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John M. Collins Jr.[a]
[a] Forensic Foundations Group, Dewitt, Michigan
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10 Criteria Defining a Model Forensic Science Laboratory

John M. Collins, Jr.
Forensic Foundations Group,
Dewitt, Michigan

ABSTRACT This article attempts to answer the question: If it had to be done over again, knowing what is known now, how would the ideal forensic science laboratory be constructed, organized, and operated? A project was initiated to answer this question by the Laura and John Arnold Foundation in Houston, Texas, which brought together select, influential, and highly recognized forensic science icons to discuss and document the elements of the model forensic science laboratory–to the extent that such a model could actually exist. Barry A.J. Fisher, Doug M. Lucas, and Jay A. Siegel (the project team) each authored, independently, a manuscript outlining what they believed were the critical elements or criteria defining the model forensic science laboratory. Once the aforementioned manuscripts were completed, the project team requested that this article be written to independently review, consolidate, and comment on the work of the project team writers.

All three of the project team's manuscripts identified core systemic risks, challenges, and opportunities related to the current delivery of forensic science services in the United States. But in style, tone, and content the manuscripts were remarkably different from one another. Despite these differences, three categories of criteria for conceptualizing the model forensic science laboratory emerged: the Economic and Political Position of the laboratory, Resources and Support, and Service Quality and Control. For each category, this author researched and considered potential criteria that could best satisfy the implicit and explicit requirements of the project team's writers. From this work, 10 distinct criteria were developed, organized, and described in this article. Also captured in the rationale for each criterion were the professional observations and opinions of this article's author when judged to be relevant, but not to the extent that the original themes and priorities emphasized by the project team would be diluted or dismissed in any way.

This article, therefore, describes and establishes 10 fundamental criteria for the ownership, organization, support, governance, autonomy, operation, and priorities of a model forensic science laboratory in the United States. Admittedly, the model, as described herein, contrasts sharply with nearly all forensic science laboratories in operation today. It is a concept, an idea, an opportunity.

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Address correspondence to John M. Collins, Jr., P.O. Box 227, Dewitt, MI 48820. E-mail: forensicdirector@gmail.com

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INTRODUCTION

This article presents a conceptual model that can be described as an ideal or model forensic science laboratory. In doing so, it answers a simple question: If one was to entirely reinvent the modern forensic science laboratory from scratch, what might it look like? The answer to this question came, at least preliminarily, in the form of written manuscripts in which specific structures, compositions, and sets of practices and priorities were proposed by a small but impressive team of thought leaders drawn from the forensic science community by the Laura and John Arnold Foundation. What is described here is an attempt by one author to capture elements of a model forensic science laboratory that, if all could exist concurrently, would afford the laboratory every conceivable opportunity to maximize its value to society, and to earn the highest degree of confidence among those stakeholders who would ultimately rely on the quality and timeliness of the laboratory's work product. Said another way, this article describes a "dream" forensic science laboratory.

STARK REALITIES

When striving for the ideal, however, it is easy to forget that perfection is unattainable. What may seem logical to one observer may be politically impossible to another. Solutions that may accelerate the services of a forensic science laboratory may actually create an unacceptable threat to the laboratory's quality. Similarly, that large quantities of resources should be drawn from the public treasury and directed towards forensic science laboratories, however justified it may be, will offend those who argue that such funds should be spent on policing or other important criminal justice functions. Essentially, that which is set forth as the perfect solution from one perspective may, in fact, be remarkably flawed from another. Indeed, these struggles are entirely congruent with the overall experience of living and working within a democratic society that tends to regard imperfect government as being perfectly less capable of infringing upon one's personal liberties. In the United State of America, effective, efficient, and well-coordinated government is viewed by many as a threat to freedom. Others may view it as necessary to fully preserve public safety and security.

Another unfortunate part of reality in considering the elements of a model forensic science laboratory are intensely adversarial legal and political systems whose players tend, sometimes for self-serving reasons, to repackage and portray good, forward-thinking ideas as admissions of current shortcomings. Many reliable crime laboratories in operation today will not satisfy the various criteria proposed here for the model forensic science laboratory. This should not be construed as evidence of any malpractice, incompetence, or other forms of professional shortcoming.

ASSUMPTIONS ABOUT CRIME

A remarkably difficult assumption to consider while writing this paper was whether or not a model forensic science laboratory should be designed for an American society plagued with elevated levels of crime or a society that has learned to control crime using a variety of innovative social, enforcement, and predictive strategies. Curiously, the work of the project team writers tended toward a portrayal of forensic science as being big, significant, well regulated, and well funded. But this portrayal tends to conflict with the sentiments of most American citizens who expect crime to be *prevented*, not *accommodated*. Ironically, when this expectation is met, the demand for forensic science services is reduced. In an *ideal* world, the forensic science laboratory may be of only marginal social importance.

CONSIDERATION OF SOCIAL PRIORITIES

But this is not an article about the ideal *world*; it is an article about the ideal *forensic science laboratory*, the criteria for which must balance logic with reality. And, yes, forensic science laboratories do prevent crime by accelerating the identification and arrest of offenders before they have the opportunity to commit more crimes. Although a free society's hesitancy to encroach on personal liberties tends to increase quality of life and access to opportunity, it sometimes comes at the expense of society's ability to prevent predation and depravity. For this reason, it is assumed here that crime will always be a part of American life. But it is also assumed that the American public has very good reasons to expect its innovativeness and social awareness to eventually produce strategies that suppress crime, even if they cannot fully eliminate it. Just recently, for example, RTI International (2013) published comprehensive

research estimating billions of dollars of savings to the criminal justice system when prison terms for drug abusers are replaced with proper medical treatment. Some of these costs are associated with reduced recidivism, which also represents fewer new cases requiring intervention by police and the testing of associated evidence by forensic science laboratories. Innovations such as these have long-term benefits for public safety and may be more worthy of public investment than forensic science. To this end, the ideal forensic science laboratory, in meeting its responsibilities, should not exhaust those portions of the finite American treasury that would be better spent on efforts to prevent young people from ever becoming criminals in the first place. Admittedly, this is a very difficult balance to maintain. But the ideal forensic science laboratory should have an appropriately sized footprint within the criminal justice system it serves–not too big, not too small.

Finally, one can hope but not always expect that the model forensic science laboratory will operate within a model criminal jurisdiction. Some jurisdictions are highly effective, others are not. Ideally, forensic science laboratories are able to work collaboratively with collaborative stakeholders. They should also employ methods designed to continuously measure the satisfaction and engagement of their beneficiaries. The model forensic science laboratory is only a concept, but one that can encourage forensic science, criminal justice, and legal professionals to make smarter choices about the testing and control of forensic evidence. This article explains how and why the model crime laboratory was conceived and what its significance might be to the future of forensic science in the United States.

MANUSCRIPT REVIEW

Three manuscripts authored by the project team writers were provided to this author on June 18, 2013. A preliminary reading of the manuscripts was performed the following day. Among the most remarkable observations noted during this review, as noted by Siegel, were the stark differences in style, content, and vision. The following are brief summaries of the ideas expressed by the project team writers:

- Barry Fisher's manuscript presented the idealism of the model forensic science laboratory in the form of provocative questions that would necessarily have to be answered in order to begin the process of conceptualizing the model forensic science laboratory. Fisher implores the reader to remember that "In considering these questions, it is important first to recognize the complexity of the forensic science delivery system in the United States and to be aware of the many stakeholders–many who expect to be consulted about any decisions recommended in the improvement process" (Fisher 2013, 1). Through the questions he poses and the concerns he raises, a thoughtful reader is able to uncover the basis of Fisher's idealism despite his construct of potential challenges inherent to the design and establishment of a model forensic science laboratory. Interestingly, Fisher's idealism is not readily accessible to his readers; he challenges them to find it beneath many intellectual layers of thought and nuance that must be considered before the criteria for the forensic science laboratory might actually emerge within the real world. Fisher clearly expects his readers to think hard about the nature of forensic science before even attempting to contemplate the ideal laboratory.
- Doug Lucas takes his readers on a journey through the history of forensic science. Like Fisher, Lucas challenges the reader to understand where forensic science came from and how it arrived at this point in history with all its strengths, weaknesses, opportunities, and threats. But unlike Fisher, whose idealism lies behind barriers of potential political and economic resistance, Lucas's idealism is hidden beneath layers of *time*. To recognize the possibilities of the model forensic science laboratory coming into existence, the reader must come to terms with the long, arduous journey the profession of forensic science has taken for over a century. As Lucas explains, "It may reasonably be argued that the existing. . .delivery of forensic science services in the United States [is not systematic] because it was never planned or developed as a system. It is what it is because . . . it just grew" (Lucas 2013, 43). Lucas eventually offers a vision for how the model forensic science laboratory might look, but to have optimism that his vision could become a reality, readers must believe that change can happen despite so many years of what Lucas argues was mostly unmanaged growth.
- Jay Siegel's manuscript is direct, unapologetic, and transparent. There are no layers for the reader to peel away and no need to interpret hints or inferences. To some extent, Siegel captures the "existing political

and financial considerations" underscored by both Fisher and Lucas, but only for the purpose of helping the reader understand the reality in which forensic science laboratories operate. Siegel's comments are demanding. He outlines a number of faults and weaknesses in the forensic science apparatus and calls for action to bring the profession to where it needs to be. But with his criticisms he is also able to maintain a tone of optimism and respect for forensic science. This balance allows the reader to grasp the current set of challenges facing the profession of forensic science while appreciating its worthiness for more attention and support. As Siegel argues, "The model laboratory will point the way to what is possible and doable" (Siegel 2013a, 3–4). Although there may be challenges, the energy behind Siegel's vision suggests that the best chance for success may be to exercise assertiveness and resolve despite any challenges that may be faced in creating the model forensic science laboratory.

HOPE FOR THE FUTURE

Although the project team was confronted with the prospect of managing and merging a diversity of styles and viewpoints, like pieces to a puzzle the totality of their work undoubtedly set the stage for an important project to be undertaken–one that allows the composition and operation of a model forensic science laboratory to be envisioned with an adequate degree of clarity. It is expected and hoped that this work will be but the beginning of a lengthy and meaningful discussion about the future of forensic science laboratories in the United States.

CATEGORIZING THE ELEMENTS OF A MODEL

In 1966, Dr. Avedis Donabedian, a researcher and physician at the University of Michigan, published what would become one of the most important papers in the history of medicine. In *Evaluating the Quality of Medical Care*, Donabedian (1966) pointed to three distinct categories into which every element necessary for assessing the quality of healthcare could be divided:

Structure–the people, expertise, facilities, equipment, funding, and organizational arrangements used to deliver healthcare services.

Process–the actions taken and decisions made for the purpose of delivering health care services.

Outcomes–the results or effects of health care delivery, including the improvement or deterioration of the patient's condition, and patient satisfaction with the quality of services received.

The Donabedian model remains the primary governing framework for the evaluation of healthcare to this day, but it also provides a glimpse at how fundamental elements of quality in forensic science might be similarly categorized. For two reasons, however, the Donabedian model is not entirely adequate in capturing the critical priorities of forensic science without some modification. First, even the most reliable and innovative forensic science services are delivered within political and socioeconomic contexts that require consideration to a degree of political complexity that is likely not necessary for the evaluation of healthcare. This may include, for instance, the exposure of forensic science practitioners to political or adversarial pressure. Second, although Donabedian would likely have regarded it as a matter of process, the remedial or corrective action responsibilities and the transparency thereof, are worthy of scrutiny as an element of quality forensic science that is separate and distinct from the routine processes involved with the delivery of the actual services. With the exception of these two observations, Donabedian's work in 1966 is highly relevant to the project at hand.

With Donabedian's work in mind, the manuscripts developed by the project team were carefully reviewed to identify common themes and patterns of thought from which a framework of categories could be constructed for the purpose of capturing the foundational elements of the model forensic science laboratory. As a result of this evaluation, three categories were identified, and are shown in Table 1.

Other Considerations

Other considerations relating to the effectiveness of the forensic science delivery system may not necessarily be under the control of the laboratory. Even the personalities and egos of various authorities and elected officials with whom the laboratory interfaces on a regular basis can either enhance or compromise the ability of a model forensic science laboratory to deliver maximum value. This phenomenon is obviously not unique to forensic science. The criminal justice system is composed of many agencies that compete with each

TABLE 1 Categories of the Model Design

Category	Description
Economic and Political Position	This category relates to those considerations that make the model forensic science laboratory feasible and maximally effective. They relate directly to the role, purpose, structure, and independence of the laboratory, the channels the laboratory follows to access its resources, and they define who the customers of the laboratory actually are.
Resources and Support	What might be referred to as "inputs" in the business world, resource and support considerations are those related to what is *given to* or *made available to* the laboratory in order for it to meet the expectations of its stakeholders. Support and resources have the effect of empowering the laboratory and, therefore, act like fuel that drives the laboratory's operations over any given period of time.
Service Quality and Control	Considerations in this category might be referred to as "outcomes" according to the Donabedian model. They relate to those things the laboratory delivers to its many stakeholders, and the level of satisfaction and confidence they have in the laboratory. Service quality considerations assess the value and reliability of laboratory services and the perception of those services among stakeholders and perhaps the public at large; they relate to things the laboratory *gives to* or *makes available to* its customers.

other for public funding. Perhaps Barry Fisher cited the best example of this problem when he observed that, "As a practical matter, police departments have an easier time obtaining funds when compared with other branches of government. Funding public safety is a compelling argument from taxpayers that elected officials find hard to ignore" (Fisher 2013, 3). With Fisher's thoughts in mind, it can be said that the model forensic science laboratory should be able to compete for adequate funding, but it cannot control how other agencies engage in this competition. Nor can it control whether or not those agencies would ever be willing to place the needs of the forensic science laboratory above their own.

ECONOMIC AND POLITICAL POSITION

Doug Lucas closed his manuscript with a profound statement appropriate for beginning a discussion about the economic and political position of the model forensic science laboratory. "Efficiency in the eyes of the bureaucracy seems to mean providing some level of service at lower cost," he remarked. "To [those of us on the project team], it must mean developing a system for providing high quality service at the most realistic cost" (2013, 62). Lucas's concern is clearly centered on the age-old problem of low-cost for low-quality in government service, and his fellow project team members would likely agree with him.

Current Risk Exposure

In characterizing problems with the current forensic science system in the United States, the project team members collectively identified four significant risks associated with the economic and political position of today's forensic science laboratory:

1. A government-run forensic science laboratory is, not surprisingly, prone to the politics and perils inherent to government agencies. The primary goal of a government agency is to be relevant and well funded, and it is therefore against its very nature to demonstrate concern for the relevance and funding of other agencies with whom it competes for scare fiscal resources. Because forensic science is a service that transcends the needs and wishes of *individual* government agencies, its organization within any *single* agency will tend to disenfranchise other agencies having equal stakes in the effectiveness of the forensic science laboratory. By its very nature, forensic science is a multi-agency endeavor.
2. The organization of a forensic science laboratory within a police agency may create an unacceptable loss of both the laboratory's credibility and the perception of the laboratory by its stakeholders as being objective and dispassionate. Although forensic science has its roots in law enforcement for very good reasons, police commanders are not scientists and may not be well positioned or empowered

to provide support, direction, or advocate for the needs of the laboratory. Also, as a matter of course, police generally work in tandem with prosecutors in the investigation and charging of criminal offenses. In this regard, the police laboratory is often viewed, fairly or unfairly, as being in the *prosecution* business, not the *science* business.

3. The model forensic science laboratory is a check and balance in the criminal justice system. When afforded a reasonable degree of scientific autonomy, it can discourage and expose government misconduct or incompetence. But as Jay Siegel (2013a, 2) complains, today's forensic science laboratories "have little discretion," which can hinder their ability to fully contribute to society's goal of fair and reliable justice.
4. When forensic science services are free to customers, there are no economic disincentives to prevent excessive demand. As a result, backlogs rise, services are delayed, and perpetrators of crime are afforded more time to commit additional crimes before they are finally identified and arrested.

No matter how appealing the concept of a model forensic science laboratory may be, it cannot be ignored that police, prosecutors, judges, and defense attorneys bear significant constitutional responsibilities in our system of justice. Therefore, it is reasonable to argue that they should have appropriate degrees of influence over the administration of forensic science laboratories.

Criterion 1: State Sanctioned

The model forensic science laboratory exists under the authority of state statute or other state administrative authority of similar influence.

The model forensic science laboratory (or its parent organization overseeing multiple model forensic science laboratories), its governance, and its responsibilities to the state's criminal justice system are set forth by *state* statute, with, as Jay Siegel (2013a, 15) describes, "an independent funding line."

Currently, public forensic science laboratories exist at the federal, state, and local levels. Private laboratories also operate as a way to meet overall demand for services that, for any particular reason, cannot be met by public laboratories. For the purposes of this article, criminal justice is viewed as a state affair. The majority of violent crimes and property crimes in the United States are state offenses. Federal laboratories exist for processing evidence in federal offenses; however, the concept of a model forensic science laboratory is intended to apply to state criminal justice systems.

Experience, however, is painfully revealing how strongly tied to state government forensic science really is. In an article published recently by this author in *Police Chief Magazine* by the International Association of Chiefs of Police, the following observation was noted:

> In Massachusetts, a scientist in one laboratory (a crime laboratory, incidentally, run by the Department of Public Health—not law enforcement) caused widespread chaos as a result of her misconduct. On April 1, 2013, another person who worked at the same laboratory was charged with four counts of tampering with evidence. No one agency can clean up the mess, which suggests that no one agency should have been left to prevent it in the first place; it should have been a jurisdictional priority. (Collins 2013, 31–32)

Similarly, the Michigan State Police was forced to take over all forensic testing from the City of Detroit when the city closed its crime laboratory in 2008 after some 80 years in service (McDonough 2008).

Barry Fisher discusses this difficult issue, not as an exploration of failure, but as a potential justification for expanding regulatory oversight of the forensic sciences. Of the various options available, Fisher (2013, 7) believes that "a state approach is probably more likely. Oversight at the state level . . . offers the best chance of improving the system."

The public record seems to favor Fisher's observations. It is clear that state government is burdened with the responsibility of remedying catastrophic laboratory failures when they occur. Perhaps, then, this is the greatest evidence of *who really owns* forensic science—those who clean up the biggest messes when they happen.

Criterion 2: A Nonprofit Corporation

The model forensic science laboratory is a nonprofit corporation, or similarly arranged entity whose Board of Governors is comprised of leading criminal justice authorities and relevant stakeholders and advisors.

The model forensic science laboratory should be organized and positioned in a way that mitigates the aforementioned risks, but gives statewide criminal justice authorities some control over the services they receive

from their laboratory. It is proposed here that the model forensic science laboratory be a facility owned and/or managed by a nonprofit corporation whose Board of Governors is comprised of leading criminal justice authorities and an appropriate blend of other relevant stakeholders and advisors.

This concept of utilizing a corporate entity to advance statewide goals is well established. Among the most instructive examples are Economic Development Corporations funded by state governments. In Wisconsin, for example, its "Economic Development Corporation (WEDC) was created in 2011 and replaced the Wisconsin Department of Commerce." According to a National Governors Association (NGA) white paper, "The new public-private partnership focuses exclusively on job creation. Other Commerce Department responsibilities have been redistributed among other state agencies" (National Governors Association 2012, 7).

Also highlighted by the NGA (2012) is the Michigan Economic Development Corporation (MEDC) "created in 1999 to coordinate business delivery across state government and to make this delivery as seamless and non-bureaucratic as possible" (8). MEDC is governed by a 20-person executive committee. The committee "is comprised of business leaders, government representatives and economic developers. The executive committee is appointed and chaired by the governor" (NGA 2012, 9).

The primary advantage of creating state economic development corporations is the ability they afford state governments to convene a variety of leaders from both the private and public sectors to collaborate, innovate, and evaluate state economic policy and job creation strategies. The NGA concludes the following:

> States that want to increase the effectiveness of their state economic development agencies can employ three foundational strategies to ensure their success–engaging the private sector in partnership in the economic development process, creating mechanisms to encourage collaboration among industry clusters and government agencies, and instituting a system of quantitative measures to evaluate the state's return on investments in economic development. (NGA 2012, 19)

Success and collaboration across multiple domains requires the nurturing of strong partnerships. Indeed, the delivery of forensic science services also occurs across multiple domains and is equally dependent upon collaboration and partnerships. Too often, forensic science laboratories are incapacitated by the adversarialism and competition that exist across entire criminal justice systems. Barry Fisher (2013) notes:

> Building support from stakeholders for forensic science laboratory providers is also an important element. When forensic science is considered as a whole and compared to the much larger criminal justice system, it is small, indeed. However, stakeholders–police, prosecutors, defenders, innocence groups, victim advocacy groups, the press and the public–can be engaged to demand more of forensic science. However, these groups have to become aware and understand the problems as well as the ramifications of inactions.

Although it is proposed here that the model forensic science laboratory will be a nonprofit corporate structure set forth by state statute and managed by a Board of Governors representing key stakeholders and advisors, individual states may have provisions for the creation of inter-governmental arrangements that may also be satisfactory. The State of Illinois, for example, allows for the creation of such agreements. The Northern Illinois Regional Crime Laboratory in Buffalo Grove, Illinois, is governed by a board of directors comprised of the police executives of the agencies served by the laboratory. Each agency pays an annual fee to access the laboratory's services (Glassburg 2013).

Jay Siegel (2013a, 15) argues that forensic science laboratories must have prominence within the governmental hierarchy. "The laboratory should have department status within the government and its budget should have co-equal status with other departments." In lieu of a corporate or intergovernmental arrangement, Siegel's comments hold merit; however, prominent departmental status alone would not necessarily mitigate the significant political conflicts that arise as individual departments compete against one another for a state's fiscal resources. This creates a potentially volatile conflict of interest as some of these competitors are also customers of the laboratory.

Criterion 3: Responsible for Long-Term Evidence Control and Storage

The model forensic science laboratory directly manages the long-term security and preservation of the physical evidence it tests.

A third criterion is proposed for the model forensic science laboratory, which deviates significantly from

current practices and would be set forth by state statute. The model forensic science laboratory is responsible for the long-term control, storage, and disposition of the forensic evidence it receives and tests–and has the facilities, equipment, staff, and funding to do it. Most laboratories today simply return tested evidence to the submitting police agency. Consolidating and transferring this responsibility to the model forensic science laboratory produces some important advantages:

- The added responsibility and the consolidation of like functions create economies of scale that elevate the value of the laboratory and reduce the redundancies associated with many police agencies storing evidence that was previously submitted to the same laboratory.
- The proper control of forensic evidence is kept in the hands of forensic experts.
- Valuable space within police agencies is not consumed by growing quantities of forensic evidence, which, in some instances, can create environmental hazards.
- Forensic scientists have access to evidence they have tested if it becomes necessary to conduct additional testing at a later time. This can also be a distinct advantage in post-conviction litigation.
- The laboratory can better control the disposition of criminal sexual assault kits, the mismanagement of which has emerged as a national concern.
- Evidence remains on hand for the laboratory to produce more realistic blind proficiency tests and to conduct random reanalyses for quality assurance purposes.

Criterion 4: Restricted by Reasonable Case Management Policies

The submission of evidence to the model forensic science laboratory, as well as decisions made by the laboratory to prioritize, delay, or cancel testing, is controlled by rules and policies developed in partnership with the laboratory's stakeholders and approved by the Board of Governors.

In order to manage the ever-present risk of excessive demand for forensic testing services and the backlogs that result, rules governing the intake and prioritization of evidence for testing will be set forth by policy, which is supported and approved by the laboratory's Board of Governors. The primary goal of the policy, which may be modified from time to time, is to maintain an appropriate balance between the laboratory's capacity and the volume of evidence being submitted for analysis.

Doug Lucas (2013, 31) remarked that "An almost universal problem for most laboratories is the excess of demand for service over the ability to meet it, resulting in substantial backlogs of unreported cases." The model forensic science laboratory, by its very nature, should never have excessive turnaround times or "backlog crises" because evidence intake will always be controlled and balanced with what the laboratory's resources are able to accommodate. This also has the effect of mitigating the problems caused by the offering of a free service where no price can be set to regulate demand.

Corporate policy must also prescribe the procedures used to sequence and prioritize evidence testing. Whenever the laboratory opts to expedite, delay, or deny a testing request, it must conform to the corporate policy. Appeal procedures and strategies for resolving disputes should be included in the policy document.

Criterion 5: A Non-Union Workplace

There is no collective bargaining in the model forensic science laboratory.

The employees of the model forensic science laboratory do not bargain collectively. The advantages of this are numerous and are based on the underlying premise that personnel decisions within the model forensic science laboratory are made, first and foremost, to preserve the scientific integrity and credibility of the laboratory. The employees of the model forensic science laboratory are focused on their customers and professional responsibilities, not a labor contract. Management, however, has its own responsibilities in this regard, which are discussed later in this paper.

In his manuscript, Jay Siegel emphasizes the laboratory's *independence* as a critical priority. Admittedly, Siegel intends for the word "independence" to mean not beholden to the exclusive authority or influences of police or prosecutors. Fisher and Lucas also make specific references to the concept of laboratory independence, but not as strongly as Siegel. This author, however, recognizes and has personally witnessed the damage that organized labor can have on a scientific organization when basic principles of science, quality assurance, and professional ethics are subordinated to

the provisions of a labor contract and, for the most serious grievances, the bound rulings of arbitrators having no scientific expertise.

Achieving the sort of independence envisioned by Fisher, Lucas, and Siegel is nearly impossible within a union laboratory. But there is good news for those who worry that unorganized labor is more prone to abuse from bad management. According to the National Labor Relations Board (2013), the most historic victories for organized labor over the last 100 years, particularly those related to "wages, hours, and other terms and conditions of employment," have now been codified in federal and state laws. These victories benefit all employees, including forensic scientists, whether they organize or not. Collective bargaining is no longer necessary to enjoy these protections, so it is not worth risking the laboratory's commitment to good science, the confidence of its stakeholders, or the erosion of its *independence*.

RESOURCES AND SUPPORT

The term ***resource*** is largely ambiguous and has many potential applications in describing what is needed to operate the model forensic science laboratory. Resources can be fiscal, human, technological, and intellectual. For the purposes of this paper, the discussion will focus on fiscal and human resources exclusively, for the others are merely outcomes of these two. Admittedly, all resources, including human resources, ultimately stem from an organization's access to funding. Employees cannot be hired without the fiscal resources necessary to award competitive compensation and benefits. But because of the criticality of management decisions related to staffing, employee development, and organizational structure, human resources will be addressed separate from fiscal resources.

As a courtesy to the more discerning reader, he or she may observe here some curious omissions. Things such as equipment, supplies, books, and other tangible assets are not included as critical elements of the model forensic science laboratory for to do so would be unnecessarily microspective. This omission is based on the reasonable assumption that adequately funded forensic science laboratories, which also hire and retain employees of adequate expertise, will naturally procure the equipment and commodities necessary to produce reliable work. Said another way, it is the quality of the people and the adequacy of the fiscal resources found in the model forensic science laboratory that ultimately define it.

Criterion 6: An Adherent to Formula-Based, Variable Budgeting

The model forensic science laboratory adheres to a formula-based system of variable budgeting where future income and expenses are projected for individual laboratory activities.

Barry Fisher (2013, 4) remarked, "Forensic science services at the state and local level are frequently underfunded. Often, calamities have to occur before budget issues come to the forefront." Fisher's lament, although not entirely unique to forensic science, is an accurate description of how governmental budgeting practices and priorities seem, for whatever reasons, not to favor forensic science among other priorities. Doug Lucas (2013, 47) also commented on this phenomenon. "Assuming government funding, forensic science must compete for shrinking budgets with other entities in the administration of justice–and after justice has competed with health care, education, and all other government services." Lucas' observations are humbling. Yet, it is in this general discussion of budgeting for the provision of forensic science services that the potential benefits of a nonprofit arrangement begin to emerge.

In *The Price of Government–Getting the Results we Need in an Age of Permanent Fiscal Crisis*, David Osborne (2004) and Peter Hutchinson offer a good starting point for designing the optimum budget scheme for the model forensic science laboratory. They argue that current methods of governmental budgeting (although such primitive methods are common in the private sector as well) incentivize destructive behavior on the part of governmental managers who threaten to terminate their most valuable public programs as a way to render the trimming of departmental budgets as politically undesirable as possible. This manipulation of the public funding apparatus tends to be more effective at defending obsolete programs than initiating new, more cost-beneficial ones. The resulting effect is an inherently expansionary fiscal system with few contractional forces that contain costs of decreasing priority as the organization and its environment evolve from year to year.

As an alternative, Osborne (2004, 65) and Hutchinson urge a resolute departure from the common practice of routinely submitting last year's budget, also

known as *base funding*, with additional budget requests added to accommodate new projects and annual cost increases. As they explain:

> The new game, which we call Budgeting for Outcomes, has no concept of "base." Last year's number is not an entitlement, and there is no argument about adding to or subcontracting from it. Instead, the starting point is an agreed-upon price of government, and the objective is to buy results. Accordingly, the department head's job shifts from padding the base to proving that his or her programs will produce the desired outcomes for the best price.

Effective outcomes in forensic science laboratories relate most closely to three measurable factors:

- Rates of crimes in the jurisdiction(s) being served
- Policies controlling and limiting, within reason, the intake and testing of evidence by the laboratory; and
- The average time required for the laboratory to issue its testing reports.

In the ideal forensic science laboratory, budgets will be developed annually based on formulas and intelligent projections that take in account the above three factors. Moreover, the budgets will not be held hostage by what can be described as the archaic line item budgeting practice that remains common in the public sector. Osborn (2004, 92) and Hutchinson implore mangers to "eliminate line items in your budget below the program or strategy level; appropriate lump sums for the result of each strategy and program." Consequently, a system of *variable budgeting* should be employed by the model forensic science laboratory, where variable budgeting:

> . . . outlines the levels of resources to be allocated for each organizational activity according to the level of production within the organization. It follows, then, that a variable budget automatically indicates an increase in the amount of resources allocated for various organizational activities when production levels go up and a decrease when production levels go down. (Certo 2000, 458)

Two considerations are important when attempting to apply this reasoning to the forensic science laboratory. First, it is envisioned that an "organizational activity" would refer specifically to a particular technical discipline or unit within the forensic science laboratory. Second, in lieu of line-item budgeting, outcome-based variable budgeting that continuously accounts for the past, current, and future needs of individual laboratory units is relied upon to maintain balance between the production capacity of the model forensic science laboratory and the demand for its services. A constant evaluation of the laboratory's production as compared to service demand, as well as the monitoring of those factors tending to create problematic imbalances, would be expected in the model forensic science laboratory, which would benefit from the accountability and flexibility that variable budgeting affords. During any fiscal year, if imbalances appear in the budget, adjustments can be made easily and quickly.

Criterion 7: A Decentralized Organization with Required Structural Elements

The model forensic science laboratory is managed by an Executive Director who supervises a Director of Technical Operations, a Director of Administration, and a Director of Compliance and Control.

Reporting to the Director of Technical Operations are the supervisors of each technical unit.

Reporting to the Director of Administration are:

- **Case Management and Intake**
- **Facilities and Accommodations**
- **Finance and Procurement**
- **Human Resources**

Reporting to the Director of Compliance and Control are:

- **Evidence Retention and Storage**
- **Legal Counsel**
- **Scientific Integrity (quality control/accreditation)**

Each of the laboratory's technical units and support functions listed above are represented on an internal laboratory business committee that collectively manages the operations of the laboratory (see Diagram 1). By appointment of the Executive Director, the committee is chaired by one of the three division directors, who by virtue of the appointment, carries the title of Assistant Executive Director.

Of the three project team members, Jay Siegel outlined the most specific recommendations related to laboratory personnel. According to Siegel (2013a, 7–8):

> Laboratory technicians and bench scientists must have at least a bachelor's degree in a natural or physical science, preferably biology or chemistry. Bench scientists should have some forensic science and law courses in their degree programs (aspirational). The educational component for a bench scientist must contain

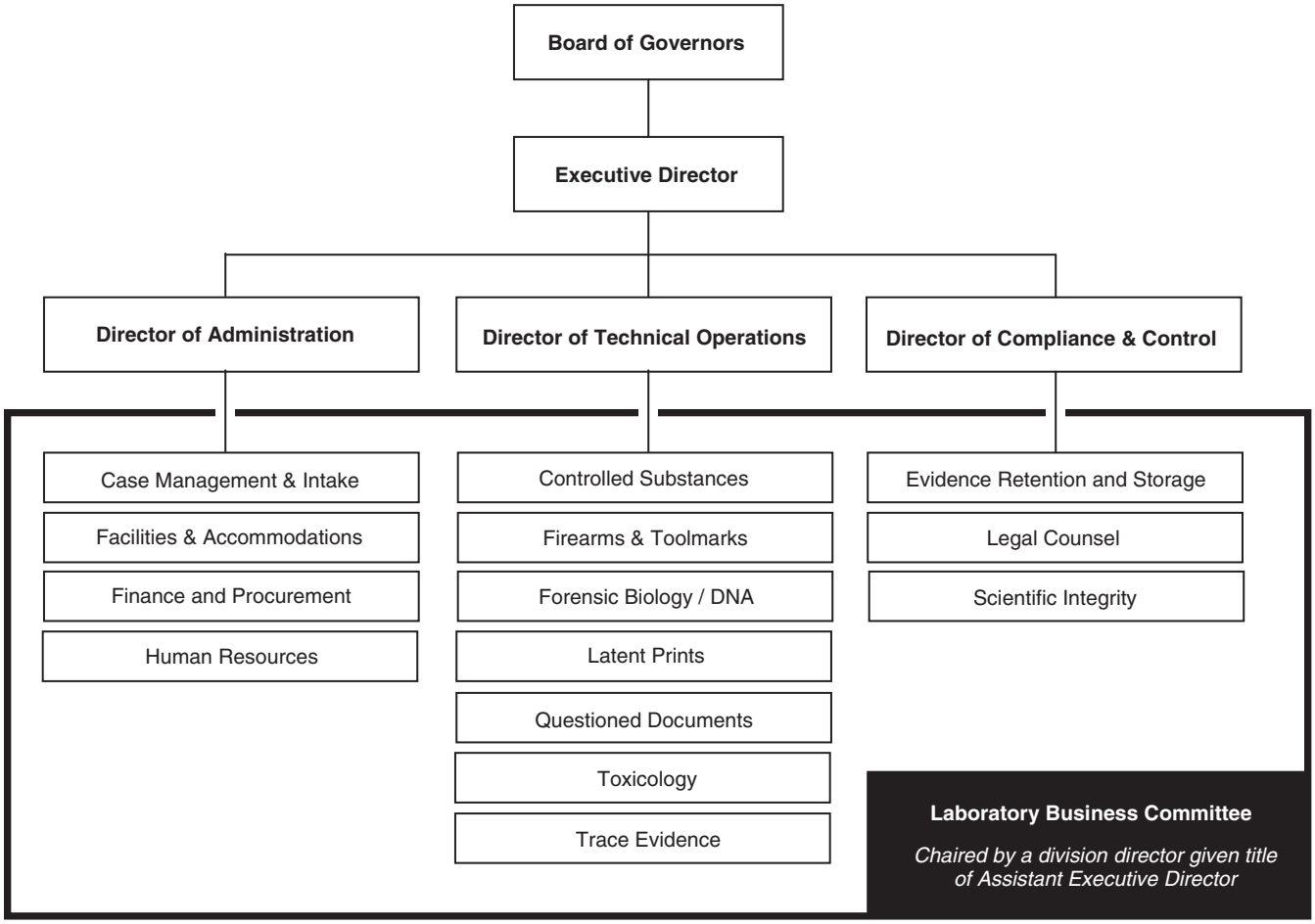

DIAGRAM 1 **Organizational structure and governance.**

an internship or practicum experience in a scientific laboratory. Unit supervisors must have significant experience in that unit and should have a Masters Degree in a natural or physical science or forensic science (aspirational).

To his credit, Siegel expands on his recommendations to include the training and certification of employees, as well as prescribing a specific management structure sufficiently fit to handle the rigors of the modern day forensic science laboratory. Siegel (2013a, 15) also suggests an "aspirational criterion" whereby "the laboratory encompasses both the crime scene unit and the fingerprint bureau," a viable but difficult reality to achieve in light of the collective bargaining rights that police unions have to these sorts of positions. Siegel's comments, however, are born of important thought processes that the model forensic science laboratory should be expected to execute for itself–assuming it has the right people to do so. For example, Siegel argues that scientists should have baccalaureate degrees and be certified within their respective subject matter areas. This author agrees wholeheartedly with Siegel, but would also argue that if the model forensic science laboratory housed a dedicated compliance division, as well as a human resource management division, both of which would be expected to pay close attention to trends and emerging best practices in the profession of forensic science, it may likely come to the same conclusions regarding employee credentials as Siegel. Incidentally, they would also remove burdens that are frequently placed upon laboratory supervisors whose time would be better spent focusing on their technical operations and employee performance. In conceptualizing the model forensic science laboratory, one cannot have full confidence that the right decisions will be made without the right people in charge having the right credentials.

"Managers choose to make structural changes within an organization if information they have gathered indicates that the present structure is the main cause of organizational ineffectiveness." (Certo 2000, 283) A common challenge in the forensic science laboratory

is structuring authority in a way that provides adequate management support and oversight to the individual technical units such as DNA, Latent Prints, Drug Chemistry, and the like. This leads to an important discussion about the nature of forensic science and the limitations imposed by the traditional, chain-of-command organizational structures that are so common today, especially in paramilitary organizations such as police or fire departments. To accommodate the quick flow of multidisciplinary information across lateral and vertical lines of communication that are necessary in the forensic science laboratory, the organizational structure must be flexible. The supervisor of a technical unit, for instance, may execute a remarkably diverse set of responsibilities that, at any one time, may be technical, administrative, financial, legal, managerial, or environmental. They may also be routine or urgent, such as when an instrument fails, requiring the immediate procurement of parts or other supplies. The traditional, command-and-control structure, in the experience of this author, is frequently ill suited to manage the wide diversity of issues, problems, and opportunities that are inherent to the technical and administrative functions being executed in the laboratory. It also tends to discourage the lateral communication between different technical units that can often lead to important evidentiary discoveries during the testing process. For this reason, a more decentralized structure that encourages rapid lateral and vertical communications would likely serve the model forensic science laboratory best.

"Decentralization is the degree to which decision-making authority is given to lower levels in an organization's hierarchy" (Society for Human Resource Management 2008, 99). While there are significant pros and cons to both centralized and decentralized structuring, "greater decentralization tends to provide higher employee satisfaction and quicker responses to problems. It also facilitates on-the-job training of employees for higher level positions. Decentralization has become more and more popular, since many people want to be involved in decision making that effects them and their work" (SHRM 2008, 100). These advantages would seem to also encourage the sort of performance and application of forensic expertise in the model laboratory that the project team members viewed as imperative. But this also requires identifying the key support functions that would be expected to maximize the effectiveness of each technical unit and its employees.

Diagram 1 outlines a collaborative cross-functional management structure for the model forensic science laboratory:

The above structure is a hybridized version of two common organizational structures: functional and matrix (Certo 2008). It is designed to maximize communication among a wide variety of subject matter experts in multiple functional areas while maintaining enough control to ensure accountability. Under this system, the laboratory houses individual technical units like most forensic science laboratories, or as Siegel (2013a, 6) wrote, "all of the scientific services that are offered by the governmental jurisdiction." These units report to a Director of Technical Operations and are responsible for the production of the laboratory. To support this responsibility, two other divisions are envisioned that give proper support to the technical units while also relieving them of having to execute these functions themselves. These two other divisions are Administration and Compliance and Control, each with their own director.

Under the Administration Division, the following functions are managed:

- Case Management and Intake
- Facilities and Accommodations
- Finance and Procurement
- Human Resources

Under the Compliance and Control Division, the following functions are managed:

- Evidence Retention and Storage
- Legal Counsel
- Scientific Integrity

This structure provides the following advantages to the model forensic science laboratory:

- It is collaborative and creates opportunities for potential leaders to be developed or recognized
- It provides strong administrative support to technical units who can focus on evidence testing and testing methods
- It eliminates inefficiencies of traditional command-and-control structures
- It encourages communication and the development of professional relationships across the entire organization

- It creates a number of possible career tracks for employees seeking promotion to leadership positions
- It gives the laboratory support in areas of expertise, such as HR and legal counsel, for whose attention many of today's forensic science laboratories have to compete within their parent agencies.
- It places the management of the long-term storage of evidence under appropriate legal counsel qualified to make determinations about evidence status and suitability for disposal.
- It gives the laboratory its own legal counsel to assist with the wide variety of legal issues, such as Freedom of Information Requests, evidence discovery requests, and the management of employee subpoenas.
- It provides for a Scientific Integrity unit to manage accreditation, quality assurance, auditing, and other requirements.

Conversely, this structure creates the following risks that must be managed for it to be successful:

- It requires a competent, well-trained workforce
- It is somewhat sensitive to internal politics and difficult personalities
- It requires effective communication skills and interpersonal skills among employees and leaders
- It may become unstable with executive directors or division directors that are prone to micromanaging their employees
- Cross communication among units occurs beyond the view of the directors, creating an opportunity for internal political struggles.

Barry Fisher, like Siegel, also emphasized the importance of organizational structure in the forensic science laboratory. Although Fisher did not make specific recommendations, he framed the issue for his readers in the form of a basic question:

> It's a worthwhile exercise to examine the present operational and organization structure of modern U.S. public crime labs. One thing becomes clear: there are many ways public laboratories are set up and operated. No single, exemplary structure exists. A simple criterion that may be used as an indicator of success is: does a particular laboratory work; does it deliver an appropriate level of service to those who rely on it? (Fisher 2013, 1–2)

Fisher's observations make sense. If a laboratory is meeting the needs of its customers and is functioning effectively, then the structure can reasonably be thought of as appropriate. But it is safe to say that any laboratory found to be in a state of failure probably, at one time or another, was perceived as meeting the needs of its customers. So, another import question is worthy of consideration as well: What organizational structure is most likely to *prevent* failures by making collaboration, communication, flexibility, and accountability critical parts of the laboratory's organizational culture?

Whatever structure is adopted, it will depend on good people and good leaders to make it work. The structure proposed here is likely to serve the model forensic science laboratory and its employees quite well.

Criterion 8: The Steward of a Special Services Fund

The model forensic science laboratory has a funding source used to pay for the completion of special testing requests. This fund is not managed by the Executive Director, but is instead managed directly by the Board of Governors and is used for the funding of:

- **Expedited testing**
- **Testing for post-conviction purposes*; and***
- **Testing that falls beyond the scope of the laboratory's case management / case intake policies**
- **Testing or consulting provided directly to defense counsel.**

A remarkable omission was evident in the manuscripts of all three project team writers—never does the phrase "burden of proof" appear in their writings, nor do the words "proof" or "prove." This is significant because the very purpose of forensic science laboratories is to support and make more effective the overall process of *proving* the guilt of suspects of crimes before administering punishment or other corrective actions. With due respect to the project team writers, this omission would seem to suggest a lack of regard for the complex constitutional responsibilities placed on prosecutors in our criminal justice system, as well as the unique importance of forensic science services to prosecutors in the United States. In fact, the entire basis of the American criminal justice system lies upon the requirement that prosecutors bear the full burden of proof in criminal cases. Defendants have no such legal burden, at least in theory. Defendants also do not respond to crime scenes or collect evidence, which means

they are not part of the linear production process leading to a request for laboratory services.

Both Fisher and Siegel, however, expressed strong sentiments about making forensic science services more available to defendants. Doug Lucas (2013, 60–61), was more reserved:

> The normally expected clients of the laboratory include law enforcement officers, coroners/medical examiners, fire marshals, wildlife enforcement officers, prosecutors and any other government agencies requiring forensic science service in connection with matters of regulation.
>
> Whether lawyers representing defendants in criminal cases should have the same access will be a matter for discussion and consideration. One argument in their favour would be that, in the two-sided adversary system, would it be fair for an objective, impartial, government-funded scientific organization to provide its services only to one side?

Clearly, forensic science is a *proof* business, just as policing and prosecuting are. It is much more efficient for society and its criminal justice institutions to prove the guilt of one or two people in the commission of a crime rather than prove the innocence of the 7 billion people on the planet who did not. Criminal justice is about proving guilt and doing so accurately. But there is an unmistakable reality that must be confronted and allowed to shape the conception of the model forensic science laboratory. Factually innocent defendants do, from time to time, find themselves in the unenviable position of having to prove an exculpatory fact in a case, especially if overzealous prosecutors or investigators actively resist such attempts–however rare that may or may not be. From the perspectives of the project team writers, their omissions are somewhat understandable. There is likely little shortage of access for prosecutors to the forensic science services available in their jurisdictions. But for a defendant that feels compelled to affirmatively prove an element of his case with scientific evidence, it can be prohibitively expensive and difficult to do so. For this reason, some provision affording defendants, as determined by the Board of Governors, a reasonable degree of access to the laboratory's services is ideal.

It is therefore envisioned that the model forensic science laboratory has a special operating fund used to recoup costs associated with special services. But as this author has personally experienced time and time again, the intense adversarial politics that can be associated with things such as testing for defendants, requests for expedited services, or requests to test evidence that may fall outside the scope of the laboratory's case management and intake policies, such a fund is best managed by the laboratory's Board of Governors. In this capacity the board, which represents the interests of all stakeholders, are in a strong position to set policies for the expenditure of these funds and negotiate disagreements that may arise. These disagreements and the politics behind them are not for the laboratory's Executive Director or his/her staff to resolve.

SERVICE QUALITY AND CONTROL

The terms *quality* and *control* go hand in hand mainly because the former is an outcome of the latter. Laboratory controls, whether procedural, analytical, or psychological, all have the intended effect of reducing the number of instances of nonconformity or failure. A quality control may be as complex as installing a temperature alarm on a biology freezer that is able to send an automatic text message to a supervisor in the event of a power failure. Conversely, it may be as simple as checking a testing report for spelling errors. To a degree, these controls are also a cost containment strategy because laboratory failures come with costs that can sometimes be measured in real dollars while other times they cannot. In manufacturing, for example, "cost of quality includes any cost that would not be expended if quality were perfect. This includes such obvious costs as scrap and rework, but it also includes less obvious costs, such as the cost to replace defective material, expedite shipments for replacement material, the staff and equipment to process the replacement order, etc" (Pyzdek et al. 2010, 97). For some products and services, quality must be near perfect, which justifies the investments in the related controls. In others, however, efforts to maximize quality above and beyond what is expected of customers may hinder production for no real return on investment–in other words, the cost of the controls is greater than the potential cost of a nonconformity.

Interestingly, the word *quality* appears nowhere in Barry Fisher's manuscript; although this observation is slightly misleading. Fisher's concerns, as are Siegel's and Lucas's to some extent, are centered on the need for research, which Fisher notes is heavily influenced by academia and the availability of funding sufficient to justify a university's effort to compete for such funds. Fisher's (2013, 8) optimism, however, is tempered. "Without research grants," he warns, "it is not likely that universities will look into forensic science."

Indeed, a shortage of funding is destructive to the advancement of important research, but then again, all of the project team writers agreed that a shortage of funding has long plagued forensic science anyway.

Interestingly, some conflicts of reason seem to go unresolved in the manuscripts of the three project team writers. Clearly, Fisher argues that more research and better oversight are the keys to better forensic science. For Lucas, understanding quality in forensic science first requires a deep exploration of the history of forensic science and knowing how its many strengths and weaknesses have evolved over time and led us to where we are now. Although Lucas is not so blunt, his readers might be inclined to sense his true sentiments, if spoken aloud, as being "you get what you pay for." Siegel's concerns about quality in forensic science, however, are more implied than expressed. Siegel undoubtedly views forensic science as being plagued by a diversity of shortcomings that, as a matter of course, would lead a reasonable person to conclude that quality in forensic science is exposed to unacceptable risk. But in their totality, the project team manuscripts seem to fall short of bringing clarity to the question of whether quality control risks in forensic science are more externally influenced (oversight, research, mandatory accreditation, and the like), or more internally influenced (employee credentials, training, education, management). Each of the project team writers expressed his own thoughts and feelings about these issues, but leave unanswered questions about where the greatest exposures to risk are originating.

Realistically, however, in designing a model forensic science laboratory, the external influences controlled by other authorities cannot be a dominant part of the equation. Whether or not there is sufficient research, oversight, or professional certification in forensic science is immaterial to the design of the model laboratory. Although, professionally, these remedies are of great interest and potential importance, they are part of the external environment in which the model forensic science laboratory operates–not part of the laboratory itself. If the model forensic science laboratory is funded, organized, staffed, and managed properly, it will not only navigate potential environments effectively, it will also be in a strong position to influence its environment by influencing the community of forensic science professionals and helping to shape the evolution of relevant scientific and professional standards. Employees of the model forensic science laboratory are more likely to publish articles, conduct research, and speak at professional conferences, which in science are the main drivers of progress.

The final two criteria for the model forensic science laboratory are based on a concept explained by David Stevenson Huyink and Craig Westover in their 1994 book, *ISO 9000*, written and published for the National Center for Manufacturing Sciences. Huyink (1994, 119–120) and Westover portray any organization's effort to maximize quality as being based on a "quality attitude," driven by "customer-focused individuals who are not afraid to buck the system in support of customers." This quality attitude, whether in presence or in absence, ultimately predicts the effectiveness of the laboratory's reliability. As in any organization, this quality attitude must not only be a *goal* of executive management, it must be to some extent, a *preoccupation*.

Criterion 9: A Demonstrable, Impassioned Analyzer of Employee Technical Performance

An audit or assessment of the model forensic science laboratory will reveal in striking clarity an impassioned effort to critically and continually analyze the technical or scientific work of employees for the purpose of exposing real or potential threats to quality.

Currently in the profession of forensic science, the annual and sometimes semiannual proficiency testing of forensic scientists is among the more routine and heavily institutionalized methods of scrutinizing employee technical work. Laboratories have relied on proficiency testing for many years, and it is generally regarded as an affordable minimum standard of practice in the forensic sciences. But since the U.S. Supreme Court Ruling in *Daubert v. Merrill Dow Pharmaceuticals* (1993), which ignited controversial interest in the concept of error rates as a barometer of scientific admissibility in court, the current proficiency testing system in forensic science has come under criticism for a number of reasons:

- Scientists are aware they are being tested
- The testing does not sufficiently mimic real casework
- Testing data are not sufficient to establish reliable rates of error for forensic disciplines; and

- There is little evidence that proficiency testing has ever been heralded by forensic science leaders as the best way to identify emerging threats to quality.

The most dangerous threat a laboratory should endeavor to expose as quickly as possible is employee incompetence or any other lack of fitness for his or her employment as a forensic scientist. A model forensic science laboratory will work diligently to create as many opportunities as practicable for real or potential failures within the organization to be exposed–and this priority will be culturally engrained in the psychology of every manager and employee. The project team writers place great emphasis on research, oversight, and other external remedies. But for managers of forensic science laboratories, at least in the opinion of this author, the greatest threat to quality is an overwhelmed or emotionally unstable employee who takes shortcuts or perhaps fails to adequately execute basic quality controls in a way that would detect shortcuts taken by others. This may be where the weakness of the current proficiency testing system is most evident–even the worst employee will be smart enough to give extra effort on a proficiency test.

Blind Testing

Jay Siegel (2013a, 3) makes mention of blind testing, but only by noting what he suggests is a weakness of the current proficiency testing system; "it is not mandated that such testing be blind or external." As a point of fact, many proficiency tests are external, provided by independent, approved testing providers–and there is a provision in ASCLD/LAB accreditation standards requiring external testing. But Siegel is correct that current proficiency tests are not blind, meaning that test takers are aware they are being tested.

It is envisioned, as Siegel likely does but does not specifically discuss, that the model forensic science laboratory would work to construct an affordable but effective system of blind testing. But such a system might also appear strikingly different from what others have envisioned in the past, especially those who correctly argue that the administration of a single blind test is more expensive than its non-blind counterpart. In the opinion of this author, forensic science laboratories have been conditioned to regard testing as requiring yearly frequency, which is even mandated by accreditation standards. But the model forensic science laboratory might design and employ a blind testing system where each employee, for example, is only tested once every three years. This certainly conflicts sharply with the common annual approach to testing in forensic science. But the psychological impact of such a system–or as Huyink and Westover would likely characterize it: the building of a quality attitude, where employees never know if the next item of evidence they test is actually part of a blind test, would likely be profoundly greater than a routine annual system where employees know they are being tested. Moreover, the data collected from these blind tests, especially if a national effort was undertaken to coordinate a blind testing system, would allow for a much better estimate of error rates in various forensic disciplines. Worries about the cost prohibitiveness of blind testing are somewhat mitigated by relaxing the requirement of annual testing of employees. Even though an employee may be tested every three years, the cultural and psychological influence of the testing system is daily. This is not so for the predominant proficiency testing model in place today.

Random Reanalysis

Finally, in addition to a blind testing system, the model forensic science laboratory will likely employ a system of random reanalysis of evidence. Random reanalysis is a method of quality control in some forensic science laboratories where evidence samples meeting certain criteria are pseudo-randomly selected for retesting by a different laboratory scientist–what might also be called a second opinion. There are costs associated with this form of testing because it usually requires coordination with the laboratory's customers, such as police departments, who are the long-term custodians of evidence. But such a system has value because, similar to blind testing, employees never know what evidence will be recalled for reanalysis. Furthermore, because it is envisioned that the model forensic science laboratory will be the long-term custodian of a jurisdiction's evidence, the laboratory can more efficiently recall evidence for reanalysis.

Whatever efforts are undertaken by the model forensic science laboratory to consistently scrutinize the technical work of its employees, it will be most evident to any auditor or assessor that such programs are of extreme value to the laboratory and are executed frequently and consistently.

Criterion 10: The Follower of a Comprehensive and Predictable Quality Management Schedule

The many administrative, technical, and cultural techniques employed by the model forensic science laboratory to control and produce quality will be set to a schedule and followed.

Predictability and rhythm are the hallmarks of smooth-running, low-anxiety organizations. Employees, for example, who know exactly when the next staff meeting will be held and the topics to be discussed, are much less likely to waste time attracting attention to their concerns by writing provocative emails, for example, or burdening other employees with their grievances. Similarly, forensic scientists who know exactly when the next review of the laboratory's technical procedures will be conducted will give more thought to how those procedures could be improved because they know there will be a time and place to express those ideas.

Perhaps nothing is more devastating to organizational culture than chaos and unpredictability. And nothing explained this phenomenon better than a groundbreaking report published in 2009 by IBM Global Business Services. As the report explains, although IBM was a large, respected company with a rich history, "Approaching 1993, IBM was in rough shape operationally" (IBM 2009, 3). As far back as 1992, according to IBM (2009, 5), Fortune Magazine described IBM as a "dinosaur."

IBM's 2009 report, however, was a success story of how the company had turned itself around. As explained below, the report found major problems with the company's sales groups, which were exacerbated by a variety of factors that some forensic science professionals might find eerily familiar:

> Sales is often the untamed "wild west" in many organizations, especially in those organizations with intensive sales cycles and diverse, multi-disciplinary, expert sales teams. Sales organizations thrive in chaos, relying on the energy, heroism and savvy of independent-minded sales professionals. Like other large firms with long histories of traditional sales and big-company behavior, IBM knew this environment intimately. But as IBM strove to become more agile in response to market demands, IBM discovered that sales processes needed to be refocused, sales intelligence leveraged, and teams orchestrated across clients, product lines, roles, geographies and function. More so, sales needed to be a leader of integration–alignment of people and technology–within the enterprise, forging unexpected partnerships with the likes of finance and other strategic functions. Chaos needed to be managed with cadence, providing the organization with a tightly measured and rhythmic harmony that would drive more sales and improve overall business efficiency, all while providing more value to our clients. This transformation to sales Cadence, together with our experience with over 2,000 Sales-focused client engagements, taught us the new competencies required to become a better Sales organization. (IBM 2009, 1)

In the typical forensic science laboratory, chaos comes from a number of sources, not the least of which is the large number of cases and special requests being submitted by customers. When it comes to technical operations and the need to keep those operations synched with the demands of the laboratory's customers, chaos is a part of forensic science that must be managed. Chaos has the effect of causing uncertainty, instability, and anxiety, which in turn produces a very real threat to quality if it is not mitigated by other means.

The model forensic science laboratory will specifically identify the most important initiatives and techniques that minimize threats to quality and will work diligently to build a healthy organizational culture that thrives. These initiatives will not be taken for granted or casually implemented as time and interest allow. They will be scheduled, and that schedule will be followed. If laboratory management, for example, feels strongly about the importance of structured but flexible all-staff meetings where managers can inform employees about important issues, and employees, in turn, are able to inform management about what they are experiencing and observing in the laboratory or in the courtroom, then these meetings will be set to a schedule and that schedule will not be disrupted except for emergencies. Similarly, if the laboratory decides to implement systems of blind proficiency testing or the random reanalysis of evidence, it will ensure that the program stays on schedule and is well documented. In other words, if the laboratory believes that something is important, then it will be important enough to plan, schedule, and execute.

It is expected that the model forensic science laboratory will be accredited under ISO/IEC 17025, General Requirements for the Competence of Calibration and Testing Laboratories. Conveniently, the above philosophy of predictability and rhythm also reflect themes appearing in the ISO/IEC 17025, which is the basis of modern-day forensic science accreditation. Section 4.2 specifically requires testing laboratories to "establish, implement and maintain a management system

appropriate to the scope of its activities" (International Organization for Standardization 2005, 3). It is arguably the most important section in the document because it is the management system that drives conformance to the rest of the standard. When the model forensic science laboratory establishes and sets into motion a wide variety of methods and programs aimed at producing a quality work product, the resulting system can be documented and presented as the laboratory's management system as required by ISO/IEC 17025.

If an auditor or assessor were to question an employee of the model forensic science laboratory about what the laboratory does to preserve quality and promote a healthy culture, the employee will not only be able to explain *what* the laboratory does, but also *when it will happen again*. Ultimately, it is effective management that turns chaos into cadence as experienced by IBM.

CONCLUSION

Entire books could be written on how to apply each of the criteria proposed in this article. The object here, however, was to simply provide a defensible rationale for each criteria and afford readers an opportunity to envision how this model laboratory would operate if it actually came into existence. Although these criteria may invite significant discussion and debate, one fundamental truth about organizational management should not: Even the model forensic science laboratory can fail miserably under poor leadership or unmanageable political or fiscal circumstances. But with strong, innovative leadership, the right economic and political positioning, adequate resources and support, and an unwavering commitment to quality and customer service, the model forensic science laboratory will not only succeed, it will encourage remarkable progress across the entire industry.

Admittedly, it was impossible to address every valid point made by the project team writers–and there were many. But as the project unfolded, an interesting phenomenon laid to rest any concerns about inadvertently dismissing elements worthy of consideration. As the model forensic science laboratory took shape, it became increasingly clear just how much this ideal laboratory would be both empowered and motivated to engage in *model behaviors*. In other words, the model laboratory will *do things right* and *do the right things*. Therefore, criteria were not established to define what the model forensic science laboratory *does*, but rather what it *is*:

1. State sanctioned
2. A nonprofit corporation
3. Responsible for long-term evidence control and storage
4. Restricted by reasonable case management policies
5. A non-union workplace
6. An adherent to formula-based, variable budgeting
7. A decentralized organization with required structural elements
8. The steward of a Special Services Fund
9. A demonstrable, impassioned analyzer of employee technical performance
10. The follower of a comprehensive and predictable quality management schedule

To reiterate, not all of the criteria and sentiments expressed by the project team writers were specifically mentioned here; but all, in one way or another, were accommodated by the criteria proposed. Over time, countless more criteria worthy of discussion might also expand the definition of the model forensic science laboratory. In arriving at the 10 criteria explained in this article, this author sought to design a set of conditions that would most likely produce the outcomes expressly and implicitly desired by the project team writers. Indeed, it might be said that this is exactly what the leaders of today's forensic science laboratories hopefully do as well: Create the conditions for success.

It is acknowledged that the publication of these criteria will coincide with ongoing public policy debates and initiatives related to the administration of forensic science in the United States. In no way was this article intended to shift opinion about such efforts. Anyone interested in applying these criteria to public policy initiatives, however, must first consider the degree to which existing forensic science laboratories do or will come to meet these criteria in the future. If it is believed that laboratories are naturally evolving towards conformance to these criteria, it suggests that efforts to better organize and manage existing laboratories should take priority over any public policy remedies. Conversely, if it is believed that laboratories are "stuck" in an unacceptable state of status quo, public policy remedies would seem more appropriate–if they are based on reliable, meaningful research and debate. Like most issues vetted in the public domain, the best solutions might be a blend of the two.

Finally, it is worth mentioning that perhaps the greatest value of a model forensic science laboratory is to

shape thinking about future decisions. But in our highly adversarial political and judicial systems, it is possible that it will also, from time to time, serve less honorable purposes. Dreams of the ideal, no matter how enlightening or exciting they may be, face a bitter and unfortunate demise when they are used to humiliate. It is hoped that the concept of a model forensic science laboratory will never be used as a weapon to unfairly discredit or disparage existing laboratories and scientists, for to do so would ultimately weaken its potential to inform future decisions about the administration of forensic science in the United States.

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DISCLAIMER

The opinions expressed in this article are solely those of the author and, where cited, the project team writers. These opinions do not represent those of any other persons or organizations with whom the author and project team writers may be affiliated or employed.

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