge rotors.

	Currently using	Purchasing
Swinging-bucket rotors	**46%**	**39%**
Fixed-angle rotors	**47%**	**40%**
Vertical rotors	**7%**	**19%**
Other	**1%**	**2%**

Most survey respondents have an annual purchasing budget for maintenance and consumables (tubes and rotors) of $2,000 or less.

Less than $500	**41%**
$500 - $2,000	**36%**
$2,000 - $5,000	**14%**
$5,000 - $10,000	**7%**
$10,000+	**3%**

Forty-seven percent of the respondents who are planning to purchase a centrifuge are looking to replace aging equipment.

Replacement of aging centrifuge	**47%**
Addition to existing systems; increase capacity	**22%**
Setting up a new lab/Developing a brand new method	**19%**
Require more speed (g-forces) and capacity	**9%**
Changing from the current type of centrifuge	**2%**
Other	**1%**

There are two main groups of centrifuge purchasers: those who perform routine work and those who value flexibility. The first group includes technicians in environmental or blood processing labs relying on a limited number of protocols; members of the second group are more science-oriented. They look for instruments capable of evolving with the laboratory. These customers consider the centrifuge as more of an investment than a routine tool.

What type of centrifuge is best to follow the evolution of the laboratory?	**32%**
How do I select the appropriate centrifuge tube for the centrifuge I am purchasing?	**18%**
What are the considerations for selecting a centrifuge that increases the speed (g-force) and capacity?	**16%**
Can I get the features and function of a floor-standing centrifuge in a benchtop?	**16%**
Plastics and composites vs. metal rotors: which makes the most sense for my lab?	**14%**
Other	**4%**

Centrifuges tend to be inexpensive compared with other high-use lab instruments. Prices can range from $300 for unrefrigerated, single-speed mini-centrifuges up to about $6,000 for high-speed, refrigerated benchtop instruments. A majority of respondents have a budget range of $1,000 to $5,000 for the purchase of a new centrifuge.

Less than $1,000	**17%**
$1,000 - $5,000	**34%**
$5,000 - $15,000	**31%**
$15,000 - $50,000	**14%**
$50,000+	**4%**

Lab professionals are looking for centrifuges that deliver outstanding performance and reliability in the lab that meet their application needs and follow the evolution of the laboratory. Other factors and features important to lab professionals include low maintenance, ease of use and safety.

Important in the decision-making process	
Low maintenance/operating costs	**95%**
Reliability	**95%**
Ease of use	**92%**
Price	**89%**
Safety features	**88%**
Warranty	**84%**
Service and support	**79%**
Accuracy	**77%**
Noise reduction	**70%**
Fast acceleration	**66%**
Ease of installation	**65%**
Small footprint/size	**64%**
Fast stopping	**63%**
Type of centrifuge rotor	**60%**
Energy efficiency	**50%**

Field of work that closely aligns with respondent's labs:

Biochemistry and biology	**25%**
Clinical and blood banking	**21%**
Chemical	**10%**
Microbiology	**10%**
Pharmaceutical industry	**8%**
Environment	**6%**
Food and related products	**4%**
Other	**18%**

➔ **For more information on centrifuges, visit www.labmanager.com/centrifuges**

Completed Surveys: 264

PRECISION WEIGHING FOR STATIC, DYNAMIC APPLICATIONS

by Angelo DePalma, Ph.D.

Laboratories have numerous weighing options, including sliding-scale mechanical balances, top loaders, and analytical balances. The latter, which are accurate to at least 0.0001 g or 0.1 mg, represent the highest precision weighing standard for general use. Analytical balances also excel at quantifying changes in mass, for example as a result of evaporation, deposition, gas evolution, and hydroscopicity.

Software built into balances is a huge time-saver, says Tom Delano, business development manager at Adam Equipment (Danbury, CT). Software that performs calculations such as density or mass differences save operators many hours over the course of a work week.

Sources of error

Because their mechanisms are delicate, analytical balances are sensitive to almost any mechanical or environmental disruption. Some of the more common sources of sample-associated error include condensation on cold objects, evaporation of volatile fluids, chemical reactivity (e.g., rapid corrosion), and convection from hot/cold objects. Systemic or external errors arise from drafts, temperature changes, vibration/movement of the instrument or its environment, and static electricity.

Depending on usage, balance calibration may be carried out every few weeks or as frequently as twice during a shift. Lab workers should consider recalibration after noting fluctuations of more than about half a degree, moving the instrument, or disconnecting it from the wall socket.

Analysts should take special precautions to ensure weighing accuracy. Users are urged not to handle samples with their bare hands, lest oils and moisture from the skin add to the sample's weight; leaning on the bench during weighing is another taboo, since vibrations can cause shifts in the balance's mechanism.

Features to look for

A single-cell, or "uni-block," weighing mechanism is becoming standard for high-end balances, particularly for labs that make repeated measurements that demand high accuracy. In a single-cell mechanism, the weighing pan consists of a single block that provides constant temperature, shorter stabilization times, and shock-proofing. Single-cell weighing is accurate even when the sample is placed at the edge of the weighing pan.

"Single-cell is an advanced technology with fewer moving parts than conventional balances," says Rachel Kohn, Ph.D., a partner at Tovatech (South Orange, NJ). "This means the balance lasts longer [and] has shorter stabilization times, and corner-load performance is improved because response is uniform over the surface of the weighing pan."

Another feature, drift compensation, is useful for labs that perform weighing experiments over very long time periods or perform kinetics experiments involving the gain or loss of mass or whose sample masses change regularly over time, e.g., through evaporation. Automated drift compensation will change the baseline constantly and linearly, and only record changes that occur suddenly. Users can also program the balance to adjust for planned additions or withdrawals from the sample.

Other desirable factors to consider before purchase, according to Dr. Kohn:

- Absolute capacity and resolution: how much are you weighing, and to what degree of accuracy?
- Do you need internal or external calibration?
- For very accurate work, buyers should consider a semi-micro analytical balance, with a resolution of 0.00001 g, or 0.01 mg, an order of magnitude higher than for standard analytical balances.
- Availability of accessory sets for determining densities of solids or liquids.
- Compatibility with GLP/GMP (pharmaceutical industry best practices) or ISO record-keeping through a standard computer-printer interface. These standards require time/date and balance identification stamping of every measurement.
- Automated calibration, which initiates at preset times or in the event of a potential interference such as rapid temperature change. Make sure the balance is "smart" enough not to begin calibrating in the middle of a weighing.

According to Ann Crowley, product manager at Rice Lake Weighing Systems (Rice Lake, WI), analytical balance technology, applications, and instrumentation are continuing to evolve despite the fact that weighing is a mature technology. Ms. Crowley identifies two significant trends.

The first is the move away from internal (software-controlled) to external (manual) calibration. External calibration models tend to be less expensive than internal models but require time and effort on the part of operators.

The second, computer connectivity, can take the form of traditional RS-232 connections, USB, Ethernet, and even wireless.

Connectivity with data repositories and other instrumentation is critical, says Tom Delano, because these days technicians and lab workers are collecting more data than ever before. "It's virtually impossible to generate all those numbers, include them in reports as error-free as possible, without computerization."

Since balances are often used repeatedly (sometimes constantly) throughout the day, Mr. Delano suggests purchasers seriously consider ergonomics, usability, and the human interface in their purchase decisions.

But at the end of the day, he says, "it all comes down to product performance, and the simple truth that a balance is used to take mass measurements."

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SURVEY SAYS: ARE YOU IN THE MARKET FOR A REFRACTOMETER?

A refractometer is an optical instrument that is used to determine a concentration of a particular substance within a given solution. The measure of how much the speed of light is reduced when traveling through a substance such as a gas, solid, or solution is referred to as the refractive index (RI). On obtaining the index, you can calculate different properties of the element, such as the concentration of blood protein, sugar content or salinity.

There is an angle of light at which refraction no longer occurs; the light beam instead is reflected back into the original material. This is called the critical angle. Critical angle is the result of light interfacing at two mediums.

It is equally important to note that the critical angle and refractive index are both closely related to the temperature of the liquid. The refractive index of a liquid at 20°C will be different from the refractive index of the same liquid, at the same concentration, when the liquid is heated to 90°C. Accurate temperatures for the process to be measured are therefore necessary for achieving an accurate measurement.

Refractometers have become fairly common over the past few decades in various industries: water treatment, chemistry, biology, foods, beverages, brewing and viticulture, paints, lubricants, personal care products, pharmaceuticals and many others.

Survey respondents' primary applications for refractometers:

Pharmacy, Medicine, Biotechnology	21%
Food and Beverage	20%
Chemical Industry	13%
Education, Research	13%
Environmental	5%
Fragrance, Cosmetics, Personal Care	3%
Petroleum	3%
Minerals, Mining, Raw Materials	2%
Other	19%

There are currently four types of refractometers:

- Traditional manual handheld devices are widely used by respondents
- Digital handheld devices are used by 11 percent of the respondents, but their compact size, excellent water-resistant properties, tolerance for extremely high temperatures and almost instant measurements make them one of the fastest-growing devices
- Laboratory or Abbe refractometers are benchtop devices used for solids and special fibers because they offer a much wider range and higher accuracy than that of handheld refractometers
- Inline process refractometers are designed for the continuous measurement of a fluid flowing through a pipe or inside a tank

Types of refractometers respondents are using:

Manual Portable	39%
Digital Benchtop	26%
Abbe (manual) Benchtop	22%
Digital Portable	11%
Other	2%

In purchasing a refractometer, lab professionals need to know:

- The range of readings (highest to lowest), to make sure it will suit their purpose.
- The ease with which the refractometer can be read and understood.
- The calibration temperature of the refractometer.
- How easy it is to calibrate. Must you purchase a calibration liquid, or can you calibrate with distilled water? Does it calibrate with a set screw or a dial or knob?
- How easy it is to clean

Product performance was selected by 100% of the respondents as an important feature in the decision-making process when purchasing a new refractometer.

Important factors/features in the decision-making process	
Product performance – consistent accurate reading	100%
Ease of use	98%
Price	97%
Low maintenance/operating costs	97%
Reputation of manufacturer	91%
Service and support	90%
High resolution	85%
Warranty	85%
Temperature control range	82%
Speed of measurements	80%
Smaller footprint	63%

Refractometers range in size and capability, from handheld units costing a few hundred dollars to full-featured devices that can cost more than $8,000.

Respondents' budgets for the purchase of a new refractometer:

Less than $1,000	24%
$1,000 to $2,500	31%
$2,500 to $5,000	21%
$5,000 to $8,000	10%
$8,000+	15%

Refractometers require calibration in order to give an accurate reading across the four different types of devices. They should be calibrated at the beginning of each use and, depending on how many samples are being measured, periodically throughout the sampling process.

Nearly half of the respondents have a calibration solution with their refractometers.

Calibration Solutions	44%
Printer	28%
Automation	19%
Other	9%

Refractometers must be properly maintained for accurate readings. Respondents' annual budgets for parts, maintenance, service and repairs:

$100 - $999	38%
$1,000 - $1,999	11%
$2,000 - $3,999	5%
$4,000+	18%
Don't know	28%

For more information on refractometers, visit www.labmanager.com/refractometers

Completed Surveys: 334

UNIVERSAL CONCENTRATION METERS

by Angelo DePalma, Ph.D.

Refractometers are instruments that quantify and identify chemicals and materials based on their refractive index (RI). A unique property related to the speed of light as it passes through a substance, RI is defined as the ratio of the speed of light in a vacuum relative to its speed in the test material.

For example, the RI of pure water is 1.33, meaning that light passes through a vacuum 1.33 times faster than it does through water.

Since light also changes direction as it passes from one medium to another, RI is conveniently measured as a function of this unique "angle of refraction." Everyone is familiar with how a partially submerged stick seems to "bend" as it enters water. Refractometers quantify RI by measuring the angle formed by light as it leaves air and enters the test object.

Priced to fit the job

Refractometers range in size and capability, from handheld units costing a few hundred dollars to full-featured instruments in the $10,000 to $15,000 range. Handheld models may be of "traditional" or digital design; higher-end instruments operate on a benchtop or, in some industries, in-line to monitor manufacturing processes.

Refractometers are priced to fit the job and the value of what is being analyzed. A truck driver uses a $200 handheld visual refractometer to check the water content of an ethylene glycol coolant, while a top-of-the-line benchtop unit may be used in food, chemical, or pharmaceutical quality testing.

> "RI is defined as the ratio of the speed of light in a vacuum relative to its speed in the test material."

Refractometry is one of the most versatile analytical techniques. Pure substances that transmit light have unique RIs that change as the concentration of additives changes. For example, the RI rises with increasing sugar concentration since sugar molecules dissolving in water slow light down as it passes through.

As a "universal concentration meter," refractometry serves a range of industries: water treatment, chemistry, biology, foods, beverages, brewing and viticulture, paints, lubricants, personal care products, pharmaceuticals, and many others. Manufacturers routinely use RI to check incoming raw materials as well as complex products used in manufacturing, research, and development.

Refractometers in constant use must be maintained, primarily by cleaning the prism. If this is not done after every test, fluid from the previous run will evaporate, leaving the solute on the prism and distorting the next measurement. "Cross-contamination between samples is another source of error," observes Richard Spanier, sales and marketing director at Rudolph Research Analytical (Hackettstown, NJ). Rudolph Research specializes in benchtop refractometers priced in the $10,000 to $14,000 range.

Protecting the sample during measurement is another precaution. Volatile liquids like alcohol evaporate, which distorts the concentration, while hydroscopic liquids like glycerol can dilute if they pick up water.

A ductless fume hood requires no ductwork, arrives fully assembled, and may be installed in locations where, barring a significant and expensive renovation process, a traditional fume hood could not.

Enabling filter/adsorption technology

At the time of their introduction, ductless hoods were limited by their filtration systems, which tended to be application-specific. "If you used formaldehyde, you needed a filter specifically designed for removing formaldehyde," says Mr. McGough. Ductless designs were therefore marketed to labs that were highly protocol-driven, where one or several operations using the same chemical reagents were carried out repeatedly and exclusively, or to elementary and high school labs. "Dedicated" applications are still the principal market for ductless hoods.

That is changing rapidly with the 2009 debut, from Erlab (Rowley, MA), of Neutradine molecular filtration, a type of super-activated carbon that is nearly a universal chemical adsorber. Neutradine incorporates binding sites for various chemical families, and neutralizes acids as well. Independent tests have demonstrated that this filtration medium removes 98 percent of all chemical fumes used by 99.9 percent of laboratories. Erlab has partnered with Thermo, Airmaster, and ALC Collegedale to supply Neutradine media for ductless hoods.

> "Ductless hoods can save significant operating costs while protecting the environment."

Karl Aveard, VP of GreenFume-Hood Technologies at Erlab, recognizes that environmental health and safety professionals have been wary of ductless hoods and that the technology may not be appropriate for heavy-duty organic chemistry or isotope labs. "A bias has developed over several decades against filtration versus venting," he admits.

Thermo's Jon Sboralski puts it succinctly: "The idea makes people queasy, and that's totally expected."

But Erlab has worked hard to convince users and facility personnel that ductless hoods are for real. "We have installations at a number of top universities and are working closely with the EH&S community as well as architects and lab planners. So far they like what they see and plan to be early adopters."

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INNOVATION AT HIGH, LOW ENDS OF INSTRUMENT SPECTRUM

by Angelo DePalma, Ph.D.

In response to reduced reliance on core lab services, manufacturers of flow cytometers have been busily upgrading instrument capabilities for expert and casual users. We have seen this trend before, notably in high-priced instruments like nuclear magnetic resonance and mass spectrometers.

> "Labs that do not require the high level of sophistication of five-, six-, and seven-laser instruments benefit from running sorting or counting experiments themselves."

Toward this end, BD Biosciences (San Jose, CA) has launched a non-core four-laser cell analyzer that detects up to 18 colors, as well as a seven-laser cell sorter that paves the way for six-way sorting (for six distinct cell populations) in core labs. Similarly, BD has created an upgrade path for its Aria line of cell sorters, from three or four lasers to six or more.

"This means that users who are experienced users can experience higher throughput and get more information out of their experiments," notes J. Clark Mason, Ph.D., senior director for research instrumentation at BD.

Core vs. individual lab models

Dr. Mason resists the temptation to call any flow cytometer with two or more lasers a "desktop" instrument. "In my opinion, desktop means something that takes up about a square foot and can easily be moved."

For Dr. Mason, the cutoff or distinguishing characteristic of core lab vs. individual group instruments is not so much size as capability or instrument complexity. It all comes down to economics and usage. It generally makes more sense, particularly if an instrument will not be used around the clock, to install a half-million-dollar flow cytometer as a core instrument. "Flow cytometers with five- to seven-laser capability are almost always found in core labs, where the workflows justify the capital equipment cost. Research labs tend to operate more economically."

Dr. Mason expects that over the next year BD will continue to "consolidate innovation," with an even greater emphasis on the "extreme ends" of the flow cytometry user spectrum, i.e., what he calls "expert experts" and technician-level operators. The first group of thought leaders, who invent methods and experiment with cutting-edge instruments, thrives on complexity; the second group on usability. "The notion of a ten-laser system makes even my head spin," he admits, "but it is our goal to make flow cytometry accessible to them through compact instrumentation and straightforward workflows. We have a number of such analyzers and sorters in beta testing as we speak."

Serving both ends of the market

Similarly, Accuri Cytometers (Ann Arbor, MI) believes manufacturers must simultaneously serve the needs for complex, multicolor analysis and what VP of Marketing Grant Howes calls "bread and butter analysis with four colors or less, which constitutes the vast majority of current work." Instruments and methods serving the latter market segment need to be easy to learn, use, and teach; be highly reliable; and have a low cost of ownership across the lifecycle.

"Miniaturization and standardization have become critical for reaching

these less sophisticated users," Mr. Howes says.

Instrument makers have done a good job of serving this group, which, according to Mr. Howes, has "broadened the user base of flow cytometry" while freeing core lab resources for more complex experiments, where their cost and operator expertise are more justified. Accuri's C6 flow cytometer is an example: a system featuring two lasers (red and blue), four-color detection, computer control, and computer control/data analysis.

Labs that do not require the high level of sophistication of five-, six-, and seven-laser instruments benefit from running sorting or counting experiments themselves: Results are obtained in minutes vs. hours or days, and personnel acquire hands-on experience with flow methods. Facilities gain as well, since core instrument operators, who tend to be experts, are now free to pursue data analysis and other "brain" work.

Purchase decisions

When scouting an FC purchase, buyers should seek the "best fit for function," according to Mr. Howes.

Users running simple assays involving cell viability or counting often do not require a high level of sophistication. "These purchasers should balance ease of setup, of running samples, and [of] acquiring/analyzing data against cost of use and investment in learning to use the instrument."

"Users should be able to operate a two-laser system within a few hours of opening the box."

Users should be able to operate a two-laser system within a few hours of opening the box; more-complex instruments may require a three-to-four-day training course.

Data features are critical: For example, must the instrument be networked? Need it be compatible with third-party data storage or analysis applications?

Finally, Dr. Mason of BD encourages potential buyers to analyze their current and future cytometry needs in light of their technical expertise and to budget accordingly.

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SURVEY SAYS: ARE YOU IN THE MARKET FOR A WATER PURIFICATION SYSTEM?

Water is the most commonly used laboratory reagent; however, the importance of water quality is often overlooked. Because impurities can be a critical factor in many research experiments, water purity ranks high in importance. There are several types of impurities and contaminants in water such as particulates, organics, inorganics, microorganisms and pyrogens that can adversely affect results.

Achieving water of a high quality requires the careful use of purification technologies and a method for accurately measuring and monitoring contaminants.

Trends in laboratory water purification technologies are dictated by:

- Advances in instrumentation or applications toward higher sensitivity and analyte selectivity
- The existence of "emerging" contaminants in tap water that may not be efficiently removed by existing purification technologies
- Smaller analysis volume requirements

Water purification has come a long way in a short time since the first filtration and membrane systems of the twentieth century. Purified water, in particular, serves a variety of operations and applications, from wet chemistry to instrumental analysis.

Number of water purification systems respondents are currently using in their labs.

None	6%
1	50%
2	24%
3 or more	20%

There are several feed sources for purifying water in the lab. The most commonly used method is "raw potable," which is used by nearly 50% of the respondents.

Raw potable	48%
Deionized	17%
Distilled	10%
Reverse osmosis	12%
Di/RO	9%
Other	3%

Lab water purity is classified into three different types (based on the ASTM system of grading water purity): Type 1 (the purest), Type 2, and Type 3. Type 1 ("ultrapure") water, which is the most expensive to produce, is used for highly sensitive analytical techniques with very low detection limits, such as HPLC, LC-MS, GFAA and ICP-MS. Type 2 water is used in general laboratory applications such as buffers, standard pH solutions and microbiological culture media preparation, as well as to feed clinical analyzers and cell culture incubators. Type 3 water has the lowest purity of the three types. It is recommended for glassware rinsing, heating baths, filling autoclaves, and to feed higher-grade lab water systems. Most of the respondents use Type 1 water in their labs.

ASTM Type I	53%
ASTM Type II	33%
ASTM Type III	11%
Other	3%

Once pure water has been produced, it must be validated and then carefully stored and maintained to ensure that its quality does not deteriorate. To ensure that water quality is maintained, the following components are also used in the lab.

Dispensing points	57%
Storage tank	56%
Water quality monitor	53%
UV sterilizer	43%
Polisher	34%
Distiller	25%
Water softener	16%
Other	6%

Respondents' annual purchasing budgets for water purification system supplies/accessories such as filters.

Less than $2,000	42%
$2,000 - $5,000	35%
$5,000 - $10,000	16%
$10,000+	7%

Forty two percent of respondents who are planning to purchase a water purification system are looking to replace aging equipment.

Replacement of current water purification system	42%
Setting up a new lab	27%
Addition to existing systems; increase capacity	24%
First-time purchase of a water purification system	5%
Other	2%

The price of a water purification system ranges from less than $5,000 for a simple single unit instrument to over $30,000 for a complete system that combines pre-treatment and polishing in one unit, and produces Type 1 water directly from tap water. Complete systems eliminate disadvantages of central water purification systems that serve as a pre-treatment step. Complete systems are popular in large R&D organizations such as pharmaceutical companies.

Respondents' budget ranges for a new water purification system purchase:

Less than $5,000	30%
$5,000 - $10,000	22%
$10,000 - $15,000	18%
$15,000 - $20,000	15%
$20,000 - $30,000	5%
$30,000+	10%

Price and budget are always considerations at the point of purchase; however, when choosing a laboratory water purification system, the method must be matched with the application. You need to consider your application, the amount of water you need for your application, and the existing condition of your feed water. Hand in hand with the proper method is the consistency of the pure water. All water purification systems may produce the highest purity of water, but not all have features that ensure high-quality water is produced consistently.

In addition, when considering a water purification system, both the quality and the quantity are important. You should take into account instantaneous as well as daily water volume requirements. For labs that have variable demands on quality and quantity, flexibility and modularity become very important. After choosing the right system, performing regular, preventative maintenance is equally important. Newer models have built-in alarms and calibrators that warn customers if certain components are coming to the end of their life cycles.

Important in the decision-making process	
Water quality	99%
Durability of product	97%
Low maintenance; Easy to clean	97%
Availability of supplies and accessories	95%
Ease of use	94%
Price	90%
Service and support	88%
Warranties	82%
Self-monitoring	78%
Safety and health features	68%
Footprint/size	65%

Field of work by respondents.

Hospital/Medical center	18%
Biochemistry and biology	16%
Environment	15%
Pharmaceutical industry	12%
Chemical	10%
Microbiology	8%
Food and beverages	7%
Other	14%

For more information on water purification, visit www.labmanager.com/water-purification

Completed Surveys: 398

EVOLUTION OF LABORATORY MILLS AND GRINDERS

BY JOHN BUIE

The process of grinding and milling is essential in many laboratory situations. Certain solvent-free reactions are conducted, for example, by the fine grinding of reagents together in a vessel to ensure close contact of individual particles. Grinding or milling is also essential to ensure that a sample is fully homogeneous before it is analyzed. Analyzing a sample that has not first been ground can produce misleading results, as the particular sample chosen may not be compositionally representative of the entire sample. It is for these reasons that many laboratories use some form of lab mill or grinder.

The basic action of milling and grinding has been used since the beginning of time. However, over the years, the tools used to grind materials have become more sophisticated, allowing particles of decreasing diameter to be produced within increasingly short periods of time. Much of this development was focussed on large-scale mills for mining and other industrial processes. This article gives a brief outline of some of the most important stages in the evolution of mills and grinders specifically for use in the laboratory.

EARLY DEVELOPMENT

The process of grinding and milling has its origins in prehistoric times, when early humans pounded grains and nuts with stones to free the kernel from the hard protective shell. The earliest dedicated tools for this task are the mortar and pestle, which were developed during the Stone Age and have remained essentially unchanged throughout history. By around 2000 BC, the saddlestone mill had been invented, incorporating a horizontal fixed stone over which a moving stone was moved forwards and backwards. Corn and other materials could be ground more finely using a saddlestone.

Millstones, including the saddlestone, were the predominant grinding tools used until about 2500 BC, when the rotary quern was invented. The quern required a circular motion, which was much easier to maintain than the back-and-forth motion of the saddlestone. Although the particles produced from the quern were not as fine as could be achieved with the saddlestone, the quern became very popular because of its increased ease of use.

Around 1500 AD, the grinding of minerals was revolutionized when high demand for metals led to the development of water-driven stamp mills for grinding large volumes of pebbles into small particles. At this time, stamp mills were developed in which the pebbles were shattered by impact from a pounding hammer.

1850-1900

It was during the second half of the nineteenth century that jaw crushers, ball mills and air classifiers were developed. At the same time, high-capacity machines for ores and cement were introduced, with Schranz inventing the roller mill for grains in Germany in 1870. A patent for a beater cross mill with hinged hammers was granted to H. Currier in Great Britain in 1875.

Grinding machines became more precise during this time, allowing greater control over the final particle size and allowing grains and minerals to be ground incrementally.

1900-1920

During the early twentieth century, the introduction of electricity dramatically improved the technology of size reduction. The first two decades of the twentieth century saw the invention of vertical roller mills, as well as autogenous pebble mills in which rocks are thrown into a rotating drum, causing impact breakage of larger rocks and compressive grinding of finer particles. Rake classifiers were also introduced during this time to separate the fine particles from the coarse.

In 1909, the first patent for cryogenic breakage was granted to Gaston Galy. Cryogenic breakage employed liquid air to cool the sample before crushing to make it more brittle and increase the crushing efficiency.

1920

In **1922**, Dr. Andrew Szegvari devised a brand new type of mill to create the extremely fine sulfur dispersion he required for rubber vulcanization in his new liquid latex process. He had discovered that conventional ball milling methods took too long to deliver the fineness he required. Szegvari developed a mill based on the dynamics of grinding media in random motion, now known as Attritor grinding and dispersing. This breakthrough marked the beginning of a new era in milling technology. In 1946, Szegvari went on to found the company Union Process, which is still in existence today.

In **1923**, Retsch developed the company's first piece of laboratory equipment, a mortar mill. This mill became known as the Retsch Mill, and is still in demand and highly regarded for enabling easier and better sample preparation.

In **1928**, a patent was issued for Loesche GmbH's roller mill by the Reichspatentamt in Berlin.

1940

Also in **1928**, a patent for the original vertical stirred ball mill was issued. This type of mill tends to be used for low-capacity, non-abrasive applications.

In **1930**, the first vibrating mills were introduced. In this type of mill, a mechanical vibrator causes a drum to perform circular vibrations of high speed and small radius for the low-output milling of materials of moderate hardness. Very small particle sizes can be produced with a vibrating mill.

In **1950**, the jet mill was invented. The Jet Pulverizer Company, Inc. was awarded one of the original patents for jet energy milling equipment, an instrument which has now evolved into the Micron-Master® mill. In a jet mill, the process material is driven at near sonic velocity around the perimeter of the mill by jets of air or steam. No grinding media are involved. Jet mills are available in a range of sizes, from laboratory scale to high-capacity production sizes.

1960

In the early **1960s**, Willy A. Bachofen (WAB) introduced the TURBULA® mixer worldwide. The TURBULA is a three-dimensional shaker mixer used for the homogeneous mixing of powdery substances of different weights and particle sizes. The efficiency of the TURBULA mill was achieved by a combination of rotation, translation and inversion motions.

In **1961**, Fritsch GmbH registered its first patent for a laboratory planetary mill with cantilevered grinding bowls. Planetary ball mills can be considered the 'workhorse' laboratory mill, ideal for rapid and loss-free grinding of laboratory samples. Planetary ball mills are able to crush all manner of materials, including soft, elastic, hard, brittle and fibrous samples. They are also able to mix and homogenize emulsions and pastes.

At the end of the **1960s**, WAB introduced the DYNO®-MILL, the first agitator bead mill with a completely enclosed horizontal grinding cylinder. In the DYNO-MILL, specially designed agitator discs mounted symmetrically on a shaft transfer the energy required for wet milling and dispersion to the spherical grinding beads.

In **1975**, centrifugal mills were invented for ultra-fine grinding by exploiting centrifugal forces generated by gyration of the axis of the mill tube in a circle. The mill charge motion depends on the ratio of the gyration diameter to the mill diameter, varying from a motion similar to that of a conventional tumbling media mill to that of a vibration mill.

In **1975**, computer-control techniques were introduced for grinding circuits, improving control over grinding and milling.

In **1982**, Daesung Chemical Machinery Ind. Co. developed a pilot Dyna Mill for ultra-fine wet-grinding and dispersing applications in the laboratory.

In **1984**, a U.S. patent was granted for the horizontal media mill, which represented an improvement over previous vertical mills. The horizontal mill allowed a high degree of fineness/dispersion without clogging the mill itself.

In **1993**, high-speed horizontal disk mills were developed for the rapid production of fine particles or dispersions.

In **1995**, Fritsch GmbH invented and patented the planetary mono-mill, a single station planetary ball mill equipped with only one grinding station.

In **2000**, Daesung Chemical Machinery Ind. Co. developed the 'Mystery super Dyna Mill', capable of producing ultra-fine particles up to 0.169 µm in diameter by combining three distinct dispersing and grinding principles. Products prepared with this mill are reported to show an unsurpassed degree of fineness, an extremely narrow particle size distribution and consistent particle shape.

The PULVERISETTE 5 planetary ball mill from Fritsch.

1980

In **2001**, Daesung Chemical Machinery Ind. Co. developed the 'ultra-micro-fine impact' mill, a high-performance, dry-grinding and size-reducing pulverizer for ultra-super-micro-fine powder.

The MM400 mixer mill from Retsch.

THE FUTURE OF LABORATORY MILLS AND GRINDERS

With the current level of interest in nano-technology, there is an impetus to develop particles on a smaller and smaller scale. New mill designs, as well as existing mill types such as planetary ball mills, are currently helping scientists and engineers advance nanotechnology by providing a consistent way to produce nanoscale powders. On the laboratory scale, mills will continue to be developed and refined, allowing researchers to produce particles that are even smaller, with a uniform shape and narrow size distribution.

2000

In **2005**, a patent was filed for a bladeless mixer/mill for agitating and mixing compounds and products.

In **2006**, Fritsch GmbH introduced its premium line of planetary mills, which offered higher performance and capacity, improved operation and greater safety than planetary mills available at the time.

The Model 6870 Freezer/Mill® from SPEX SamplePrep.

In **2007**, SPEX SamplePrep LLC introduced the Model 6870 Freezer/Mill® for samples that cannot be ground at ambient temperatures, such as polymers, wood, bone, hair, rubber and plant/animal tissue. Samples were placed in the grinding vial and then immersed in liquid nitrogen to make them brittle before being pulverized. Applications of the Freezer/Mill included DNA/RNA extraction, diffraction studies of soft materials and pharmaceutical research.

In **2010**, Fritsch GmbH redesigned its Pulverisette 5 planetary ball mill for a range of sample grinding ideal for mixing and homogenizing emulsions and pastes.

The GM 300 knife mill from Retsch.

In **2010**, Verder introduced the Retsch Grindomix GM 300 knife mill for the grinding and homogenization of foodstuffs for laboratory and analytical requirements. This mill allows the user to process sample volumes up to 4.5 L quickly and reproducibly.

In **2010**, Retsch developed new synthesis methods and mills, including the MM400 mixer mill, to improve the reaction process in mechanochemistry applications. Retsch's MM400 mixer mill offers the possibility of producing sample series and influence ambient conditions, for example, by pre-cooling the grinding jars in liquid nitrogen.

The Model 6970 Enclosed Freezer/Mill® from SPEX SamplePrep.

Finally, in **2010**, SPEX SamplePrep LLC introduced the 6970 Enclosed Freezer/Mill®, which was based on the 6870 model. It included a totally enclosed liquid nitrogen auto-fill system for true cryogenic grinding, while eliminating user exposure to liquid nitrogen.

ASK THE EXPERT

« EXPERT: Emily Anna Bridges

ASK THE EXPERT

HOW TO CHOOSE THE RIGHT WATER PURIFICATION SYSTEM FOR YOUR LAB

by Tanuja Koppal, Ph.D.

Emily Anna Bridges earned her B.A.in Biology and Music in 1999. She worked as a laboratory technician from 1999-2002 in the Infectious Disease Unit of Massachusetts General Hospital in Boston, Mass., where she specialized in the development of new vaccine technologies and immunological diagnostics. She relocated to Philadelphia, Pa., in 2002 to pursue her love of music in the form of a doctoral degree from the University of Pennsylvania, which she finished in 2009. In 2006, during graduate school, she returned to the lab to work as a lab manager for Dr. Gideon Dreyfuss, an HHMI investigator at the University of Pennsylvania Medical School. For the past five years, she has managed a large laboratory and contributed to various research projects related to the study of spinal muscular atrophy, an often lethal genetic disease.

Emily Anna Bridges, laboratory manager in the Department of Biochemistry and Biophysics at the University of Pennsylvania, School of Medicine, shares her harrowing experiences when the aged water purification system supplying water to her research building stopped functioning entirely, after months of causing leaks and contamination problems. She emphasizes the need for a good and reliable source of purified water for research use and touts the benefits of the new point-of-use system that the university has installed in all its labs.

Q: What prompted you to upgrade the water purification system that you had?

A: Our building is a part of the University of Pennsylvania Medical School and has seven floors with labs belonging to different research departments. Our lab is in the Department of Biochemistry and Biophysics, and we study spinal muscular atrophy. We have a large lab with about 30 people, and we have many different things going on in our lab. It's a very fast-paced research environment, and when you have the water quality compromised in such an environment, it's very stressful because we cannot afford to slow down.

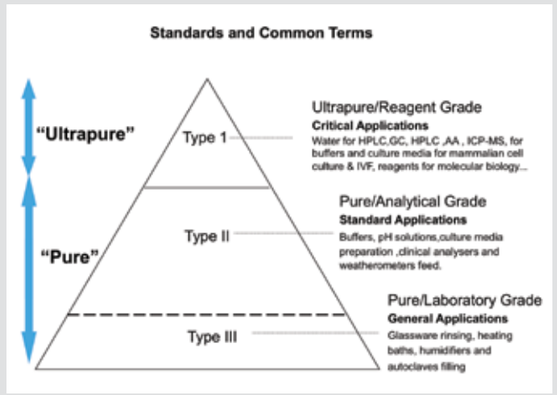
We pursue a lot of different applications involving biochemical assays, tissue culture, high-throughput screening, protein purification and crystallization, flow cytometry, PCR, and immunofluorescence. A lot of these applications, particularly protein purification and crystallization, require very stringent purity conditions. We need polished water for making all our solutions, buffers, media plates, broths and agars. We also need deionized water for rinsing all our lab equipment after it's been washed. What we had in the building previously was a centralized system for deionizing water, and when that failed it caused big problems. Now we have multiple point-of-use systems in our lab, almost one at every sink, and that seems to be working well.

Q: Can you share with us the details of some of the problems that you were facing with your old water purification system?

A: The water purification system that we previously had was about 25 years old and was used for the entire building. We used to have frequent leaks, and many times the water became contaminated. Since we had to deal with these problems constantly, we had a water polisher installed just for our lab so that we could get clean water. But that kept failing, too. When we started talking to other labs in the building, we found out that everyone was facing the same problem. Our water filters were always getting clogged and had to be changed frequently, which was proving quite expensive. Eventually the entire water purification system blew up, the pipes burst and one of the cisterns cracked open. According to our facilities management group, it was a "catastrophic failure." So the centralized deionizing system was deactivated and was later replaced with point-of-use water polishers installed throughout the building. But all this took time. We first started out with just one unit installed per floor, and later these point-of-use systems were installed in each lab.

Q: How long did it take to figure out that something was wrong?

A: When I joined the lab in 2006 as the lab manager, I realized that we were not changing the filters on our water polisher as frequently as we should. So I got a service contract to get the filters changed every six months or so. That worked well for a couple of years. Then we started seeing the purity numbers drop on our polisher. We initially thought that our polisher had gone bad because we had to change the filters so frequently, but then it stopped dispensing water altogether because it was so badly clogged up. This happened a few times, but before we got around to doing anything, the system cleared itself up. May 2010 was when the purification system for the entire building collapsed. Then systems got installed on every floor for common use, and through the fall of 2010 the point-of-use systems got installed in every lab. Now we get really clean water. We still measure the purity of our water very regularly, but we haven't had any failures so far. Our deionized water now is almost at the same purity as polished water. That's been a pleasant surprise.



▲ *Millipore has broken purified water down into 3 categories. The categories should each be targeted at different applications.* Source: EMD Millipore

Q: What are some of the advantages of the new system that you now have in place?

A: One of the advantages of the new system is that you can set it to dispense a fixed volume of water, then go away and come back without having to worry about overflowing and flooding. This saves us a lot of time, money and water too. Also, the maintenance of the water, purification system is all centralized and handled by the Medical School. We have also retired our water polisher in the lab, since the purity of the deionized water is fairly close to that of polished water. So the lab is no longer spending any money from its grant budget for good water. The new water system also saves us a lot of bench space. The tank is installed underneath the sink and sits on one side of the cabinet. So we still have some space to store things, but what really helps is that we now have more work space on the top and around the sink. We have at least 75 percent more space than we used to. The system also has built-in alarms and displays to warn us if anything goes wrong.

Q: Do you have any advice for people facing a similar situation in their labs?

A: Labs that have an aging water purification system need to figure out if they should upgrade their existing purification system or install point-of-use type systems before a major problem occurs. In most labs that work with a centralized water purification system, you don't have much control over the water quality on a daily basis, and if something goes wrong you are at the mercy of the management. With a point-of-use system in your lab you can monitor changes, and if one system fails there are other systems in the lab that you can rely on or other labs in the building that you can go to. Perhaps centralized systems were most cost-effective in past years, but now I would recommend that people look into point-of-use systems as a possibility. Since we switched to the new system, there have been no problems. We now start out with clean water and we have water that we can trust. Water affects everything that you do in the lab, and to have the water contaminated is a lab manager's nightmare, particularly if there is nothing you can do about it. The point-of-use system gives me more control and more peace of mind. There is now one less variable to worry about.

PRESERVING ANYONE?

GUIDELINES FOR THE SAFE USE OF FORMALDEHYDE

by Vince McLeod

From tissue fixation to benchtop perfusions to instrument sterilization to preserving everything from cell cultures to whole animal specimens, formaldehyde is one of the most commonly used chemicals in research laboratories. It is typically used in a 37 percent aqueous solution known as formalin that is sometimes mixed with other chemicals. But improper or careless use can cause a plethora of problems. In this article we will take a closer look at the hazards of formaldehyde and how to safely use this common sterilizer and preservative.

What's the worry?

Plenty! To be blunt, formaldehyde is one of the nastiest chemicals around. For starters, we will examine its physical and chemical properties and the health effects.[1] Formaldehyde is a flammable, colorless gas with a pungent, suffocating odor. The vapor is just slightly heavier than air. It is classed as both a powerful irritant and a sensitizer. It is intensely irritating to mucous membranes, and its presence is easily felt even in very low concentrations. Published studies have shown the odor threshold is well below one part per million (ppm).[2,3] The eyes, nose and throat are first to feel the tingling and then irritation. High concentrations, above five ppm, are not tolerated by most individuals. You can experience severe tearing in the eyes as well as coughing and irritation of the upper respiratory tract.

What most people fail to note is that formaldehyde is also a sensitizer. This means that the irritating effects, especially from low-level concentrations, which are so easily felt upon initial exposure, will gradually subside with continued exposure as the senses become fatigued and the chemical's numbing effect takes over. We have met many employees not wanting to be labeled complainers that tell us they just "tough it out" for a few minutes and the feeling goes away. They just do not understand that they are still being exposed.

> "Formaldehyde is one of the nastiest chemicals around."

Formaldehyde is also a skin irritant and may cause dermatitis and possible allergic reactions from repeated exposures due to skin sensitization. Vapors or solutions may cause pain, white discoloration, roughness and burns. In exposed individuals, subsequent exposures may result in a sensitization dermatitis characterized by the sudden eruption of blisters on the eyelids, face, neck, scrotum and arms. Prolonged or repeated exposures may cause burns, numbness, itching rash, fingernail damage, hardening or tanning of the skin, and sensitization. Absorption through the skin also adds to the total exposure.

What's the harm?

Potentially serious health effects can result from formaldehyde exposures. In addition to the mucous membrane and skin effects, which are largely reversible upon one's removal from the exposure, formaldehyde can cause biological effects. These range from central nervous system depression to kidney and liver damage, reproductive and fetal effects, and cancer. Repeated or prolonged low-level exposure may cause headache, rhinitis, nausea, drowsiness, respiratory impairment, kidney injury and pulmonary sensitization. Neuropsychological effects may include sleep disorders, irritability, altered sense of balance, memory deficits, loss of concentration and mood alterations. Menstrual disorders and secondary sterility have occurred in women.

LAB SAFETY

SAFETY TIP

FORBID SMOKING, EATING AND DRINKING IN THE LABORATORY

By James A. Kaufman

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

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

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

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

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

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

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

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

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

Formaldehyde is listed by EPA, NIOSH, OSHA and others as a suspect human carcinogen.[1,3] EPA considers formaldehyde a probable human carcinogen (cancer-causing agent) and has ranked it in its Group B1. Long-term exposure may increase risk of upper respiratory tract cancers, including those of the nasal cavity and sinuses.

What should you do?

First and foremost, you need to determine where and how formaldehyde is used in your facility. Inspect all those areas while activities are ongoing. Note any odors. Interview employees on their procedures. Note the type of formaldehyde products used. Using this information, take time to evaluate the exposure hazards you may have.

As is our custom, the Safety Guys turn to the OSHA formaldehyde standard, 29CFR1910.1048, for regulatory requirements and guidance.[4] This standard covers all occupational exposures to formaldehyde, including gas, solutions and any materials that release formaldehyde.

The first step is to determine employee exposures by conducting appropriate monitoring. If in-house capability is not available, a competent industrial hygienist or similar professional can handle the job. OSHA has established an action level of 0.5 ppm and a permissible exposure limit (PEL) of 0.75 ppm, both based on eight-hour time weighted averages (TWA). There is also a short-term exposure limit (STEL) of 2.0 ppm, a 15-minute average that employees should never exceed. Periodic monitoring should be conducted every six months for employees exposed at or above the action level.

Following the monitoring, employees potentially exposed above the limits should enter a medical surveillance program. An initial medical history is documented by use of a questionnaire and a baseline physical is conducted. OSHA provides considerable guidance in the rule appendices and on its website.

Safety and health training is essential for all employees falling under this standard. Training should focus on the signs and symptoms of exposure, the possible health effects of exposure, proper personal protective equipment, medical surveillance, monitoring, exposure controls and first aid.

Prevention is key

The essential exposure control is properly designed and adequately maintained engineering systems, i.e. ventilation. We have experienced problems with facility spaces changing uses over time. Turn around, and suddenly you have anatomy labs in what was office space before. Or surgeries performed out on the bench top without any exhaust. Review ventilation in all formaldehyde use areas. Ensure adequate exhaust and proper design. Ideally, you should capture vapors as close to the source as possible though use of snorkel exhaust or fume hoods. Provide sufficient room air changes, dilution and mixing. Most important, make sure formaldehyde use areas are on dedicated single-pass ventilation systems. Recirculation systems are not recommended for these areas.

Protecting our employees and providing a safe workplace is our number one goal. Formaldehyde is ubiquitous and essential to successful research in many applications. It is potentially hazardous and, used carelessly, can produce serious harm. But with careful planning and well-thought-out procedures combined with the right personal protective equipment and exposure controls, we can use formaldehyde safely and protect employees.

Vince McLeod *is an American Board of Industrial Hygiene–certified industrial hygienist and the senior industrial hygienist in 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.*

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PERSPECTIVE ON: A QUALITY CONTROL LAB

FOR LAB SUPERVISOR BRIAN NEWELL, LACK OF ROUTINE IS PART OF THE FUN

by Sara Goudarzi

In order to ensure that products going into the market meet the highest standards, many manufacturing companies have a designated division that tests the quality of its material. Brian Newell heads one such division. He is a quality services lab supervisor at Playtex Manufacturing, Inc., in Delaware, a division of the Energizer Holdings, Inc.

"Our lab is a conglomerate of a couple of different things," Newell says. "We perform testing for the quality control of raw materials, work in process and finished goods, using validated methodologies. We work as quickly as possible so that we don't hold up our production."

The Energizer Battery Company produces items such as batteries, tampons, sunscreen, personal wipes and antibacterial products. Newell's lab tests most of these products for their quality except for batteries, which are tested elsewhere.

"We test for different product lines," he says. "For the sunscreens, we typically perform consumer complaint testing and stability shelf-life testing. For tampons, we either test the raw materials or components. For Nurser [baby bottles], we typically do spot-checks on a variety of things, and for the wet wipes, we do microbiological testing of the antibacterial products and then we also perform stability shelf-life testing."

The testing entails a variety of checklists where Newell and his team check off key items unique to each specific product. For example, when Newell's team tests a sunscreen or sunblock, they perform organoleptic screening, which looks at the color, odor and appearance of the material. Additionally, they look at the active ingredients, such as oxybenzone, titanium dioxide and zinc oxide.

"About 75 percent of our work is now sunscreen related; probably about 15 percent of what's left is related to tampons—in particular the Playtex Sports and Playtex Gentle Glide products," Newell says. "About 10 percent of our work is the Playtex Nurser testing, and we also do a little bit of testing for the Playtex Wipes product line, specifically Wet Ones."

The operation

Newell works in the Playtex offices in Dover, Delaware. The site encompasses about 531,500 square feet. There are four quality labs within that location, including the one that Newell is in charge of. Newell's group takes up 5,000 square feet, including storage and offices. Newell, along with six employees, runs the lab.

"I have two people working in the microbiology lab, three people working in the analytical lab, and one stability administrator and myself," Newell says. "I report to a senior manager. That manager then reports to a director who reports to a global director who reports to a vice president."

Newell's employees all have a solid science background and education. The stability administrator and the three employees working in the analytical lab are all degreed chemists, while the two staff members in the microbiology lab are degreed biologists.

Newell himself is a degreed chemist with 27 years of experience. "I've been in a quality environment my entire career. I was with the Perrigo Company of South Carolina, Inc. for the first 13 years, and then I moved here and have been with Playtex ever since," he explains.

Together, the seven-person team analyzes more than 3,000 samples a year.

"Over the years we have seen the number of samples increase but the testing per sample has been very slowly decreasing," Newell says. "To keep my group from becoming overwhelmed by the increased volume of samples, we work smarter not harder."

"To keep the volume of samples under control, we utilize skip-lot testing," Newell adds. "We observe historical trends of test results on incoming samples from various

suppliers or contract manufacturers using an assortment of statistical analyses. And we always ensure checks and balances are in place to guarantee that a consistently high quality is maintained. However, my group's role in the organization has also expanded to include assisting suppliers and contract manufacturers in troubleshooting analytical or microbiological issues they may have. This requires a wide range of expertise, which is possible because of the diverse backgrounds of my group."

For shelf life testing, the group experienced a 500 percent increase in volume when they were shipped stability samples after Playtex purchased Hawaiian Tropic in 2008.

"We have been mitigating this increase through the use of temporary employees during the peak of each production season, upgrading equipment—including evaluating the change from HPLC to UHPLC—and utilizing computer software to perform more of the tedious paper-pushing tasks such as managing training records and controlled documents," Newell says.

Hiring, inventory and maintenance

When the need for a new position arises—be it a permanent or temporary arrangement—the local director receives approval from higher management to create a spot and lets Newell know through his boss, who is a senior manager. Newell then interviews candidates to ensure that they have the correct skill set and that they'd be a good fit with the rest of his team.

> "The workhorses of his operation are four liquid chromatographs and two gas chromatographs."

In addition to their daily duties, Newell's team members work together to ensure that all necessary items are in stock and that the inventories for his labs are up to date.

"The supplies are maintained and kept up by the various people working in the two different labs," Newell says. "Typically I'll sign off on things; there's one person in each of the two labs who has the authority to order the supplies and anyone who does not have the authority, obviously just creates a list and passes it to the person who can place an order."

In the analytical lab, the senior chemist, who has two chemists reporting to her, is in charge of ordering supplies. In the microbiology lab, one of the two microbiologists has the authority to place orders.

Newell's lab employs a variety of equipment for the tests involved. The workhorses of his operation are four liquid chromatographs and two gas chromatographs. For the rest of the tests, the team relies on wet chemistry.

Newell's staff is largely in charge of maintaining the equipment, while Newell himself calibrates and validates these instruments to ensure that workflow is not affected by any hiccups in the system.

"We do have service contracts for the heavy-duty analytical equipment, that being anything above the level of items like a pH meter or a viscometer," he says. "So the liquid chromatographs, the ultra high performance liquid chromatographs, the two gas chromatographs, those are all under service contracts."

Incentives and communication

In order to keep employee morale high and enhance productivity, the company typically organizes a picnic around springtime each year. This helps employees from different departments get to know each other and also gives the staff a chance to be around one another in a relaxed environment.

"As far as within the department, our local director will occasionally have us go out and celebrate large events, such as when we finish implementing a new program," Newell says. [Last time,] we actually met at a local pizza and sub restaurant and took a two-hour lunch. In the past we've also met on occasion after work for an early dinner."

Newell also indicates that he uses communication as a tool to keep his employees both happy and productive. Because when the job gets done effectively, everyone is satisfied.

"With workloads at their current level and our current budget restrictions, we have found that using email, instant messaging and telephones reduces unnecessary meetings and actually speeds up finding solutions to urgent problems," he says. "Energizer has close ties with Microsoft so we make full use of the Microsoft Office Suite, including Office Communicator and Outlook. This helps keep communication within my group and our department efficient and timely."

"We also discuss things with people in other departments. For example, there are three other quality labs; we support them in certain ways so there's got to be communication between the different labs. There's also communication with other plants and other cities."

Challenges

The biggest challenges that Newell faces as manager are the heavy workload and the economic side of the business, such as the appropriation of funds for new equipment.

"I constantly have to determine what equipment needs to be acquired and what equipment can work double-duty," Newell says.

"We can't just buy a piece of equipment that does single testing anymore; it has to be able to do more than one. Chromatography is a prime example: We can't dedicate one piece of equipment to perform one testing method; it has to be able to do multiple things."

Another challenge that Newell faces is the lack of routine.

"I actually don't have a routine," he says. "But my schedule consists of a variety of tasks, such as approving purchases or test results, attending various meetings, and helping develop validation protocols and test methodologies. I'm involved in almost anything and everything that's chemistry-related."

This lack of routine is the reason Newell gets up each morning and goes into work. It keeps things ever changing and ever interesting.

"It's part of the fun of the job, I'm afraid," he says. "The fact

MOST FREQUENTLY USED EQUIPMENT

- 3 liquid chromatographs, PerkinElmer Series 200
- 1 ultra high performance liquid chromatograph (UHPLC) from PerkinElmer
- 3 gas chromatographs from PerkinElmer

that the job is ever changing is a continual challenge. There are a lot of opportunities to review what's currently being done and try to make it better. For example, Energizer's implementation of Lean within this building has helped me realize some of those challenges and find ways of assisting the organization in making itself better."

Energizer is currently investigating its stability program and reviewing it to see where they can make it more Lean compliant and still meet regulatory guidelines.

"[The] FDA currently has a draft monograph out for sunscreens. We are going above and beyond their recommendations to find what we can do to cut back on some of that workload to generate cost savings and reduce workloads—even if it's only by a small percentage," Newell says of the Lean program.

"There are also various synergies that we might be able to better employ between the different labs within Energizer," he adds. "For example, our Analytical Services Group in New Jersey might be performing a particular test on a more frequent basis than my group. If my group could send those few samples we test to the Analytical Services Group without increasing their workload too greatly, then we should be able to return the favor in the future."

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

LEARNING MANAGEMENT SYSTEMS

A STREAMLINED METHOD FOR MANAGING EMPLOYEE TRAINING AND REGULATORY COMPLIANCE

by Lyle C. Emmott

Managing a lab is a tough job for a number of reasons, especially for those lab managers who work in regulated industries. In those industries, keeping your team members up to date on the latest safety, environmental, or process information is critical to a company's success. In fact, the more high-stakes your industry, the more critical this becomes and the more regulations your company must follow.

Add the challenge of disseminating the latest training to a global workforce spread throughout multiple facilities, and keeping your company up to date can seem like an insurmountable task.

Many companies and lab managers are turning to learning management systems (LMSs) and e-learning to centrally manage the process of creating, delivering, and tracking personalized training programs for employees. LMS systems allow for creating, assembling, publishing, delivering, and storing content, as well as sharing learning objectives and managing learner performance data. With an LMS, an employee's level of compliance can be automatically tracked and reported, and users can be notified by the system to keep everyone on track; users can also be warned when they are close to noncompliance. Organizations can rapidly deploy updates and additions and can immediately access learning compliance data for regulatory and legal purposes.

Key standards for some organizations include Section 508, GMP, ISO 9000, QA, OSHA, QS 9000, and ISO 14000 QS, which are important to government agencies, and in particular the pharmaceutical, biotech, medical, auto, and manufacturing industries. These standards ensure that companies are compliant in areas ranging from meeting the quality standards of customers and stakeholders to meeting environmental standards for protecting employees on the job to maintaining the security of customer information.

For companies specifically regulated by the Food and Drug Administration (FDA), an LMS must be validated for 21 CFR Part 11 Compliance—meaning that it is compliant with the regulation that defines the FDA guidelines on electronic records and electronic signatures in the U.S. Part 11 specifically defines the criteria under which electronic records and electronic signatures are considered to be trustworthy, reliable, and equivalent to paper records.

Companies save time and money using an LMS; LMSs also help create a unified employee experience and help maintain a consistent brand image throughout the entire company. Most importantly, organizations benefit from being able to track the entire training

"LMSs also help create a unified employee experience and help maintain a consistent brand image."

▸ *Gen-Probe Incorporated Headquarters, San Diego, CA.*

ARRAY TAPE™ PLATFORM PROVIDES HTP SCREENING WITH REDUCED PLASTIC, REAGENT AND ENERGY CONSUMPTION

Mike Salentine and Kjersten Larson-Cook, Ph.D.

Douglas Scientific
3600 Minnesota Street, Alexandria, MN
Phone: 320.762.6888
www.douglasscientific.com

OVERVIEW

Purpose - Compare environmental impact of Array Tape™ Platform vs. microplate-based technology for high throughput (HTP) processing.

Methods - Plastic consumption, reaction volumes, overall laboratory footprint and energy use were compared in labs processing 200, 400 or 600 384-well arrays per day.

Results - All parameters at all throughputs were reduced using the Array Tape Platform compared to microplate-based technology.

Conclusions - Array Tape and customized Platform provide environmental benefits to HTP laboratories based on reduced plastic consumption, reaction volumes, laboratory footprint and energy use.

INTRODUCTION

The Array Tape Platform is an automated, HTP technology based on a continuous strip of a light and flexible polymer that is serially embossed with reaction wells in customized volumes and formats.

Inline, parallel automation provided by the Array Tape liquid handling (Nexar®) and detection (Araya®) instruments speeds processing and reduces wasted motion inherent to robotically driven microplate-based processes.

The Array Tape Platform has proven to increase throughput, flexibility and cost savings in HTP laboratories that previously used robotically driven, microplate-based technology.

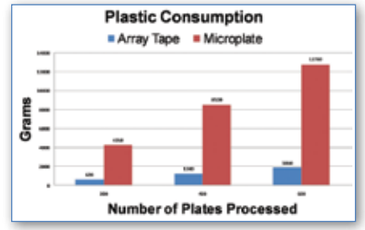
We will demonstrate how the properties of Array Tape and customized Platform also provide environmental benefits based on a comparison of plastic consumption, reaction volumes, laboratory footprint and energy efficiency.

REDUCING PLASTIC CONSUMPTION

Plastic consumption is based on the amount of material required to manufacture an SBS array of reaction wells in Array Tape vs. a commonly used 384-well PCR microplate (Axygen Biosciences, RGD-C),

Results

- ~7 times more plastic is required to manufacture a single microplate (21.3 g) compared to a 384-well equivalent in Array Tape (3.1 g).
- Array Tape reduces plastic consumption by as much as 11,000 g per day (~25 lbs) in HTP laboratories processing 600 arrays per day.



MINIATURIZING REACTION VOLUMES

Array Tape is optimized for small volume reactions. Standard reaction volumes in Array Tape were compared to 384-well microplates.

Results

- Array Tape reduces minimum practical reagent volume to < 800 nL per well compared to 5µL in microplates.

REDUCING LABORATORY FOOTPRINT

Compact Storage

Array Tape is thin and flexible - 200 microplate equivalents (76,800 reaction wells) spooled onto a single, compact reel (90 mm by 560 mm).

Results

- Array Tape reels reduce storage requirements necessary for standard microplates.

Inline Automation

Indexing holes running along each edge of the Array Tape guide reaction wells through liquid handling (Nexar) and scanning (Araya) instruments.

Results

- Array Tape Platform reduces laboratory footprint by minimizing robotics and manual handling required to move microplates from station to station.

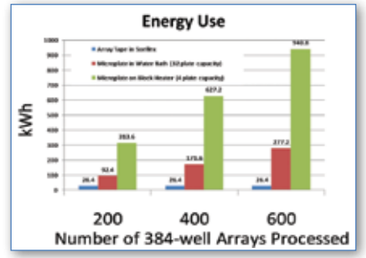
REDUCING LABORATORY FOOTPRINT & ENERGY USE

Thermocycling in Soellex™

A comparison of the instrumentation (laboratory footprint) and energy use (kWh) required to thermocycle samples in Array Tape (Soellex) vs. microplates (water baths or block heaters).

The heating system in the water bath tightly controls the thermal gradients throughout the water column and provides rapid energy transfer from the water through the Array Tape reaction wells.

- Soellex: 3-chambered ultra-HTP PCR thermal cycler optimized for Array Tape
- Simultaneously thermocycles up to 3 spools of Array Tape
- 230,400 reaction wells thermocycled in a single process run



Results - 600 Arrays per Day

- Array Tape (3 spool capacity): A single Soellex (26.4 kWh)
- Water Bath (32 microplate capacity): 18 water baths and ~11 times more power (277.2 kWh)
- Block Heater (4 microplate capacity): 150 heaters and ~35 times more power (940.8 kWh)

CONCLUSION

The Array Tape Platform provides an environmentally responsible solution for laboratories striving to achieve HTP processing with minimal impact to the environment.

process and have immediate access to information to identify which employees have completed their training, when their training was completed, or when their training is due.

LMSs provide training history documentation for each employee and include important information on course titles, descriptions, and dates training(s) was completed. An LMS ensures training consistency throughout a company by ensuring all employees receive the same customized content, delivery, and evaluation within a centralized learning environment. Companies benefit from consistent tracking and reporting that allows administrators to track progress and review employee scores as required. Administrators can also easily analyze data to determine areas where employees are successful or need improvement.

Gen-Probe Incorporated, a global leader in the development, manufacture, and marketing of rapid, accurate, and cost-effective nucleic acid tests—used primarily to diagnose human diseases and screen donated human blood—is a perfect example of a company working within a regulated environment. For years, Gen-Probe managed and tracked employee training manually using a paper-based system. As the company grew, a better solution was needed—one that would allow management to track learning across multiple facilities and the entire global workforce.

Being in such a high-stakes business, Gen-Probe must ensure that its workers comply with operating practices and safety regulations to ensure the safety of all workers and customers. Many of these practices are necessary procedures implemented by the company, but others are imposed on the company by external regulatory organizations. Audits are conducted by the FDA and other regulatory bodies to ensure that the company continues to follow internal and external regulations. The company is regularly audited for product compliance and safety and for compliance across all of its manufacturing processes, customer interactions, production, and shipping.

Regular audits make tracking imperative

Regular audits assure government agencies that all Gen-Probe employees are up to date on the latest information and training, and confirm for Gen-Probe that all its employees have the latest information pertinent to performing their jobs correctly and safely.

Implementing an LMS provided some huge automation advantages for Gen-Probe, as it allowed the company to deliver training and to more easily track the courses each employee completed. As part of the implementation, Gen-Probe validated the LMS for 21 CFR Part 11 compliance. With the launch of the LMS, the company shortened the time required to compile reports and historical data for external audits.

Gen-Probe wanted e-learning in place for several course areas including business skills, desktop skills, and managerial training. The company also uses the LMS as a system of record for all training (procedural, classroom, conferences, webcasts, etc.) and to track the courses (both classroom and web-based) each employee completes. This allows the company to generate and print full reports on demand showing employee training history, and to sort information by topic, employee, course, type of training, and much more.

Timely generation and ease of producing training records on demand is a big advantage when using an LMS. "When our regulating bodies walk in the door, they will often walk around our facility, select employees and ask to see their training records. With the LMS, we can easily pull those records and have them in the auditors' hands within 60 seconds. The auditors can then follow up with those employees on the items and procedures in which the reports show those employees are trained," said Tina Asher, senior manager of organizational development and learning for Gen-Probe.

Company benefits globally from LMS

Before implementing an LMS, Gen-Probe used a mix of e-learning, Access databases, and spreadsheets to handle learning management and report tracking. The paper-based method was time-consuming, inefficient, and lacked the immediate visibility to training compliance the company needed.

"We had an unbelievable number of paper training records," said Asher. "The LMS has allowed us to move from a paper records system to electronic records and has given us immediate visibility into training that we have never had before. It's also allowed us to better manage our training from a global perspective since we are all using the same system."

Prior to adding the LMS to manage the learning process, Gen-Probe had more than 50 employees who devoted a portion of their time to help track and manage the company's training records. With the launch of the LMS, these people have turned their attention to more critical tasks, and Gen-Probe now has only one LMS administrator.

"Using an LMS ensures the timely and consistent delivery of lessons and training."

Since implementing its LMS, Gen-Probe has saved an estimated 2,900 hours that were previously spent administering and tracking training on paper. In addition, the deployment of e-learning courses has saved the company 400 instructor hours and reduced by 80 percent the time spent by managers reviewing and approving training records, all of which translates into real time and money savings for the company.

As an added bonus, the system has also resulted in a reduction in no-shows for classroom training. With its LMS, Gen-Probe can now send email notifications to employees to remind them of courses that need to be completed. Notifications are also sent to alert employees when new e-courses are added to learning plans, and when learning due dates are thirty days away, just five days away, or when the time frame to complete the courses has expired.

"We attribute our decrease in no-shows for classroom training to the fact that employees receive an Outlook meeting invite that puts the learning reminder right on their calendars," said Asher.

Like Gen-Probe, most organizations must meet some level of regulatory requirements, or need to have regular reviews or re-certifications to meet training standards. Using an LMS ensures the timely and consistent delivery of lessons and training and allows administrators/managers to view results in real time. The visibility this brings to organizations allows them to act immediately on issues that could put them at risk of noncompliance.

In industries where lives are at stake, LMSs go a long way to giving companies visibility into the knowledge base of their workforce. LMSs highlight areas where employees need improvement and track which employees are behind on courses. But the most valuable asset is the ability a company gains to immediately share training and compliance records with its governing bodies.

Lyle C. Emmott is the GreenLight product manager at SilkRoad technology and can be reached at Lyle.Emmott@SilkRoad.com. You can also follow SilkRoad on Twitter @SilkRoadTweets.

MINDMAP: REDUCE MY LAB'S ENVIRONMENTAL IMPACT

By John Buie

The annual energy usage in a typical U.S. life science laboratory has recently been estimated at 4.54 GJ/m²/year,[1] almost three times the energy usage of a medium intensity commercial building (1.79 GJ/m²/year).[2] In such an energy-intensive environment, even small measures can often result in significant energy savings. By considering methods for conserving energy and other resources, the day-to-day running costs of the laboratory can be significantly reduced, as well as its overall environmental impact.

This MindMap explores some of the different options available for reducing the environmental impact of a laboratory by considering ways to limit energy, water, and chemical usage.

REDUCE MY LAB'S ENVIRONMENTAL IMPACT

USE INSTRUMENTS AND EQUIPMENT WISELY

Identify those pieces of equipment and processes that can be shut down when not required.

Undertake batch processes when constant operation is not necessary.

ORGANIZE FREEZERS CAREFULLY

Improving the organization of your freezer can drastically reduce the amount of time the door needs to be open, and therefore energy consumed.

Freezers can be organized efficiently using an indexed rack system. Freezer inventory management software can also be purchased to help manage samples contained in the freezer, providing an inventory of all contents as well as helping with sample labeling, tracking and management.

ENSURE FREEZERS ARE OPERATING AT FULL CAPACITY

Freezers operate at their most efficient when fully loaded. Ensure they are used to their full capacity, and always have the minimum possible number of refrigerators and freezers in the laboratory.

SELECT LOWER-POWER SETTINGS FOR OVERNIGHT

Certain instruments can be operated on a reduced setting overnight to save energy. For example, if an ultra-low freezer is used purely for the rapid freezing of samples, and is not used to store samples at ultra-low temperatures, the temperature can often be elevated overnight, and restored to its low temperature upon returning to the lab.

SWITCH OFF INSTRUMENTS WHEN NOT IN USE

Switch off all equipment when not in use, where appropriate. Do not leave in standby mode. A lot of instruments can be switched off immediately after use.

RESPOND TO AMBIENT CONDITIONS

Manually adjust temperature and humidity controls on equipment where appropriate in response to demand due to seasonal ambient temperature and humidity loads.

USE FUME HOODS WISELY

Chemical fume hoods and biological safety cabinets are some of the most energy intensive pieces of equipment in the lab, with the average fume hood consuming around 3.5 times the amount of energy consumed by the average household in the U.S. Fume hoods and safety cabinets are essential and irreplaceable laboratory tools. However, the simple action of closing the sash whenever possible can dramatically reduce the amount of energy consumed by the fume hood.

SWITCH OFF WHEN NOT IN USE

Always turn off the blower and turn on the U.V. light when a fume hood or biological safety cabinet is not in use.

REMOTE FUME HOOD COMMUNICATION

Fume hoods can now be operated and managed remotely using software. This provides laboratory managers and safety officers access to real-time status information and remote management capabilities, allowing them to easily adjust the settings of the fume hood for maximum energy conservation.

SASH POSITION DETECTION SYSTEM

A sash position detection system, which adjusts the fume hood's blower speed to the height of the sash opening, can prevent situations in which the fan is left permanently on maximum. Some detectors can be remotely managed and monitored using software for optimum security.

IMPROVED FUME HOOD FILTRATION SYSTEM

Installing an advanced fume hood filtration system allows for efficient handling of a wide range of chemicals, including acids, bases and solvents, without increasing energy consumption.

Modular filtration columns allow the system to be adapted to handle multidisciplinary chemistry and to constantly adjust to the changing needs of a laboratory.

PACKAGING

Order materials that are packaged in recyclable materials.

RECYCLE

Labs tend to order vast amounts of supplies, all of which come packed in enormous amounts of protective material.

RECYCLING SCHEME

Introduce a recycling scheme using color-coded boxes or bins to separate different materials.

CHOOSE REUSABLE OPTIONS

Although recycling is important, a better way to reduce the environmental impact of the lab is to reuse equipment and accessories where possible. For example, it is possible to purchase pipette tip refill systems that enable the same rack to be refilled and reused repeatedly. This dramatically minimizes waste and a lab's environmental impact.

AVOID DISPOSABLES

Where possible, avoid use of disposable and single-use items for non-sterile activities.

USE GLASS

Always purchase glass or other reusable and washable laboratory ware where possible.

USE CENTRALIZED LAB WASHERS

Consider using centralized wash programs as opposed to bench-side washers positioned under the counter. Under appropriate circumstances, centralized lab washers can be far more efficient.

USE ENVIRONMENTALLY FRIENDLY LAB WASHERS

Some lab washers are much more environmentally benign than others in terms of their water and energy requirements. Always choose the most efficient lab washer.

SELECT ENERGY-EFFICIENT EQUIPMENT

The amount of electrical equipment in a laboratory far exceeds that in most commercial spaces. This represents a major source of energy consumption. Choosing energy-efficient freezers, refrigerators and other equipment should be a priority when attempting to reduce the environmental impact of the laboratory.

PURCHASE EQUIPMENT WISELY

Ensure that energy efficiency is a primary consideration in the purchase of all new laboratory equipment and instruments. Ensure new equipment has a 3+ star rating, and look for low energy usage instruments.

As well as being more energy efficient, newer models tend to be more efficient in other respects. For example, newer generations of instruments, such as DART mass spectrometers, require much lower levels of solvents than earlier models.

PURCHASE USED EQUIPMENT

Purchasing pre-owned equipment from a reputable supplier, such as LabX.com, is an environmentally benign way to purchase replacement equipment for the laboratory, reducing the amount of equipment ending up in landfills.

REPLACE OLD OR INEFFICIENT EQUIPMENT

Holding onto old or out-dated equipment can prove false cost savings. Modern laboratory equipment is designed with energy efficiency as a primary feature, and the running costs and energy consumption of modern equipment often far outweigh that of equivalent older models.

REDISTRIBUTE EQUIPMENT INTERNALLY

Reallocating less well-used equipment from other areas of your facility into your lab can prevent the unnecessary purchase of brand new equipment, and reduce the environmental impact of your laboratory.

CONSERVE WATER

Labs use vast amounts of water for many different applications. Water resources are under increasing stress, and it is the responsibility of every individual to ensure that all water is used responsibly. There are a number of practical steps that can be taken to conserve water.

USE WATER BATHS SPARINGLY

Only turn on water baths when they are needed in order to reduce evaporation and thereby decrease the amount of replacement water needed.

Also consider investing in a waterless bath that uses beads or other materials to keep samples warm or cold. These products not only eliminate the reliance on water, but can also maintain a more organized and clean sampling environment.

INCREASE RECOVERY FOR LABORATORY WATER

Much of the water that is used in a laboratory can be collected and reused. Upgrade laboratory water systems to those that are less wasteful or that recycle water.

DON'T LET THE TAP RUN

When rinsing or washing, be sure to run the tap only when water is needed. The average faucet dispenses 3 gallons per minute. The amount of water you save every time you use the tap will add up to significant environmental and cost savings each year.

USE LESS DISTILLED WATER

The distillation process involves heating water to its boiling point and then cooling the vapor back to liquid. This process is incredibly water and energy intensive, as well as expensive. When washing equipment, use tap water for the initial wash and distilled water for the rinse.

REPLACE WATER PUMPS

The days when laboratories had multiple water pumps running constantly for solvent extraction should be long gone. Eliminate all water aspirators for suction and replace them with electrical vacuum pumps.

USE CHEMICALS RESPONSIBLY

All laboratories rely on chemicals of some description. The use of chemicals is one of the greatest potential environmental hazards in a laboratory, and an important area of attention when considering the lab's environmental impact.

INVEST IN NEW CHROMATOGRAPHY INSTRUMENTS

Liquid chromatography is one of the principal solvent-consuming techniques in the laboratory. Newer chromatography techniques such as Supercritical Fluid Chromatography (SFC) or new ultra high-pressure liquid chromatography (UHPLC) require much less solvent than traditional HPLC instruments. The initial capital cost of upgrading to newer chromatography instruments can ultimately be recovered in reduced spending for solvents.

REDUCE SOLVENT USAGE

Always use the minimum quantities of solvent possible for a given analysis or reaction. Conduct micro-scale experiments where possible.

USE A SOLVENT RECYCLER

Investing in a dedicated solvent recycler can be an effective way to reduce costs and minimize environmental impact. Using a recycler, solvents can be restored to their original purity. The most common applications of solvent recycling include: HPLC solvents, GPC solvents, Freon solvents, as well as general lab solvent recycling.

USE LESS HAZARDOUS AND LESS TOXIC CHEMICALS WHERE POSSIBLE

If a choice of reagent or solvent is possible, always choose the least toxic alternative. Using pre-prepared reagents can sometimes eliminate the need for certain toxic or hazardous chemicals.

STORE, USE, AND DISPOSE OF CHEMICALS RESPONSIBLY

Always store and use chemicals in containers or spill trays. Never pour chemicals into the sink or allow chemicals to leak into drains.

ADOPT AN OVERNIGHT AND WEEKEND 'SHUT-DOWN' ROUTINE

Introduce a 'shut-down' routine at the end of the day, manually closing fume hoods and switching off lights, equipment and computers, and checking that all faucets are turned off.

Never leave water distillers or reverse osmosis units running over the weekend.

ENVIRONMENTAL AUDITS

Conduct a regular environmental assessment and audit to ensure that all necessary environmental measures are being undertaken and that existing practices are still valid.

ENVIRONMENTAL PROTOCOLS

Ensure that formal systems and protocols for different procedures are drawn up where appropriate, that staff are made aware of them, and that they are readily accessible in the lab.

STAFF TRAINING

There is no point in conducting full environmental audits and installing sophisticated environmental measures unless all staff members are committed to reducing the environmental impact of the lab. Staff training is therefore essential so that all employees understand what the goals are and what is expected of them.

MEETINGS

Hold regular lab meetings to discuss environmental issues and check progress. As well as a practical way of improving compliance, these meetings emphasize the importance of this issue.

COURSES

There are a number of courses available covering different environmental issues, particularly those pertaining to the laboratory. Staff should be sent on environmental training courses as appropriate.

MANAGE WASTE RESPONSIBLY

Most laboratory procedures generate some form of waste: often a solvent or a by-product. All laboratory waste must be disposed of according to all internal protocols and legal requirements. Ensure that no laboratory waste enters the normal drainage system.

RADIOACTIVE WASTE

Radioactive liquids should be collected and stored until below exposure limits for disposal. Dispose of radioactive waste according to the approved laboratory waste disposal policy.

CHEMICAL WASTE

Chemical waste should be collected in plastic bottles or containers according to type. Avoid the mixing of potentially reactive chemicals. Dispose of chemical waste according to the approved laboratory waste disposal policy.

BIOLOGICAL WASTE

Autoclave liquid media to inactivate harmful agents, and neutralize with bleach to inactivate harmful agents. Biological waste is more easily disposed of when completely neutralized.

1. Mahler, S. et al. Energy-saving Strategies for New Research Facilities: Part 2. Lab Design Newsletter. 2010. Available at: http://www.micro-nanonews.com/Lab-Design-News/Articles/2010/10/Sustainability-Energy-Saving-Strategies-For-New-Research-Facilities-Part-Two/
2. Arc Solare presentation. Canadians and Kyoto. Available at: http://www.arcsolar.com/solar.html

TECHNOLOGYNEWS

ANALYTICAL

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"This enables lab scientists to get accurate viscosity measurements in the shortest time," said Seong-Gi Baek, Ph.D., President of RheoSense. "In addition, small sample volumes enable low-cost product development at early stages of R&D."

The device facilitates measurements for a wide range of viscosities (0.2 cP ~ 5,000 cP) with hot-swappable sensor cartridges. Featuring multiple operational modes to assist any user, the device can log up to 20 tests, each with a user-definable sample ID.

"No evaporation during testing ensures [integrity] of data," added Baek. "No air interface in particular eliminates the interfacial effect of adsorbed proteins at the interface."

Since each sample is contained in a pipette, there is no need to clean the device. Samples can be continuously run.

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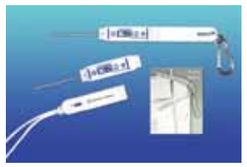

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TADM 96

- Air pressure sensors are built into each channel to monitor pipetting
- Total Aspiration and Dispense Monitoring (TADM) technology monitors in real time, giving users the chance to react to problems such as empty samples, clots or foam
- TADM verifies and documents with a traceable digital audit trail to confirm a sample has been successfully transferred

Hamilton Robotics
www.hamiltonrobotics.com

Coulometric Karl Fischer Titrator

AQUACOUNTER® (AQ-300)

- Features six built-in calculation modes for solid, liquid and gas samples
- Includes a fritless cell option, for fast and accurate results
- Four files can be stored in memory; allows instant recall of data for up to 20 samples
- Features a built-in detector to monitor titration status

JM Science
www.jmscience.com

Automated Gas Standards Generating System

FlexStream™

- Uses proprietary Trace Source™ permeation tubes to add known concentrations of various oxygenate species to a flow of purified food-grade CO2
- Secondary dilution feature gives low ppb and ppt concentrations adjustable over a 400:1 range
- Mixture concentrations are traceable to NIST through physical standards

KIN-TEK www.kin-tek.com

Filtered Glove Box

Protector®

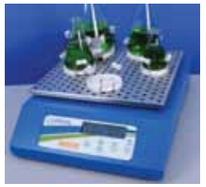
- Provides inlet and outlet 99.99% efficient HEPA or 99.999% efficient ULPA filtration
- Real-time performance data is provided on internal static pressure (inches of water)
- No detectable leaks greater than 1 x 10^{-6} ml/sec
- Liners are available in either one piece molded fiberglass or Type 304 stainless steel

Labconco www.labconco.com

Orbital Shaker

Helix 250

- Designed for biological, chemical, liquid mixing and cell cultivation for various laboratory settings
- Features quiet operation and constant shaking speed independent of load or input power fluctuations
- Includes an optical movement sensor that prevents the shaker from "walking"
- Features a new EZ Clamp™ tool-free clamp system



LabStrong www.labstrong.com

Vacuum Pump Inlet Trap

MV Visi®Trap

- Prevents users from contaminating a central source vacuum system
- Features clear 9.5" sumps for visually monitoring filter condition
- Can be supplied with replaceable copper or stainless steel gauze, molecular sieve, Sodasorb®, activated charcoal, activated alumina and Polypro 2-, 5- and 20-μm filter elements

Mass-Vac, Inc. www.massvac.com

Digital Hydraulic Tester

HFP-110/120

- Designed for fast diagnostic troubleshooting of all types of mobile or stationary hydraulic systems
- Generates flow pressure and temperature measurements simultaneously from one point
- Features pressure-relief disc protection and low battery/over-range indicators
- Includes a 3.5-inch digital LCD

Omega Engineering www.omega.com

Oxygen Deficiency Monitor

10+ Year Sensor

- Zirconium Oxide sensor does not rely on partial pressure, or need a reference gas
- Features a 24VDC power source, rather than a depleting source, such as an electrolyte
- Features a built-in audible alarm that sounds in the event of a leak from any cryogenic gas
- Eliminates the inconvenience associated with disposable sensors

PureAire www.pureairemonitoring.com

Laboratory Chiller

Oasis

- Available in 160, 170, 180 and 190 watt heat removal capabilities
- Provides precise Thermoelectric temperature control (± 0.05°C) for lasers, low-light CCD cameras and instrumentation cooling
- Features quiet operation and a compact size (8 lbs) with temperature ranges from 2°C to 45°C
- Consumes up to 90% less electricity than comparable compressor-based chillers

Solid State Cooling Systems www.sscooling.com

Microbiological Incubators

Thermo Scientific Heratherm™ Series

- Available in three models: General Protocol, Advanced Protocol and Advanced Protocol Security
- Feature stainless-steel, easy-to-clean rounded interiors
- All models include an inner glass door to maintain temperature uniformity
- Available in 60-, 100- and 180-liter sizes

Thermo Fisher Scientific
www.thermoscientific.com

Desk Lamp

Task-Vision

- Includes a 5" glass lens with 3X distortion-free optical quality
- Features 22-watt color-correct circular fluorescent illumination
- Tilting function allows users to view objects at any angle

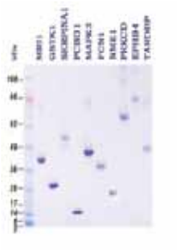
Vision USA
www.visionusasupplies.com

CHEMICALS, KITS & REAGENTS

Full-length Human Proteins

Affinity Purified

- Expressed in HEK293 cells; derived using an extensive collection of human cDNA clones
- Guaranteed to be greater than 80% pure
- Ideal for use as native antigens for optimized antibody production; positive controls in antibody assays; ELISA assay standards, in vitro biochemical assays, etc.



AMSBIO
www.amsbio.com

Mycoplasma Detection Kit

Universal

- Brings together universal primers, optimized reagents and touchdown PCR
- Includes buffers for cell lysis, sample lysis tubes, PCR mixes and primers
- Kit will detect as few as 10 genomes of *M. arginine* in three hours
- Recognizes more than 60 species of *Mycoplasma, Acholeplasma, Spiroplasma* and *Ureaplasma*

American Type Culture Collection
www.atcc.org

Certified Reference Standards of Tapentadol Metabolites

Snap-N-Spike®

- N-Desmethyltapentadol, Tapentadol-β-D-glucuronide and Tapentadol-O-sulfate
- Suitable for quantitative or qualitative applications including pain prescription monitoring, toxicology applications or urine drug testing
- Certified to highest industry standards, including ISO Guide 34 and ISO/IEC 17025

Cerilliant www.cerilliant.com

Ion Exchange Chromatography Media

Capto™ ImpRes

- Capto SP ImpRes (strong cation) and Capto Q ImpRes (strong anion) enable high-throughput, high-resolution polishing and flexibility in process design
- Available in several formats, including Predictor™ 96-well filter plates and pre-packed HiTrap™ and HiScreen™ columns

GE Healthcare www.gelifesciences.com

Oligo Manufacturing Service

DNA and RNA Oligos

- Deprotected, desalted and quantified using UV spectrophotometry and checked for quality using mass spectrometry
- Available in a range of amounts, from 25 nmol up to 10 μmol, with the additional option of large-scale production up to 10 g
- Can be delivered in individual tubes, as well as 96- or 384-well plates, either lyophilized or resuspended in liquid

Integrated DNA Technologies
www.idtdna.com

Mouse miRNA Expression Assay Kit

nCounter®

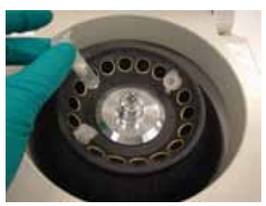
- Enables users to perform direct digital detection and counting of miRNAs at single-base resolution without the need for amplification
- Provides the capacity to perform multiplexed profiling of more than 600 murine and murine-associated viral miRNAs in a single tube, with specificity and sensitivity comparable to qPCR

NanoString Technologies www.nanostring.com

Chromatin Immunoprecipitation (ChIP) Assay Kit

Chromatrap™

- Used to investigate the interaction between proteins and DNA in the cell
- Aims to determine whether specific proteins are associated with specific genomic regions
- Technique is based on a rigid porous polymer matrix rather than the traditional sepharose or magnetic beads



Porvair Filtration Group www.porvair-filtration.com

GREEN TECHNOLOGIES

Fume Hood

Green Solution Hood

- Features Neutrodine® technology from Erlab
- Allows users to reduce energy costs by 96% and reduce operation costs by 70%
- Reduced CO2 emissions by not replacing treated air
- Handles liquids and solids individually or together with a single hood

Air Master Systems www.airmastersystems.com

Class II Type A2 Biological Safety Cabinets

CellGard Energy Saver NU-475 and NU-477

- Feature a 10 degree sloped sash
- Reduce noise, vibration and operating costs by decreasing energy consumption
- Extends HEPA filter life with less heat production

NuAire
www.nuaire.com

Energy-Efficient Thermal Cycler

TC-PLUS

- Features a proprietary Thermal Energy Recovery System (TERS®) to save energy
- TERS works by harnessing some of the heat transferred from the block during the cooling phase for re-use in the next heating phase
- Features a ramp rate of up to 5°C per second

Techne
www.thebestthermalcycler.com

Benchtop Ovens

Heratherm Series

- Three models available in three sizes: 60-, 100- and 180-liter capacities with a choice of gravity or mechanical convection
- Special insulation and a heat-decoupled door reduce energy consumption and minimize heat transfer to the environment
- All models include an easy-to-use interface, automatic over-temperature alarm and data monitoring

Thermo Fisher Scientific www.thermoscientific.com/hot

LIFE SCIENCE

Target Enrichment System

SureSelect XT

- Lets researchers sequence just the genomic regions of interest rather than the entire genomes
- Allows geneticists to interrogate the genome of more samples per study than previously possible
- Facilitates the processing of 192 samples weekly per workstation

Agilent Automation Solutions www.genomics.agilent.com

PCR Thermocycler

Soellex™

- Optimized for proprietary Array Tape™ to provide high-capacity DNA amplification
- Simultaneously processes up to 230,000 reaction wells in a standard run
- Supports microplate-based PCR thermocycling with a maximum capacity of 152 plates per run

Douglas Scientific www.douglasscientific.com

Personal Sequencing System

MiSeq™

- Lets users prepare clusters, sequence and analyze data on a single machine with walkaway automation
- Applications include highly multiplexed PCR amplicon sequencing, targeted resequencing, ChIP-Seq, small RNA sequencing and more
- Features TruSeq technology, reversible terminator-based sequencing by synthesis chemistry

Illumina www.illumina.com

Multimode Microplate Reader

EnSpire®

- Features Corning® Epic® label-free technology and classical label detection in a single instrument
- Identifies novel molecules and characterizes cellular and biochemical mechanisms of action (MOA)
- Includes an optical biosensor in each well; supports 96- and 384-well formats

PerkinElmer www.perkinelmer.com

Pneumatic Pipetting Solution

Cavro® Air Displacement Pipettor (ADP)

- Uses air displacement to aspirate and dispense fluids
- Correct operation is monitored by onboard pressure-based liquid level detection and self-diagnostics
- Features an integrated tip ejector, allowing tips to be ejected by a simple command
- Tip sensor can determine if a disposable tip has not been correctly picked up or has fallen off the probe

Tecan www.tecan.com

Personal Cell Imager

Thermo Scientific CellInsight™

- Features a solid-state illumination source, high-efficiency filters and a custom optical design for high-quality imaging and virtually maintenance-free operation
- Typical plate scan times are less than four minutes for a 96-well plate, while a 1,536-well plate can be scanned in just over one hour for a three-color assay
- Includes iDEV software to eliminate assay development bottlenecks

Thermo Fisher Scientific
www.thermoscientific.com/cellinsight

PRODUCT SPOTLIGHT

FROZEN SAMPLE MANAGEMENT SOFTWARE

ENTERPRISE-CLASS PERFORMANCE FOR LARGE AND SMALL LABS

RURO's FreezerPro 2011 software is now available in three new editions. The reliable and secure Web-based application lets users know exactly where a frozen sample is located even before opening the freezer door. Complete with revised audit trails for samples and vials with greater detail, the new software maintains compliance with the FDA's current GLP/GMP requirements.

"By keeping the inventory organized, researchers save themselves lots of time every day," said Vlad Lebedev, Systems Architect with RURO. "All their samples are a few clicks away, no matter where they are."

The new barcode label designer lets users keep their existing label formats and use a wide range of popular printers. In addition, an enhanced user interface puts users in control of their FreezerPro experience via user-defined fields and sample views including a box view that displays sample icons.

Available in FreezerPro Standard, Enterprise and Multisite, there is an edition for every type of application. The Enterprise and Multisite versions include extended APIs which enable full read/write access to sample data, as well as an integrated real-time notification system for communicating changes in sample data to external applications.

For more information, and to download a free trial version, visit www.ruro.com.

LIMS & SOFTWARE

Software for Multicapillary Gel Electrophoresis

ScreenGel

- For DNA fragment and RNA analysis with proprietary QIAxcel® multicapillary gel electrophoresis system
- Supports electronic record requirements specified under CFR part 11
- Enables standardized sample processing with process templates that cover the entire workflow

QIAGEN www.qiagen.com

Image Acquisition Software

GeneSys

- Lets researchers quickly capture excellent images of even complex multiplex gels
- Users can select up to five dyes; the software calculates the best possible combination of filters and lighting to ensure each dye is accurately detected with minimal crossover
- Intuitive touch screen prompts users to select type of gel or blot and what it is stained with

SynGene
www.syngene.com

LIMS

Qualoupe

- Displays results parameters with clarity and flexibility
- Enables various types of results parameters to be used to record test sample data: numeric, color, free text, date, time, calculated value, etc.
- Features an intuitive, configurable user interface

Two Fold Software
www.twofold-software.com

Scientific Data Management System

NuGenesis® 7.1

- Supports both Professional and Enterprise 32-bit versions of Windows 7, and proprietary Empower™ 3 chromatography data system
- Stores and manages all types of scientific data to a centralized database
- Features a "file and print capture" function

Waters www.waters.com

Data Management Software

On-Demand

- Compatible with PC, Mac, Linux and mobile platforms such as Apple's iOS 4.3, BlackBerry OS 6 and Android 2.2 for touch tablet and phone operation
- Lets users meet data requirements associated with laboratory quality testing and batch processing, including full audit trail, 1 and 2D barcoding, batch and lab integration, and support for voice input & barcode scanning

The Weaver Group
www.theweavergroup.com

Solid Phase Extraction (SPE) Microplate

Development Microlute™

- Offers users a choice of up to 12 different phases and sorbent loadings (10 – 100 mg) in a standard format 96-well plate
- Constructed from a single piece of moulded high-quality polypropylene
- Will not bend or distort because SPE cartridges do not have to be repeatedly plugged in and out
- Each well has an individual drain spout, ensuring 100% sample transfer and zero crossover contamination

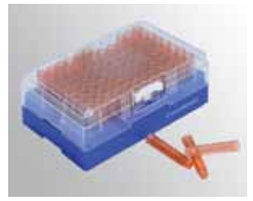
Porvair Sciences www.porvair-sciences.com

SUPPLIES & CONSUMABLES

Polypropylene Storage Tube

1.4 mL Amber

- Ensures the integrity of light-sensitive biological samples even over long-term storage periods
- Supplied in a 96-position sample tube storage rack that meets the SBS standard footprint
- Produced from high-quality FDA-approved polypropylene in a class 7 automated facility
- Available in non-coded, alphanumeric coded and laser encrypted 2D coded formats



Micronic www.micronic.com

Co-Extruded Plastic Tubing

EVA

- Combines the functionality of polyethylene with the flexibility of EVA (ethylene vinyl acetate)
- Can be used with economical barb-style fittings
- Produced from Class VI, FDA-sanctioned ingredients
- Resists gases and moisture and remains pliable even after extended contact with alcohol

New Age Industries www.newageindustries.com

Solid Phase Extraction (SPE) Sorbent

Strata™-X-Drug B

- Specially designed and quality-control tested for drugs of abuse
- Polymeric strong cation-exchange sorbent does not require conditioning
- Does not promote interconversion of norcodeine and normorphine to parent compounds
- Detection for all 11 common drugs of abuse is below new, lower SAMHSA cutoff levels

Phenomenex
www.phenomenex.com

Reagent Trough

25 m L

- Designed to reduce waste of valuable reagents in automated liquid handling applications
- Features a conical base design to minimize the liquid volume inaccessible to the liquid handling arm
- Made of grey polypropylene; suitable for light-sensitive reagents
- Available free from human DNA, RNase, DNase and PCR inhibitors

Tecan www.tecan.com

Freezing Containers

Nalgene Mr. Frosty®

- Accommodate 3.6, 4.5 and 5.0 mL cryotubes
- Enable simple cooling of samples at an optimal rate of -1°C per minute
- Require only 100% isopropyl alcohol and a mechanical -70 to -80°C freezer

Thermo Fisher Scientific
www.thermoscientific.com/mrfrosty

Glass Vials

One Closure

- Available in three sizes: 20 ml, 30 ml and 40 ml
- Available in amber or clear, providing solutions for working with light-sensitive compounds
- 24-414 closure comes in one size, for easy ordering and stocking
- Closure is available in polypropylene open-top lined with PTFE/silicone (0.125); a closed-top version is also available

Worldwide Glass Resources www.wwgrinc.com

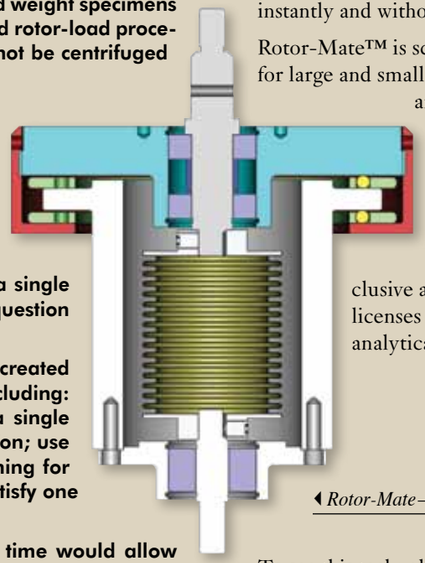
Self-balancing Centrifuge Rotor Technology

Problem: With the invention of the centrifuge came the problem of rotor balance. Specimen containers must be properly sized and properly located on the rotor to provide rotor balance each and every cycle. Rotor balance is achieved by symmetrically placing opposing size and weight specimens on the rotors as they are loaded. Within this standard rotor-load procedure, an uneven number of sample containers cannot be centrifuged as this creates out-of-balance rotors.

Similarly, an even number of specimen containers, but with unequal mass, such as 5 and 10ml samples, cannot be centrifuged in a single centrifuge cycle. This also creates out-of-balance rotors that can damage the centrifuge or cause it to shut down. Centrifuge operators and robotics software must be aware and trained to avoid these day-to-day real-world sample processing restrictions. Centrifuging a single microtiter plate or blood bag is presently out of the question without installing dummy counterweight containers.

These sample handling process limitations have created commonplace workarounds in the laboratory including: avoiding odd-numbered specimen cycles; use of a single specimen container size within a laboratory operation; use of dummy specimen counterweights; operator training for balanced rotor loads; and process bottlenecks to satisfy one or more of these conditions.

A general solution permitting any sample at any time would allow clinical and analytical laboratories to provide more efficient sampling handling, thus lowering the cost of services and increasing profit margin. Hospitals and clinics embracing a general solution as well as manufacturers providing the technological solution would enjoy competitive advantages over those who do not.



Rotor-Mate—Cross Sectional View

Solution: A newly patented technology, called Rotor-Mate™, provides a powerful transparent solution to the aforementioned problem. Centrifuge rotors are typically designed and mounted with their center of geometry coincident with rotation and mass centers. The rotor spins about this center without vibration. But any eccentric rotor load, such as a single specimen container, causes the rotor's fixed center of geometry and rotation to be at variance with its new center of mass and vibration ensues. Rotor-Mate solves this problem by allowing the rotor to physically shift its geometric center and rotate about the new center of mass in proportion to the eccentric mass. In so doing, the rotor operates totally smooth, even with enormous out-of-balance eccentric loads such as specimen serial loading or single microtiter plates.

The practical result is to free the operator or robot to process specimens of various sizes and in odd quantities without regard to specimen balance. Existing centrifuge manufactures have some form of rotor imbalance management, but none tolerates an imbalance in excess of 200 grams, as does Rotor-Mate™, or do so automatically, instantly and without electronics.

Rotor-Mate™ is scalable up/down for large and small centrifuge rotors and is devoid of springs, elastomers and sensors. Rotor-Mate™ is currently available for commercial application exclusive and non-exclusive licenses in both clinical and analytical applications.

To see this technology in action, search "rotor-mate4m" at www.youtube.com

For more information, e-mail howellgw@windstream.net

Maximizing ELISA Throughput and Efficiency

Problem: Enzyme-linked immunosorbent assays (ELISAs) are commonly used in diagnostic and quality-control laboratories. During an ELISA, an unknown amount of antigen is immobilized to the surface of a microplate well and an enzyme-linked antibody is subsequently bound. Between each step, the plate needs to be washed with a solution to remove any non-specific background, such as that caused by unbound proteins or antibodies. After the final wash step, the addition of an enzyme substrate produces a measurable change to indicate the quantity of antigen in the sample.

Reducing background noise and assay variation is the main challenge when interpreting ELISA data. To ensure reliable results with excellent accuracy and precision—while maximizing assay sensitivity—high-quality washing is essential. It is vital that all of the washing steps of any ELISA are performed as efficiently as possible. Any unbound material left in the wells increases levels of background noise, decreasing assay sensitivity and the quality of resulting data. As such, the well washing process needs to be as thorough as possible to remove any unbound material and provide optimized assay conditions.

Solution: In order to provide confidence in the accuracy, precision and sensitivity of obtained ELISA data, a standard and reliable washing protocol needs to be employed, where wash parameters are controllable and fully optimized. The Thermo Scientific Wellwash and Wellwash Versa microplate washers are excellent tools for effectively washing 96- and 384-well plates, ensuring that any unbound protein is eliminated from the reaction well.

Parameters for washing, such as volume, cycle number, speed, position, time, aspiration mode and shaking during soaking are easily adjustable to guarantee the best possible washing performance. As a result, unbound materials are efficiently removed at each washing step of the ELISA, maintaining background noise at a minimal level to increase assay sensitivity. If not removed, unbound protein can bind non-specifically to the enzyme active sites, reducing assay specificity. Through the incorporation of a sweep mode, the possibility of this occurring is significantly reduced, since these washers ensure extremely low residual volumes, efficiently removing any un-bound or non-specifically bound protein. Furthermore, by shaking the assay during soaking, experimental efficiency is increased, while saving on liquid consumption.

The Thermo Scientific Wellwash strip washer is compatible with 96-well plates, making it an ideal fit for routine clinical use. The more advanced Wellwash Versa performs efficient washing of cells, as well as 384-well plates.

It is essential that during these washing steps, there is no cross contamination of the wells within the ELISA plates, to ensure accurate data generation. Sensitive washing steps together with a special wash head design ensure that contamination is minimized, while preserving the covalent bonds of the solid phase antigen. Potentially damaging mechanical actions are therefore eliminated, providing a gentle, yet thorough, wash.

The accurate dispensing and aspiration of washing solutions via specially developed wash heads maximize efficiency. A reliable and accurate ELISA is obtained every time, through the automatic prime and rinse features which prevent clogging of the liquid channels. The addition of an aerosol cover also prevents aerosols of infectious diseases from spreading, therefore maintaining the integrity of resulting data for any downstream analysis.

With such importance on the effectiveness of the ELISA wash steps, microplate wash systems need to be easy to use. The Wellwash and Wellwash Versa incorporate language options and a context-specific help feature, which ensures that washing protocols are developed quickly and easily, with minimal user training. All users can therefore effectively use the equipment regardless of experience levels, resulting in increased throughput.

The more advanced Wellwash Versa can also be connected to robotic systems, making it a suitable tool for high-throughput laboratories. As such, multiple ELISAs can be performed with outstanding precision, accuracy and repeatability.

For more information, please visit www.thermoscientific.com/wellwash

***NAOSMM**'s goal is to educate and assist in the professional development of our members. **NAOSMM** will help make your responsibilities and job functions safer, more efficient and more economical.*

NATIONAL ASSOCIATION SCIENTIFIC MATERIALS MANAGERS

NAOSMM

WE ARE HERE FOR YOU!

Storeroom Managers
Laboratory Managers
Teaching Lab Coordinators
Purchasing Agents
Business Managers
in
Universities
Colleges
Community Colleges
Private Industry
Government Agencies
Research Institutions

FOR MORE INFORMATION, PLEASE VISIT US AT WWW.NAOSMM.ORG

WHO ARE WE?

The National Association of Scientific Materials Managers (NAOSMM) is a group of approximately 500 individuals in the USA and beyond involved in purchasing, inventory management and control, and the safety and regulatory matters of laboratory chemicals, supplies, instrumentation and special services in academia, research and industry. We are the go-to people/problem solvers in our departments and workplaces.

HOW DO I JOIN?

Joining NAOSMM is simple. Visit our website at **www.naosmm.org**. Annual membership fees are $75.

JOIN US AT OUR 38TH ANNUAL CONFERENCE AND TRADE SHOW, MINNEAPOLIS, MN

Monday, July 25 – Friday, July 29, 2011

Experience professional development, networking with fellow members and quality vendor interaction at the NAOSMM trade show.

TRADE SHOW:

With nearly 200 million dollars in buying power NAOSMM members receive excellent discounts from many vendors. Trade show booth reservations and sponsorship opportunities available. **www.naosmm.org**

KEYNOTE SPEAKERS FOR THE 2011 CONFERENCE ARE:

DR. ALISON HUBER, "Bridging the gap: the need to stabilize biological systems to facilitate biomedical and scientific research".

GREGG GREGORY is a nationally known, dynamic speaker who will speak on teamwork and collaboration in laboratory settings.

Other topics include: handling hazardous waste, CFATS regulations, RCRA Subpart K, Freight Costs, OSHA recordkeeping, RFID/asset management and more.

Travel grants are available for first-time conference attendees. **Deadline April 30. Apply at www.naosmm.org**

UPCOMING ▸ 39TH ANNUAL CONFERENCE AND TRADE SHOW, ALBUQUERQUE, NEW MEXICO
July 30 –August 3, 2012

ADVERTISER INDEX

Marketplace

PARTING POINTS

Takeaways from this month's issue:

SCIENTISTS AND THE SOCIAL MEDIA

Laboratories are at the forefront of research and analysis. But when it comes to communication, they are often followers rather than leaders and can be very slow to adopt innovations. A recent survey of nearly 200 lab managers revealed the reasons they have thus far resisted adoption of social media. Those reasons are, in order of importance:

1. It blurs the boundaries between private and business use
2. It leads to a loss of productivity
3. It threatens security with the possibility of confidential information being leaked

PERSONAL ACCOUNTABILITY

There is a lot more to getting things done than assigning tasks. Personal accountability is necessary, but it's not your job to follow your staff around, ensuring tasks are accomplished. Here are some tips for achieving a climate of accountability:

- Get input from your staff frequently and openly
- Nurture involvement in decision making, goal setting and performance monitoring
- Lead through collaboration
- Spot and reward individual initiative

OPTIMIZING ENERGY EFFICIENCY

By implementing a few smart choices in instrument design, managers can ensure that their automated laboratory equipment will run efficiently—and generate energy savings at the same time.

- If a process includes both horizontal and vertical motion, such as in pipetting applications, the weight of the mechanical components becomes a factor in energy consumption
- Examine the true cleanliness requirements of the equipment to avoid systems that have been over-engineered for cleanroom compatibility and consume more energy than is necessary

GREENING OLDER LABORATORIES

Retrofitting labs and science facilities to be more energy efficient involves a number of strategies to reduce energy consumption. Some of the most effective are as follows:

- Replace outdated fume hoods with either low-flow hoods or variable air volume (VAV) hood controls
- Install energy recovery systems that recycle thermal energy from exhaust air
- Consider "smart lighting" systems that incorporate daylight-responsive and occupancy-sensor lighting
- Unplug equipment when not in use, rather than simply shutting off

PERSPECTIVE ON: A QUALITY CONTROL LAB

For Brian Newell, quality services lab supervisor at Playtex Manufacturing, Inc., the biggest challenges he faces as manager are the heavy workload and the economic side of the business, such as the appropriation of funds for new equipment.

- Newell's lab uses skip-lot testing to keep the volume of samples under control
- He says using email, instant messaging and telephones reduces unnecessary meetings and speeds up finding solutions to urgent problems
- The lab uses software to perform tedious paper-pushing tasks such as managing training records and controlled documents

Glove Boxes

Smart Glovebox includes N_2 controller that auto-adjusts flow to maintain RH setpoint.

Starting at $1,755

Series 600 stainless steel glovebox includes dissipative PVC viewing window. RH controls available.

Starting at $8,000

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

Safety Glasses Dispensers in acrylic or dissipative PVC, designs hold from 8 to 48 glasses.

Starting at $232

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

Lab Apparel

Advanced Vi-Gard® I polyester/cotton lab coat combines durability, comfort and static control. Wide range of sizes and colors.

Starting at $29