Ashraf Mozayani
Carla Noziglia
Editors

The Forensic Laboratory Handbook Procedures and Practice

Second Edition

Humana Press

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Preface

It takes two for the truth – one to speak and another to hear
–Thoreau

Mention a forensic science laboratory and Abby of NCIS might spring to mind. Nice, but not exactly a reality. Perhaps you think of writers such as Sir Arthur Conan Doyle (closer) or Kathy Reichs (reality). Whatever your persuasion, forensic science is and has been interesting to the public for many years.

In this *Forensic Handbook*, 21 of the best of the best, the cream of the crop, the "Energizer bunnies of forensic science" (to quote Abby) have written of their specialties in the careers they love. These are real world heroes and heroines who fight crime not with a cape, but a lab coat.

Just as forensic science has become more in depth and broader in scope, so, too, has this second edition. This edition contains 21 chapters to the first edition's eight chapters, giving the reader a better insight into more uses of forensic science.

There are more issues in, more challenges to, and more applications of the principles of forensic science than ever before. The information gleaned from the testing of evidence yields much more information. The procedures, analytical instruments, and interpretation of results in forensic science require the scientists to have higher and broader levels of knowledge, skill sets to encompass the tiny micro to the vast macro levels of evidence, and a myriad of abilities both in the laboratory and in the courtroom. Thus, they who perform the testing must have more and more education and career-long continuing education. The practices have also reached into areas unheard of a mere ten years ago, such as anything digital. This has resulted in scrutiny of procedures, practices, laboratories, and people. Accreditation of laboratories and certification of scientists are now the accepted norm. From the first collection of evidence through analysis and interpretation to the final presentation to courts and other official bodies, ethics must be the guiding principle. The myriad legal issues of evidence and testimony are presented.

The well-appointed and well-equipped laboratories of today are a far cry from the closets (literally) where scientists were relegated. Safety procedures, contamination abatement, and ergonomic modules now allow the scientists to work in comfortable areas, with the latest in technology, following strict standards. Thus, one chapter discusses planning and design of a laboratory.

And not to forget the animal kingdom, the reader will learn how insects and bugs can assist in determining many things including a margin of time of death. You will read about the Fur, Fin, and Feather Lab, where scientists practice forensic protocols as applied to animals and their products.

In reading this handbook, you will find that, in many chapters, authors have discussed similar areas: accreditation, certification, ethics, the National Academy of Science report, and quality. These important facets of forensic science apply to varied disciplines.

No forensic handbook would be complete without the tried and true forensic disciplines: fingerprints, trace evidence, chemistry, biology, explosives and arson, forensic anthropology, forensic pathology, forensic documents, and firearms and toolmarks. However, even here, there are new and modern practices.

New to this edition are questions at the end of each chapter that can be used by the reader or, if used as a text, by the instructor. Also, at the end of each chapter is a brief biography of the author.

If these chapters tweak your interest, you will find information about educational requirements. To assist you, the Appendices contain resources such as national and international degree programs, forensic societies and websites, and granting organizations. With the advent of technology, old evidence has been tested successfully, and, indeed, the truth has set some free.

There is but one goal to which all of this progress is directed: truth. Enjoy your reading and may the truth be with you.

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Contents

1 **Forensic Laboratory Accreditation** 1
Anja Einseln, BA, MEM

2 **Forensic Biology: Serology and DNA** 15
Lisa Gefrides, MS, FABC and Katie Welch, MS, FABC

3 **Forensic Chemistry/Controlled Substances** 51
Donnell Christian, BS

4 **Crime Reconstruction and Evidence Dynamics** 105
W. Jerry Chisum, BS

5 **Explosives and Arson** 123
James B. Crippin, BS

6 **Fingerprints** 145
Carmine J. Artone

7 **Legal Issues Concerning Expert Evidence and Testimony** 181
Carol Henderson, JD and Kurt W. Lenz, JD

8 **Digital Evidence** 213
Mark Pollitt, MS and Robert Bianchi, BS

9 **Firearms and Toolmarks** 227
Edward E. Hueske, MA

10 **Forensic Odontology: Teeth and Their Secrets** 265
Helena Soomer Lincoln, DDS, PhD

11 **Forensic Pathology and the Investigation of Death** 283
Elizabeth A. Laposata, MD, FCAP, FASCP

12 Quality in the Forensic Science Laboratory 335
William J. Tilstone, PhD

13 Forensic Document Examination 369
William L. Leaver, BS, D-ABFDE

14 Toxicology in the Forensic Lab 385
Ashraf Mozayani, PharmD, PhD, D-ABFT

15 Trace Evidence 403
William M. Davis, PhD

16 LIMS: Laboratory Information Management Systems 417
Simon Key

17 Forensic Entomology 447
M. Lee Goff, PhD

18 Forensic Facility Plan and Design Guidelines 479
Kenneth C. Mohr, Jr., BS and Louis Hartman, PE, LEED, AP

19 Introduction to Forensic Anthropology 509
Jennifer C. Love, PhD, D-ABFA and Michelle D. Hamilton, PhD

20 Introduction to Forensic Engineering and Accident Reconstruction 539
Scott D. Batterman, PhD, PE and Steven C. Batterman, PhD

21 Wildlife Forensic Science 563
Ken Goddard, MS

Appendix 581

Index 585

Chapter 1
Forensic Laboratory Accreditation

Anja Einseln, BA, MEM

Contents

1.1 Purpose of Accreditation . . . 1
1.2 Why Accreditation? . . . 2
1.3 Employee Responsibilities . . . 2
1.4 Quality System . . . 3
1.5 The Process of Accreditation . . . 5
1.5.1 The Choice . . . 5
1.5.2 Applying . . . 6
1.5.3 The Assessment Team . . . 6
1.5.4 Assessment Team Preparation . . . 7
1.5.5 Laboratory Preparation . . . 7
1.5.6 On-Site Assessment . . . 8
1.5.7 The Report . . . 9
1.5.8 Corrective Actions . . . 9
1.5.9 Accreditation Maintenance . . . 10
1.6 Continuous Improvement . . . 11
1.6.1 Plan . . . 11
1.6.2 Do . . . 11
1.6.3 Check . . . 11
1.6.4 Act . . . 12
1.7 Glossary . . . 12
1.8 Questions . . . 13
1.9 About the Author . . . 14
References . . . 14

1.1 Purpose of Accreditation

There are multiple reasons why a laboratory may elect to become accredited. One may be because it is mandated to become accredited. These mandates can include legislative, organizational, and in response to specific critiques received by the laboratory. Another reason may be that the laboratory director sees the intrinsic value accreditation provides to a laboratory's operations via a peer-review process

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as well as providing external recognition. A third possible reason to pursue accreditation may be the perceived requirement of work needing to be performed in an accredited forensic laboratory that occurs during the court qualification of a forensic expert. Regardless of the reason *why* a laboratory seeks accreditation, the true value of the accreditation process are the activities involved in developing a sound quality system and then being committed to continually improving the laboratory's practices and procedures. All of these activities are done to ensure the ongoing quality of work being performed in the laboratory.

When a person first hears the phrase "accreditation," several ideas may come to mind. A new forensic scientist may not seem deeply concerned or interested in accreditation, as "it's something management should take care of." There could also be inclusion or confusion with the concept of individual certification (see keywords). The primary focus of this chapter will be accreditation, but it is also important to recognize how accreditation and quality assurance are closely related, therefore the organizational acceptance of operational review and commitment to continuous improvement will impact both quality assurance and accreditation. One essential element of success will be commitment to the quality process. Without a solid foundation of structure and commitment to continuous improvement throughout the organization, the process is little more than empty gestures and a waste of time and resources.

1.2 Why Accreditation?

Laboratories that commit their management practices and organizational culture to quality practices will be rewarded with high-functioning personnel, reduced costs (after an initial time and effort investment in the process), quality work output, clear channels of communication (internally and externally), and an external recognition process that can be demonstrated to both stakeholders and parent organizations. While some may see quality control and accreditation as burdens of working in a forensic laboratory, the true benefit is often articulated best by former opponents of the process. As we move through this chapter, several examples will be provided to help demonstrate that when the process is embedded in a laboratory and then woven into the culture of our day-to-day practices, the result benefits all levels of the organization.

1.3 Employee Responsibilities

When you become an employee of a forensic laboratory, several things will be expected of you. First, you will need to become familiar with the practices of the laboratory. Some labs may call this their "quality system." These practices may include building security, access to operational areas of the lab, completion of training programs, operational instructions for analysis, directions regarding recording technical notes, annual proficiency testing, handling evidence, maintaining chain of custody, quality control steps during evidence examinations, and report writing

requirements. While this level of detail may be overwhelming at the beginning, the structure provided by these requirements will provide assurance of consistent practices and agreed upon methods of operation. Some of you may welcome the structure: "just tell me what to do, and I'll do it." Others may see the structure as restrictive and suppressing creativity. What is essential to be aware of is that the laboratory has defined its operations based upon the needs of the science and the stakeholders within the judicial system. I would ask you to reflect upon the idea of each person being allowed to maintain their own version of a chain of custody – would this be a quality practice? Would having a defined process where evidence is handled, tracked, and secured in a similar manner be seen as a burden by the justice community? The concept I would like for you to start considering is that defining boundaries of quality and then electing to accept them as part of the working environment is an essential part of your forensic science practice.

An example of resistance to structure can be provided by Jackie. Jackie sighs again as he looks up the initialing requirements for examinations records. "Why does this have to be so complicated?" he asks himself and his computer screen. After finding the requirement for initialing each dated entry in his notes, he applies his handwritten initials in pen to the fourth entry he made on the same page. "Why can't someone see that this is my handwriting?"

A few weeks later Jackie goes to trial and is asked to identify the notes he made in a particular case. When looking at the notes handed to him, he sees that John also had notes on this case, and John's handwriting is very similar to his own. After taking a moment to sort through all the forensic notes that attorney handed him, Jackie is able to sort out his own from John's and then proceed with his testimony. Remembering his previous thoughts of the "waste of time" associated with initialing his exam records, he is now very thankful that the lab had this procedure in place.

1.4 Quality System

Once a laboratory has gone through the process of documenting their operational practices, they may then elect to go through a process of accreditation. As you read previously, accreditation is a process of external review. In most states, within the United States, accreditation is voluntary. At the time of writing of this book, four states do have various versions of legislatively mandated accreditation: New York, Texas, Oklahoma, and Missouri. If you work in a forensic laboratory in one of these four states, you should make yourself aware of the specific legislation that will affect your forensic work. Someone new to the accreditation discussion may assume that forensic labs should all work identically and follow all of the same procedures. An important "larger picture" idea is to become aware of the operational variability of state governments, the law enforcement community, and judicial community and how this same variability is mirrored in the forensic community. You should be very careful in making assumptions about operational practices from one laboratory to the next. Each laboratory is a product of the needs of the community it serves, the parent organization, the judicial system, and the requestors of

forensic services. After becoming aware of this variability, you will begin to see why accreditation and the process of preparing a laboratory for accreditation allow each laboratory to develop its own quality system. In the United States, we have an individualistic approach to our lives and our work. With this type of culture, we are very hesitant to mandate or dictate uniformity in our lives. It seems to go against the grain of our cultural fabric. Other countries have a more pluralistic approach – where the benefit of the whole society outweighs the needs of the individual. This individualism lends itself to an innate perceived "right" to be able to choose our own way. This perceived "right" may occasionally get in the way of a successful accreditation effort. If I manage a forensic laboratory with fourteen employees, each wanting to do things their own way, and I do not define a quality system, I then have no process of ensuring quality and consistency. How do I know that the analysis done by one person is of equal quality when compared with the next person? By defining and then requiring the same practices within the laboratory, I can be assured of consistent quality of the results.

There is a fine line between rote analysis and enabling the creativity of the forensic practitioner. I would like to bring to mind the physician that you may go to for your routine care. When it comes to a cough or cold, a broken leg bone or appendicitis, having a consistent process for treatment is favored, because it has been validated and practiced, but allowing the doctor to make adjustments based on what they encounter during the procedure ensures quality of care. This same process can be seen when flying a commercial airliner from New York to Los Angeles. Although having procedures for take-off and landing, flight plans, and safety are excellent, having the variability of modifying the flight plan based on weather encountered or turbulence is a way of ensuring a safe and hopefully calm flight. An effective quality system will provide a structured environment, but will also have a mechanism to both adapt to variables and a way of modifying or improving procedures when necessary for the quality of the work.

Now you can begin to consider the process of continuous improvement. This whole idea ties back to accreditation via the process of "plan > do > check > act." This concept is one that can be found in the ISO website (www.iso.org), and serves as the foundation of all quality practices. Without feedback into the process, all the audits, assessment, reviews and checklist would amount to a volume of dead trees, rather than a treasure chest of opportunities to improve a laboratory's quality system and the practices within the laboratory.

The Internal Audit

Mike looks at his Blackberry and sees that Pam has sent another e-mail reminder about the audit that will begin tomorrow as well as a revised audit worksheet. He quickly looks at the attached audit form and then deletes the e-mail, because the worksheet he printed out three days ago looks almost identical, plus he already took notes on his printouts. He's sure the changes are minor and won't impact his work. He's so familiar with the quality requirements, he could do it without all these checklists Pam is constantly creating. She's still mad at him for not sitting through the three hour training meeting she held on Tuesday. She'll realize soon enough that he's a lot smarter than the other folks on the audit team.

Pam sees Mike walking into the conference room where the case files have been collected and stacked for each of her auditors. She sees Mike pulling out some worksheets. She's relieved that he seems to have prepared for this audit. She has some misgivings about asking him to be on the internal audit team, but he had worked for the state crime lab for twenty years and seemed to be a nice enough guy. After the first two hours of file review, Pam walks over to Mike to check on his progress. She takes a quick glance at the worksheet he's using and sees that he's missing a complete section of checklist items. "Mike, did you get my e-mail yesterday?" "Yes, Pam, I did." "Well, I see that your notes haven't recorded the three clause requirements I added in the latest version of the checklist." "What three clause requirements?" "Sections 5.6.3, 5.6.3.1, and 5.6.3.2 about the noting of photographs section." Mike sighs – he looks at the stack of case files he's already reviewed and remembers that each one of them had at least a few photos in each of them. "I'm sorry Pam. The checklist you sent last night looked so similar, I just used the one's I had already printed out." Pam looks at him, the files he's already completed and walks over to her section of the table to pick up some copies of corrected checklists. "No worries Mike. I had a chance to review the reports from last year's internal audit and recognized that this was an area that we didn't catch during our last round of internal audits. I realize now that I should have highlighted this in my e-mail, so I'll review the files you've already done." "Thanks Pam, but you shouldn't need to do that. I should have used the checklist you sent. The catch you made in last year's internal audit was an astute one. I don't think we would have noticed that in our section, and considering our next assessment will be next year, I'd rather be in a position where we catch it, rather than the assessment team." "Thanks Mike. Care to help me comb through our procedures for evidence handling next month to help fine tune that audit checklist? Your experience at the state lab may give us some good ideas for things to consider." "Sure Pam. Thanks for asking. I'll start reviewing through these files again so we can finish on time today."

1.5 The Process of Accreditation

1.5.1 The Choice

The first step in the process of accreditation would be the laboratory management, typically the laboratory director, making the active choice of pursuing accreditation. As mentioned previously, this may be mandatory or it may be elective. The next step would be to become familiar with the specific requirements of the accrediting body. This may require purchasing or acquiring copies of various accreditation manuals and documents, and then beginning an in-depth review of the steps required to make an application. If a laboratory is pursuing accreditation for the first time, adequate time and resources should be planned to address the scope of the application project. It is highly recommended that this process not be undertaken by only one person in a laboratory, as the quality system within a

laboratory affects many individuals. Ensuring sufficient time for planning, review, feedback, and modification will allow laboratory management to thoughtfully prepare and acclimate all personnel to the process of accreditation. By taking a single-person approach to the process of preparing a quality system and an accreditation application, opportunities for gaps and misconceptions creep in. One of the important parts of the on-site assessment is the review of staff and operations, and if only one person "has the answers" then it becomes clear that the laboratory is not functioning as one organization, but more of a one-person-show where everyone else is kept in the dark.

1.5.2 Applying

The application for accreditation will most likely require a laboratory to submit copies of all of its operational policies, procedures, manuals, and documents. This will give the assessment team an opportunity to prepare checklists for the on-site review. Documents that may be requested by the accrediting body may include, but are not limited to: laboratory quality manual, casework analysis procedures, training programs and competency testing practices, proficiency testing program, evidence handling procedures, laboratory security requirements, report writing and note taking procedures, testimony monitoring program, statements of qualification for all case working personnel, organizational charts, job descriptions, and calibration and maintenance procedures. The task of pulling together all of the application materials takes time, and a laboratory shouldn't try to slap things together and hope that they are buying some time until the team arrives at the laboratory. It will become very apparent to the person reviewing the application, and the team leader will typically have many years of experience when it comes to accreditation and quality assurance, and this will signal that the laboratory is not taking this process seriously. The laboratory should approach the process of finalizing and submitting an application as a major milestone in the accreditation process – this usually takes a few weeks or months, rather than hours. Once an application is completed, the laboratory management needs to focus on ensuring that the employees are prepared and that they are continuing to work in compliance with their laboratory quality system. Changes to the quality system should be avoided after making an application, as these changes would need to be communicated to the accreditation body for incorporation to the laboratory's application.

1.5.3 The Assessment Team

Once the application has been received and reviewed by the accreditation body, an assessment team will be organized by the accreditation body. The team size will be based on the size of the laboratory, the forensic disciplines that the laboratory offers services in, and the total number of case working staff in each discipline. A conversation