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The article review process should begin with a query by e-mail or phone followed by a brief abstract or outline. Please state your topic and objective, and indicate your perspective as well as your professional relationship to the topic. Content must be unbiased and cannot promote a particular product or company. Article length may range from 1500-2500 words. All manuscripts must be submitted electronically by email or disk.

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The Truth about Quitting

You think it would be for more money. Or maybe better benefits. Or to shorten a commute and be closer to home. Or you might think it had to do with an opportunity that offered new challenges or career advancement. While all these possibilities are reasons people change jobs, in actuality, most people quit because of poor management.

According to Leigh Branham, author of *The 7 Hidden Reasons Employees Leave: How to Recognize the Subtle Signs and Act Before It's Too Late*, “More than 85% of managers believe employees leave because they have been pulled away by ‘more pay’ or ‘better opportunity.’ Yet, more than 80% of employees say it was ‘push’ factors related to poor management practices or toxic cultures that drove them out.”

The Herman Group (www.hermangroup.com) concurs. Their “Five Principal Reasons People Change Jobs” says that employees leave because:

1. It doesn’t feel good around here. (related to corporate culture)
2. They wouldn’t miss me if I were gone. (lack of appreciation)
3. I don’t get the support I need to get my job done. (on-the-job frustrations such as red tape and incompetent supervisors)
4. There’s no opportunity for advancement. (this includes opportunities for learning as well as promotions)
5. Compensation is the last reason people most leave. (it’s not always about the money)

That’s the bad news. The good news is that your management choices could be a key factor in why employees stay. Assessing the “quality of life” in the lab is a good place to begin.

What I see when I look at the list of five reasons people leave are five clues on how to retain staff. Starting with the first one, make your lab a good place to work. Think about the corporate mission, safety, overall environment, and other factors that give the lab its “feel.” Second, find ways both formally and informally for employee recognition. Make it clear that good work will be recognized and appreciated. Third, ensure that your lab and personnel have the tools to do the tasks assigned. See that your staff has what they need in terms of equipment, knowledge, and other resources to perform competently and in a timely manner. Fourth, look for learning opportunities — courses, conferences, online training, and other ways to keep skills current. In addition to external learning, encourage cross-training when possible so people feel that they are learning something new as well as becoming more valuable to the company. Fifth, when a there’s an employee you would hate to see leave, advocate on their behalf if a raise, more vacation time, or other benefit is available to them.

“Show me the money” is really not the mantra of staff retention. In work as in life, it’s the little things, such as courtesy, respect, appreciation, and career development that keep employees loyal and maybe not happy but at least content with their jobs.

While your staff probably won’t be sporting “I ♥ my boss” t-shirts (recently on eBay for $5.50 in pink, white, and blue), it might be worthwhile considering how they view life in the lab. Ask for their feedback. Create an atmosphere where they, and you, want to work.

Patrice Galvin
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Data kindly provided by Dr. Weston Patrick Kue, Harvard Medical School, USA

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ISSUES IN THE MANAGEMENT OF A Core Imaging Facility

THE MOST IMPORTANT ASPECT OF A MULTI-USER CORE FACILITY IS THAT THE DATA GENERATED ARE ACCURATE AND USEFUL FOR THE GOALS OF THE RESEARCHERS.

A successful core facility relies on a combination of knowledgeable staff that understand technological advances, have the ability to educate and inform users, and have a workable system of offering a service.1

Over the last few years, new innovations in specimen labeling, coupled with an increased sensitivity of detection leading to molecular imaging and analysis, has resulted in an increased interest in microscopy and to a proliferation of imaging facilities. The arrival of a user with their precious sample is often the culmination of many hours of research, for example, optimizing immunostaining protocols, transfecting cells with fluorescent tags, or anticipating changes in live cell behavior following treatment with a compound of interest. A novice will need advice on how best to capture useful, relevant data and tell a story with pictures to ensure the message is clearly understood. There is always more than a single way of doing things and in microscopy, as in art, creativity is rewarded. An effective manager of such a facility must be available to facilitate the optimal use of its resources.2

EQUIPMENT AND MAINTENANCE

Hardware
Walking into a typical imaging facility, a visitor will find some basic pieces of equipment, each connected to a computer and image capture device, as in the partial list shown in Table 1. In an institution where microscopy is a priority and ample funding is available, additional equipment will include duplicate systems and fully accessorized high-end models that can add to the cost. One can also find some highly specialized systems that carry out limited functions at exceptionally complex and accurate levels.

A collection of such equipment requires maintenance, and thus, the operational costs of an imaging facility are considerable. The major expense is the maintenance contract on the larger systems. The risk is too high to operate without such support, since the repair cost of a single major breakdown can exceed the cost of a yearly service contract. Several cost-saving models exist;3 some institutions arrange group service contracts from a single provider. However, in our facility, our complex and highly specialized instruments have never qualified for this type of group arrangement.

A capable manager can carry out several preventative measures to extend the life of the equipment or repair some breakdowns. Long-term benefits can result from being present at the time of installation of new equipment to observe and ask the company representative basic questions, such as how do you gain access to replacement parts and how do you achieve optimum optical alignment? While the scanning parts of microscopes are too complex for routine maintenance by the facility manager, the microscopes themselves, the condensers, and lenses have to be cleaned and light sources require regular alignment. Users are encouraged to report problems as soon as they are apparent, before they escalate into a major breakdown.

Software
In the age of digital imaging, all equipment comes with its own software, each with a different
level of complexity. Some will collect images very easily but may not do extensive image analysis; others only carry out post-collection processing and quantification. In a typical imaging facility, there should be at least one dedicated image processing computer workstation that has several software packages installed. Many data collection systems have an offline version of their software package and this is a practical solution to avoid tying up the microscope with lengthy analysis. It is not within the scope of this article to evaluate various commercial software products, except to mention that it is difficult to find a single software package that contains all the functionalities required to carry out novel image analysis.

A manager should be familiar with the software programs offered in their facility and be able to recommend one to answer a specific question. There are a few recognized software programs, such as Adobe Photoshop; however, a user must be cautious in using it because any image processing prior to subsequent quantification will irreversibly alter the content of the data. Free software is available on the internet and can be sufficient to carry out many tasks. For example, Irfanview (www.irfanview.com) is an excellent browser to quickly scan directories to find a particular image and will convert formats. ImageJ (http://rsb.info.nih.gov/ij), software developed at the NIH on a Java platform, has resulted in scientists worldwide posting new plugins for different analyses that are available for download.

Generally, service contracts do not cover the computer; therefore, users should organize their data properly, store images at an appropriate location on the computer, and remove files at regular intervals. Since surprisingly large amounts of data can be collected within a relatively short period of time, it is not unreasonable to specify a maximum storage space for each user on the hard drive and a time limit (e.g., 60 days), before data is removed from a shared computer. The most common backup medium is on a CD, preferably in duplicate, or on DVD, also in duplicate, although more complex systems exist. A USB key is unreliable as a storage device but can be used to move data from one computer to another. In institutions where the network has been configured to allow the transfer of large amounts of data between computers, microscope users should include this step as part of their logoff procedure.

### Table 1: Partial list of some basic equipment for an imaging facility.

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission electron microscope</td>
<td>Cryostage, field emission</td>
</tr>
<tr>
<td>Scanning electron microscope</td>
<td>Cryostage, environmental microscope</td>
</tr>
<tr>
<td>Widefield upright microscope</td>
<td>Water immersion lenses</td>
</tr>
<tr>
<td>Widefield inverted microscope</td>
<td>Environmental controls for live cell imaging</td>
</tr>
<tr>
<td>Laser scanning confocal microscope</td>
<td>Multiple lasers, including UV spectral separation</td>
</tr>
<tr>
<td>Spinning disc confocal microscope</td>
<td>Advanced light source, back-thinned EM CCD camera</td>
</tr>
<tr>
<td>Multi-photon confocal microscope</td>
<td>Modern laser</td>
</tr>
<tr>
<td>Live-cell accessorized microscope</td>
<td>XYZ stage, sensitive CCD camera, incubator, gas and temperature regulators</td>
</tr>
<tr>
<td>TIRF system</td>
<td>Camera with high spatial, temporal resolution, optimal objectives</td>
</tr>
<tr>
<td>Laser microdissection</td>
<td>(none)</td>
</tr>
<tr>
<td>Software for image analysis and processing</td>
<td>Computer with fast processor, added RAM volume rendering, 3D quantification, deconvolution</td>
</tr>
</tbody>
</table>
RULES AND REGULATIONS
All imaging facilities should have established rules of operation clearly implemented, as expected within any shared facility. The equipment is expensive, the operational learning curve can be steep, and since there are many settings on any microscope to obtain an image, once users learn to get optimal data from properly (and optimally) operating equipment, they should not expect less.

Guidelines are not merely instructions for using equipment, they also address safety issues. By the time a sample is brought into the imaging facility, it should no longer have the same degree of hazard associated with it as it had during the preparation. In other words, emphasis is now on maintaining a safe environment for others using the shared equipment. Gloves should not be worn when using a computer keyboard or focusing a microscope, contamination should not be a concern for the next user. A microscope stage should not have any residue on it after someone has finished using it, and both slides and outside surfaces of samples should be clean and dry. It is a definite advantage for a manager to be familiar with histochemical techniques to provide advice on different slide preparation procedures.

New Users
In our facility, I arrange to meet new users to discuss their project and decide which of the various imaging modalities would best suit their needs. Even for a task as simple as viewing fluorescent images, the possible wavelengths of the fluorescently labeled specimen have to be determined in order to match the available detection systems, filters, lasers, etc. If a study entails live-cell imaging, the person doing the work is given an explanation of the necessary conditions required for keeping cells alive and are shown the additional equipment we have for achieving this goal. This may include a stage/objective heater, gas regulators, an enclosed stage incubator, and humidity control.

After the initial meeting the user fills out a form containing information about their laboratory, grants that support the study, and the anticipated level of usage. If heavy use is expected, a brief description of the project is included to be approved for merit prior to proceeding. The form also includes the specific microscopy experience of all individuals from the same laboratory who would be using the equipment. In this way, all users will be identified and their levels of expertise determined for training sessions. In return, a user is supplied with the rules of operation such as the fee schedule, how booking is done, appointments made or broken, and rules of data handling on shared computers. During the first training session, everyone is given their own password-protected user account on each computer with the lowest level of permission required by the software to operate properly.

The amount of training is determined by the complexity
of the instrument and a user’s microscope experience. Personally, I prefer individuals or a small group of 2–3 people and instruction with a user’s own preparation will make the session more stimulating and will encourage questions. During the optimization of settings, the important message is underlined that a clear question will determine the magnification, choice of area, and composition of an image. A training session should touch on basic principles of imaging, microscope alignment, and principles of confocal microscopy. If the initial training is thorough and users feel comfortable with the controls, they will feel as if we are working with them on the project and are more likely to ask for help when things are not working as planned. Periodically, we may look through the images together and re-visit their initial project goals.

Final image analysis and possible quantification are also discussed and should be done soon after the beginning of image collection. It is essential to analyze preliminary data because one may find that settings, resolution, and contrast are not adequate and have to be modified before proceeding.

Ultimately, a manager should be assured that a user is comfortable with the equipment, treats it with respect, and will get useful data. Even if they have used similar equipment in the past, manufacturers and models use different procedures, and therefore, all new users should attend at least one instruction session before working independently. It is helpful if a brief set of instructions is displayed at each microscope and should contain essential information such as sequence of turning machine on/off, initialization steps, and folders to open to get started.

**Scheduling**

A system needs to be in place to schedule time on the various microscope systems. The simplest method is to have a schedule book or calendar at each work station where users can book times, and at the end of a session, hours of use are written into a log book. Although this process can work reasonably well, there are more precise and accurate methods, especially for users who are not located physically within an institution. Web-based calendars are now commonly used and have several advantages. From a user’s point-of-view, they can schedule time from their own work areas, and should a problem arise, can promptly cancel their appointment. Electronic scheduling can instantly provide a manager with the overall level of activity in the facility, and furthermore, most software can produce reports for billing purposes and can be used to identify

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### Table 2. Microscopy listservs and websites

<table>
<thead>
<tr>
<th>Microscopy Listservs</th>
<th>Web site</th>
</tr>
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<tbody>
<tr>
<td>Confocal microscopy</td>
<td><a href="http://listserv.acsu.buffalo.edu/cgi-bin/wa?S1=confocal">http://listserv.acsu.buffalo.edu/cgi-bin/wa?S1=confocal</a></td>
</tr>
<tr>
<td>General microscopy</td>
<td><a href="http://www.microscopy.com">http://www.microscopy.com</a></td>
</tr>
<tr>
<td>Image J software</td>
<td><a href="http://rsb.info.nih.gov/ij/list.html">http://rsb.info.nih.gov/ij/list.html</a></td>
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</table>

<table>
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<tr>
<th>Microscopy education</th>
<th>Web site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microscopy, Imaging Resources</td>
<td><a href="http://swehsc.pharmacy.arizona.edu/expath/micro">http://swehsc.pharmacy.arizona.edu/expath/micro</a></td>
</tr>
<tr>
<td>Microscopy Primer</td>
<td><a href="http://micro.magnet.fsu.edu/primer/anatomy/imageformationhome.html">http://micro.magnet.fsu.edu/primer/anatomy/imageformationhome.html</a></td>
</tr>
<tr>
<td>Imaging Technology</td>
<td><a href="http://www.microscopy.com/">http://www.microscopy.com/</a></td>
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<tr>
<td>Microscopy Resource Center</td>
<td><a href="http://www.olympusmicro.com/primer/">http://www.olympusmicro.com/primer/</a></td>
</tr>
<tr>
<td>Useful Microscopy Links</td>
<td><a href="http://www.ludwig.edu.au/confocal/Links.html">http://www.ludwig.edu.au/confocal/Links.html</a></td>
</tr>
<tr>
<td>J. Paul Robinson</td>
<td><a href="http://www.cyto.purdue.edu/flowcyt/educate/pptslide.htm">http://www.cyto.purdue.edu/flowcyt/educate/pptslide.htm</a></td>
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<tr>
<th>Microscopy courses</th>
<th>Web site</th>
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<tr>
<td>Woods Hole Marine Biological</td>
<td><a href="http://www.mbl.edu">http://www.mbl.edu</a></td>
</tr>
<tr>
<td>Cold Spring Harbor</td>
<td><a href="http://www.cshl.edu">http://www.cshl.edu</a></td>
</tr>
<tr>
<td>UBC 3D Live Cell Imaging</td>
<td><a href="http://www.3dcourse.ubc.ca/index.htm">http://www.3dcourse.ubc.ca/index.htm</a></td>
</tr>
</tbody>
</table>
inexperienced users who may have operated the equipment inappropriately.

Generally, scheduling software has a separate calendar for each piece of equipment and can be configured according to the established rules. Contiguous hours of use can be limited, maximum hours per week per person can be defined, and cancellations at the start time or soon after can be denied. Scheduling software may be written or modified from existing programs by in-house programmers. Several free scheduling programs can be found on-line and standard commercial software used by many imaging facilities is called "Calcium" (www.brownbearsoftware.com).

Of course, if equipment is immediately available, people will use it without prior booking and a system is needed to monitor use at each workstation. The simplest system, an honor system where entries are made in a book, is not always the most efficient, and a better method is to install monitoring software. Since this is difficult to find, I use a simple macro that, as it launches the microscope program, records the name of the user, date, and times of both start and end. This solution may be difficult to implement if a single executable program and its location cannot be clearly identified.

**User fees**

Operational costs of an imaging facility are high and administrators encourage cost recovery in the form of user fees. Useful discussions on this topic can be found in the Archives of the Confocal Listserv (see Table 2). Since complete cost recovery is not possible primarily because of steep maintenance contracts, the debate continues on how much revenue should user fees generate. Fees for using equipment are inevitable in most institutions; however, they should not be at a level that discriminates against those with modest funding.

It must be appreciated, however, that core facilities containing technologically complex equipment require long range plans and financial support to remain competitive, to develop new techniques, to upgrade the instrumentation to the highest performance, and to invest in education. A scientist cannot fully explore novel methods that require time to validate if the results will be based on cost rather than on outcome.4

Fees are often posted on facility web sites and are given to new users. The initial training fee, which may include a microscope tutorial, is higher than the unassisted hourly rate, and those from other institutions and/or non-academic users could also pay more. A database can keep track of users, their supervisors, grant information, hours of use, and can generate bills at regular intervals.

**A MANAGER'S CONTINUING EDUCATION**

Many managers of imaging facilities are hired not because of their managerial training and abilities but because of their scientific background and expertise in the field of microscopy. However, to be effective in that position, a technically trained person also requires interpersonal communications skills while focusing on people, the users of the facility. Our role is further extended by helping researchers answer their biological, genetic, and biochemical questions using some form of optical microscopy and some novel techniques. The field of imaging is constantly changing and we should remain up-to-date with current techniques to make the scientists competitive in writing papers, getting grants, etc. There are several easy ways to achieve this.

It is simple to subscribe electronically to the TOCs (Tables of Contents) of a few journals and skim through the titles for new articles on imaging. It is also easy to subscribe to some listservs and listen to interesting discussions from the scientific community as well as vendors and to participate in the threads. Their archives are easily searchable for topics. Additionally, there are some excellent microscopy tutorial web sites. The most useful ones are listed in Table 2.

I file potentially useful emails from the listservs into different folders on my computer for use in the future. Thus, when asked a question, I may not know the answer immediately, but have built a resource to look for answers. Staying knowledgeable attracts users and makes our work more interesting.

**EXTERNAL RESOURCES**

An imaging facility's operation can be greatly enhanced by resources from other departments within an institution. Due to the nature of our work, an electronics or biomedical engineering department can provide a service. Unfortunately, they are often reluctant advisors because at times they do not understand the problems, they may fear warranty issues, or they are just too busy to make an open-ended service call. Nevertheless, they can help troubleshoot connections, provide generic parts, fuses, cables, tools, and help build some electronic devices, such as monitoring systems. At times they actually welcome the challenge of non-routine questions.

An Information Technology (IT) department is also an essential adjunct to an imaging facility. Internet access, transfer of files to remote sites, and advice on operating systems should all be within their capabilities even though most departments will not support the complex imaging software used in many facilities. IT staff generally do not view imaging workstations as friends because in many institutions, especially in hospitals where confidentiality issues and internet hacking are large concerns, computers may be
absorbed into a limited-access environment where users lose administrative rights that result in software not operating properly. This can become a heated issue and has to be resolved at each institution.

The public relations department can be an ally by promoting the establishment and maintenance of a website. Some of the topics could include the history of the facility, naming any benefactor, description, and photos of the equipment, instructional documents, an image gallery, the scheduling software, forms for new users, fee schedule, etc. This public display is very beneficial, raising the profile of a facility, even of the institution. The visually pleasing nature of microscopy can create an eye-catching design very easily.

Finally, most core imaging facilities are under the supervision of a scientist or a committee with members who represent both scientists and administration. This upper level of management fulfills a useful function, such as a periodic review of policies, approval of long-term studies that anticipate extensive utilization of the facility’s resources, and act as general scientific advisors for ongoing projects.

REFERENCES:

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Tuning-up Lab Instrument Service

SELECTING THE OPTIMAL INSTRUMENT SERVICE MODEL MEANS FINDING THE RIGHT BALANCE BETWEEN COST, RISK, AND QUALITY.

Just as instrument technology is evolving to meet the changing needs of laboratories everywhere, so are the dynamics of instrument maintenance as lab managers seek the optimal balance of risk, quality, and costs. In recent years, four instrument service models have risen to prominence and a fifth, a blend of each has emerged:

- In-house Metrology Model
- Service Consolidator Model
- Independent Service Provider Model
- Original Equipment Manufacturer Service Model
- Integrated Service Delivery Model

Each of these choices offers advantages and drawbacks, and a clear understanding of how they relate to a particular lab or network of labs is vital to achieving optimal results.

Every experienced lab manager knows the considerable amount of time required to select and manage contracts for repair, maintenance, calibration, and compliance service for key equipment. Also, instrument maintenance ranks right up there with personnel costs among the biggest budget items for most labs. While commercial labs are facing increasing pressure to control these costs, service requirements must be assessed holistically — looking beyond the asset list to critical factors such as position in process and how each instrument’s downtime affects lab productivity.

Each laboratory’s requirements can vary due to factors such as past procurement policies, management changes, and how much effort has already been devoted to fine-tuning its instrument service program.

Imagine this scenario: You manage a lab that has ten liquid chromatography systems, two LC/MS systems and a full complement of ancillary equipment such as pH meters, centrifuges, and micro pipettes to support your staff of three analysts. You’re the third manager of this lab in ten years and, as it grew, the equipment vendor choice changed with each manager. In mid-year it’s smooth sailing. When it’s time to renew contracts, however, your personal productivity comes to a grinding halt as budgeting and negotiating contracts for each type of equipment dominate your work life.

If this sounds familiar, you’re not alone. Most labs employ a wide variety of analytical techniques (LC, GC, LC/MS, NMR, etc.) from several vendors. Therefore, it’s not uncommon for lab managers to spend a large amount of time directly working on contracts or working with procurement teams to secure service coverage for mission-critical systems.

Factors such as technology type, maturity, and the role each instrument plays in the workflow will help point you to the service model that will provide the best cost/benefit ratio.

IN-HOUSE METROLOGY MODEL

Many organizations have their own teams of engineers to service their mainstream instru-
mentation. This in-house metrology model often offers fast response because the engineers are usually on-site. Another benefit of this approach can be quality: service engineers are often trained by the original equipment manufacturers (OEMs) under ‘shared care’ programs which provide training and certificates suitable for audit purposes. In many cases, shared care programs also provide in-house engineers with service notes or special training topics to help keep them current. While most in-house metrology teams are focused on scheduled, periodic tasks such as preventive maintenance or calibration, some also repair instruments. While in-house servicing reduces the need for OEM service contracts and associated costs, lab managers also need to consider the real cost of the in-house metrology group which can be larger than expected.

Depending on the responsibilities and scope of an in-house service team, the fully weighted cost of a headcount must be weighed against the costs of other instrument service models. Many companies find that outsourcing instrument service is the most economical approach when the costs of staffing, training, infrastructure, and parts inventory are considered. The bottom line: does the rapid response of an in-house team outweigh the costs and the risk burden? The organization must also consider whether instrument service fits within its area of core expertise.

SERVICE CONSOLIDATOR MODEL

The Service Consolidator model is often employed by larger labs or whole sites. You may hear this called the service aggregator model or the service insurance model, as it’s based on actuary tables compiled by these service organizations to guide contract purchases. Often the favorite service model of procurement organizations, the Service Consolidator model generally reduces service contract spending by 15-25% compared to other models. They do this by assessing the customers asset list against the costs of other contract spending. Often the favorite service model of procurement organizations, the Service Consolidator model generally reduces service contract spending by 15-25% compared to other models. They do this by assessing the customers asset list against the costs of other instrument service models. Many companies find that outsourcing instrument service is the most economical approach when the costs of staffing, training, infrastructure, and parts inventory are considered. The bottom line: does the rapid response of an in-house team outweigh the costs and the risk burden? The organization must also consider whether instrument service fits within its area of core expertise.

The Service Consolidator model focuses predominantly on the cost variable in the instrument service value equation. There can be tradeoffs, however, in terms of risk, quality, and convenience. Although, service consolidators provide a single point of contact for service-related issues, they typically do not offer any direct instrument service themselves. When a service event is reported to the consolidator, the laboratory must get approval from the consolidator to get quotes from the OEM or other third party for service. Once the quote is received and provided to the consolidator, the repair must be approved before the lab can schedule a service engineer to visit. Upon completion of the service event, the consolidator reconciles invoices and can reject those deemed outside the scope of the repair. While the reduction in service spending is attractive to procurement departments, the service process under the consolidator service model can be costly to lab managers in terms of lost productivity. Managers are more involved in service events, often interfacing between the OEM and the consolidator, and must typically do initial triage themselves before escorting an OEM engineer into their lab. In the event that repair is required on a piece of instrumentation on which the consolidator did not take a service contract, the impact on lab productivity can be major. OEMs typically offer priority response only to contract customers, so if repairs are required on a time and materials basis, labs may expect delays in dispatching service engineers to the site. This is a recipe for tension between the laboratory, the consolidator, and the original equipment manufacturer.

INDEPENDENT SERVICE ORGANIZATION MODEL

The Independent Service Organization (ISO) model is based on service delivery through regional organizations that offer support services for a variety of instrumentation, usually within a limited distance from their corporate office. The greatest attraction to the ISO model is price, usually the lowest of the service model options. ISOs tend to be small businesses, able to offer lower-priced service because they don’t carry the overhead of larger companies. In addition, because ISOs are usually operated and staffed by engineers formerly employed by a variety of OEMs, they can service more than one vendor’s instruments or technology. This helps lab and procurement managers reduce the number of service agreements they deal with by consolidating services with the ISO. This scenario tends to work best with relatively mature, mainstream HPLC and GC instrumentation. Finding an ISO to service more complex instrumentation like the LC/MS or any custom instrumentation is more challenging.

There are other tradeoffs with the ISO model. First, there can be more risk when it comes to quality because ISOs do not have factory support for instrument repair, maintenance, or compliance. While many ISO engineers are factory trained, this ended when they left their OEM jobs. Some equipment manufactures are even considering limiting certification to the period an engineer is directly employed by them. The rationale is that only while employed by the OEM does an engineer receive service notes, bug fixes, and new product skills training. This can be critical, especially in a regulated environment.
Another area that deserves scrutiny is services developed directly by each ISO. The degree to which each ISO follows stringent standards varies, so labs are well-served by conducting due diligence in this area. Lastly, due to their size, ISOs are often not a viable solution when service standardization is required across labs at different sites, states, or countries. Just as size can be an asset when it comes to holding costs down, it can also be a liability when harmonization is needed across multiple locations.

OEM SERVICE MODEL

Having each key instrument serviced by its manufacturer falls at the high quality/low risk end of the service model spectrum. It also falls at the high cost/high administrative load end. The OEM service model is based on the premise that labs will receive the highest quality service from the companies who manufactured their systems. While OEM service contracts are often more expensive, they are also considered to be the lowest-risk service option. Factory-trained and supported engineers have access to product bulletins, service notes and R&D personnel, service fixes, plus warehouses of parts. These strengths, combined with the global infrastructure of many of today’s larger instrument suppliers, make the OEM model the frequent choice for highly complex systems or those that are critical to laboratory productivity.

The tradeoff for this low-risk, high-quality service is cost. There is more to this cost component than the price of service agreements alone. When considering the OEM service model, it’s important to look beyond the hard costs such as replacement part prices, contract prices, and labor rates. To clearly assess the viability of this model for your laboratory, you must also address the soft costs associated with contract administration and analyst productivity. Time truly is money, and understanding the number of hours spent purchasing and managing service contracts from multiple vendors is critical. Even if you spend as little as 15 minutes discussing contract options with an OEM sales specialist, this time adds up quickly when you do this for 80 or 150+ systems in your laboratory. In addition, analyst productivity is impacted when your service program is spread among several vendors. They must often determine the right service hotline to call, then under most OEM contracts, do some initial troubleshooting over the phone before an engineer will be dispatched. Our studies have shown that there can be well over 25 process steps involved on the laboratory side from problem reporting to final resolution. There’s the initial triage time, the need to escort OEM engineers while onsite, explaining or reproducing the problem, and verifying the repair. These hours represent lost laboratory productivity as well as additional administrative cost.

Five things to consider when designing your instrument service program

1. Consider the solution globally. Form a team of lab, procurement, and others to evaluate solutions efficiencies across functional departments.
2. Assess your service requirements holistically. Designing your service program based on your asset list alone may not take critical factors such as position in process, instrument-criticality, or sensitivity to downtime into account.
3. Know your service provider. Understand their business model and what they expect from you; get the specifics on their infrastructure and ask others about their service reputation.
4. Verify your provider has the right expertise. Ask for training records and certifications for anyone who works on your instruments upfront — it’s not only a good idea, in some regulated environments it may be required.
5. Don’t choose a service strategy based contract price alone. Consider the “soft costs” associated with instrument downtime and lost analyst productivity. The lowest priced contract may actually be more costly in the long run.
lab that we described in the scenario at the beginning of this article, then the OEM model and ISO model are likely to be high on your consideration list. On the other hand, if you’re tasked with managing service for larger labs or are participating in a service program design team for your entire site or organization, the Service Consolidator or In-house models deserve closer consideration. There’s also a fifth model that’s emerging in response to customers’ evolving needs.

**INTEGRATED SERVICE DELIVERY (ISD) MODEL**

A recent trend in the analytical instrument service industry has been for equipment manufacturers to develop service programs that blend aspects of each of the traditional service models according to the requirements of each organization.

These new programs are designed to overcome the administrative burden of managing multiple OEM contracts, while allowing procurement personnel and lab managers to consolidate multiple service contracts into one. The ISD provider becomes the single point of contact for all instrument service across the laboratory to streamline service processes and make the service program more convenient for lab managers and analysts. The ISD can leverage the advantage of the In-house model by placing engineers and a parts cache on-site to manage scheduled services, as well as to triage instrument service events. This frees lab personnel from the time-consuming involvement in service events while reducing the biggest delay-causing steps in most instrument service events — engineer travel and parts shipping (Figure 1). Because the engineers work for the vendor, the Integrated Service model can provide the benefit of onsite resources without the weighted costs and infrastructure limitations inherent with the In-house Metrology service model. When compared to traditional instrument service models, the ISD model reduces the number of process steps associated with service events and shifts responsibility from analysts to the vendor’s on-site resources. Not only does this make the service program more convenient, it also helps lab managers protect analyst productivity by keeping them focused on lab goals rather than participating in instrument service events.

An additional advantage to blended service models is the asset management and reporting functions typically available under these programs. Most of the traditional service models provide very little information to lab managers about service delivery. It’s often difficult for managers to track service histories, service costs, or return on services investment. This type of asset management and service reporting is a key feature of today’s multi-vendor service provider programs.

**CONCLUSION**

Choosing the right instrument service program can be a daunting task as you consider all of the service factors that drive your service-level requirements. Lab managers must consider all components of the instrument service value equation. When considering any of the traditional service models reviewed here or even investigating a blended model, it’s important to remember that anything that impacts service quality, reliability, or responsiveness can have a direct impact on laboratory efficiency and analyst productivity. And, while the price of your service program will always be a consideration, consider the costs and risks of your choices to your company’s business goals.

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The Confusion Around COTS

IF A VENDOR CLAIMS TO PROVIDE A COTS SOLUTION, WHAT SHOULD A BUYER EXPECT? BETTER STILL, WHAT SHOULD A BUYER DEMAND?

In software for the pharmaceutical industry, these days it seems like “COTS” (Commercial Off-The-Shelf) is inescapable. Suddenly, everything is COTS. However, the rapid proliferation of the term has far exceeded its actual availability. The terminology may have changed, but in most cases the reality of system deployments has not.

In order to understand the current overuse, and in some cases blatant misuse, of the term “COTS,” a short recap of the LIMS industry is in order. LIMS themselves did not originate in the pharmaceutical industry; they can trace their heritage to environmental laboratories. However, in serving one laboratory environment, vendors quickly realized that there were many similarities between laboratories in different industries and aggressively marketed their systems to other industries. To make the adoption of their solutions tenable in other industries, LIMS vendors worked to design highly adaptable systems which was a logical approach. Customers were provided with a basic environment and database, and a set of tools with which to extend the system.

At the time, most laboratories were completely paper-based, and their choices were restricted to two options: build something completely internally, or build something on top of a commercial LIMS platform. In many cases, the LIMS platform provided a good starting point and could save the laboratory time and money compared to a completely custom solution. However, in many cases, the limitations imposed by the basic LIMS platform could actually prove to be complex or insurmountable barriers to a successful deployment, and custom solutions were not uncommon. The pharmaceutical industry in particular saw many custom solutions developed due to the intense regulatory scrutiny and complex testing requirements of their day-to-day business. Commercial LIMS platforms continued to improve, however, and over the past 5-10 years it has become very uncommon for even pharma companies to develop solutions internally, despite the fact that there remain many significant gaps between the commercial, generic LIMS platforms and their specific business needs.

In the past decade, pharmaceutical companies have increasingly recognized that software development is not their core competency. Executive management has encouraged their IT teams to seek commercial solutions to their needs as much as possible, and has actively discouraged internal development. LIMS vendors responded to this trend by claiming that their solutions no longer required “customization,” but rather could now be “configured.” This wordplay was in many cases nothing more than marketing. Pharma companies responded, knowing that customizing a LIMS system to meet their needs could often represent greater effort than simply building one themselves and hoping that this new “configurability” would reduce their deployment...
and maintenance burdens.

At this point, it is important to provide some clear definition of the difference between configuration and customization:

**Configuration:** A configuration option should require no programmatic code at all and be completely tested by the vendor before software release. Ideally, configuration should be done through the user interface, although in some cases configuration files may be used, provided that appropriate testing has been completed.

**Customization:** Customization is ANY form of programmatic code, including any and all varieties of SQL+Plus, Scripting, etc.

Some systems did make progress in offering greater levels of configurability. Unfortunately, in many cases vendors claims of configurability were in fact based on customization. Wrapping a GUI window around a script does not change the fact that the script represents a customization. If it didn’t come with the system, it was not tested and the validation burden rests completely on the customer.

The purpose of this lengthy digression was to provide a context in which we can examine the current trend of claiming that systems are COTS. This trend began in the past 1-2 years, as the FDA began using the term in presentations. The term has been in use in other industries for many years, particularly in engineering fields. It has been applied to software components and to hardware components. In our context, it is being applied to software systems, particularly LIMS. LIMS vendors are aware, sometimes painfully so, of the impact of customization on system validation, deployment, and maintenance. The message they try to convey is that all that pain is a thing of the past. In some cases, vendors have made significant progress; in other cases, the product has barely changed at all, despite the marketing claims.

So, the question is, what should a customer be looking for in a COTS solution?

The first step is to approach the term realistically. No solution will meet 100% of a company’s needs out of the box (OOTB). However, it should not be unreasonable to set a lower target of 75%, and optimistically look for greater than 80% of your functional requirements. The challenge is to evaluate whether the requirements that are presented in a demonstration are in fact included in the basic software system. Most of the LIMS vendors have been demonstrating their systems for years, and are prepared to show what their systems are “capable” of doing. This will frequently include custom functionality that is NOT delivered as part of the core product, and is not documented or supported. Critical evaluation of the true OOTB capabilities of a system must discriminate between what a system is “capable” of and what it truly delivers.

In the pharmaceutical industry, there are several areas that have represented challenges for LIMS systems in the past that are excellent indicators of the scope and true capabilities of the basic product.

**PRODUCT AND BATCH MANAGEMENT**
Most LIMS systems are sample oriented. In order to accurately connect samples to a product of interest, many fields are typically added to the sample tables in the database to include information like potency, product identification, formulation type, and more. For a pharmaceutical LIMS system to be truly useful OOTB, it should manage drug products and drug substances independently, then simply relate the samples to those products. The same is true of manufacturing batches; these should be independent entities, with their own set of properties, and be related to samples that represent those batches.

**DISSOLUTION (USP 711) AND DRUG RELEASE (USP 724)**
There are several common tests in the USP and other national pharmacopeias that require multiple stages and logic for evaluating the results of the testing but dissolution is one of the most common, and most commonly lamented.

- Can the software easily handle multiple analytes and multiple timepoints when designing dissolution test methods and processing dissolution data?
- Does the software understand Q values and how to handle them?
- Does the software provide the flexibility to deviate from the USP guidelines where required?
- Are additional testing stages automatically created based on the collected results?

**STABILITY TESTING**
Most LIMS vendors that target the pharmaceutical industry have some kind of stability functionality available. However, it can sometimes be too rigid to adapt to the reality of stability testing, particularly during R&D. Special considerations include:

- Can stability studies be altered easily to include additional timepoints or conditions?
- Can stability studies easily reference release data as time zero results?
- Can inventory material be easily tracked and managed?
- Can multiple packages be simultaneously evaluated, in multiple orientations?
SYSTEM EXTENSIBILITY
As previously mentioned, no system will be able to satisfy 100% of a customer’s needs. With that in mind, it is important that the vendor provide capabilities to configure and, if necessary, customize the solution.
• What configuration abilities exist?
  - Approval lifecycles?
  - Status cascades?
  - Security options?
• Are there tools to extend the system without programmatic code?
  - Adding new properties and new entities?
  - Designing new GUI screens?
• Does the system employ an industry standard programming environment when customization is necessary? Proprietary programming languages present significant challenges in terms of resource management.

CONCLUSION
Laboratory information management systems have clearly progressed significantly since their inception. However, much of their evolution has been realized in the capabilities they offer for customization. While many vendors now include the term COTS in their marketing materials, that claim is not always substantiated. The prudent pharmaceutical LIMS buyer should require clear evidence that there is truly applicable business functionality offered OOTB to avoid the need for extensive customization. There are specific areas that can be examined to determine how capable a system is by reviewing not only software demonstrations, but also available supporting documentation and support offerings to differentiate between what a LIMS is “capable” of, and what it truly delivers off-the-shelf.

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RELIABILITY ENGINEERS
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RELIABILITY MEANS REDUCING SURPRISES AND FAILURES. TESTING FOR WEAKNESSES CAN INCLUDE FREEZING, HEATING, DROPPING, AND MORE.

Some engineers specialize in the reliability of military, naval, medical, and financial equipment, where “up time” is very important and “downtime” (at least unscheduled downtime) is to be avoided. While some reliability engineers focus on software, others (and this article) focus on the reliability and durability of hardware, the kinds of stresses that can shorten the life of hardware, and appropriate tests to uncover weaknesses.

One group of those stresses and tests can be called climatics. This group includes natural environments, such as thermal, altitude (low pressure), pressure (immersion), humidity, sand-and-dust, salt fog, corrosion, etc.

Another group of stresses and tests can be called dynamics. It includes man-made environments, such as EMI (electromagnetic interference, also called EMC or electromagnetic compatibility and RFI or radio frequency interference), as well as vibration, mechanical shock, and noise. The latter are my fields and are given some emphasis in this article.

IN-HOUSE ENVIRONMENTAL TEST LABS

Many organizations own their own testing labs in which they have climatic chambers that can reproduce the natural environments listed earlier. Such a test may involve a low-temperature test on a military vehicle, a test that is far cheaper and faster than taking the vehicle to arctic terrain. On other days, such a chamber might be used for elevated temperature testing, high-humidity testing, and other climatic environmental testing.

Such an organization may well also have a lab dedicated to dynamic (vibration and/or mechanical shock) testing. This type of testing may consist of a vibration test that simulates road inputs to a land vehicle, freeing test personnel from weather-related limitations on test tracks and highways. Figure 1 shows, for example, a package being drop-tested to verify that the contents will survive shipping and severe handling.

COMMERCIAL TESTING LABORATORIES

Other organizations instead depend upon “outside” environmental testing labs, such as those listed at http://www.equipment-reliability.com/link.htm#laboratories. Some of these labs are independent. Others belong to rather vast organizations of multiple labs in various countries. Not all labs offer all kinds of environmental testing.

ACCREDITED LABORATORIES

Many of these labs (in-house as well as independent, both in the U.S. and abroad) have become accredited to offer certain kinds of tests. A2LA (www.a2la.org), the American Association for Laboratory Accreditation is one of these accreditation bodies. Assessors visit labs that offer testing and evaluate their abilities to meet the requirements of International Standards Association ISO 17025.

Wayne Tustin
However, many organizations want greater assurance that hardware won’t fail in service and won’t surprise users by failing in some unexpected way. Never let it be said, “We didn’t test for that.”

ENVIRONMENTAL STRESS SCREENING OR ESS
High-reliability hardware is increasingly screened. Visualize 100 electronic, just-completed assemblies. There is a chance that some of them contain defects or latent failures. Sure, they work fine on the test bench. But (as in Figure 2) once a blast of heated and then refrigerated air is passed through flexible ducts and through the assemblies, inducing heating and cooling, expanding and contracting, some failures will occur. Subjecting the assemblies to multi-axis random vibration from pneumatic vibrators on the bottom of the softly-spring platform shown will precipitate other failures. If ESS is made more severe, accelerating the screen, the effort may be called HASS or Highly Accelerated Stress Screening.

HIGHLY ACCELERATED LIFE TESTING (HALT)
If the foregoing is part of development of new hardware, the acronym HALT is applied. It is not a well-chosen acronym, but it’s widely used.

THIRSTING FOR FURTHER KNOWLEDGE?
The Equipment Reliability Institute (ERI) (www.equipment-reliability.com, www.vibrationandshock.com) offers message boards at which you are invited to leave questions.

Wayne Tustin, Equipment Reliability Institute, Santa Barbara, CA; 805-564-1260; tustin@equipment-reliability.com.

Figure 2: Environmental Stress Screening subjects assemblies to conditions intended to detect defects or latent failures.

STIMULATION VS. SIMULATION
In most of the environmental tests mentioned thus far, labs attempt to simulate real-world environments, both climatic and dynamic. The general idea is this: if hardware passes the lab test, it will probably survive in service.

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The toxicological effects of chemicals can manifest themselves in a number of ways. The results of exposure from some materials can be felt immediately such as watering of the eyes with lachrymators. With other chemicals, there may be both immediate effects like irritation and delayed effects such as pulmonary edema. With carcinogens there may be no symptoms yet effects are seen decades later. Effects of teratogens and mutagens are not seen until the next generation. With the thousands of chemicals that can be encountered and the different effects, how does one go about determining what is a safe exposure?

OSHA COMPLIANCE – A MINIMUM STANDARD

Exposure concentrations and limits in air are typically given in parts per million (ppm), milligrams per cubic meter (mg/m³), or fibers per cubic centimeter (fibers/cm³). Where additive exposure potential exists via absorption through the skin, a “[skin]” designation appears with the exposure limit.

The OSHA permissible exposure limits (PELs) (29 CFR 1910.1000) are typically the least restrictive exposure values and serve as a minimum performance standard in the United States. It should be noted that when PELs are established, the process is a mixture of science and politics. Economic factors related to exposure compliance are presented by industry groups during the standard setting process and influence the final selection of exposure limits as a compromise value. OSHA limits may also lag behind new scientific literature, as the entire political rulemaking process must be followed to make changes to a PEL. PELs are typically time-weighted average concentrations that must not be exceeded during any 8-hour work shift. Short-term exposure limits (STELs) have been established for some materials and are usually measured over a 15-minute period. OSHA ceiling concentrations must not be exceeded during any part of the workday.

The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) are also expressed as time-weighted averages and short term limits. ACGIH committees of experts in public health and related sciences determine these values. TLVs are based only on health factors and not subjected to a political process. The TLVs can adapt more rapidly to new scientific information than OSHA PELs. Most health and safety professionals we have known rely on the more conservative ACGIH TLVs as minimum protective standards for their clients.

We have found the Poison Information Centers and Teratogen Information Service excellent sources of information when standard literature searches yield poor or equivocal results. The professional staff at these centers are often willing to help, however, please let them know this is not an emergency and that you are willing to wait a few days for an answer. We would caution not to request assistance...
except when your efforts fail to find results by conventional means or of course when you have an actual exposure event.

There is a term “ALARA” taken from the nuclear industry. It stands for “as low as reasonably achievable.” This is a good mantra. Compliance with OSHA is a legal obligation; meeting ACGIH guidelines can help limit liability further. But reducing levels as low as one can using reasonable means makes good sense, further limits potential liability, and helps create a more pleasant and possibly more productive workplace.

So, at this point we have identified the chemicals we will be using; have consulted sources of chemical safety information; have an idea of the possible routes of exposure of concern for the particular chemicals and the types of biological effects (e.g. simple toxin, sensitizer, carcinogen, etc.); and the relative hazard of the materials. Next we must select the appropriate procedures to minimize exposures and prepare for contingencies.

HIERARCHY OF PROTECTIVE METHODS
There are a variety of means to protect oneself from hazardous chemicals. These include in order of preference: substitution, engineering controls, administrative controls, and personal protective equipment. In fact, in terms of airborne exposures, OSHA requires engineering controls for controlling exposures except when it can be demonstrated to be infeasible.

Substitution is the most effective method of hazard control. A less hazardous or relatively harmless material is substituted for a hazardous chemical. An example would be the use of one of the new glass cleaners as a substitute for Chromerge (an oxidizer containing hexavalent chromium, a probable human carcinogen). By using a different material the hazard is largely eliminated.

Engineering controls are the next preference when use of the hazardous chemical cannot be eliminated. One example most commonly used in the lab is the use of differential air pressure to control exposures to airborne contaminants. Where there is the potential for airborne contamination, a chemical fume hood is a very effective first line of defense. The contaminants generated in the hood should be retained in the hood, drawn away from the worker, and exhausted up the stack.

Fume hoods are not foolproof however, and we have seen many exposures to materials used in hoods. These exposures usually stem from misuse or hoods that have been compromised in some fashion. The hood should be set up with the work at least six inches back from the sash. The back baffles (slots) through which the air flows should not be blocked. We have seen the entire back bottom slot blocked by reagent and sample bottles. The airfoil on the bottom leading edge of the hood is also frequently blocked by users placing “benchcoat” (absorbent pads) on the bottom and taping it to the edge. The proper functioning of the hood requires airflow passing around the items in the hood and passing directly out the back slots. Overloading the hood can cause eddies and back drafts allowing chemicals to escape.

We have also seen many hood users with the sash fully raised. This not only removes a line of defense against explosion but also reduces the hood face velocity to a point where simple room currents blowing by the hood may aspirate contaminants into the open room. The face velocity V = (Q)/(A) where Q is the volume flow (a constant) and A is the face area of the hood. You can see, as the area increases (by raising the sash) the velocity decreases. Newer hood systems are often variable volume systems that maintain a relatively constant face velocity regardless of sash position.

Administrative controls to prevent chemical exposure are fairly uncommon in laboratory settings though these may include posting signage warning of hazards such as areas where fume hoods exhaust at roof level or limiting staff participating in a procedure.

Personal protective equipment is widely used in the laboratory and a thorough discussion would require an article devoted to the topic. Some key points to make, however, include matching the equipment to the chemicals and the hazards they present.

Glove compatibility charts should be consulted and selection made based in part on chemical permeation resistance. We were involved in a case where a worker was using an organic solvent with neurotoxic properties. The worker was convinced his fume hood was not operating properly and he was exhibiting symptoms of overexposure. Upon investigation and observing the process, we determined that in fact the hood was working well but that he was wearing latex gloves and his fingers were contacting the solvent. The solvent was absorbed by the glove material and actually increased his exposure by holding the solvent impregnated glove material against his skin.

Chemicals can be worked with in a safe manner, but to do so the worker needs to understand the properties of the chemicals with which they work and the means to protect themselves. The development and use of the chemical hygiene plan with standard operating procedures that consider the hazards associated with the use of chemicals and protective measures can go a long way in preventing exposures in the laboratory.

Diligence of all workers in the lab is necessary however to protect not only themselves but those around them. As always, make safety in the lab a habit for life.

Useful reference information and links:
• Prudent Practices in the Laboratory: Handling and Disposal of Chemicals. Copyright 1995 by the National Academy of Sciences.
• Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment, American Conference of Governmental Industrial Hygienists (ACGIH) (latest edition).
• Poison Information Center National Toll-Free Number: 1-800-222-1222
• Teratology Information Service in your area, OTIS Information at: (866) 626-OTIS or (866) 626-6847
http://monographs.iarc.fr/monoeval/crthall.html
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http://www.practicing safescience.org/

Glenn Ketcham is a Certified Industrial Hygienist with 22 years experience in the health and safety field. He is currently the Risk Manager for the University of Florida with responsibility for the loss prevention, ergonomics, disaster preparedness, and the occupational medicine surveillance programs. He has managed the laboratory safety programs for both the University of California, San Diego (UCSD) and the University of Florida. In addition, he served as an industrial hygienist with federal OSHA compliance and has a masters degree in environmental engineering sciences with a health physics concentration.

Vince McLeod is a Certified Industrial Hygienist and the senior IH with the University of Florida’s Environmental Health and Safety Division. He has 17 years of occupational health and safety experience in academic research with focus in the research laboratory. His specialties are in hazard evaluation and exposure assessments.

The Safety Guys welcome your comments and questions. You can email them at thesafetyguys@labmgr.com.
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www.bruker-biosciences.com

DISPOSABLE BIOPROCESS ASSEMBLIES
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www.coleparmer.com/bioconnect

SELF SEALING TUBES
SAFE-FILL self-sealing capillary blood collection tubes are a safety improvement for laboratories that use cap-piercing analyzers for their hematology testing. All SAFE-FILL capillary blood collection tubes are cap pierce-able. The new self-sealing cap increases laboratory worker safety by preventing blood from spilling, ejecting, or splashing after the analyzer probe has pierced the cap. RAM Scientific www.ramsci.com

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GLUCOSE MONITORING
The Nova StatStrip™ point-of-care glucose monitor incorporates a patented new strip technology that uses four measuring wells. Nova's Multi-Well™ system measures and corrects hematocrit interference as well as interferences from acetaminophen (Tylenol), uric acid, ascorbic acid (Vitamin C), maltose, galactose, xylose, and lactose. StatStrip also eliminates oxygen interference to provide accurate glucose results regardless of the sample's oxygen status. Nova Biomedical
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MOTORIZED STAGE SYSTEM
The ES10 OptiScan™ II controller with USB includes an upgraded drive circuitry for smoother and quieter motion and an available DLL (Dynamic Link Library) for writing new code. The space saving design houses drives for a motorized stage, focus, two filter wheels, and three shutters which eliminate the need to upgrade the controller when adding additional components such as filter wheels. Prior Scientific

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Problem: Competitive pressures are forcing laboratories to look for ways to operate more efficiently, reduce costs, and increase productivity. The scientist-managers charged with achieving these improvements lack the data to identify the most significant opportunities for improvement and may lack the business skills to manage for high performance. It is not unusual for productivity initiatives to fall short of goals in spite of strong effort by the staff and for managers to experience a high level of stress and frustration in leading these efforts.

Solution: Just as good science is based upon the logical interpretation of data to derive conclusions, good business decisions also come from reasonable interpretations of hard data. In driving productivity and efficiency improvement, it is invaluable to know the exact performance areas where the laboratory lags its peers, by how much, and what is a reasonable expectation for improvement. Unfortunately, these hard data have been nearly impossible to obtain in the absence of a systematic method to collect, analyze, and report on laboratory performance. Thermo Electron Productivity Services now offers a cost effective solution by acting as an independent unbiased third party to confidentially collect a comprehensive set of performance metrics from laboratories and report back each lab’s standing versus their peer group. These metrics provide the hard data to guide the manager in selecting improvement initiatives with the greatest potential for success or for superior labs to validate exceptional performance and to obtain recognition from executive management. Thermo recognizes that its success is inextricably linked to the success of its laboratory customers and has developed a suite of service solutions to partner with labs to help them succeed operationally. A very important aspect of this service is Thermo Electron’s pledge to maintain complete confidentiality and to never use any participant’s data for marketing or commercial purposes.

After using the benchmarking metrics survey to identify weaknesses and strengths, the lab managers need the management tools to implement their decisions. Recognizing that lab managers typically come from a scientific background, Thermo Electron has developed three, one-day management workshops specifically tailored to the unique environment of the laboratory. These reasonably priced workshops are offered in major metropolitan areas in the U.S. to provide exposure to a wide range of the latest management techniques and styles and to provide a forum for managers to meet and exchange best practices. These shared experiences are especially valuable since they provide insight into the reasons why management initiatives succeeded or failed in a laboratory environment. The workshops cover the three critical areas of laboratory management — managing the performance of the staff, managing the financial affairs, and managing the quality of testing results.

For more information, go to www.thermo.com or e-mail wayne.collins@thermo.com.
“Seeing Red” may imply that someone is very angry, but for someone using polarized light microscopy (PLM), the ability to see red is important to correctly identify many materials.

As an undergraduate geology student, one of the most interesting courses I took was optical mineralogy. However, since I have a subtle form of colorblindness, this course was more challenging for me than it was for my classmates. By using a polarized light microscope, it is possible to determine chemical composition and crystallographic information about an unknown sample that can provide an accurate identification of that unknown material. PLM is used routinely for the analysis of possible asbestos-containing materials. However, most of the phenomena observed with a polarized light microscope are dependent on the user’s ability to accurately observe subtle color differences. This fact makes the use of this powerful tool difficult for individuals, such as myself, with colorblindness. Fortunately, I was able to find ways to compensate for my color vision problems and continue to use PLM for the identification and characterization of many different types of materials.

Colorblindness, or more accurately, color vision confusion, is a condition that affects a person’s ability to correctly perceive color. Color vision confusion is typically an inherited genetic defect that affects the sensitivity of the retina to various colors of light. It is most common in men (about 10% of all men are colorblind) but about 0.5% of women are colorblind also. The degree of colorblindness is highly variable and ranges from subtle color confusion in some, to others who see the world in only shades of gray.

Color vision originates at the retina. Cells in the retina, called cones, are sensitive to specific wavelengths of light. When these cells absorb photons of a specific wavelength, chemical reactions occur and produce a signal that is sent to the brain via the optic nerve. The brain processes that signal and we “see” a color. People with normal color vision have three types of cones that are sensitive to long (red), medium (green), and short (blue) wavelengths of light. People with abnormal color vision also have cones; however, one or more of these types of cones may be insensitive to a specific wavelength, or may have a sensitivity that is shifted away from the normal ranges of sensitivities. As an example, an individual may lack cones that are sensitive to medium (green) wavelengths. This person would perceive red and green to be the same color. Another individual may have cones that are sensitive to medium wavelengths, but the peak sensitivity of...
these cones may be shifted to either longer or shorter wavelengths. If a person with normal color vision looks at something that is green, the individual with the color vision abnormality described above may see that green object as either more brown or yellow depending on which way the peak sensitivity of the medium wavelength sensitive cones was shifted. There are also individuals who lack any ability to perceive color and are truly colorblind.

Many properties observed using PLM are very dependent on color. The ability to correctly identify the colors observed while examining a sample with PLM is extremely important. Dispersion staining is a technique used to determine the refractive index of a material based on the color that appears when illuminated in a very specific manner. Very slight differences in color can translate into significant differences in refractive index (Figure 1). This is important because slight changes in chemical composition can cause significant changes in refractive index. Fortunately, it is possible with good training, quality reference samples, and plenty of experience for a colorblind microscopist to learn how to compensate for this handicap and accurately determine the refractive index of a material using this technique.

Observing interference colors of minerals using PLM is also highly dependent on the ability to observe color. Using various accessories routinely used with the PLM, a microscopist can determine certain optical properties. The same information can be determined using two different accessories: one that produces bright colors (Figure 2) and one that produces a different set of colors that may be more easily recognized by an individual with color vision confusion. By knowing how to use these accessories a colorblind microscopist can adapt to their specific color vision problems. There are also several different illumination techniques, such as oblique illumination, that can produce different color effects that may help a microscopist better determine various properties of an unknown sample.

Looking back, I believe I would not have come out of that optical mineralogy course with the same understanding of the phenomena I was observing had I had normal color vision. By having to find valid ways to compensate for my color vision, I needed to study and understand the physics behind what I was seeing.

Color perception is also important in other microscopy techniques, such as fluorescence microscopy. Through years of experience, we have become keenly aware of the importance how color is perceived, and the need for instruction on the proper use of a wide variety of microscopy techniques.

Bryan R. Bandli is a research microscopist at MVA Scientific Consultants. He can be reached at bbandli@mvainc.com.
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MVA SCIENTIFIC CONSULTANTS AND MICROBAC LABORATORIES ANNOUNCE ALLIANCE

MVA Scientific Consultants and national testing laboratory group, Microbac Laboratories Inc., have joined forces in a strategic alliance to offer their clients additional analytical choices. As part of the alliance, Microbac will serve as MVA Scientific Consultants’ preferred provider of microbiological and chemical analysis for food, environmental, and other samples. MVA will serve as Microbac’s preferred provider of forensic food microscopy and other microanalytical services. The alliance is the first of its kind that Microbac has undertaken and will involve the participation of all of its laboratory operations across the country.

NHGRI AWARDS $54 MILLION TO THREE CENTERS OF EXCELLENCE IN GENOMIC SCIENCE

The National Human Genome Research Institute (NHGRI), part of the National Institutes of Health (NIH), announced grants totaling $54 million over five years to establish one new Center of Excellence in Genomic Science (CEGS) and continue support for two existing centers. The CEGS program pulls together multinstitutional, interdisciplinary teams of scientists with the goal of making critical advances in genomic research. With the original centers’ five-year awards slated to end this fall, NHGRI will renew the awards for the Microscale Life Sciences Center at the University of Washington, Seattle, WA; and the Yale Center of Excellence in Genomic Science, Yale University, New Haven, CT. Each center will receive $18 million over the next five years. In addition, NHGRI awarded $18 million over five years to create a new CEGS at the California Institute of Technology, Pasadena, CA, which will be called the Center for In Toto Genomic Analysis of Vertebrate Development.

POLYSCIENCES’ ANNOUNCES NEW LINE OF FURAN BUILDING BLOCKS

Polysciences, Inc. announced the release of a new line of furan-based synthons for use in organic and polymer synthesis applications, including the pharmaceutical, graphic arts, agricultural, flavor/fragrance, as well as organic intermediates industries.

LABCYTE AWARDED 27TH U. S. PATENT DESCRIBING ACOUSTIC TRANSFER FOR THE PREPARATION OF PROTEIN MICROARRAYS

Labcyte, Inc. announced the issuance of U.S. Patent 7,090,333 describing the use of acoustic droplet ejection (ADE) for the preparation of microarrays of proteins and peptides. ADE uses sound to move fluids, eliminating all physical contact with the liquid transferred. This disposes of the need for pin tools, pipettes, and nozzles that are currently used to make protein arrays and are known to cause loss of protein due to adsorption on the device surfaces. ADE is also extremely precise with the coefficient of variation, the measure of precision, often less than a few percent even at the nanoliter and picoliter level. ADE can even transfer volumes as low as 2 femtoliters (0.000025 nanoliters).
Don't Let Procrastination HOLD YOU BACK AT WORK

Eugene Raudsepp
From CareerJournal.com

Procrastination. Who doesn't feel at least somewhat guilty about it? We all procrastinate on occasion, particularly when we dislike or feel overwhelmed by a task at hand. But there are procrastinators who habitually immerse themselves in busy work to avoid tasks that must be done.

The penalties paid for procrastination can be as mild as paying extra interest on a charge account or as harsh as getting fired or missing a career opportunity by sending in an application late. The psychological price we pay ranges from minor self-guilt and irritation to intense anxiety and self-disgust. Habitual procrastination, however, keeps some people from working to their potential.

WHY PEOPLE PROCRASTINATE
If your to-do list continues to grow longer rather than shrink, the first step is to identify the types of projects or situations that suck you into the swamp of inaction. If you can't pinpoint an exact cause, or if you find procrastination difficult to eradicate, psychological issues may be involved.

Most often, procrastination represents a form of fear. It's a symptom of anticipating critical judgment or a perceived threat. The most prevalent is fear of failure.

Fear of Failure
Failure-fearers usually avoid important projects and busy themselves with routine, familiar tasks. When something important is at stake, they have trouble concentrating, voice all kinds of excuses, or complain about obstacles that stand in the way. They tend to overestimate the difficulties involved and underestimate their own abilities to resolve them. As a result they vacillate, delay, or give only half-hearted effort.

Perfectionism
Many perfectionists also put off tasks because they fear failure. In contrast to failure-fearers, however, they set exceedingly high standards and overambitious goals. Aiming too low would be tantamount to being judged just average or mediocre.

Another aspect of perfectionism is the misplaced attempt to do everything perfectly, regardless of its importance. They treat even trivial matters so thoroughly that they miss important deadlines. Perfectionists can't set priorities or determine which tasks require minimum or maximum effort.

A typical perfectionist case is that of a staff analyst assigned to prepare a brief review of U.S.-French trade problems. He produced an exhaustive, meticulously researched 50-page study. Instead of being commended he was reprimanded by his boss for not spending more time on higher priority projects.

If you have a tendency to put disproportionate effort into tasks, ask yourself these questions:
1. Do the means really suit the ends?
2. Do the results on this project warrant the time and effort put into it?
3. Are there easier, less rigorous ways to accomplish it?
4. What could be the consequences, both positive and negative, of using a less exacting approach?
Fear of Success
While people who have a marked fear of failure prefer to retreat by endless procrastination, success-fearers welcome challenging assignments. But as soon as they’ve made any significant progress, they feel compelled to check themselves and cast about for ways of postponing additional work. Many of them are quite cunning and elaborate in the excuses they employ.

REMEDIES
Understanding why you procrastinate is helpful, but that alone isn’t enough to overcome the problem. You must have a strong desire to rescue yourself and be willing to get tough if need be.

The following methods have been helpful for curing procrastination. Choose those techniques that seem to work best for you. Be diligent in applying them. The point isn’t only to be aware of alternative methods, but to find more efficient ways of handling the projects that get put off until the next day. Chances are that applying just a few of these practical suggestions will release your energies for action.

Delay gratification. M. Scott Peck, a psychiatrist and author of “The Road Less Traveled” (Buccaneer Books, 1993) recommends delaying gratification by experiencing the pain first and getting it over with. He feels that it is “the only decent way to live.”

He reached this conclusion after working for several months with a 30-year-old financial analyst who was locked into a cycle of procrastination on her job.

Dr. Peck and his client analyzed her attitudes toward her parents, job, boss, her own ability, and her possible fear of success. To no avail.

Finally, Dr. Peck asked her, “Do you like cake?” She replied that she did.

“What part of the cake do you like better, the cake or the frosting?”

“Oh, the frosting!”

“And how do you eat a piece of cake?”

“I eat the frosting first, of course.”

Having gained this insight, Dr. Peck started probing her work habits. Invariably she would devote the first hour or so of each day to the most gratifying and easiest of her tasks and the remaining six hours getting around—but never quite accomplishing—the more onerous tasks.

Dr. Peck suggested she force herself to do the objectionable tasks during the first two hours, then enjoy the remaining time. She acted on his advice and no longer procrastinates.

Identify action steps. Sometimes it’s difficult to know how to start a complex project. Successful execution begins with a series of specific actions: doing research, collecting information, writing letters or memos, calling or seeing people, assigning responsibilities, holding meetings, reading reports, etc.

As a first step, list as many specific tasks as you can. Next, organize the tasks and establish an action sequence. Third, set deadlines for tasks and draw up a master list—a continuous, single listing of everything that must be done. The tasks are then transferred each day to your daily list of things to do.

Breaking the project into feasible units and taking it in small doses lessens the drudgery. Some people allow as many sessions as it takes to complete the job, but they limit each to just one hour.

Sitting down to a well-defined work interval helps. You know that there’s an end in sight. Open-ended sessions, on the other hand, usually magnify the scope of the project and induce a mood of discouragement.

Make an arbitrary move. If you’re unable to establish a satisfactory starting point, make an arbitrary opening move. For example, if you can’t decide whether to break a report into several parts, proceed as if the report won’t be divided and make a beginning. You soon will discover if your approach is right, and if it isn’t right, you can make the necessary changes.

Build mini-completions. When there is no prospect of immediate results or benefits, it’s useful to build mini-completions. Starting a project that can’t be completed for weeks or months can be exceedingly difficult. Motivate yourself to make a beginning and provide the necessary gratification by establishing interim completion points.

The Swiss-cheese method. When faced with an overwhelming or complex project, most people feel they must have a big block of time available before they tackle it. Since big blocks of time are rare, they put the project off until pressure from a deadline makes them finally dive into it.

As an alternative, Alan Lakein, the author of “How to Get Control of Your Time and Your Life,” (New American Library, 1996) suggests turning overwhelming projects into Swiss cheese by poking holes in them.

Think of several easy instant tasks that can be done in five minutes. If, for example, the project is writing a report, instant tasks might be organizing the necessary data, making a phone call to gather more information, or getting a co-worker’s input.

According to Mr. Lakein, whenever you have a few minutes, do one of the instant tasks. You may find you get involved and spend more than five minutes, or that the project isn’t as overwhelming as you expected. In that case, you’re well on your way to completing it.

If the project still seems overwhelming, continue with the instant tasks. After several mini-task sessions, you will know about how much time the project will take. This helps you schedule enough blocks of time to complete it before the deadline.

Divide large tasks. This means choosing tasks that will fill the time available. For example, if you have a three-
hour time slot, tackle one big task rather than several smaller jobs.

Sometimes the only time available is before or after work, or on weekends. One engineer produced the necessary documentation for a radically new design for a motor on alternate Sunday mornings between 6 and 8 a.m. — his only free time. And New York Times reporter Jane Brody claims to have completed a 50-page book working from 5 to 6:30 a.m. on weekday mornings.

Delegate. When faced with a routine or unpleasant task, it sometimes is possible to assign the project — or parts of it — to a subordinate. There also are many outside services that can be hired to do time-consuming, routine work.

Some people swap tasks they dislike with a colleague who doesn’t mind them, and do for the colleague tasks he finds objectionable. Ask yourself, “Is it more important that I do this job, or that it gets done?”

Use the penalty method. Alan Rosenberg, a lawyer and psychiatrist, advises procrastinators to use the “pester-and-penalty method.” “Play a game with yourself,” he says, “make up minor penalties, such as missing a TV show, and penalize yourself if you still haven’t finished the job. Or ask a colleague to remind you of a task at certain intervals, and have him pester you until you’ve done it.”

Reward yourself. It’s important that you provide your own positive reinforcement. Give yourself a treat when you’ve completed the job. This can be anything from a new CD to a trip to the mountains or a game of racquetball.

Some people who find it particularly difficult to break the procrastination block reward progress after 30 minutes or an hour of work. These rewards could be reading a favorite magazine or talking to a congenial colleague — anything that you enjoy or that makes you feel good.

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Your great research or business idea won’t be implemented unless you convince your supervisor, coworkers, and funding sponsors that it is feasible and will be profitable. Failure to accomplish this is the main reason excellent ideas fall by the wayside.

Tap the same creativity you used to conceive your idea in order to sell it. Begin by describing your idea in a dated “Note to File” or in your laboratory notebook. This will protect you should someone else try to take credit for your idea. Then discuss your idea with your coworkers and supervisor. Veteran employees in particular may have valuable insights based on previous company efforts in related areas. Opinions of successful innovators are particularly valuable. View these critiques as opportunities to improve your idea.

Be sure you aren’t re-inventing the wheel. Has your firm studied this idea before and rejected it? Review internal reports to determine this. Experienced employees can often tell you if your idea has come up before. If a similar idea was rejected, find out why. The reasons may no longer be valid. Then research the public literature; see if another organization has put your idea into practice. Check the patent literature as well.

Armed with this information, decide whether to continue. If you do, refine and clarify your idea. Try to turn it into a network of related ideas. Then, if one aspect of your idea doesn’t develop as desired, others may still be feasible. Just as lack of muscle definition seldom wins body-building contests, an idea without technical and commercial definition will seldom win management approval. Estimate the time, effort, and funding needed to develop your idea.

Be sure your idea fits your employer’s business culture. For instance, a commodity manufacturer is unlikely to implement a great idea for a new specialty product. Ideally, your employer is already successful in the markets where your product would be sold.

Now you begin to sell your idea in earnest. Start by selling the “thought leaders” in your company. These are people with their own track records of successful innovation. Their opinions carry weight with corporate decision makers. Their support can add greatly to your idea’s credibility.

Informally talk to people to whom you are selling your idea. This “pre-selling” before formally submitting your idea can help you tailor the proposal to your employer’s needs. Pre-selling makes it easier to anticipate questions and concerns when you formally try to sell your idea. This formal proposal should include both oral and written presentations.

It is best to make your oral presentation first. Then, should someone raise important but previously unconsidered issues during your talk, you can modify your written proposal to deal with them.

Present your idea in terms your business sponsors understand. The ideal presentation takes listeners to a point where they independently draw the same conclusions you do. Do this without burying your audience in technical details. Start your presentation with a “hook”—a clear statement of the business incentives to develop and commercialize your idea. Using appropriate buzzwords that fit your corporate culture is helpful.

A product prototype can be a great hook. 3M chemist Arthur Fry used this approach to sell his “Post-it” notes idea. Fry decided he needed some satisfied customers to convince 3M managers to manufacture his product, which was based on a weak, not strong, adhesive. So he had prototype “Post-its” made and gave them to the secretaries of 3M executives. They loved them and wanted more. When they couldn’t get them, they complained to their bosses. These executives were already sold before Fry began his presentation.

You probably won’t be as lucky as Fry. Your audience will probably be more skeptical and have questions. Be direct in responding to
these concerns. Any information you provide must be correct or you will damage your credibility.

Ask for commitment. Make it clear what is the next step you are asking your business sponsor to take.

You may find you need to sell your idea in stages. Be politely persistent until you get a clear "yes" or "no" answer. Be prepared for disappointment. Sometimes, the right answer is "no."

However, don't let your idea die due to inaction.

If management rejects your idea, keep it in your file. They are declining to spend the money to develop your idea, not rejecting you personally. Your idea may be a good one submitted at a bad time. Changes in business conditions or technological advances may make it worthwhile to resubmit your idea later. Understanding the reasons for the idea's rejection will help you determine if and when to do this. It will also help you when you submit other ideas.

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Lauren McNew admittedly came out of the chute pretty fast, “always the kid in the gifted or advanced program.” Captivated by marine life as a child, she showed an early knack for cataloging her universe, soon able to identify more than 250 species of tropical fish by sight. “But I realized the thing you love is not always the best career,” she said. “I was afraid I might not love it anymore.”

Now, at 26, her snorkeling excursions are squeezed by the demands of her new job managing the microbial identification lab at Accugenix in Newark, DE, sandwiched by commutes to Towson State University north of Baltimore, where she expects to earn a master’s degree in cell and molecular biology in December 2007, and a weekly “date night” with her husband, where “we don’t talk about work.”

Yes, it’s a juggling act. To keep all those balls in the air, one must prove nimble.

“I think women are more dexterous, both mentally and physically, with a wonderful, meticulous detailed nature that shines through in the lab,” said McNew. “We’re a little more keen about working with very small volumes. And I’ve seen a trend toward more women in the lab, and more women pursuing biology degrees.”

McNew’s ride on the fast track has not been without its war stories. At 22, she was managing a male staff with military backgrounds in a government bio-defense test lab. Her supervisor, in order to dispel allegations that he favored her, summoned McNew to a group meeting and proceeded to “criticize all my shortcomings in front of the group, without giving me advanced warning. So I packed up and went home, came back the next day and told him to never do that again. He thought I was being hypersensitive – like toughen up, soldier!”

So she soldiered on and filed it away under “what not to repeat.” McNew’s managerial style — “my pseudo mentor” — is an amalgam of the best and worst of the bosses she’s encountered.

Upon becoming lab manager at Accugenix this past summer, McNew found herself overseeing a “sisterhood” — an all-female staff of ten technicians and assistants. The company provides a range of microbial identification services for multi-national clients in the pharmaceutical, biotech, and cosmetic industries.

Her managerial style is malleable and “different at each company I work. The most difficult part of management is identifying and understanding what style works best for each individual.”

To assess the capabilities of her staff, McNew is at her lab bench daily. “Working alongside the techs also helps me identify areas of the laboratory process that require improvement, and helps me gain the trust and confidence of my staff. I like show my support for the staff by acting on grievances and requests.

“A happy lab is a lab where things get done, and when people are happy they do their best work.”

As the third youngest in the lab, she makes no apologies for her relative youth.

Her managerial style was influenced by the mishaps of a previous boss “who was working so hard to please both her upper management and her employees that she sent mixed signals to both sides,” which impaired lab productivity.

“My ideal world is to have everybody in the lab trained to do everything,” said McNew, who is overhauling her lab’s job descriptions, “so we can cover whatever happens.” Companies tend to “pigeonhole employees who do one thing really well. Giving employees the opportunity to grow and learn something new keeps them coming back.”

McNew has no regrets about her career choice. Whereas marine biology “has limited job opportunities” owing to its “specialized nature,” molecular applications are “evolving. With better technology, scientists are learning about how the recipe of organisms determines their function. The need for environmental monitoring grows with our dependence on pharmaceutical manufacturing.”

Nor does she mind elbowing what she calls the “Old Boys Network.”

“Scientific fields are frequently dominated by highly educated men who are less secure with knowledgeable women playing a significant role than knowledgeable men. I hope to act as a role model for young women in science.”

McNew aspires to move into upper-management. If that happens, listen for the laughter from the board room.

“Humor,” she said, “is the one thing that bridges all the gaps between everybody.”

“So who’s the joker-in-residence in McNew’s lab?”

“I think I’m the clown.”

Francis Key Kidder started out as a journalist before moving on to politics and government relations, where he still keeps his hand in writing. He may be reached at 410-828-6529; info@labmgr.com.

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