Precision CJ
CONSULTING

OCTOBER 2024

MEMPHIS CRIME LAB FEASIBILITY STUDY

Financial Cost, Evidentiary Timeframe, and Implementation of Forensic Laboratory Technology

PRESENTED TO
Memphis Police Department

PRESENTED BY
Precision Criminal Justice Consulting

Memphis Crime Lab Feasibility Study: Financial Costs, Evidentiary, Timeframe, and Implementation of Forensic Laboratory Technology

PCJC Report 2024-02
October 2024

Submitted to:
Mayor Paul Young
City of Memphis

Chief CJ Davis
Memphis Police Department

Project Director: Dr. James C. McCutcheon
3720 Alumni Avenue, Browning Hall Room 320
Memphis, TN, 38152
Email: PrecisionCJConsulting@gmail.com

Contract Number: 41062

Suggested Citation: McCutcheon, James, Amanda Johnson, Kiarra Fortney, Karli Province, and Larisa McKinnerney, 2024. *Memphis Crime Lab Feasibility Study: Financial Costs, Evidentiary, Timeframe, and Implementation of Forensic Laboratory Technology.* [Report Number, 2024-02]. Memphis, TN: Precision Criminal Justice Consulting.

Table of Contents

Tables and Figures

Executive Summary

Introduction

This report presents findings from a comprehensive feasibility study of the proposed crime lab development for Memphis/Shelby County. The study aimed to assess the current forensic infrastructure, operational processes, accreditation requirements, and potential costs associated with establishing a centralized crime lab in the region. It explores the benefits and challenges of centralizing forensic services, focusing specifically on improving efficiency, processing times, and supporting law enforcement efforts.

This feasibility study is part of Memphis/Shelby County's broader efforts to address forensic services in the region and to support the region's crime reduction initiatives. The study examines existing processes in the Memphis Police Department (MPD) and the Tennessee Bureau of Investigation (TBI), assesses space and staffing requirements, considers options for facility construction or refurbishment, and reviews case studies of other crime labs. The objective is to provide informed guidance on the potential structure, operations, and impact of a new crime lab in Memphis/Shelby County.

Study Overview and Purpose

The study sought to review and outline the limitations of the current forensic setup in Memphis. Presently, the MPD manages various forensic units, including latent prints, crime scene investigations, digital forensics, and parts of ballistics analysis. Context is provided around current needs among these units. Other forensic evidence is tested by both TBI and private lab outsourcing. Establishing a centralized crime lab would look to streamline these processes, enhance investigative outcomes, and address the growing demand for forensic services.

The proposed crime lab would likely consolidate forensic functions under one roof, providing facilities for DNA analysis, toxicology, digital forensics, firearms analysis, and evidence management. This study examines costs and what resources would be required, and how adoption of such a lab would integrate with existing law enforcement operations.

Research Questions and Methods

The feasibility study explored several key research questions:

- What is the current state of forensic operations in Memphis/Shelby County, and what challenges do they face?
- How should the proposed crime lab be structured to meet the county's forensic needs, including considerations for accreditation and validation?
- What are the space, staffing, and cost requirements for building a comprehensive crime lab?
- What immediate actions can be taken to improve current forensic processes, and how might these feed into the development of a new facility?

To answer these questions, the study employed multiple research methods, including:

- Interviews and Observations: Engaging with staff at existing forensic units in the MPD and TBI to gather qualitative insights into current operations, challenges, and needs.
- Case Study Analysis: Reviewing the structure and operations of other crime labs, such as those in Houston, Charlotte-Mecklenburg, Nashville, and Arkansas, to identify best practices and potential pitfalls.
- Space and Cost Assessment: Estimating space and cost requirements based on standards outlined in research and by government agencies, as well as analyzing infrastructure needs for specialized forensic units.

Findings and Implementation

The study identified several critical findings related to the feasibility of developing a crime lab in Memphis/Shelby County. The current forensic services face several challenges related to space, equipment, and workflow.

The study findings emphasize that developing a new crime lab would involve more than just constructing a facility; it requires designing a secure, adaptable, and workflow-focused environment. Accreditation is a crucial aspect of the lab's structure, as adherence to national standards ensures the reliability of forensic analysis and supports the integrity of evidence in the judicial process. Validating the equipment and procedures before the lab becomes operational is another essential step to maintain compliance with accreditation standards. This process would likely take longer than a year for most units.

Additionally, the study examined potential actions to improve current forensic processes. Drawing from these findings, the minimum needed is the upgrading of existing facilities to enhance working conditions. While these improvements do not replace the potential need for a new lab, they represent vital steps toward addressing immediate operational bottlenecks, while also representing movement toward a local forensic crime lab.

Preliminary Impacts and Future Considerations

A key aspect of the feasibility study involved evaluating the potential impact of a centralized crime lab on forensic processing times, case backlogs, and law enforcement outcomes in Memphis/Shelby County. If properly funded, the proposed lab's consolidation of forensic services is anticipated to streamline evidence processing, reduce dependence on external resources, and potentially improve turnaround time for some units. Additionally, it could facilitate better inter-agency coordination, enhancing the support provided to ongoing investigations.

However, the study also notes the complexity of implementing such a facility, particularly in terms of space requirements, staffing, liability, and operational costs. Creating a lab that meets current demands while allowing for future expansion is a critical consideration. Flexible design, combined with modern digital infrastructure, would be necessary to keep pace with technological

advances in forensic science. The lab would need to accommodate specialized spaces for DNA analysis, toxicology, digital forensics, and secure evidence storage, all of which have specific environmental and security requirements.

Conclusion

Immediate actions, such as upgrading current facilities can address some existing inefficiencies while laying the groundwork for the future crime lab. The decision to build a new facility involves weighing the potential long-term benefits against the upfront investment in construction, equipment, and staffing. The study's findings underscore the importance of thorough planning, robust digital infrastructure, and adherence to forensic best practices to ensure the lab's effectiveness and sustainability.

Actions discussed in this study involve a need for additional funding, space, equipment, and personnel. In addition, actions that can take place quickly include (1) investment and integration of Rapid DNA, (2) increasing the capacity current criminalist efforts and transportation of evidence, and (3) developing an agreement through a potential MOU with TBI to assist in allocating resources and personnel to test solely or mostly Memphis/Shelby County evidence, such trained personnel could potentially transition to a local lab, depending on the structure of the agreement.

Further steps in this process will involve a detailed cost-benefit analysis, securing funding, and engaging with stakeholders to refine the lab's design and operations. This study serves as an initial framework, offering insights and guidance on the path forward in developing a crime lab that meets the evolving needs of Memphis/Shelby County.

List of Abbreviations

AAFS	American Academy of Forensic Sciences
AFIS	Automated Fingerprint Identification Systems
AFTE	Association of Firearm and Tool Mark Examiners
ANAB	ANSI National Accreditation Board
ASCLD	American Society of Crime Laboratory Directors
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BJA	The Bureau of Justice Assistance
CALEA	Commission on Accreditation for Law Enforcement Agencies
CAP	College of American Pathologists
CCSA	Certified Crime Scene Analyst
CES	Certified Evidence Specialist
CFCE	Certified Forensic Computer Examiner
CLPE	Certified Latent Print Examiner
CSI	Crime Scene Investigation
DFS	Department of Forensic Science
DFU	Digital Forensics Unit
EMS	Environmental Management System
FBI	Federal Bureau of Investigation
FQS	Forensic Quality Services
FTK	Forensic Tool Kit
FY	Fiscal Year
GC-MS	Gas Chromatography-Mass Spectrometry
IAI	International Association for Identification
ICAC	Memphis Police Department's Internet Crimes Against Children

ICMDE	International Computer and Mobile Device Examiner
IAPE	International Association for Property and Evidence
IR	Infrared
LAB	Laboratory Accreditation Board
LC-MS	Liquid Chromatography mass spectrometry
LEED	Leadership in Energy and Environmental Design
MGU	Michigan State University
MNPD	Metropolitan Nashville Police Department
MOU	Memorandum of Agreement
MPD	Memphis Police Department
MSPFSD	Maryland State Police Forensic Sciences Division
NIBIN	National Integrated Ballistic Information Network
NIJ	National Institute of Justice
NMS	National Medical Services
P&E	Property & Evidence
PCR	Polymerase Chain Reaction
PPE	Personnel Protection equipment
QA	Quality Assurance
QC	Quality Control
RS&A	Ron Smith and Associates
SAKs	Sexual Assault Kits
SCDAG	Shelby County District Attorney General
SDS	Safety Data Sheets
SOPs	Standard Operating Procedures
SPE	Solid-Phase Extraction
SPR	Small Particle Reagent
STR	Short Tandem Repeat

STIS	Special Traffic Identification Squad
TBI	Tennessee Bureau of Investigation
UV	Ultraviolet
VDFS	Virginia Department of Forensic Science
VOC	Volatile Organic Compounds

Acknowledgements

This project would not have been possible without the valuable contributions, time, and effort of many individuals and organizations. We extend our sincere gratitude to the Memphis Mayor's Office, particularly Mayor Young, for his support, and to Chief Davis of the Memphis Police Department (MPD) for facilitating access to essential data and resources.

We are appreciative of the Memphis Police Department, the Shelby County District Attorney General's Office (SCDAG), the Arkansas State Crime Laboratory, the Shelby County Sheriff's Office, the Charlotte-Mecklenburg Police Department Crime Lab, the Houston Forensic Science Center, the Tennessee Bureau of Investigation (TBI), and TBI's Special Agent De'Greaun Reshun Frazier Crime Lab and Regional Headquarters in Jackson, TN. Your willingness to provide access to data, participate in interviews, and engage in in-depth discussions has been invaluable to this research and made this study possible.

We would also like to acknowledge the MPD investigators and analysts who shared their insights and expertise throughout this study. Much of the data and knowledge gathered was the result of extensive interviews, research, and the collaborative efforts of these professionals.

Lastly, we thank all who contributed their time and resources to this project, including a special thanks to Amaia Iratzoqui for her helpful thoughts and feedback on the project. All of your support, whether in providing data, facilitating discussions, or offering guidance, has greatly enriched this research. Your dedication to advancing forensic science and public safety is truly commendable.

Memphis Crime and Forensic Need

Introduction

In 1997, the Memphis Police Department (MPD) explored the possibility of establishing its own forensic crime laboratory but ultimately decided against it due to limited resources and funding constraints. Until 2021, the Tennessee Bureau of Investigation (TBI) operated a local forensic lab in Memphis, serving the West Tennessee region.[1] However, logistical challenges and transportation concerns led to the decision to relocate the TBI lab to a more centralized location, while continuing to provide services to Memphis and the Western Region.

TBI's Special Agent De'Greaun Reshun Frazier Crime Lab and Regional Headquarters in Jackson, TN, now serves as the forensic lab for Memphis and the West Tennessee region. At the time of the relocation, TBI assured that the move would have minimal impact on forensic testing. However, in recent years, high-profile cases and growing concerns over testing turnaround times at the TBI Jackson Forensic Lab have drawn increased attention.

TBI collaborates with various law enforcement agencies across the twenty-one counties it serves in West Tennessee. Each county generally has its own sheriff's department and at least one other city agency. TBI works closely with these local agencies, providing specialized services such as forensic analysis, criminal investigations, and training to support their operations.

Listed below is a breakdown of the West Tennessee law enforcement agencies that the TBI supports by county:

- **Benton:** 3 agencies
- **Carroll:** 6 agencies

[1] About TBI. (n.d.). *Who we are*. Tennessee Bureau of Investigation. https://www.tn.gov/tbi/who-we-are.html

- **Chester:** 2 agencies
- **Crockett:** 3 agencies
- **Decatur:** 3 agencies
- **Dyer:** 3 agencies
- **Fayette:** 6 agencies
- **Gibson:** 7 agencies
- **Hardeman:** 7 agencies
- **Hardin:** 2 agencies
- **Haywood:** 2 agencies
- **Henderson:** 3 agencies
- **Henry:** 2 agencies
- **Lake:** 3 agencies
- **Lauderdale:** 3 agencies
- **Madison:** 3 agencies
- **McNairy:** 3 agencies
- **Obion:** 6 agencies
- **Shelby:** 9 agencies
- **Tipton:** 7 agencies
- **Weakley:** 7 agencies
- **Tennessee Highway Patrol**
- **Tennessee Wildlife Resources Agency**

Memphis Crime

Among the West Tennessee jurisdictions served by TBI's Forensic Crime Lab, Memphis ranks highest in crime. With nearly 400 homicides in 2023, many of these cases require extensive forensic testing, including fingerprint analysis, ballistics, and DNA testing. As a result, Memphis produces a significant volume of forensic evidence, making it a key city for the West Tennessee TBI Crime Lab.

Table 1 presents the overall violent crime rate, case performance, and lab production in comparison to other municipalities and states included in this analysis. While these cities are used for context, comparisons should be viewed conservatively. The following table provides population data for each city included in the current feasibility study, based on the 2022 U.S. Census, the most recent complete dataset available. Crime rate data was obtained from the FBI's publicly available database, which compiles reported data from NIBRS for each city. It is also important to note that the number of cases solved per year does not necessarily correspond to the number of cases reported that year, as it includes backlogged cases and those with extended investigative timelines beyond the reporting period.

The data for calculating the solve rate was obtained from the FBI, which includes the number of cases solved by jurisdiction. The solve rate was determined by calculating the number of cases solved per year as a percentage of the total reported cases. It is important to note that solved cases do not correspond directly to the reported cases from the same year but may include backlogged cases from previous years. Based on this calculation, Memphis has the lowest solve rate among the cities where crime labs were toured for this project, at 21.0%, followed closely by Little Rock at 21.1%. In contrast, Charlotte and Nashville have higher solve rates, at 35.7% and 33.4%, respectively.

TABLE 1: OVERVIEW

CITY	POPULATION (2022)	CRIME RATE (PER 100,000)	REPORTED CRIME	CRIMES REPORTED CLOSED	SOLVE RATE (PER YEAR)	CASES SUBMITTED
Nashville	683,622	1095.78	7,497	2,500	33.4%	7,140
Charlotte	897,720	794.46	7,132	2,548	35.7%	3,287
Memphis	621,056	2436.01	15,129	3,170	21.0%	2,038
Houston	2,302,878	1128.46	25,987	6,587	25.3%	25,006*
Little Rock/Pulaski County*	399,145	1820.92	3,694	778	21.1%	4,287 (35,763)

* The Arkansas State Crime Lab services the entire state but provided case counts specifically for Pulaski County. This number was used for the cases submitted in Table 1, along with the total number of requests received by the Arkansas State Crime Lab. In Table 1, the population and case submission numbers are county totals, while the crime data pertains to the City of Little Rock. Therefore, the case submissions are an overestimate, including those from both the Little Rock city police and county law enforcement.

The high crime rates in Memphis have prompted both stakeholders and civilians to demand actionable solutions. One proposal under consideration is to enhance current forensic evidence testing capabilities. Suggestions range from improving existing processes to establishing a local forensic lab. The Metropolitan Nashville Police Department's (MNPD) forensic lab offers a potential model. In FY 2024, the MNPD's lab budget is $8,519,300, with the lab's initial creation costing approximately $30 million in 2014. By comparison, the Western Tennessee TBI lab in Jackson cost approximately $25.5 million to build.[2]

Forensic Lab Consideration

Ensuring case prioritization where forensic evidence is tested safely and expeditiously is a crucial factor for both public safety and meeting court deadlines. While TBI prioritizes cases

[2] Radio NWTN. (2021, April 23). *New TBI crime lab, regional headquarters opens in Jackson*. Radio NWTN. https://www.radionwtn.com/2021/04/23/new-tbi-crime-lab-regional-headquarters-opens-in-jackson/

upon request, prioritization may be more streamlined in a lab that serves only the local jurisdiction. Cases that are not prioritized, however, often face longer testing times. TBI's state regional labs, as well as metropolitan labs like Nashville's, frequently experience delays due to resource limitations and the high volume of evidence requiring testing. These larger labs are often compared to smaller facilities serving lower-population areas, which can process and test evidence more quickly, leading to inconsistent benchmarks.[3]

In addition to potential delays, legal complications and liability concerns can arise in both public and private forensic labs. In October 2024, TBI faced liability issues when it terminated an employee for violating policies, highlighting the risks of perceived or actual bias in forensic evidence processing, which could have significant legal repercussions. A notable example occurred in 2021, when Washington D.C.'s Department of Forensic Science (DFS) lost its accreditation following allegations of inaccurate evidence results and attempts to cover up or ignore mistakes made in the crime lab. A more well-known case is the Houston Police Department's crime lab, which, in 2002, was investigated after widespread errors, impropriety, and incompetence were uncovered. The issues in Houston affected thousands of cases and led to the exoneration of at least 115 individuals who had been wrongfully convicted based on false or misleading evidence, ultimately resulting in the lab's closure.[4]

For this reason, forensic labs must adhere to stringent accreditation standards, such as those set by the American Society of Crime Laboratory Directors (ASCLD), to ensure consistent quality. Failure to maintain these standards could jeopardize the lab's credibility and the

[3] Sorenson Forensics. (2024). *The case for choosing a specialized forensic lab*. Sorenson Forensics. https://sorensonforensics.com/the-case-for-choosing-a-specialized-forensic-lab/
[4] City of Houston. (n.d.). *Crime lab frequently asked questions*.

admissibility of evidence in court. Another critical issue is the management of sensitive evidence, including digital files and biological samples. Secure storage and handling protocols are essential to prevent contamination, tampering, or data breaches, especially when dealing with high-risk materials such as DNA or child exploitive digital or physical evidence.[5]

The Current Study: Objectives and Methodology

The current feasibility study evaluates existing operations, including how evidence is collected, processed, stored, and tested. It also addresses liability and safety concerns, as well as accreditation standards. Additionally, crime trends are analyzed to understand their impact on forensic evidence volume. The primary objective of this study is to provide local officials with comprehensive information regarding current and future needs for local forensic evidence testing, along with an analysis of the potential costs associated with establishing a lab. This includes considerations for personnel, location, equipment, accreditation, validation, and other critical factors.

To thoroughly analyze the scope of the study, several forensic labs were visited and toured, including the Arkansas State Crime Laboratory, the Charlotte-Mecklenburg Police Department Crime Lab, the Houston Forensic Science Center, and the Nashville Metropolitan Crime Lab. During each visit, an open question-and-answer session was held to gather additional insights. Data were collected from each lab and are presented in the current study. Additionally, local interviews were conducted with key stakeholders, including but not limited to representatives from the Memphis Police Department (MPD), Shelby County administration and investigators, TBI administration and forensic analysts, the Shelby County District Attorney

[5] National Institute of Justice. (2013). *Biological evidence preservation handbook: Best practices for evidence handlers*. National Institute of Justice. https://nij.ojp.gov/library/publications/biological-evidence-preservation-handbook-best-practices-evidence-handlers

General's Office, and private lab administrators and analysts. MPD also provided data from each unit involved in processing or testing forensic evidence. Lastly, the study includes research on current standards for accreditation, validation, and training.

The following sections commence with an analysis of MPD and TBI crime and forensic data, comparing these metrics to those of other regional cities that operate local or state forensic laboratories. This is followed by a detailed examination of MPD's forensic evidence processing procedures and the role of TBI in the testing of evidence. Subsequently, the report explores lab organization, including personnel, facilities, and equipment. The final sections present a set of recommended immediate actions and a comprehensive conclusion. Each section provides an in-depth explanation of the types of forensic evidence tested, along with a critical assessment of the current challenges and concerns specific to the local context.

MPD and TBI: Crime and Lab Statistics

As previously discussed, other regional labs were visited as part of this study to provide context for local data. It is important to note that several factors influence the data presented in this analysis. When comparing cities or labs, it is essential to recognize that not all variables or differences between cities and lab processes can be fully accounted for.

Figures 3 and 4 illustrate the 5-year submission trend from MPD and Shelby County to the TBI Jackson lab. The data provided does not differentiate between submissions from Memphis and those from other areas within Shelby County. This trend represents only the submissions recorded by TBI, excluding the latent print analyses conducted by MPD's Crime Scene Investigation (CSI) unit. Additionally, firearms data reflects only those cases submitted to TBI for DNA and firearm toolmark confirmations.

FIGURE 1: CASES SUBMITTED: TOXICOLOGY, FORENSIC CHEMISTRY, FORENSIC BIOLOGY

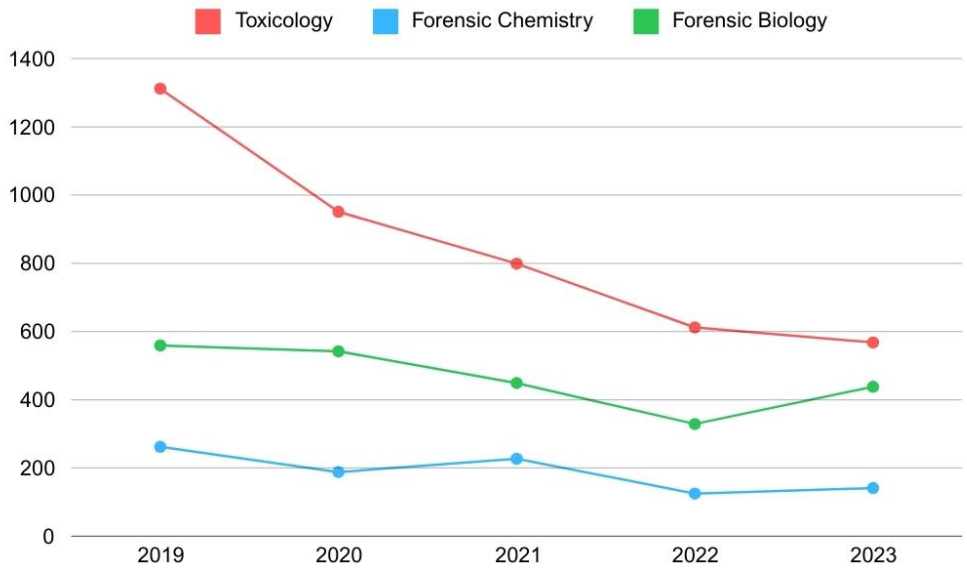
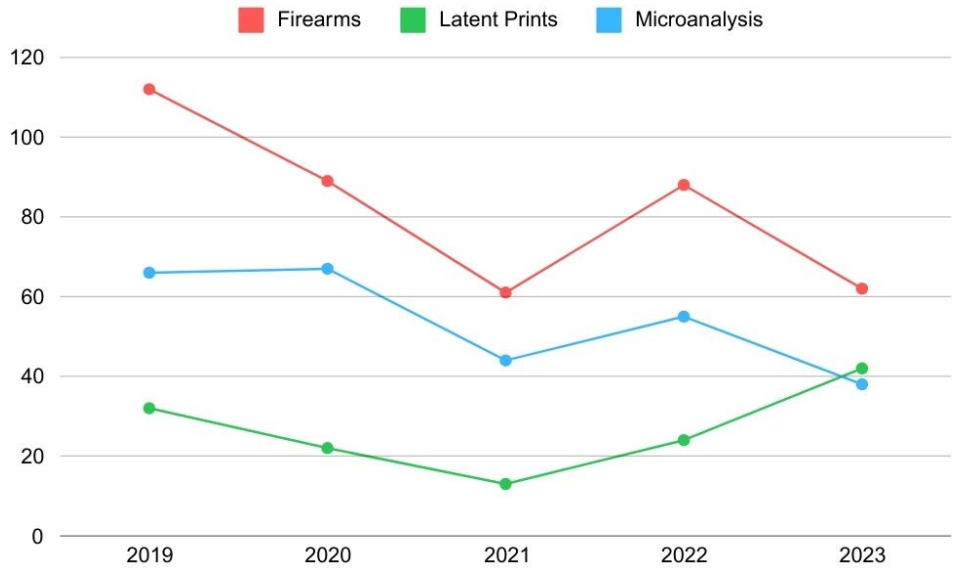


FIGURE 2: CASES SUBMITTED: FIREARMS, LATENT PRINTS, MICROANALYSIS



Since 2019, evidence submissions have generally trended downward, with the exception of latent prints, which have fluctuated due to the variable number of cases submitted to TBI for the FBI and The Innocence Project. Several factors may have contributed to the overall decline, including the impact of COVID-19 on law enforcement operations and the reduced availability of investigators. Despite the downward trend in submissions, crime counts have increased, raising the workload for most units at MPD and other law enforcement agencies. Although TBI relocated the regional lab in 2021, the decline in case submissions appears to have begun prior to the move.

The following tables present data from the labs visited for this study, including local data from the TBI Jackson lab. It is important to note that labs do not always categorize data or units consistently, and not all labs have specialized units such as digital forensics. For instance, Houston refers to its Digital Forensics Unit as 'Multimedia.' In most cases, forensic biology and DNA are grouped within the same unit or tasked similarly. Some forensic biology units include

serology, while others separate serology testing as a distinct task in their data. Firearms and NIBIN data are typically entered separately, as NIBIN primarily focuses on initial investigative work to develop leads, whereas firearm/toolmark analysis requires the expertise of firearm examiners. Consequently, there will often be more investigations through NIBIN than through firearm/toolmark analyses.

Table 2 presents Metro Nashville's reported data for 2023, including the number of requests, items received, and evidence tested. While Nashville did not provide a total count of cases submitted, they reported case numbers for each specific division. The Toxicology division reported 1,029 cases, with an equal number outsourced. Given the differing reported turnaround times for non-outsourced and outsourced toxicology evidence, it remains unclear whether the outsourcing is intended as a verification of results from the local lab.

TABLE 2: NASHVILLE - SUMMARY OF CASES SUBMITTED AND TURANAROUND TIME (TAT)

NASHVILLE (LAB DEPARTMENT)	NUMBER OF CASES RECEIVED	AVERAGE TAT IN DAYS	AVERAGE TAT IN DAYS (PRIORITY)	AVERAGE TAT IN DAYS (HIGH-PRIORITY)
Drug Identification	451	107	28	<7
Firearms	169	238	80	<7
Firearms NIBIN	3720	2	1	1
Forensic Biology - DNA	514	783	254	<7
Forensic Biology - Serology	529	944	208	<7
Forensic Biology - Outsourced	213	1118	120	30
Latent Fingerprints	131	159	113	<7
Latent Fingerprints - AFIS Entry	597	1	<1	<1
Toxicology - Blood Alcohol*	1029	28	<7	<7
Toxicology - Blood/Drugs (outsourced)*	1029	56	30	7

Table 3 presents 2023 data from the Charlotte-Mecklenburg Police Department Crime Lab, as reported in their annual management review. Each department within the lab was detailed in separate sections, and there was inconsistency regarding whether the numbers reflected total cases or total requests, which can vary per case. The data is presented here as it appeared in the report. The lab did not include turnaround times for their Firearms and Toolmarks unit. Test firings of seized guns were listed separately from reported cases, with 1,017 shooting cases involving cartridge submissions in 2023. The lab reported 338 requests for the firearms section, but it is unclear whether this figure represents total requests, total cases, or a combination of both. The Latent Fingerprints unit had an average turnaround time of 10.7 days, though the time varied significantly by request type: 3.2 days for AFIS cases, 5.5 days for comparison cases, and 23.6 days for processing requests.

TABLE 3: CHARLOTTE - SUMMARY OF CASES SUBMITTED AND TURANAROUND TIME (TAT)

CHARLOTTE-MECKLENBURG (LAB DEPARTMENT)	NUMBER OF CASES RECEIVED	AVERAGE TAT IN DAYS	AVERAGE TAT IN DAYS (RUSH)	AVERAGE TAT IN DAYS (PRIORITY)	AVERAGE TAT IN DAYS (EXPEDITED)
Biology - DNA	1063	247.8	<5	10	30
Chemistry - Drug	464	83.6	N/A	N/A	N/A
Chemistry - Blood Alcohol	183	36.1	N/A	N/A	N/A
Chemistry - Fire Debris	7	117.9	N/A	N/A	N/A
Firearms/Toolmarks	338	N/A	N/A	N/A	N/A
Firearms/Toolmarks (NIBIN Test Firing)	3942	N/A	N/A	N/A	N/A
Latent Fingerprints	1243	10.7	N/A	N/A	N/A
Questioned Documents	19	N/A	N/A	N/A	N/A

Houston's lab is perhaps the most unique for comparison, as it serves a large population and operates the largest facility among those presented in this study. As shown in Table 4, Houston reported its data based on the total number of requests received. The average turnaround

time for latent analyses is reported as a combined figure, which includes both latent comparison (89 days) and latent processing (53 days). For forensic biology, the reported turnaround time reflects the DNA processing time specifically.

TABLE 4: HOUSTON - SUMMARY OF CASES SUBMITTED AND TURANAROUND TIME (TAT)

HOUSTON (LAB DEPARTMENT)	NUMBER OF CASES RECEIVED	AVERAGE TAT IN DAYS
Forensic Biology	5916	226
Drugs	4532	60
Toxicology	1588	126
Alcohol	3422	43
Multimedia	266	16
Firearms	444	266
Prints	1372	71
NIBIN	5411	87

TABLE 5: ARKANSAS STATE - SUMMARY OF CASES SUBMITTED AND TURANAROUND TIME (TAT)

ARKANSAS STATE (LAB DEPARTMENT)	NUMBER OF CASES RECEIVED	AVERAGE TAT IN DAYS
Forensic Chemistry	10438	150
Toxicology	5040	47
Physical Evidence	1573	142
DNA	1809	465
CODIS	12430	N/A
Firearms/Toolmarks	1100	515
NIBIN	2112	N/A
Latent Prints	1080	60
Digital Evidence	81	431

The Arkansas State Crime Lab (ASCL) receives submissions from across the entire state, making direct comparisons with municipal crime labs challenging. As shown in Table 5, ASCL reported that 4,287 cases were submitted from Pulaski County, though the specific types of cases or requests were not detailed. The ASCL also operates regional laboratories in Hope and Lowell. The Hope Regional Laboratory functions as an intake point for evidence from the southern region of the state, while the Lowell Regional Laboratory, located in a HIDTA area, focuses on testing for controlled substances. Turnaround times were averaged for each section of the lab, but varied significantly depending on the type of case. Physical evidence submissions for sexual assault cases had much shorter turnaround times (35 days), while homicide and battery cases took 5 and 8 months, respectively. A similar pattern was observed in DNA testing, with DNA submissions for sexual assault cases averaging 3 months, compared to 10 months for homicide cases and 3 years for property or other cases. This variation directly impacts the overall average turnaround time for violent cases, reducing it to 195 days when property cases are excluded from the totals.

TABLE 6: TBI JACKSON - SUMMARY OF CASES SUBMITTED AND TURANAROUND TIME (TAT)

TBI JACKSON (LAB DEPARTMENT)	NUMBER OF CASES RECEIVED	AVERAGE TAT IN DAYS
Toxicology	568	51.8
Forensic Chemistry	141	89.6
Firearms	62	479.5
Forensic Biology - Total	438	151.2
Violent	89	188.3
Non-Violent	33	245
Sex Offense	316	86.1

Table 6 presents data from the TBI Jackson forensic crime lab, which reported the total number of cases received, categorized by case type. As the only lab to provide data based on case severity or type, it is not possible to directly compare lab performance by case type with other labs in this study. Turnaround times were initially reported in weeks but have been converted to days for consistency. The reported firearms cases refer only to those submitted for result verification, not for processing or NIBIN entry. Since TBI Jackson reported numbers for all of Shelby County, the totals include cases submitted by other jurisdictions within the county, in addition to those from MPD.

Figure 5 provides a comparison between the Nashville and Jackson crime labs in terms of case distribution. It is important to note that Nashville operates as a municipal lab, while TBI Jackson is a state lab serving the western region. Although Nashville's lab functions within a municipal police department and is geographically close to Memphis, it operates under the same state laws.

FIGURE 3: TBI - JACKSON CASE DISTRIBUTION

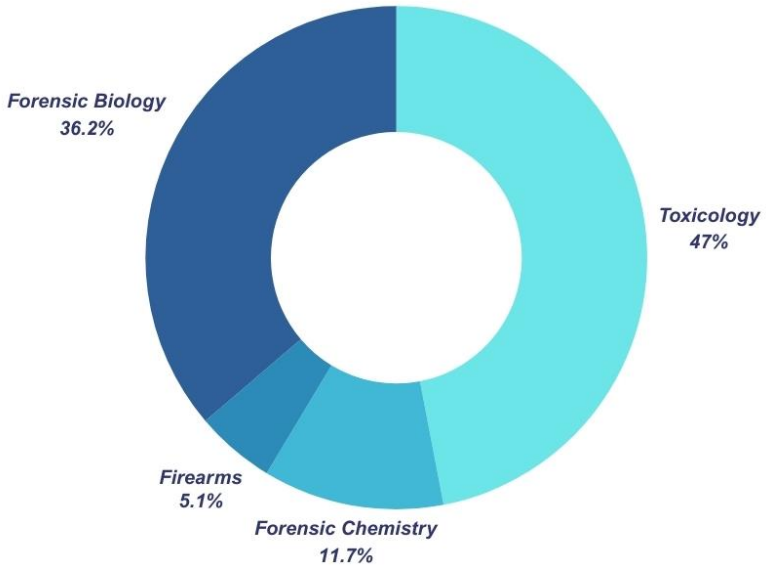
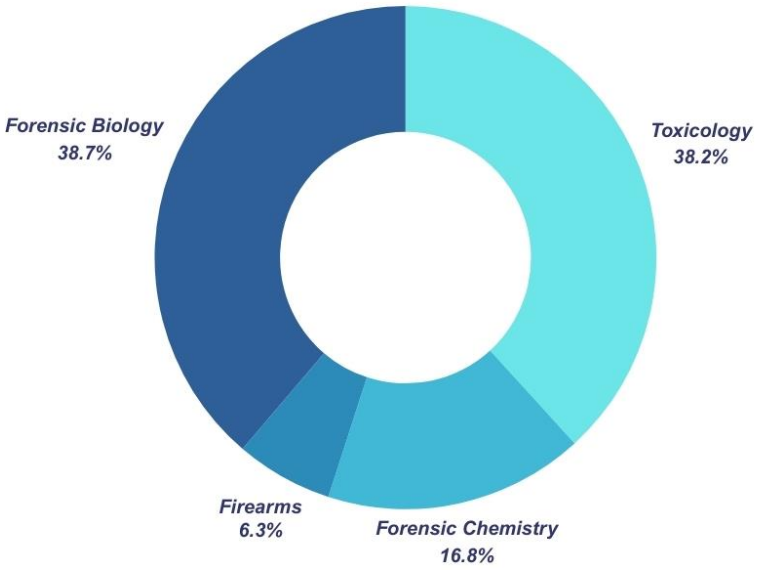


FIGURE 4: NASHVILLE CASE DISTRIBUTION



The data provided above are intended to offer context for the following sections. The next section focuses on current investigative processes in Memphis, particularly those conducted by the MPD, either independently or with partial support from TBI. These processes could serve as foundational elements for the development of a local crime laboratory, representing existing assets that could be leveraged to enhance current operations or support the establishment of a fully functional local forensic lab.

Current Memphis Processes

Crime Scene Unit

Crime Scene Unit: Background

A primary focus for CSI personnel is maintaining high standards in crime scene processing, forensic imaging, and the courtroom presentation of forensic evidence. Their work plays a critical role in clarifying the facts of each case by providing accurate, unbiased evidence that can either support or challenge investigative leads. A key aspect of their responsibilities is ensuring the integrity of the chain of custody, guaranteeing that all collected evidence is properly handled and safeguarded from the moment of recovery through to court presentation.

Crime Scene Investigation (CSI) units play a pivotal role in modern law enforcement by meticulously documenting and collecting physical evidence at crime scenes. CSI personnel are responsible for processing a wide range of scenes, from homicides and sexual assaults to property crimes and traffic accidents. The evidence they gather, which can include fingerprints, biological samples, ballistics, and trace materials, forms the foundation for forensic analysis and aids in solving cases by linking suspects, victims, and crime scenes.

A key aspect of CSI work involves following rigorous protocols to ensure the integrity of the evidence, particularly maintaining the chain of custody. This involves documenting every step of the evidence handling process, from collection at the scene to analysis in the lab and eventual presentation in court. Any break in this chain could compromise the admissibility of evidence, making CSI units crucial to the judicial process.

In addition to evidence collection, CSI units are often responsible for forensic imaging, which includes photographing and mapping the crime scene in detail to preserve its condition at

the time of the investigation. This visual documentation is critical for both investigators and the courtroom, allowing juries and judges to see the crime scene as it was originally found.

CSI units also require ongoing training and access to the latest forensic technology to keep pace with advancements in investigative techniques. New tools, such as 3D imaging, advanced DNA analysis, and digital forensics, are becoming increasingly important in processing crime scenes. These units are typically staffed by specialized personnel who receive extensive training in both fieldwork and lab-based forensic methods, enabling them to ensure the accuracy and reliability of the evidence they handle.

The ability of CSI units to adapt to evolving challenges, including those posed by resource limitations and the growing complexity of crimes, makes them a fundamental part of law enforcement operations. Their work not only supports investigations but also plays a critical role in securing convictions and ensuring justice is served.

Some labs, in an effort to maintain independence, operate their own crime scene units. For example, the Houston Forensic Science Center has its own unit with approximately 30 investigators. However, outside of homicides and a few other violent crimes, most evidence is collected by the Houston Police Department's investigators. While other labs also have their own CSI units, they typically operate under specific rules governing when these units are deployed. The primary goal is to ensure consistency in evidence processing and to guarantee that all evidence is properly collected and managed.

Crime Scene Unit: Local Processes

The Crime Scene Investigation (CSI) unit at MPD plays a pivotal role in investigating a broad spectrum of violent and property-related crimes. This unit is tasked with handling crime

scenes involving homicides, sex crimes, aggravated assaults, robberies, and serious property crimes, such as auto thefts and destruction of property valued over $10,000. Based on MPD internal documents, its primary function is to meticulously collect, preserve, and document both physical and trace evidence that is vital to the successful prosecution of criminal offenders.

The CSI unit employs approximately 30 individuals; however, it is currently operating at about half capacity, which presents challenges in maintaining efficiency and timely responses to investigations. The unit currently comprises officers and one certified civilian crime scene technician, all trained in advanced forensic investigation techniques. These individuals ensure that evidence is collected and preserved with the utmost care, thoroughly documenting all relevant details to maintain the integrity of the evidence for use in legal proceedings.

The CSI team operates 24/7, ready to respond to crime scenes at any time, while providing essential support to various bureaus within the MPD. The unit frequently collaborates with regional and national law enforcement agencies, including the TBI and the Shelby County Medical Examiner's Office. These partnerships help ensure that the forensic evidence processed by the CSI team meets the highest standards for investigation and review.

Crime Scene Unit: Data

TABLE 7: CSU SCENES AND VEHICLES PROCESSED

	2023	2022
Scenes Processed	3,935	3,919
Vehicles Processed	1,582	1,995

The crime scene unit responded to 3,365 calls and 12,276 special assignments in 2023. The table below provides the number of scenes and vehicles processed.

Crime Scene Unit: Assessed Needs

Operating out of the aging International Harvester Building, the MPD CSI unit faces logistical challenges related to the facility's structural limitations and environmental issues. A significant portion of evidence processing occurs in this building, and there is a clear desire within the unit for a new or updated facility. Additionally, the CSI unit is currently operating at around half capacity, underscoring the need for more resources.

Another key finding relates to communication. Some personnel believe that increased communication with investigators would enhance operations. A particular concern raised was that high-value evidence, as identified by the CSI unit, is sometimes not submitted for testing. While there is some communication between CSI and investigators in other units, fostering more frequent and meaningful exchanges would improve outcomes. Effective communication is crucial to connecting evidence to the broader crime scene context, ensuring coordination among those who collect, process, investigate, test, and prosecute cases.

Criminalists

Background: Criminalists

Criminalists employed by the police department play a pivotal role in deciding which evidence is submitted to the crime lab. Often working as forensic scientists, these criminalists collaborate closely with law enforcement officers to analyze physical evidence collected from crime scenes, including materials gathered during autopsies. Criminalists may be involved from the early stages of an investigation, assisting with the initial crime scene analysis. Their expertise enables them to identify and collect key evidence, focusing on items with the highest potential to provide valuable insights. Once the evidence is gathered,

criminalists work alongside detectives and other investigators to evaluate the relevance of each piece and prioritize forensic testing accordingly.[6]

In some cases, criminalists conduct preliminary examinations of evidence, such as visible bloodstains, fibers, or hair, to assess its potential usefulness before deciding to submit it to the crime lab for more detailed analysis. This initial step helps select the most relevant evidence for submission, considering factors such as the nature of the crime, the condition of the evidence, and the types of forensic analyses that could be performed, including DNA testing, fingerprint analysis, or ballistics.

Criminalists: Local Processes and Assessed Needs

Once an investigator requests evidence testing, the evidence is either transported to the local field office for delivery by the TBI or taken directly to the Jackson lab by an investigator or criminalist. For DNA evidence related to the Sex Crime and Homicide units, a criminalist uses a city vehicle to deliver the evidence every Thursday, in compliance with Memphis' mandated 96-hour rule for Sexual Assault Kits (SAKs).

Currently, one criminalist works across two different units. Criminalists have the potential to serve as liaisons, facilitating the connection of evidence between CSI, investigators, the TBI, and the District Attorney's office.[7] Locally, criminalists ensure that all evidence is properly documented and that the chain of custody is maintained. This includes labeling, packaging, and completing the necessary paperwork to accompany the evidence to the crime lab. Criminalists often consult with the lab to provide context for the evidence and

[6] Lab Tests Guide. (2023, August 28). *Understanding chain of custody: Ensuring evidence integrity and admissibility*.
[7] American Academy of Forensic Sciences. (2021, November 19). *Careers in criminalistics*.

may specify the types of tests or analyses required based on the investigation's demands. Once the crime lab has completed its analysis, the criminalist reviews the results and interprets them within the context of the investigation. They then relay these findings to the investigators, helping to integrate the results into the overall case strategy. Expanding this unit would add consistency to local processes in how evidence is processed and transported. Current criminalists needs are discussed thoroughly in the Immediate Impact section.

Property and Evidence

Property and Evidence: Background

The setup of a property and evidence room requires careful consideration of both structural and environmental factors, with security being paramount. Essential features include physical barriers, keycard or biometric access, and continuous video surveillance. Surveillance systems must be designed to eliminate blind spots, while physical security measures should incorporate reinforced doors and secure entry points to ensure maximum protection.[8]

Equally important is the organization and labeling of evidence to prevent loss, misplacement, or contamination. Every piece of evidence must be clearly marked with case numbers, detailed descriptions, collection dates, and the names of the personnel responsible for its collection and chain of custody. Effective management also requires strict adherence to

[8] National Institute of Standards and Technology. (2013, June). *Forensic science laboratories: Handbook for facility planning, design, construction, and relocation*. http://dx.doi.org/10.6028/NIST.IR.79

local, state, and federal regulations, including standards set by the International Association for Property and Evidence (IAPE).[9]

Environmental factors are crucial for preserving biological materials such as DNA. Proper temperature and humidity control are essential to prevent degradation, while dehumidifiers, ventilation systems, and vibration control help maintain the integrity of delicate evidence. Fire safety measures, including smoke detectors and fire suppression systems, provide an additional layer of protection. Agencies should also consider the environmental impact of their property rooms by incorporating green building materials, energy-efficient lighting, and air quality systems to reduce the facility's environmental footprint.[10]

Strict chain of custody procedures are essential to maintaining the integrity of evidence. Every movement of evidence must be documented, including who accessed it, when, and for what purpose. Record-keeping is also important, as any break in the chain can compromise the legal admissibility of the evidence. Regular audits are recommended to verify that records and physical evidence match, ensuring compliance with legal and regulatory standards. Employee training should align with their specific job responsibilities, with some staff focusing on evidence collection and others specializing in forensic testing or

[9] IAPE. (2024, September 6). *Accreditation programs - IAPE - International Association for Property and Evidence*. https://welcome.iape.org/accreditation-programs/
[10] National Institute of Standards and Technology. (2013, June). *Forensic science laboratories: Handbook for facility planning, design, construction, and relocation*. http://dx.doi.org/10.6028/NIST.IR.79

documentation. Regular training updates are necessary to keep staff current on best practices and legal requirements for evidence handling.[11]

The evidence handling process begins with collection at the crime scene, where first responders are trained to secure the area and manage evidence properly. Special precautions are required for hazardous substances, drugs, firearms, and biohazards. During the intake process, evidence is thoroughly documented and entered into a tracking system, with each item assigned a unique identifier. After intake, evidence must be stored securely and in a timely manner to ensure its preservation. Larger items, such as vehicles or bulky objects, may require specialized storage facilities due to their size or sensitivity.

A property and evidence room is a necessary component of a crime lab to ensure efficient, secure, and proper storage of evidence. Offering 24/7 services for these rooms increases the need for additional resources, while non-24/7 options include secure drop-off locations or lockers for use by law enforcement, prosecutors, and criminalists after hours. A property and evidence management system is vital for maintaining the integrity of investigations. After ensuring proper storage, the release and disposition of evidence must adhere to strict procedures. Whether temporarily released for court proceedings or permanently disposed of, all actions must be documented to maintain the chain of custody. The final stage in the evidence process is disposal. Due to limited space in storage facilities, departments should have clear guidelines for disposing of evidence that is no longer required.

[11] Evidence Management Institute. (2024, May 21). *The crucial role of chain of custody: Ensuring evidence integrity and quality assurance*. https://evidencemanagement.com/the-crucial-role-of-chain-of-custody-ensuring-evidence-integrity-and-quality-assurance/

These procedures should detail how items will be returned to their rightful owners, legally forfeited, or destroyed, with every step of the process documented.[12]

Property and Evidence: Local Processes and Assessed Needs

Evidence is primarily processed and stored at 201 Poplar, with larger or long-term items sent to the International Harvester Building. Interviews with officers indicated that while the current system is functional, improvements in cleanliness and organization would be beneficial. Maintenance issues at both sites have been raised as concerns, as they may affect the secure handling of sensitive materials.

Initial evidence processing, including forms of testing such as initial drug tests, also occurs at 201 Poplar. This dual responsibility, processing and storing evidence, allows for a streamlined intake procedure but presents logistical challenges. The efficiency of processing and booking evidence simultaneously increases production, yet it also raises questions about maintaining a high level of security in a multi-functional space. Ensuring proper safeguards, such as secure storage and controlled access, is crucial to protecting the chain of custody.[13] Officers noted that delays in retrieving evidence could impact investigations, improving organization and implementing consistent procedures could benefit the overall efficiency and effectiveness of the property and evidence system.

Personnel training and compensation were additional topics raised. Proper training ensures that all procedures are followed accurately and consistently, further safeguarding the evidence for use in legal proceedings. Additionally, staff raised concerns about compensation,

[12] National Institute of Justice. (2000). *Crime scene investigation: A guide for law enforcement*. https://nij.ojp.gov/library/publications/crime-scene-investigation-guide-law-enforcement
[13] IACP Law Enforcement Policy Center. (2021, February). *Property & evidence control*.

suggesting that competitive salaries may be necessary to attract, retain, and increase training for personnel.

Latent Prints

Latent Prints: Background

Protocols for handling latent fingerprints in crime labs are structured to ensure the accuracy, integrity, and reliability of the forensic process. The initial step is maintaining a strict chain of custody, which involves documenting every individual who handles the evidence from collection to final analysis. Adherence to standard operating procedures (SOPs) is required, covering the methods, tools, and processes used for detecting, lifting, analyzing, and storing latent fingerprints.

The FBI provides detailed guidelines for processing and developing latent prints, specifying various techniques tailored to different surfaces. These guidelines emphasize safety protocols when handling chemicals used in latent print development, including the mandatory use of protective equipment such as lab coats, gloves, and goggles. Engineering controls, such as ventilation hoods, are also required to minimize exposure to harmful substances.[14]

Certified analysts through organizations such as the International Association for Identification (IAI), which is widely recognized for its Certified Latent Print Examiner (CLPE) program work to provide latent print analysis for forensic science units.[15] Thorough documentation is required at every stage, including photographing prints before and after development to maintain an accurate record of the evidence. Protocols also provide

[14] Federal Bureau of Investigation. (2000). *Processing guide for developing latent prints*.
[15] International Association for Identification. (2020). *Latent print certification requirements*. https://www.theiai.org/docs/LP_Certification_Requirements_08_30_20.pdf

troubleshooting guidance to help examiners address common issues and improve their techniques. Quality control measures, including regular training, equipment calibration, and standardized procedures, ensure consistency and accuracy in latent print development. These guidelines help maintain high standards in forensic fingerprint analysis.

Developing latent prints in a crime lab involves using specialized tools and equipment designed to identify, enhance, and preserve fingerprints on various surfaces. Reagent-grade chemicals, such as acetone, ethanol, ethyl acetate, and methanol, are commonly used in latent print development, with costs varying based on purity and quantity. These chemicals are essential for techniques like fuming, soaking, and spraying and must be handled carefully due to their hazardous nature. The lab is equipped with safety features such as fume hoods, fuming chambers, and humidity chambers to control chemical applications and ensure the safety of personnel.

Once developed, prints must be lifted and preserved for analysis. Lifting tape is commonly used to transfer prints onto contrasting backgrounds, such as fingerprint cards or backing sheets, which help preserve the print details. Gel lifters are preferred for difficult surfaces, including rough, curved, or textured materials, as they conform to the surface and capture the prints without distortion.[16]

High-resolution digital cameras equipped with macro lenses are essential for photographing latent prints both before and after development. These cameras allow forensic experts to capture detailed images of prints for documentation and further analysis. Digital

[16] Parker, A., Cunningham, L., Johnson, S., Glenn, C., & Galloway, M. (2024). Techniques for processing porous and nonporous surfaces for latent friction ridge impressions. In Methodological and Technological Advances in Death Investigations (pp. 21-82). Academic Press.

scanners are also utilized to digitize prints, allowing for detailed examination and storage in an automated fingerprint identification system (AFIS). Specialized magnification equipment and microscopes assist in examining fingerprint patterns and minutiae points, which are crucial for comparing and matching prints to known samples.[17]

Additionally, crime labs may use advanced imaging software to enhance and analyze digital prints, providing forensic examiners with tools to adjust contrast, brightness, and sharpness for clearer visualization. Calibration and maintenance of all equipment are critical to ensure accuracy and reliability, supporting the overall integrity of the latent print analysis process.

Latent Prints: Local Processes

The unit operates with five full-time latent examiners, along with an additional four to five examiners hired on a temporary basis as needed. The unit is staffed by experienced professionals, including two senior examiners who are responsible for training and certifying new personnel. The unit's workload primarily consists of property crimes, with priority given to serious cases such as homicides, robberies, carjackings, and sex crimes. However, the high volume of cases, particularly involving auto thefts and burglaries, contributes to an existing backlog of 1,876 cases (at the time of data gathering for the current study). Despite the challenges, the unit maintains CALEA (Commission on Accreditation for Law Enforcement Agencies) and FBI accreditation.

Latent Prints: Data

[17] Hiew, B. Y., Teoh, A. B., & Pang, Y. H. (2007, May). Digital camera-based fingerprint recognition. In *2007 IEEE International Conference on Telecommunications and Malaysia International Conference on Communications* (pp. 676–681). IEEE.

The following table provides latent print data. The majority of latent prints are analyzed at MPD under the CSI unit. However, innocent project cases and some FBI cases are sent for analysis in Nashville's TBI lab.

TABLE 8: MPD LATENT PRINT DATA

	2023	2022
Lifts Examined	15,469	20,354
AFIS Searches Conducted	6,230	8,171
AFIS Hits	2,374	2,848
Identifications Made	657	3,102

The turnaround time on latent print services depends on the priority of the case. Violent crimes get reviewed immediately and may take 1-3 days to complete depending on complexity of the latent prints received, however as discussed above the backlog includes cases of lesser priority.

Latent Prints: Assessed Needs

The Latent Prints unit is housed within the CSI division of MPD in the International Harvester Building. At a minimum, the current space needs reliable utilities, and updated climate control. The building's conditions impede daily operations. At the time of the interview, the unit did not have an operational card printer and was unable to set up the new printer because of concerns over the heat in the building due to inoperable air conditioning. The current facility lacks handicap access for the 2nd floor, the location of the Latent Prints Units.

During interviews it was uncovered that senior examiners, face restrictions on overtime work, limiting their ability to manage the heavy workload effectively. Furthermore, salary distribution needs to be examined. The unit could benefit from additional and more advanced technology. Broader access to the AFIS system would increase the efficiency of the unit.

Currently, latent prints must be transported to TBI in Nashville for FBI searches, adding delays and logistical challenges to the process.

Digital Forensics

Digital Forensics: Background

A Digital Forensics Unit is a specialized team within law enforcement or forensic organizations responsible for recovering, analyzing, and preserving digital evidence from electronic devices. This unit typically handles investigations involving computers, smartphones, tablets, and other digital storage media, focusing on crimes like cybercrime, fraud, child exploitation, and cases involving digital data, such as emails, text messages, and internet activity.

The unit's primary goal is to extract and analyze data without compromising its integrity, ensuring it can be used as admissible evidence in court. Digital forensics experts use specialized software and techniques to recover deleted files, trace user activity, and identify tampered data. These units play a crucial role in modern investigations, as many crimes now involve digital components that require careful examination.

Digital forensics labs face unique ethical and legal challenges concerning the proper use of forensic technology. It is essential to establish strict policies and oversight mechanisms to prevent the misuse of these tools. Law enforcement personnel must be held to high ethical standards to ensure that digital forensics technology is used solely for legitimate investigative purposes. Misuse of forensic tools, such as accessing personal devices without proper legal authorization, poses significant risks to both privacy and the integrity of investigations The labs that were visited had some experience with this specific concern. Clear guidelines and

accountability measures should be in place to prevent any unauthorized use of digital forensic capabilities.

In addition to these ethical considerations, labs must also address the issue of securely storing sensitive evidence. When dealing with materials such as child exploitation evidence, it is crucial to house this evidence on secure, encrypted servers that are protected from potential hacking or unauthorized access. The sensitivity of such evidence requires not only robust cybersecurity measures but also strict access controls to ensure that only authorized personnel can view or handle the evidence.[18]

Storage capacity is another concern, as forensic labs must manage ever-increasing volumes of digital evidence. As the amount of multimedia content grows, so does the demand for secure, scalable storage solutions. Labs need to anticipate these growing storage needs and invest in infrastructure that maintains both the integrity of the evidence and compliance with legal standards. Regular audits of storage systems, encryption protocols, and access logs are necessary to ensure the safety and security of this sensitive data.[19]

Digital Forensics: Local Processes

In Memphis, all major digital forensic services, including mobile device analysis, computer forensics, and vehicle forensics, are processed in-house at MPD's Internet Crimes Against Children (ICAC) and Digital Forensics Unit (DFU) divisions. The DFU team handles the collection and processing of video evidence, including tasks such as license plate clarification

[18] Hart, S. V., Daniels, D. J., & Ashcroft, J. (2004, April). *Forensic examination of digital evidence: A guide for law enforcement*. Office of Justice Programs. https://www.ojp.gov/pdffiles1/nij/199408.pdf
[19] Kiener-Manu, K. (n.d.). *Cybercrime module 6 key issues: Handling of digital evidence*. United Nations Office on Drugs and Crime. https://www.unodc.org/e4j/en/cybercrime/module-6/key-issues/handling-of-digital-evidence.html

and extracting frames for facial recognition submissions. They are also responsible for extracting, analyzing, and occasionally repairing mobile devices, which has proven to be a critical service for many investigations. The unit conducts forensic analysis on computers, dealing with the wide variety of file systems and the technological challenges they present. The unit also processes vehicles, utilizing software like Berla to extract and analyze automotive data.

Standard Operating Procedures (SOP's) are still being developed within the ICAC/DFU. While there are currently no formal policies on digital forensic best practices, a recommended policy has been submitted and is awaiting approval. Each forensic examiner is certified as CFCE (Certified Forensic Computer Examiner) or ICMDE (International Computer and Mobile Device Examiner), ensuring that they meet the necessary professional standards while operating in the lab.

Recently, the Shelby County District Attorney General's Office has invested in digital forensics training. It's important to note that prosecutors play a crucial role in investigations, and in some cases, additional verification, analysis, and investigation are needed to ensure successful prosecution. Delays in processing digital evidence by county investigative services may sometimes occur, highlighting the need for additional resources for the DFU and ICAC. Moreover, prosecution offices, often working with victims, may seek further evidence, such as cellphone data. In some instances, these offices can develop additional digital evidence internally with relative ease.

Digital Forensics: Data

The average turnaround time was stated in a memo for both DFU and ICAC. For video collection of data took one day, however processing varies. For mobile a two-day turnaround is expected, analysis is reported as approximately a week. Computers will take longer to analyze,

depending on the number of files, estimated time was listed as 3-4 weeks. Vehicles were stated to have a similar turnaround time as computers.

Digital Forensics: Assessment of Needs

Server space as well as physical space was stated as a concern during interviews. It is crucial that files are secure on unconnected servers to maintain privacy, but also to preserve evidence. The department manages approximately 130 terabytes of stored data, and more detailed guidelines for data retention can lead to improvement. With rising case volumes and the increasing reliance on digital evidence, the department could benefit from additional personnel, clearer guidelines for managing digital evidence, and a larger budget to maintain and renew its advanced software tools.

Firearms

Firearms: Background

The initial step in any firearm investigation involves the recovery and handling of the firearm at the crime scene. This process is usually conducted by patrol officers, task force detectives, or special operations detectives, and crime scene investigators. Proper handling and documentation at this stage are critical to maintaining the integrity of the evidence, ensuring that it can be used in court and preventing contamination or loss.

Two critical systems for firearm investigations are eTrace and the National Integrated Ballistic Information Network (NIBIN). These systems allow law enforcement to trace the history of a firearm and link ballistic evidence to specific firearms, respectively.

- **eTrace:** The eTrace system is used by MPD to track a firearm's history from the manufacturer to the last known purchaser, providing vital information for tracing

stolen or illegally trafficked firearms. Currently, MPD submits firearms to eTrace monthly.

- **NIBIN:** NIBIN is a ballistic imaging network that helps law enforcement link firearms evidence from different shooting scenes to specific firearms and suspects. When shell casings or bullets are recovered at a crime scene, they are entered into NIBIN to determine if they match any existing firearms in the database. NIBIN allows MPD to identify whether the same firearm was used in multiple crimes, helping connect violent incidents and track serial shooters or gun traffickers.[20]

The NIBIN system has transformed the way law enforcement agencies investigate firearm-related crimes by allowing them to link shell casings and bullets from crime scenes to specific firearms. This ballistic imaging technology assists in identifying patterns across multiple crimes, helping investigators uncover connections between incidents that may involve the same firearm. However, as advanced as NIBIN is, it merely serves as a preliminary investigative tool. NIBIN leads, by themselves, do not meet the legal threshold necessary for establishing probable cause in criminal cases until verified by a certified examiner.[21]

NIBIN hits provide a significant role in influencing bail decisions in Tennessee, particularly in cases involving firearms and violent crime. While NIBIN hits are not conclusive evidence on their own, they provide strong forensic links between firearms and criminal incidents, which can sway judicial decisions regarding bail. These hits can raise concerns about public safety, especially when they link suspects to violent or repeated offenses.

Courts carefully weigh these factors when determining whether to release a suspect on bail and can impact public safety. While NIBIN hits are compelling pieces of evidence, they are

[20] Troyer, R. (2021). *Crime gun intelligence centers: NIBIN toolkit for prosecutors*. https://crimegunintelcenters.org/wp-content/uploads/2021/11/NIBIN-ToolkitForProsecutors_20210610-1.pdf
[21] Bureau of Alcohol, Tobacco, Firearms and Explosives. (2024). *National Integrated Ballistic Information Network (NIBIN) overview*. https://www.atf.gov/firearms/national-integrated-ballistic-information-network-nibin

typically part of a larger forensic and investigative process. In most cases, NIBIN data is combined with other forensic evidence, such as DNA or witness testimony, to strengthen the prosecution's case.

Officers are trained to follow protocols for photographing the firearm in its original location. All markings on the firearm, including make, model, and serial number, are recorded to identify the firearm. This detailed documentation helps in subsequent tracing efforts through systems like eTrace. Common errors during documentation, such as misreading letters for numbers and vice versa, can lead to significant delays or failed trace results. This can disrupt the investigative process, hindering efforts to connect firearms to suspects or previous crimes.[22]

One of the major challenges arises when firearms with obliterated serial numbers are recovered. These firearms cannot be easily traced until the serial numbers are restored. All labs visited for this study discussed this issue and had procedures to restore the serial number. Some forensic labs did not see much reward for restoring serial numbers, while others felt that this assists them on various types of investigations.

Firearms: Local Processes

Before the application of the Crime Gun Intelligence Center (CGIC) model the MGU utilized one existing lab and outside assistance from TBI for all forensic ballistic testing. After the implementation of CGIC the lab at MGU has become the regional ballistics test lab for 54 outside law enforcement agencies. This effort has expanded the scope of forensic investigation

[22] Faigman, D. L., Scurich, N., & Albright, T. D. (2024, February 20). *The field of firearms forensics is flawed*. *Scientific American*.

and increased linking new cases through test fires and submitting crime scene cases to the national training center for NIBIN correlation.

MPD, in close coordination with state and federal agencies such as TBI, the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), and the Federal Bureau of Investigation (FBI), utilizes a variety of forensic techniques to trace, analyze, and link firearms to criminal activities. Additionally, the SCDAG office plays a crucial role as they often weigh in the decision of sending firearms for forensic analysis to TBI. While some firearms evidence is sent to TBI, it is more common that cases involving firearms are pled before trial and do not require additional testing or verification.

MPD's forensic operations are not limited to in-house processing; they also rely heavily on collaboration with federal agencies like the ATF and FBI. Both agencies provide additional resources, expertise, and technologies that are essential for solving firearm-related crimes.

- **ATF Collaboration**: The ATF provides MPD with access to eTrace and NIBIN, which are indispensable for tracing firearms and linking ballistic evidence across multiple jurisdictions. The ATF's role extends beyond providing technology; they also offer training programs for local law enforcement in the latest forensic techniques for DNA recovery, serial number restoration, and ballistic analysis.[23]
- **FBI Collaboration**: The FBI provides additional support in cases requiring complex forensic analysis or national coordination. This often includes cases involving organized crime, terrorism, or large-scale firearm trafficking operations. The FBI's forensic labs offer advanced capabilities that can complement MPD's efforts, particularly in DNA analysis, fingerprint identification, and cyber forensics.

The work conducted by MPD through the MGU and its partners includes ballistic examination via test firing and other processes during initial forensic investigations. Most

[23] Bureau of Alcohol, Tobacco, Firearms and Explosives. (2024). *National Integrated Ballistic Information Network (NIBIN)*. https://www.atf.gov/firearms/national-integrated-ballistic-information-network-nibin

evidence entered into NIBIN by the MGU is derived from test fires. Initial ballistic investigation and NIBIN entry are typically completed within 72 hours, though other processes may take longer. Except for urgent court needs or public safety concerns, eTrace entries are not immediate. Firearm analysis verification is conducted as needed, while batch entry for eTrace follows a scheduled timeline rather than being done on demand.

Firearms: Data

MPD performs a significant portion of its forensic services in-house, particularly the triaging of spent shell casings. These casings are essential for linking firearms to crime scenes, as they provide ballistic evidence that can connect multiple incidents or identify the same firearm used across various crimes. The MGU and the Property & Evidence room at 201 Poplar are the two primary locations where shell casing triaging occurs. This process is crucial for feeding information into the NIBIN database, which plays a pivotal role in connecting ballistic evidence to specific firearms.

- In-House Processing Data (2022-2023):
    - In 2022, MGU triaged 2,085 shell casings, and P&E triaged 8,860 casings.
    - In 2023, MGU triaged 2,461 shell casings, while P&E triaged 8,300 casings.

These casings are examined, photographed, and documented by a team of three contract employees and one MPD officer. The average turnaround time for processing shell casings is approximately 48 hours. However, in high-profile cases, the response time can be as fast as 24 hours.

Firearms: Assessed Needs

Moving from monthly batch submissions to individual, real-time eTrace submissions would significantly reduce delays in tracing firearms. This change would ensure that firearms are traced within 24 hours of recovery, providing investigators with faster access to information related to the firearm's history and potential links to other crimes. Additionally, ensuring that officers properly document and photograph firearms at the scene is essential for preventing errors in serial number recording and eTrace submissions. Additional personnel and training may provide quick turnaround. This will be discussed further in the next section.

Current TBI Processes

Firearm Analysis

TBI Firearms: Background

The most recognized certification for firearm examiners is offered by the Association of Firearm and Tool Mark Examiners (AFTE)**.** The AFTE Certification program is considered the gold standard in the field, providing a voluntary process to validate the examiner's competence. The following is a breakdown of the certification process and what it typically involves:

- **Eligibility Requirements:** Before applying, candidates must meet specific prerequisites, including a minimum of three years of experience in firearm and tool mark identification. They must also be employed full-time in a forensic laboratory or related environment that conducts firearm and tool mark examinations.
- **Testing:** The certification process includes both written and practical examinations. The written exam covers areas like firearm manufacturing, ammunition types, comparison microscopy, gunshot residue analysis, and firearms laws. The practical exam requires candidates to demonstrate their ability to correctly identify firearms, match bullets and casings, and document their findings in a report format.
- **Proficiency Testing:** Certified examiners must participate in annual proficiency testing to maintain their certification. This process involves analyzing evidence provided by AFTE and submitting their findings for review, ensuring they continue to meet industry standards.
- **Continuing Education:** To retain certification, firearm examiners are encouraged to participate in continuing education. This may include attending AFTE annual conferences, workshops, and training programs, which help examiners stay current on advancements in firearm analysis techniques.[24]

Firearm and toolmark analyses are a crucial part of the process of forensic testing. In the most recent census of forensic crime laboratories 60 percent of all public labs in the United States have this capability.[25] Nationwide the backlog for firearm and toolmark analysis increased

[24] Association of Firearm and Tool Mark Examiners. (n.d.). *AFTE certification program*. AFTE. https://afte.org/resources/certification-program

[25] Bureau of Justice Statistics. (2020). *Publicly funded forensic crime laboratories: Resources and services, 2020*.

by 97 percent from 2014 to 2020. Based on the findings of the current analysis there is a high demand for firearm examiners nationwide.

One of the more recent developments in forensic science involves the integration of DNA analysis with NIBIN. While NIBIN helps link ballistic evidence across multiple crime scenes, combining this with DNA evidence from shell casings can significantly strengthen investigations. DNA recovery from shell casings is rare but possible under specific conditions. Forensic investigators use methods like the rinse and swab sampling method to collect biological material left on shell casings. Once a DNA profile is established, it can be compared to profiles in national databases, potentially identifying the individual who handled the firearm or linking a suspect to multiple crime scenes. The integration of DNA evidence with NIBIN results can enhance the strength of a case. A NIBIN hit that connects a firearm to multiple shootings, combined with DNA evidence from the suspect on the shell casings, provides law enforcement with two critical pieces of forensic evidence. This combination is particularly useful in high-profile cases, where the goal is to build a comprehensive and robust case against a suspect and can lead to higher rates of conviction.[26]

Firearms: TBI processes

Currently, TBI confirms ballistic evidence through firearm examinations and conducts DNA testing on firearms. MPD, in collaboration with the MGU and the ATF, carries out investigative processes, but lacks the final confirmation of evidence. Despite this, MPD proceeds

[26] Ohio Attorney General. (2023, December 21). *NIBIN database, coupled with DNA technology, paying early dividends for Ohio law enforcement*. https://www.ohioattorneygeneral.gov/Media/News-Releases/December-2023/NIBIN-Database-Coupled-with-DNA-Technology-Paying

with arrests based on available information. TBI Jackson works to confirm firearm analyses for Memphis and Shelby County, as well as, all other jurisdictions in the western division.

Firearms: TBI Data

Data provided by TBI show the number of firearms submitted/requested for analysis by Memphis/Shelby County. For 2023 the average turnaround time was 479.5 days.

TABLE 9: TBI-JACKSON FIREARMS REQUESTS

	2023	2022	2021	2020	2019
Firearms Requests	62	88	61	89	112

The total number of requests for firearm analysis received by TBI Jackson Forensic lab in 2023 was 252 from all western jurisdictions. TBI NIBIN entry conducted by the TBI Nashville forensic lab totaled 113. Data provided are not organized in a means to determine the number of DNA analysis on ballistic evidence.

Firearms: Assessed Needs Continued

Establishing a MOU with TBI to train personnel to assist with the confirmation process would likely impact turnaround time for firearm analysis. Space and equipment use would also need to be examined to ensure efficient and safe processes. This strategy could enhance TBI's capabilities and improve local evidence processing turnaround times. Additionally, such a strategy can be leveraged toward developing the personnel and resources towards a new lab or the strengthening of the existing units. This is discussed further in the Immediate Action section.

Forensic Biology

Forensic Biology: Background

Forensic biology is a branch of forensic science that applies biological principles and techniques to criminal investigations. Often synonymous with DNA analysis, forensic biology encompasses a wide range of methods used to analyze biological evidence such as blood, hair, saliva, skin cells, and other bodily fluids.[27] Specialized equipment for forensic biology (see Appendix B) represents a significant portion of a crime lab's budget. Airflow is a critical factor in DNA forensic analysis, particularly during the amplification process, where even the slightest contamination can compromise results. DNA amplification, typically performed using Polymerase Chain Reaction (PCR), involves creating millions of copies of a DNA sample, which can also amplify any contaminating DNA. Therefore, strict environmental controls are necessary to prevent cross-contamination.

DNA analysis has revolutionized the field of forensic science and plays a critical role in solving a wide range of crimes. By providing a unique genetic fingerprint, DNA evidence can link suspects to crime scenes, identify victims, and exonerate the innocent. One commonly understood aspect of forensic biologics is the testing of sexual assault kits. Collected with SAKs, body swabs, clothing, and other items, DNA helps identify suspects by matching the genetic material found at the scene or on the victim. In many cases, DNA can differentiate between consensual and non-consensual contact, clarifying the nature of the crime.

[27] National Institute of Justice. (n.d.). *Forensic biology/forensic DNA*. National Institute of Justice. https://nij.ojp.gov/topics/articles/forensic-biologyforensic-dna

In homicide investigations, DNA can be recovered from a variety of sources, including blood, hair, skin cells, and other biological materials left at the crime scene. In cases where the victim's identity is unknown, DNA can also assist in identification by matching profiles with missing persons databases or familial DNA searches.

DNA evidence has become increasingly valuable in solving burglaries, thefts, and robberies. Suspects often leave behind trace amounts of DNA including touch DNA. DNA evidence can link these suspects to specific crime scenes, providing crucial leads in otherwise difficult-to-solve cases.[28]

DNA is an invaluable tool in identifying missing persons and unidentified human remains. Forensic analysts compare DNA samples from remains with DNA profiles from family members, databases of missing persons, or even personal items that may contain the individual's DNA. In cases of kidnapping and human trafficking, DNA can help identify victims and perpetrators and establish familial relationships.[29] Another of the most impactful uses of DNA in the criminal justice system is the exoneration of wrongly convicted individuals. Organizations like the Innocence Project use DNA evidence to challenge convictions, often decades after the original verdict. This has led to numerous exonerations.[30]

In total continuing improvements in DNA analysis allow investigators to solve crimes that were once thought unsolvable due to the limitations of past forensic techniques. With advancements in DNA technology, evidence from decades-old cases can be re-examined, often

[28] National Institute of Justice. (2010). *DNA and property crimes*. Office of Justice Programs. https://www.ojp.gov/library/publications/dna-and-property-crimes
[29] International Committee of the Red Cross. (2009). *Missing persons and their families*. https://www.icrc.org/sites/default/files/external/doc/en/assets/files/other/icrc_002_4010.pdf
[30] Innocence Project. (2023, May 2). *DNA and wrongful conviction: Five facts you should know*. https://innocenceproject.org/dna-and-wrongful-conviction-five-facts-you-should-know/

leading to new arrests and convictions. High-profile cases, including long-unsolved homicides and serial assaults, have been cleared through the reanalysis of preserved DNA samples.[31] However, with such advancements additional resources are needed. Most labs interviewed in the analysis prioritized any additional space for their Forensic Biology units.

One of the emerging forms of forensic biologics is forensic genealogy, also known as Investigative Genetic Genealogy (IGG), which combines DNA analysis with genealogy research and identifies unknown persons by tracing familial connections through genetic data.[32] Though still in its early stages, this technique has already played a crucial role in law enforcement, solving over 500 cold cases.[33]

While this is a newer form of technology it is expected that IGG will become cornerstone in forensic biologics. Despite its benefits, however, forensic genealogy presents challenges, particularly in terms of privacy, legal, and ethical concerns. Genetic data submitted for genealogical purposes may be used in criminal investigations, often without the donor's knowledge or explicit consent. This raises significant privacy issues and contributes to existing tensions between law enforcement and the public, with concerns about the ethical use of personal genetic information. Misuse of genetic data can lead to security breaches, discrimination, stigma, and even misidentification of suspects or victims, highlighting the need for stringent oversight and ethical guidelines.

---

[31] National Institute of Justice. (n.d.). *Cold case investigations*. National Institute of Justice. https://nij.ojp.gov/topics/law-enforcement/investigations/cold-case-investigations

[32] United States Department of Justice. (2021). *Interim policy: Forensic genetic genealogical DNA analysis and searching*. https://www.justice.gov/olp/page/file/1204386/dl

[33] Criminal Legal News. (2023, August 1). *Forensic genetic genealogy has solved 545 cases– and counting*. https://www.criminallegalnews.org/news/2023/aug/1/forensic-genetic-genealogy-has-solved-545-cases-and-counting/

Another major challenge is the high cost of IGG, costs can be around $20,000 per case, depending on the resources required. This makes it a significant investment for crime labs, particularly when considering the specialized expertise and technology needed. Currently, only private labs have the capacity to conduct forensic genealogy, and those skilled in this field are in high demand. As the technique becomes more standard in forensic science, it is expected that public crime labs will eventually adopt it, leading to a new wave of backlogged cases due to the high costs and limited availability of skilled personnel.

Forensic Biology: Memphis and TBI Processes

In Tennessee, the handling of SAKs is governed by state and local policies designed to ensure timely collection and testing of evidence. Enacted in 2015, the statute TCA 39-13-519 mandates the use of SAKs in sexual assault cases and requires law enforcement agencies to submit the kits to a state crime lab or another qualified laboratory within 30 days of the victim filing a police report.[34] This timeline is critical for prompt and accurate processing of evidence, helping to maintain the integrity of DNA and other forensic materials.

The City of Memphis has implemented additional measures to further reduce delays in processing SAKs. The City of Memphis mandates that SAKs be submitted for testing within 96 hours (4 days) of collection. This expedited timeline aims to prevent backlogs and ensure that evidence is processed promptly. Timely processing of SAKs helps prevent the degradation of biological evidence, leading to quicker identification of suspects and ensuring that the evidence is accurate and reliable.

[34] Tennessee State Government. (n.d.). *Sex assault kits (SAK)*. Tennessee Bureau of Investigation.

The current procedure to transfer the evidence to the Jackson TBI Forensic Lab is to drop off on Mondays at the local field office. From there a TBI forensic analysts transports the evidence from Memphis/Shelby County agencies to the Jackson TBI Forensic Lab. To adhere to the SAK 96-hour rule evidence is delivered from Memphis to Jackson on Thursdays by a criminalist who works with the sex crime and homicide unit. Once on site, the criminalist will drop off and pick up forensic biology and other evidence to be transported back to Memphis.

Forensic Biology: TBI Data

Data provided by TBI are from Memphis/Shelby County requests for DNA/Forensic Biology. The average turnaround time for Memphis/Shelby County requests for forensic biology analysis from TBI Jackson Forensic Lab is total of 151. 2 days.

TABLE 10: TBI-JACKSON FORENSIC BIOLOGY REQUESTS

	2023	2022	2021	2020	2019
Forensic Biology - Violent	89	71	61	87	83
Forensic Biology - Nonviolent	33	29	14	30	31
Forensic Biology Sex Offense	316	229	374	425	445
Forensic Biology - Totals	438	329	449	542	559

The total Forensic Biology requests for 2023 totaled 569, which include 252 outsourced SAKs. Memphis/Shelby County represents a significant number of forensic DNA processed.

Forensic Biology: Assessed Needs

Discussed later in the Immediate Action section, RapidDNA could provide a quicker turnaround as it comes to identifying suspects and connecting them with other crimes. This could provide investigators and prosecutors with additional information in which to act to be assured of proper knowledge of the suspect to ensure public safety. An additional item discussed in the Immediate Action section relates to the transportation of evidence to the Jackson TBI Forensic

Lab. Processes differ between units on delivery and handling of evidence, current processes need investigation by administration.

Forensic Toxicology

Forensic Toxicology: Background

Protocols in forensic toxicology are fundamental to ensuring the accuracy, reliability, and legal defensibility of toxicological analyses. Samples must be preserved in a controlled environment to prevent contamination, degradation, or alteration, with each step of the handling and storage process thoroughly documented. Any deviation from established laboratory protocols must be recorded to maintain the integrity of the chain of custody and ensure the sample's admissibility in court.[35]

Subsequently, analytical testing is conducted on samples, typically beginning with initial screening tests to detect the presence of substances, followed by confirmation tests using advanced techniques such as gas chromatography-mass spectrometry (GC-MS). After the testing phase, toxicologists interpret the results in the context of the individual's health, medical history, and relevant legal considerations, compiling comprehensive reports and providing court testimony when necessary. To ensure ongoing accuracy and credibility, forensic laboratories must adhere to stringent quality assurance guidelines, including following standard operating procedures (SOPs), obtaining accreditation from recognized bodies, and participating in proficiency testing programs.[36]

[35] Scientific Working Group for Forensic Toxicology (SWGTOX). (2013). Standard practices for method validation in forensic toxicology. *Journal of Analytical Toxicology, 37*(7), 452–474.
[36] GenTech Scientific. (2022, October 7). *Must-have equipment for start-up toxicology labs*. https://gentechscientific.com/must-have-equipment-for-start-up-toxicology-labs/

A forensic toxicology department requires a range of specialized equipment to effectively detect, quantify, and analyze toxic substances in biological samples. Modern crime laboratories rely on advanced instruments such as analyzers, mass spectrometers, chromatography systems, blood gas analyzers, immunoassay tests, electrocardiography machines, and electroencephalography machines.

To ensure a safe working environment, forensic toxicology labs must also be equipped with fume hoods biological safety cabinets and personal protective equipment such as gloves, lab coats, and goggles. Finally, much like the forensic biology unit, essential laboratory supplies, including glassware (beakers, flasks, test tubes), refrigerators, freezers, water purification systems, and analytical balances, are necessary to support the comprehensive analysis of toxic substances. The acquisition and proper use of this extensive array of equipment are vital for a toxicology department to meet the rigorous demands of criminal investigations, ensuring that analyses are both accurate and reliable.

Forensic Toxicology: Memphis and TBI Processes

TBI is responsible for handling forensic toxicology for Memphis and Shelby County. MPD is equipped to conduct some preliminary drug testing through its CSI Unit and Property and Evidence Division, primarily focusing on common substances like marijuana, cocaine, methamphetamine, and heroin. These tests are typically conducted using field kits or simple laboratory methods, which can quickly indicate the presence of a controlled substance. However, when large quantities of drugs are involved, or when substances are complex and difficult to identify, such as synthetic opioids, designer drugs, or substances altered to evade detection, samples are forwarded to the TBI for comprehensive analysis TBI employs sophisticated testing methods, such as gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-

mass spectrometry (LC-MS), which provide more precise and reliable results than basic field tests. MPD's Organized Crime Unit (OCU) delivers suspected illicit substances to Jackson for testing twice a month.

In some cases, private laboratories may also utilize, such as NMS labs, particularly when the evidence requires highly specialized testing that may exceed the capabilities of state facilities. Private labs often have extensive databases for comparison, which aids in the identification of novel synthetic drugs or compounds that are not commonly encountered. Additionally, utilizing private labs can help address backlogs at state-run facilities, expediting the analysis process for high-priority cases. This collaboration between public and private forensic services is increasingly vital, especially given the evolving nature of drug-related crimes and the emergence of new psychoactive substances.

Forensic Toxicology: Data

TBI differentiates between forensic toxicology and chemistry in their data. Chemistry focuses on suspected illicit seized drugs, while toxicology involves forensic evidence such as illicit substances or alcohol discovered through blood tests. The table below shows the five-year trend for Memphis/Shelby County submissions, for 2023 the toxicology turnaround time was 51.8 days, while forensic chemistry totaled 89.6 days.

TABLE 11: TBI-JACKSON TOXICOLOGY AND FORENSIC CHEMISTRY REQUESTS

	2023	2022	2021	2020	2019
Toxicology	568	612	799	951	1,312
Forensic Chemistry (Seized Drugs)	141	125	227	188	262

Overall, the total number of the western region's requestion for Jackson's TBI Forensic Crime totaled 421 for forensic toxicology and 993 for forensic chemistry.

Forensic Toxicology: Assessed Needs

Increasing the frequency of transportation of evidence can provide answers on evidence more quickly. A specialized vehicle that provides secure transport of drugs (such as fentanyl) and blood samples would provide benefit in ensuring the safety of evidence and those who transport evidence. This is discussed further in the Immediate Action section of the current study.

Organization, Personnel, and Facility

Organization

Crime Lab Structure

Appendix A presents the organizational division chart for the Charlotte-Mecklenburg Crime Lab, showing that the director reports directly to police services. Notably, Memphis has double the crime counts of Charlotte-Mecklenburg, which suggests that Memphis would likely experience a higher volume of forensic evidence requests, necessitating additional personnel beyond what is shown in the chart.

Although the Charlotte-Mecklenburg Crime Lab reports to police services, it primarily employs civilian analysts, creating a clear distinction between law enforcement and the forensic unit. Most personnel in the lab are civilians, which helps maintain objectivity in evidence processing. Similarly, the Nashville crime lab operates as a civilian unit with strict policies limiting forensic scientists' knowledge of case details to only what is necessary for analysis. This approach reinforces their focus on scientific results, allowing them to remain independent from case outcomes. As a result, they do not compare their findings with prosecution rates or case closures; their role is limited to providing testimony on laboratory analyses.

In contrast, Houston and Arkansas operate their crime labs under the oversight of independent boards. These boards typically consist of diverse members, including representatives from law enforcement, attorneys (both prosecutors and defense), and sometimes civilians, including individuals who were wrongfully convicted. The boards receive reports on lab processes, budgets, and operational issues from the lab director, providing an additional layer of independent review and governance.

The structure of a forensic lab forms the foundation for all forensic operations, ensuring that processes are conducted efficiently and accurately. Effective management is crucial for facilitating the timely admittance and processing of evidence while maintaining adherence to quality control and legal standards. The primary goals of management and oversight in a forensic lab are to uphold the integrity of both the evidence and scientific processes, minimizing the potential for errors. Any mistake in the handling, processing, or interpretation of evidence can have serious consequences, not only for the individuals involved but also for public trust in the justice system.

Police-Run Labs

Forensic laboratories that operate under the direct control of police departments offer certain operational advantages. For example, police-run labs have the ability to prioritize cases according to investigative needs, ensuring critical evidence is processed quickly. Close integration with law enforcement also enables efficient communication between detectives and forensic specialists, facilitating a more immediate exchange of information regarding evidence requirements and analysis timelines. Furthermore, police-run labs can leverage the department's administrative structure for streamlined decision-making, budgetary oversight, and resource allocation.

Police-run labs are generally integrated into the department’s financial structure, allowing direct management of costs and resources. This can result in lower operational expenses compared to outsourcing forensic services. Departments can allocate budgets based on anticipated caseloads and crime trends, quickly adapting resources as needed. However, this cost efficiency may come at the expense of rigorous external audits and quality controls, potentially allowing errors to go undetected.

Despite some benefits, police-run labs face challenges, primarily due to their close relationship with law enforcement. Since these labs operate within the same agency responsible for investigating crimes, there is a heightened risk of bias—whether real or perceived—affecting the objectivity of forensic analyses. This proximity can lead to public distrust, especially in high-profile or controversial cases where the credibility of evidence is paramount. Even if the lab operates with complete integrity, its affiliation with law enforcement may create doubts about the fairness of its results, potentially undermining the justice process.

There is a potential lack of scientific expertise among law enforcement personnel who oversee lab operations. Police managers often come from investigative backgrounds rather than scientific fields, which can lead to misunderstandings of the methodologies and rigorous standards required in forensic testing. This gap in scientific literacy can result in improper prioritization of lab resources, unrealistic expectations regarding analysis speed, or inadequate chain-of-custody protocols.

The subsequent exoneration of the Central Park Five underscored the consequences of errors within police-managed forensic processes. In this high-profile case, police-run lab structures may have contributed to the improper interpretation of evidence. The coerced confessions and mishandling of forensic evidence highlighted how law enforcement's involvement can sometimes lead to prioritizing a narrative over factual evidence.

The cases of Annie Dookhan in Massachusetts and Fred Zain in West Virginia further demonstrate the risks associated with improper oversight in police-run labs. Dookhan’s misconduct over a decade—including falsifying results, mishandling evidence, and lying under oath—impacted approximately 21,000 criminal cases. Both of these cases highlight the critical

need for qualified and vetted personnel, as well as robust management and oversight within police-affiliated labs.

Independent Labs

A report funded by the Department of Justice in 2009, *Strengthening Forensic Science in the United States: A Path Forward,* recommends that crime labs should maintain independent from police departments to ensure objectivity, scientific rigor, and transparency in their operations.[37] One example of this best practice is Houston's restructured crime lab, which transitioned to an independent model governed by an oversight board.[38] This board is responsible for making policy decisions grounded in scientific expertise. The separation of forensic science from law enforcement ensures that decisions about evidence processing are guided by objective scientific standards rather than the immediate demands of the criminal justice system, which may create pressure for quick results, biases, or compromise the quality of the analysis in other ways.

The independence of crime labs is perceived as helping to mitigate the risk of legal liability associated with improperly handled evidence, biased interpretations, or incorrect testing methods. Furthermore, the pressure to solve or prosecute cases quickly and effectively can result in non-reliable testing.[39] Independent oversight reduces the risk of this type of compromise by allowing scientists to focus on thorough and methodologically sound forensic practices. This separation significantly bolsters public confidence in the impartiality and reliability of forensic

---

[37] National Research Council, Division on Engineering and Physical Sciences, Committee on Applied and Theoretical Statistics, Committee on Science, Technology, and Law, Policy and Global Affairs Division, & Committee on Identifying the Needs of the Forensic Science Community. (2009). *Strengthening forensic science in the United States: A path forward*. National Academies Press.

[38] Hensley, J. (2014, April 3). *Houston forensic science center takes over HPD crime lab*. Houston Public Media. https://www.houstonpublicmedia.org/articles/news/2014/04/03/49852/houston-forensic-science-center-takes-over-hpd-crime-lab/

[39] Rossmo, D. K. (2021). Dissecting a criminal investigation. *Journal of Police and Criminal Psychology*, 36(4), 639–651.

results, which is particularly crucial in cases involving potential police misconduct or internal reviews.

However, the complete independence between crime labs and police departments primarily involves the potential for reduced communication and collaboration between investigators and forensic analysts. In highly integrated criminal investigations, close coordination between law enforcement and forensic scientists is helpful for understanding the context of evidence, prioritizing cases, and efficiently processing time-sensitive materials.[40] If labs are fully independent, the separation can limit direct communication, resulting in a slower and/or less customized investigative process. Investigators may feel disconnected from the forensic process, which could affect the timely flow of information and the ability to adjust forensic strategies based on emerging details of a case.

True independence, where a lab operates completely detached from any influence by law enforcement, prosecutors, or even the public sector, is difficult to achieve. Crime labs, even when structurally independent, often rely on public funding, and their performance is still scrutinized by law enforcement, the judicial system, and the public. This public funding often comes in the form of government sources, such as through the police department or other public agencies. This can limit the degree to which a lab is truly independent, as financial dependencies may result in implicit biases or pressure to cater to the needs of those providing the funds. These external pressures can create indirect influences on lab operations, such as the prioritization of high-profile cases or pressure to produce results that align with broader investigative goals. In some cases, independence may also create inefficiencies in resource allocation, as forensic labs

[40] Lopez, B. E., McGrath, J. G., & Taylor, V. G. (2020). Using forensic intelligence to combat serial and organized violent crimes. *NIJ Journal*, 282, 1–11.

and police departments might not share budgets, making it harder to streamline the use of personnel, equipment, and facilities.

Independence itself is often defined in varying degrees. A crime lab may be "structurally independent," meaning it operates under its own governance and separate leadership, but still closely collaborates with law enforcement in casework. Alternatively, a lab could be "functionally independent," where its processes, decisions, and oversight are insulated from law enforcement influence, but it remains a part of the larger law enforcement infrastructure in terms of funding and resource sharing.[41]

A balance between independence and collaboration is another option, where forensic scientists have autonomy in how evidence is analyzed and reported, while still maintaining effective communication channels with investigators. A hybrid model can prioritize scientific principles while addressing the immediate needs of law enforcement and the judicial system.

Independent labs typically serve a broader range of clients, including police departments, prosecutors, and other agencies, allowing them to diversify funding and allocate resources more effectively. This financial flexibility enables investment in advanced forensic technologies and specialized personnel, enhancing their operational capacity. However, outsourcing forensic services to independent labs can be costly for police agencies, particularly when complex or high-profile cases require multiple types of forensic testing. Additionally, police departments must factor in costs for transporting evidence to the lab and coordinating with its staff, which can add expenses and delays.

[41] Lee, H. C., & Pagliaro, E. M. (2013). Forensic evidence and crime scene investigation. *Journal of Forensic Investigation*, 1(2), 1–5.

Independent labs, given their broader client base, often handle a large volume of cases, leading to longer turnaround times (TAT) for forensic results. This can force police agencies to be more selective in the evidence they submit and can impact prosecution timelines. While the impartiality of independent labs enhances their credibility, the potential delays and additional costs associated with their services can be significant hurdles for law enforcement agencies.

In relation to this a lab for use by specific government entities in the community to assist in processing cases may streamline processes. For instance, priority cases and other evidence can be tested by local partners, private and public, to help alleviate current entities, such as TBI, charged with processing the high number of cases from Memphis/Shelby County. Such labs could provide equal access to all entities, including defense attorneys. One example of this type of reform took effect in New York in 2020, which now requires that prosecutors disclose evidence automatically without requiring specific requests from the defense, a strategy designed to promote transparency and ensure that defendants receive all evidence in a timely manner. A centralized data portal was created to facilitate this process, allowing defense attorneys to view the evidence more efficiently.[42]

While New York's example is a significant step towards transparency in the criminal justice process, other cities and states have varying levels of openness. The degree of access typically depends on local laws and the policies of individual forensic laboratories. Some cities may offer defense attorneys access to evidence upon request but may not have established comprehensive portals like New York. Further research into each jurisdiction's policies would be required to identify other cities with similar practices.

[42] New York State Division of Criminal Justice Services. (2021, December 22). *Implementation of 2020 discovery law changes report*. New York State Division of Criminal Justice Services.

The Houston Model: An Independent Approach

The Houston Forensic Science Center (HFSC) is a notable example of a successful independent forensic lab model. Following the closing down of the Houston Police Department Crime Lab in the early 2000s due to use of faulty equipment, poor infrastructure, and inadequate oversight the city established the HFSC in 2014 as an Independent Local Government Corporation (LGC). This unique structure allowed the HFSC to operate independently from the police department, thereby ensuring a higher degree of transparency, scientific rigor, and accountability.

The HFSC operates as a nonprofit corporation funded by local government but maintains operational independence from daily city administration. It is overseen by a board of directors appointed by the Houston City Council, comprising experts in law, forensic science, and public policy, including individuals directly affected by wrongful convictions. The CEO, who manages daily activities, does not report to city officials but to the board, ensuring independence from political or law enforcement pressures.

The HFSC is organized into specialized divisions, such as DNA analysis, toxicology, firearms testing, latent prints, and digital forensics, staffed by scientists trained in strict protocols. The lab places a strong emphasis on accreditation and quality control, meeting international standards through the ANSI National Accreditation Board (ANAB). Additionally, a quality assurance team conducts internal audits to ensure adherence to best practices.

The HFSC's separation from law enforcement minimizes the risk of bias in forensic analysis, allowing scientists to work objectively. It collaborates with law enforcement, prosecutors, and courts while maintaining control over forensic testing priorities. The lab's

transparency—publishing performance reports and opening its processes to audits—has helped restore public trust in Houston's forensic science operations.

The HFSC's success is partly due to the unique statutory elements within Texas law that allowed it to be established as an LGC. This legal framework may not be easily replicated elsewhere. Despite its operational independence, the HFSC still navigates logistical challenges common to independent labs, such as managing case backlogs and balancing budgetary constraints with the need for advanced technology and training. Additionally, it is important to note that no lab is without liability concerns as Houston just recently had to terminate an employee and retest forensic evidence that the scientist analyzed. In fact, most labs visited for this study had recently experienced a similar liability concern. Such mistakes and negligence come at great financial costs for the lab and city/county.

Personnel

Once the structure is established, personnel must be selected. A major challenge faced by crime labs across the country is understaffing, often driven by inadequate compensation.[43] Competitive salaries are crucial to attract and retain skilled professionals. Without them, labs face high turnover rates, increased workloads, and delays in processing evidence. For example, forensic labs in North Dakota, Houston, and Tennessee have experienced employees leaving for higher-paying opportunities, further straining their operations. Addressing understaffing requires not only improved compensation but also career development opportunities and a supportive work environment to maintain staff efficiency and job satisfaction.

[43]Stenehjem, W. (2021). *North Dakota Crime Lab facing challenging staffing issues*. Forensic Magazine. https://www.forensicmag.com/580611-North-Dakota-Crime-Lab-Facing-Challenging-Staffing-Issues/

Nationally, the shortage of qualified forensic professionals makes recruitment challenging. However, a crime lab that invests in training and certification can help mitigate this issue. While Memphis has a local talent pool, fully staffing a crime lab with local hires may prove difficult. External recruitment and internal training will likely be necessary. Many qualified individuals may seek employment elsewhere due to better opportunities, and some applicants may lack the specialized training required for forensic lab duties.

Retention of skilled employees is a significant issue facing crime labs across the US. Competition with private-sector salaries and benefits makes it difficult to retain experienced staff. Furthermore, the evolving nature of forensic science necessitates continuous professional development, clear career paths, and promotional opportunities to keep employees engaged. Creating a positive work environment that addresses the emotional and physical toll of forensic work can also help prevent burnout and improve retention.

To address these challenges, Memphis must provide competitive compensation packages that rival those offered by other labs and industries. This includes not only salaries but also comprehensive benefits, opportunities for promotion, and ongoing professional development. Additionally, partnering with local universities to create specialized programs, certifications, and internships can establish a pipeline of qualified candidates. By investing in training and creating a supportive work environment, Memphis can build a stable, skilled workforce capable of maintaining high standards in forensic science.

Personnel: National Trends

From a national perspective in 2020, a total of 15,600 full-time-equivalent employees were employed by publicly funded forensic crime labs.[44] Of those employees approximately 62 percent were either analysts or examiners. The remaining percentages were managerial, technical support, lab techs, security, etc. Overall, the vacancy rate for forensic analysts is approximately 10 percent with some labs upwards to 50 percent unit depending on the overall size of the lab.

The number of staff required depends on the size of the lab and its expected caseload. According to Burch and colleagues (2014), 72% of accredited crime labs employed at least one analyst certified outside the lab.[45] This suggests that in most cases labs certify employees internally, which would mean that time would need to be factored in the development of a new lab. In addition to credentials, if a crime lab's size is not carefully planned relative to its caseload, understaffing is inevitable, leading to the loss of experienced personnel, continuity issues, and delays in investigations and court proceedings.

One way to ensure staffing is by leveraging existing units. MPD hires staff skilled in crime scene investigations, latent fingerprinting, ballistic investigations, digital forensics and other specialized areas crucial for running a crime lab. These employees are responsible for analyzing evidence from crime scenes, conducting forensic analyses, and providing expert testimony in court.

Current resource pools outside law enforcement are less focalized. Memphis, TN currently faces a significant demand for laboratory technicians, with a wide range of

---

[44] Bureau of Justice Statistics. (2020). *Publicly funded forensic crime laboratories: Resources and services, 2020* (NCJ 300993). U.S. Department of Justice. https://bjs.ojp.gov/document/pffcl20.pdf

[45] U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics, Burch, M., M., Durose, M. R., R., Urban Institute, Walsh, K., & Tiry, E. (2016). Publicly Funded Forensic Crime Laboratories: Quality Assurance Practices, 2014. In Bulletin (Report NCJ 250152). https://bjs.ojp.gov/document/pffclqap14.pdf

opportunities highlighting the availability of talented individuals suitable for staffing a forensic crime lab. Laboratory techs and analysts in local medical centers and hospitals such as St. Jude would likely impact retention, and competitive salaries would be necessary. Based on interviews with HFSC, one of the reasons Houston experiences a high rate of openings is due to the oil and gas industry, which utilizes the skills of analysts to conduct chemicals tests on oil and gas products.

Even if Memphis lacks immediate forensic scientists, local talent can be trained through partnerships with educational institutions like the University of Memphis, Southwest, and the University of Tennessee Health Science Center. Further support can be gained through collaborations with MPD, TBI, and national organizations such as the FBI and the National Forensic Science Technology Center. By leveraging online certification programs, professional organizations like the American Academy of Forensic Sciences (AAFS) and the International Association for Identification (IAI) and applying for federal and state grants aimed at forensic science education.

In 2020, the combined operating budget for crime labs nationwide was around $2 billion, highlighting the resources allocated to maintain forensic services across different jurisdictions. This budget reflects the operational needs of crime labs in processing evidence and maintaining infrastructure, particularly as they work to manage high volumes of forensic requests while adhering to resource limitations and timelines.

According to the Department of Justice in 2020, state crime laboratories represented just over half (51% or $1 billion) of the nearly $2 billion total annual operating budget for all crime labs. County labs accounted for about 22% of the budget, municipal labs for approximately 16%,

and federal labs made up around 11%. Larger crime labs, with 100 or more full-time employees (FTE), accounted for nearly 46% of the total budget, while labs with 25 to 49 FTEs represented 20%. The average operating budget per individual lab or lab system in 2020 was roughly $6.7 million. On average, state labs had a budget of $10.9 million, federal labs $5.5 million, municipal labs $5.0 million, and county labs $4.4 million.

The average cost per request for forensic services across all labs in 2020 was around $620. State labs had the lowest cost per request, approximately $550, while federal labs had the highest, at about $900 per request. From 2002 to 2020, the total operating budget for all crime labs rose from about $1.8 billion (adjusted for inflation) to $2 billion. During this period, state, county, and municipal labs saw their budgets increase, while federal labs experienced a decrease.

At the end of 2020, crime laboratories across the United States reported a backlog of approximately 710,900 forensic requests that had not been completed within 30 days of submission. To manage this demand, 47% of crime labs outsourced portions of their workload to other laboratories, including private labs. This outsourcing allowed them to share the burden and address various requests more efficiently.

Personnel: Memphis

To provide estimates of what may be expected or needed for Memphis/Shelby County various data were gathered. All data utilized come from the crime labs visited, TBI, MPD, and public sources such as the National Incident-Based Reporting System (NIBRS) and the U.S. Census. It is important to note that the data compared may have been measured differently by each entity. Therefore, all data should be considered approximate, as variations in definitions, metrics, and measurement methods may exist. Some labs supplied the total number of requests made to the lab, which may include multiple requests per case, while others provided the number

of cases submitted, which could also involve multiple requests. Individual cases could be counted more than once if evidence was submitted to different sections of the lab.

The number of full-time equivalent employees (FTE) is not a linear relationship and varies for each forensic division. Each division requires a different analyst-to-caseload ratio, which can fluctuate depending on the caseload. Therefore, it is not possible to calculate a fixed optimal number of analysts needed per case for a lab.

The following estimations were performed using multiple methods, including the workforce calculator for forensic labs provided by the Workforce Calculator Project from the Forensic Technology Center of Excellence. This calculator was developed using data collected from major accredited labs across the United States. The models within the calculator are based on jurisdiction type, state, population, and crime rate. The workforce calculator provided uses these models to determine the number of operational (analysts) and administrative staff required for each forensic unit. Staffing data from Nashville indicated a minimum ratio of four analysts or scientists to each technician. This ratio was applied to estimate the number of positions and to calculate the estimated minimum salary required for a Memphis lab.

Table 12 presents the calculations based on the total caseload reported for Shelby County by TBI Jackson. The number of latent print cases reported by MPD was added to this total to estimate the required workforce. The firearms case total, as reported, does not include NIBIN entries, so this calculation was limited to cases sent to TBI and excluded from the total operational FTE needed. Using the Nashville lab as a reference, as discussed below, the estimations indicate that at least 12 analysts should be included in the final FTE count. However,

this model would likely absorb the budget for current employees, suggesting that 4-5 additional latent print analysts would need to be added to the existing MPD unit.

TABLE 12: ESTIMATED WORKFORCE (TBI-JACKSON SHELBY COUNTY SUBMISSIONS)

FORENSIC DIVISION	CASELOAD	TOTAL FTE	OPERATIONAL FTE	ADMINISTRATIVE FTE
DNA	438	3.82	2.98	.84
Drugs	141	.72	.57	.15
Fingerprint	749	9.08	7.24	1.84
Fire Analysis	24	.80	.67	.13
Firearms	62	1.91	1.58	.34
Gunshot Residue	12	.26	.22	.04
Toxicology	568	6.50	5.61	.89
Total	1287	23.10	18.87	4.23

For ballistics, there are currently three contract employees at ATF/Eagle Harbor and one MPD officer triaging shell casings. In 2023, the MGU triaged 2,461 shell casings, while the 201 Poplar Property Evidence unit triaged 8,860 shell casings. Since multiple casings from multiple guns can be associated with a single incident, it is not possible to determine the exact number of incidents or cases the current unit handled. Additionally, this figure does not account for the work requested by the Shelby County District Attorney's Office, which is also responsible for requesting evidence testing.

These factors plus the uncertainty of whether the (1) digital forensics unit would be housed within the proposed lab, (2) how much of the current firearm investigators and analysts would be absorbed in a lab, and (3) also whether latent prints would be absorbed in the lab make it difficult to accurately estimate the number of FTEs required. However, based on the available data and caseload projections for lab development, the most conservative estimate, excluding current employees, is approximately 18-20 additional FTEs.

TABLE 13: ESTIMATED WORKFORCE (NASHVILLE CASELOAD DOUBLED)

FORENSIC DIVISION	CASELOAD	TOTAL FTE	OPERATIONAL FTE	ADMINISTRATIVE FTE
Toxicology/Blood Alcohol	2058	2.04	1.60	.44
DNA	1028	7.16	5.63	1.53
Drugs	902	2.61	2.07	.54
Fingerprints	1456	12.46	10.01	2.45
Firearms	7778	14.75	12.61	2.14
Serology/Biology	1058	5.46	4.39	1.07
Total		44.48	36.32	8.16

Table 13 provides caseload estimations using data reported by Nashville's lab for each forensic division. Since Nashville experiences roughly half the amount of reported crime as Memphis, the initial calculation doubled Nashville's caseload to estimate the potential workload for a Memphis lab. Additionally, both Charlotte and Nashville consistently show that their number of submissions is about half of their total crime counts. While these are two distinct measures, they offer a basis for approximating caseloads based on data from other municipal labs. These calculations exclude outsourced cases but include fingerprint and firearms/NIBIN

cases, assuming that these would be processed by a Memphis lab. The estimate may be more accurate, as the ease of submitting evidence would likely increase if a local lab were established.

TABLE 14: ESTIMATED WORKFORCE (NASHVILLE CASELOAD RATIO)

FORENSIC DIVISION	CASELOAD	TOTAL FTE	OPERATIONAL FTE	ADMINISTRATIVE FTE
Toxicology/Blood Alcohol	1059	1.25	99	.27
DNA	530	4.40	3.44	.96
Drugs	462	1.64	1.30	.34
Fingerprints	738	9.02	7.18	1.83
Firearms	3994	11.13	8.86	2.27
Serology/Biology	545	3.62	2.91	.71
Total		31.06	24.68	6.38

Table 14 shows another estimation of caseload, which was developed using the ratio of cases *per forensic division* reported by Nashville, not the overall number of submissions. As a basis for the total expected submission, half the reported crime in Memphis was used for this estimate. This estimation is more accurate when reflecting the number of fingerprint cases reported by Memphis, and also more reflective of caseload reported by TBI Jackson.

Table 15 shows the average number of expected analysts required with an estimated workforce salary. Salary information was provided by both TBI Jackson and Nashville and averaged for each position to calculate a lower and higher end for a salary range. The workforce distribution from Nashville was used to calculate the minimum number of FTE for each position, as well as the ratio of analysts to technicians required.

TABLE 15: ESTIMATED FTE COST

FTE POSITION	LOWER SALARY	HIGHER SALARY	MINIMUM NUMBER OF FTE	TOTAL LOWER SALARY	TOTAL HIGHER SALARY
Forensic Technician	53,388	73,167	7	373,716	512,169
Forensic Technician Supervisor	70,571	87,036	5	352,855	435,180
Forensic Scientist	70,571	87,036	26	1,834,846	2,262,936
Forensic Scientist Supervisor	107,224	163,416	5	536,120	817,080
Forensic Scientist Manager	107,224	215,592	1	107,224	215,592
Crime Laboratory Administrator	131,084	175,242	1	131,084	175,242
Total			45	3,335,845	4,418,199

Facility and Space Requirements

Comparison Labs

All labs visited for this project expressed the need for additional space and personnel to meet their operational demands. Below is a detailed overview of the facilities and resources of several crime labs across various locations, highlighting their budgets, personnel, and space requirements. Importantly, a standard suggesting that each crime lab analyst requires between 700 and 1,000 square feet of space is referenced in the "Forensic Laboratories: Handbook for Facility Planning, Design, Construction, and Moving" published by the National Institute of Standards and Technology (NIST). This handbook provides guidelines for designing and building forensic labs, including space considerations for various specialized units.

- **Metro Nashville Crime Lab**
  - In 2014, Metro Nashville invested $30 million in purchasing and renovating their current facility. An additional $4 million was allocated for initial equipment purchases.

- Their annual operating budget is approximately $8.5 million, excluding grants and utilities. Of this budget, around $6 million goes towards salaries and benefits.
- The facility has undergone $150,000 in renovations since its establishment. Currently, it spans 35,000 square feet at cost of $857 per square foot, with plans for a DNA unit expansion estimated at $10 million. This expansion is pending approval, which they anticipate might take more than a year.
- The lab employs 59 staff members, 49 of which are analysts or technicians and processes 14,510 requests annually, outsourcing around 1,200 of these to private labs.

- **Charlotte-Mecklenburg Crime Lab**
  - The Charlotte-Mecklenburg crime lab has been operational since 1969, with its current building constructed in 1996. The lab is experiencing space constraints, particularly for evidence requiring long-term refrigeration. Refrigeration units are presently placed in hallways and outside the designated units due to lack of space.
  - The lab has a long-term plan to remove office space and restructure its layout to expand the DNA unit. Their DNA unit's annual budget, following the initial equipment and supplies cost of $740,000, includes personnel costs amounting to approximately $613,000. This budget covers a Biology/DNA criminologist, DNA supervisor, two DNA analysts, and a technician.
  - Additionally, they allocate $180,000 annually for supplies.

- **Houston Crime Lab**
  - The crime lab in Houston, not including its property and evidence room, covers 82,480 square feet. The lease for this facility amounts to $31 million.
  - Houston’s lab employees 220 staff and forensic scientists.

- **Arkansas State Crime Laboratory**
  - The Arkansas State Crime Laboratory is also facing space issues and is currently constructing a new lab building. Their existing facility is 85,000 square feet, while the new building will be 188,000 square feet at an estimated cost of $200 million ($1,063 per square foot).
  - The lab employs 163 staff, of which 149 are analysts, serving the entire state. They receive 26,300 cases annually, resulting in 42,293 requests.

- **Jackson TBI Lab**

- Salary costs for the Jackson, TBI lab are approximately 4.7 million a year. Jackson has 40 total analysts or technicians. Their total budget was just under 6.5 million for 23-24. They received 1.1 million in grants to support various projects and training.
- The TBI Jackson lab is 43,717 gross square footage in size and the rent is $65,575.50 per month. However, additional space is needed as a plan is being put into place to add 10,000 square feet. The cost of the build in 2020 was 22 million based on what is publicly available from TBI's News Room, approximately $450 per square foot.

Estimating Space for Memphis/Shelby County

The space required for a crime lab in Memphis/Shelby County depends on the number of analysts and the specific units to be included. Precise estimates vary based on these factors.

- *Current Resources*

  Considering the existing units in Memphis/Shelby County (property and evidence, latent prints, CSI, digital forensics, and a portion of ballistics), the estimated space for approximately **15 analysts** (including toxicology, DNA, and firearm toolmark analysis) ranges between **10,500 and 15,000 square feet**. This estimate focuses on analyst numbers and does not include support staff, whose requirements would vary based on the lab's structure.

- *Future Expansion*

  If a future lab in Memphis/Shelby County were to encompass all current investigative and forensic processes with **37 forensic analysts**, the estimated space requirement would be **27,750 to 37,000 square feet**, excluding additional support staff. If the lab were to grow space would be needed for any expansion.

  According to the *Forensic Science Laboratories: Handbook for Facility Planning, Design, Construction, and Relocation*, an overall staff size of **30-70 employees** typically corresponds to a lab size of **30,000 to 60,000 square feet**. If the total staff comprises fewer than 30 employees, the lab size would generally be around **30,000 square feet**. Based on these standards, Memphis/Shelby County would most likely require a facility within the **30,000-60,000 square foot range**, making its costs relatively comparable to Metro Nashville's lab, however this price would have to be adjusted for cost increases over the previous 10 years.

Estimated Construction Reference Costs:

- **TBI Jackson Facility**: In comparison to TBI Jackson's Lab an approximate cost of **$450 per square foot**, a Memphis/Shelby Forensic Lab building at 45,000-square-foot would cost around **$20.3 million**. Note that TBI Jackson also pays a monthly rent of **$65,575.50**.

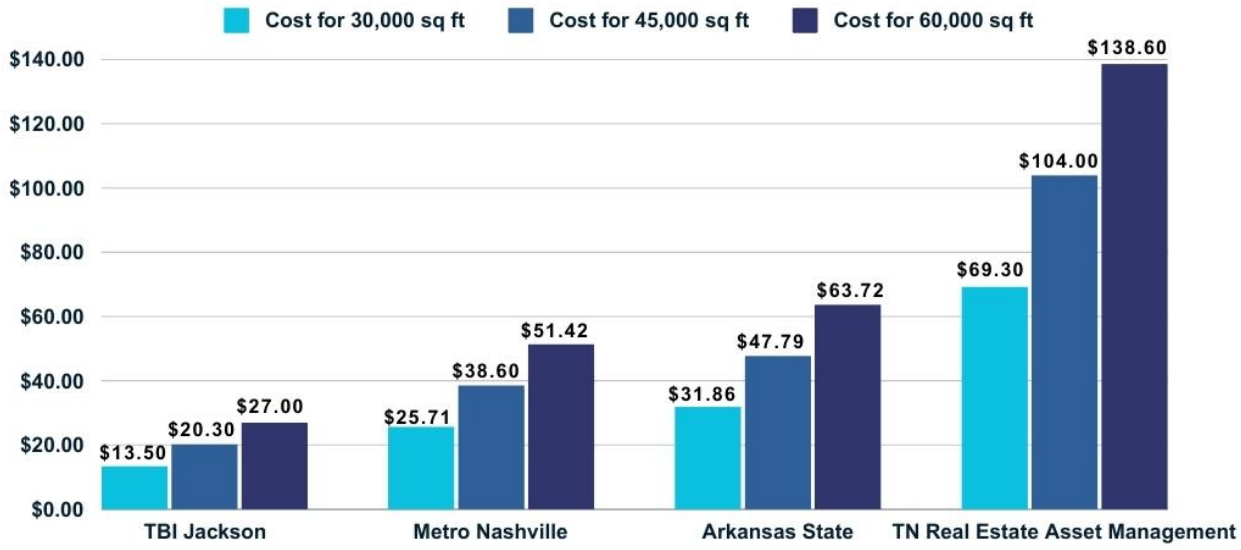
- **Metro Nashville**: Refurbishing costs are higher, at about **$857 per square foot**, resulting in a cost of approximately **$38.6 million** for a 45,000-square-foot facility. Note that the lab does not include utilities or any other rent costs in their lab budget.

- **Arkansas Crime Lab Estimate**: Based on recent figures, a 45,000-square-foot lab would cost approximately **$47.8 million**.

- **TN Real Estate Asset Management**: An outlier estimate of **$2,310 per square foot** was provided locally, which would bring the cost of a similar-sized lab to **$104 million** at **45,000 square feet**. However, it's unclear what specific factors are included in this cost.

Figure 5 shows the breakdown of the most conservative to the most expensive estimates, presented in the millions. The Arkansas Crime Lab, although a bigger lab, provides the most up-to-date estimate.

FIGURE 5: COST BASED ON OTHER REGIONAL LAB PRICING



Estimate Costs Based on Future Factors:

Each forensic analyst generally requires **700-1,000 square feet**. With current construction costs ranging between **$800 and $1,000 per square foot**, the total cost per analyst can be estimated, based on these figures.

- **Salaries**: Most technician salaries range between **$50,000 and $70,000** annually, while analysts typically earn between **$65,000 and $85,000**. Additionally, the costs for DNA units would be higher due to the need for specialized equipment, validation, and maintenance.
- **Equipment and expenses**: Initial equipment purchases for Nashville's lab were **$4-5 million**, and their annual budget is **$8.5 million** including salary **$2.5 million** on all other budget items. The budget for Memphis would depend on the specific services and units it includes, which may vary based on jurisdiction and bureaucratic structure. However, if Memphis included all units Nashville includes, the budget would likely be similar.
- **Final Number:** Overall budgets will vary over a multitude of factors. However, a facility would likely cost between **$40-50 million**, $**4-6 million** for initial equipment purchase, and an annual budget that includes salary at $**8-10 million**. Totaling and estimated cost of $**52-66** million for the initial cost and first budget year. This does not include the initial cost of searching for personnel, training, utilities, and other unexpected expenditures.

Some of this cost may be offset with grant funds for special projects. Additionally, there are current processes done locally that represent overlapping costs that may be leveraged, including NIBIN entry, Latent Prints Unit, CSI unit, and Digital Forensic.[46] All of these units currently have their own equipment, personnel, and space. That said, upgrades to space, equipment, and policy may be needed along with additional training and personnel.

Architects

Using commercial real estate public websites, current information indicates 27 locations in Shelby County are currently for sale that have a minimum of 30,000 square feet, with more

[46] DUI and Special Traffic Identification Squad (STIS) Service data were also provided by MPD, however were not included in this analysis as most of these services are examined locally. All DNA, toxicology, and blood tests would be included in TBI Forensic Toxicology data. The local data are presented in Appendix C.

locations that are currently for lease. There are pros and cons in using an existing building and refitting it for a forensic lab. Metro Nashville was able to do this for approximately $30 million in 2014. Arkansas's crime lab repurposed an existing state police building, however, they had challenges in allocating space and providing a smooth process between sections of the crime lab. Serology testing was on the first floor; however, the remainder of forensic biology was on the 2nd floor. This is one reason they chose to build their own laboratory recently as moving evidence into common areas during DNA testing can increase the potential for contamination. Additionally, purchasing and refurbishing a building may not come at lower expense, especially to stay consistent with accreditation and space requirements. Construction or refurbishment costs tend to be higher per square foot due to the need for specialized infrastructure in forensic laboratories, including climate control, security, advanced technology, and evidence-handling requirements.

Firms such as McClaren, Wilson & Lawrie Architects have a recognized track record in designing sustainable architecture specifically for forensic science facilities, including police and public safety buildings. Their experience spans federal, state, county, municipal, and academic clients, offering a tailored approach to the planning and design of crime labs to suit various needs. They have been involved in over 450 diverse projects since 1995, highlighting their deep expertise in this field.

Another firm, Crime Lab Design, focuses on architectural, engineering, planning, and design services for the forensic science community. With over 25 years of experience, they have designed over 10 million square feet of forensic facilities and have been involved in projects valued at more than $2.5 billion. They use their Space and Budget Estimating Resource

(SABER) tool to provide space and budget projections for early-stage facility planning, ensuring that new construction or renovations are optimized for functionality and cost-efficiency.

Dekker Perich Sabatini is another example of an architecture firm that has experience in forensic lab design, having worked on the New Mexico Department of Public Safety Forensic Laboratory. This project received recognition for its innovative and user-focused design, incorporating features like natural light and ergonomic elements to support and retain lab staff. Locally, the Jackson TBI lab used the Lewis Group Architectures.

As a final note, the volume of evidence that is sent to TBI from Shelby County is low relative to comparison cities. This could be due to the cities having their own crime labs or differences in crime. A local crime lab may provide more ease in the submission of forensic evidence and in turn lead to higher workload for analysts. Additionally, once again salaries would need to be competitive with local medical laboratories, hospitals, and other forensic labs within a 300-mile radius.

Environmental Impact of the Facility

Once a facility is built or selected, its environmental impact must be understood locally. The environmental impact of crime labs can vary significantly based on numerous aspects such as the size of the facility, types of analyses conducted, chemicals and reagents used, waste management practices, energy consumption, and pollution prevention measures. Additionally, labs require substantial energy for heating, cooling, lighting, and operating specialized equipment like analytical instruments and ventilation systems. Some laboratory processes, including sample preparation, chemical analysis, and incineration of waste, can release air

pollutants like volatile organic compounds (VOCs), particulate matter, and greenhouse gases.[47] Proper classification of waste streams is crucial to ensure they are processed, disposed of, or incinerated in accordance with regulatory requirements.

The use of chemicals, reagents, solvents, and consumables are integral to forensic analyses. Improper storage, handling, and disposal of these chemicals can lead to environmental contamination, soil and water pollution, and health risks. Minimizing excess chemical usage and implementing proper waste management practices are crucial. Collaborating with certified waste disposal companies ensures that hazardous waste is treated and disposed of according to environmental regulations.

Toxicology, DNA, drug identification and other types of chemical analysis tend to have the greatest environmental impact due to the extensive use of hazardous chemicals and solvents. The processes generate significant amounts of chemical waste, which, if not managed properly, can lead to soil and water contamination and pose health risks. Firearms, Latent Prints, and Digital Forensics all have low to moderate environmental impact

Designing crime lab facilities with sustainable features, such as energy-efficient lighting, heating, and cooling systems, water-saving fixtures, renewable energy sources (e.g., solar panels), and green building materials, can significantly reduce environmental impacts and operating costs over the facility's lifespan. Incorporating sustainable design principles in new and existing laboratory buildings and utilizing green building certifications, such as Leadership in Energy and Environmental Design (LEED), can guide and validate sustainability efforts.

[47] Oskouian, A. (2023, August 25). *The impact of industrial emissions on air pollution level*. Environmental Protection. https://eponline.com/articles/2023/08/25/the-impact-of-industrial-emissions-on-air-pollution-level.aspx

Implementing an Environmental Management System (EMS), such as ISO 14001, helps crime labs systematically identify, monitor, and mitigate their environmental impacts. ISO 14001 is an internationally recognized standard that provides a framework for organizations to manage their environmental responsibilities in a systematic manner.[48] EMS frameworks enable continuous improvement in environmental performance through setting objectives, implementing controls, and conducting audits to ensure compliance.

Incinerator Study

Not always common in crime labs are incinerators. They are primarily used for the destruction of hazardous or sensitive materials, such as controlled substances, biological evidence, or materials that could pose a security risk if not properly disposed of. The use of incinerators is highly regulated due to environmental concerns and the need for proper handling of the remains to avoid contamination or other risks.

The local community is important to consider, as concerns about emissions and potential health risks can lead to community opposition or regulatory scrutiny. Incorporating an incinerator into a crime lab involves specific considerations due to the nature of the materials being incinerated and the need for stringent control over emissions and residue management. A crime lab incinerator is designed primarily to dispose of hazardous, sensitive, or potentially infectious materials, including biological waste (such as tissues, fluids, and cultures used in forensic analysis), chemical waste (including reagents, solvents, and other chemicals used in

[48] International Organization for Standardization. (n.d.). *ISO 14001: Environmental management systems*. https://www.iso.org/iso-14001-environmental-management.html

testing), and confidential materials. Ensuring the incinerator is secure and accessible only to authorized personnel is crucial to prevent unauthorized disposal or access to sensitive materials.

Integrating an incinerator into a crime lab involves addressing specific security, regulatory, and operational challenges to safely dispose of hazardous materials while complying with environmental standards. Careful planning and investment in technology and training are essential to mitigate risks and ensure effective waste management.

Examples of Manufacturers and Providers:

- **Elastec:** Offers a range of incinerators for various waste types, including medical and evidence destruction.
- **Addfield:** Specializes in incinerators for various applications, including hazardous and medical waste.
- **INCINER8:** Provides a variety of incinerators for waste management in different sectors, including forensic and crime labs.

Installation costs vary based on the location and complexity of the setup. Regular maintenance, operational costs, and the need for trained personnel add to the overall expenses. Advanced filtration systems to comply with environmental regulations can significantly increase the cost. Units designed for higher energy efficiency might have higher upfront costs but lower long-term operating expenses.

The incineration chamber must be designed to handle diverse materials safely and efficiently, with specific features for different waste types (i.e. biological, chemical, confidential). Maintaining high temperatures (usually above 850°C) is necessary to ensure complete combustion and destruction of hazardous components. Advanced filtration and scrubbing systems are required to minimize emissions of particulates, volatile organic

compounds (VOCs), and other pollutants. Continuous monitoring of emissions is essential to comply with environmental regulations and ensure safety standards are met.

There are initial costs due to the specialized equipment and construction required to meet regulatory standards and ensure safety. Ongoing costs include energy consumption, maintenance of specialized equipment, and compliance with disposal regulations. Basic incinerators suitable for minor evidence or small-scale labs can range from $10,000 to $50,000. More robust units capable of handling larger volumes of waste or specific types of evidence typically range from $50,000 to $150,000. High-capacity or specialized incinerators, designed for extensive use, hazardous materials, or with advanced features like pollution control, can cost between $150,000 to $500,000 or more. Custom-built incinerators, depending on the unique needs of a crime lab, such as specific regulatory compliance, can exceed $500,000.

Autoclaving is a common alternative that uses steam and pressure to sterilize and decontaminate biological materials. Shredding is another method, where industrial shredders destroy sensitive documents, plastics, or DNA samples. Chemical decomposition involves using chemicals to neutralize hazardous or biological materials before disposal. Some labs rely on contracted waste disposal companies that specialize in handling hazardous waste. Secure landfills are used for the controlled burial of non-hazardous evidence that is no longer needed for active cases.

Equipment and Quality Assurance

As discussed in previous sections all forensic laboratories will need to purchase equipment and supplies. Discussed in the Forensic Biology section and as can be seen in Appendix A, DNA analysis requires the highest investment in equipment. Other divisions come with their own needs, this is more the case for forensic toxicology, but also extends to ballistic

analysis, and latent prints. For instance, ballistic analysis requires test fire tanks, a large inventory of comparison firearms, bullets, and other supplies. There are procedures in place to ensure that equipment used for forensic evidence testing is effective and accurate.

Quality assurance (QA) in laboratories is essential for ensuring the accuracy, reliability, and integrity of forensic analysis results. Before adopting new methods or technologies, labs conduct rigorous validation studies. These studies are designed to demonstrate the accuracy, sensitivity, specificity, and reliability of the new methods, ensuring that they are suitable for their intended use and valid for legal proceedings.

Quality control (QC) measures are a key component of QA in forensic labs. Labs perform both internal and external QC measures to monitor the accuracy and precision of their results.[49] Internal QC involves running known samples alongside case samples to verify analytical performance, while external QC includes participating in proficiency testing programs administered by external organizations. As document control is an important part of QA, DNA labs maintain detailed records of all procedures, analyses, results, and quality assurance activities.

This process of validation is resource-intensive and can impact both the lab's time and financial resources. The time required to validate new equipment can vary significantly based on the complexity of the equipment and the specific validation protocols. Typically, validation studies can take several months to over a year, during which the equipment is unavailable for normal forensic testing. During the validation process, analysts who would typically work on

[49] Federal Bureau of Investigation. (2011). *Quality assurance standards for forensic DNA testing laboratories*. https://ucr.fbi.gov/lab/biometric-analysis/codis/quality-assurance-standards-for-forensic-dna-testing-laboratories

casework are diverted to perform validation experiments.[50] This can lead to a temporary reduction in the lab's capacity to handle ongoing cases.

Financial Costs of Validation:

- **Direct Costs:**
    - **Equipment Purchase and Installation:** The initial cost of purchasing and installing new DNA analysis equipment can range from tens of thousands to hundreds of thousands of dollars.
    - **Reagents and Consumables:** Validation studies require significant amounts of reagents and consumables, which add to the overall cost.
- **Indirect Costs:**
    - **Training Costs:** Analysts and technicians must be trained on the new equipment and validation procedures. Training programs and workshops can cost between $500 and $1,500 per participant.
    - **Operational Downtime:** The time taken to validate new equipment can lead to operational downtime, where the lab's throughput is reduced. This can indirectly increase costs due to the slower processing of cases and potential backlog.
- **Ongoing Costs:**
    - **Maintenance and Calibration:** Regular maintenance and calibration of new equipment are required and these ongoing costs must be factored into the lab's budget. Maintenance contracts and calibration services can range from a few hundred to several thousand dollars annually.

[50] National Institute of Justice. (n.d.). *Advancing justice through science*. National Institute of Justice. https://nij.ojp.gov/

Accreditation

Once a facility is built it should be ensured that all personnel are properly trained, and policies are in place to ensure credible forensic analyses. Crime lab accreditation is a rigorous process that ensures forensic laboratories meet high standards of quality, competence, and reliability in conducting forensic analyses. This process verifies that a lab operates according to established protocols, employs qualified personnel, and utilizes appropriate equipment and methodologies. Independent accreditation bodies typically oversee this accreditation, assessing the laboratory's management, personnel, facilities, equipment, procedures, and quality assurance practices.[51]

There are a small number of organizations which grant accreditation to forensic labs. Each will have its own jurisdiction, standards, and best practices. The most well-known of these are:

- ANSI National Accreditation Board (ANAB) - The ANSI National Accreditation Board (ANAB) is a major accreditor in the United States, offering accreditation for a wide range of forensic disciplines. ANAB operates under international standards such as ISO/IEC 17025 (General Requirements for the Competence of Testing and Calibration Laboratories) and ISO/IEC 17020 (Requirements for the Operation of Various Types of Bodies Performing Inspection). ANAB accredits organizations in over 75 countries and covers various sectors such as testing and calibration laboratories, inspection bodies, proficiency testing providers, and product certification bodies.
- American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) - The American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) is one of the oldest accrediting bodies for forensic laboratories. ASCLD/LAB offers accreditation based on internationally recognized standards such as ISO/IEC 17025 for testing and calibration laboratories.[52]

---

[51] American National Standards Institute. (2011, November 29). *ANSI-ASQ National Accreditation Board acquires Forensic Quality Services, Inc.* American National Standards Institute. https://www.ansi.org/standards-news/all-news/2011/11/ansiasq-national-accreditation-board-acquires-forensic-quality-services-inc-29

[52] A2LA. (2024, August 8). *Forensic examination lab accreditation program*. A2LA. https://a2la.org/accreditation/forensics/

- Forensic Quality Services (FQS) - Forensic Quality Services (FQS) is an accrediting body recognized for its specific focus on forensic science. FQS provides accreditation for forensic laboratories based on international standards and best practices.

The Accreditation Process

Achieving accreditation involves a comprehensive evaluation, including on-site assessments, proficiency testing, and detailed document reviews. Accreditation increases acceptance of forensic evidence in legal proceedings by demonstrating compliance with established standards and quality assurance measures. Accreditation also facilitates international recognition, making forensic evidence more credible in cross-border investigations and legal matters.

The time frame for a crime lab to achieve accreditation varies significantly based on the lab's status, the specific accreditation body, and the scope of services offered. The process typically starts with an initial assessment and preparation phase, which can take up to a year. During this period, the lab conducts a gap analysis to compare its current operations against accreditation standards, identifies areas for improvement, and develops a plan to address deficiencies. This phase may also involve hiring additional staff or investing in new equipment.

Following the initial assessment, the lab implements the necessary improvements. This phase, which can last up to two years, involves making recommended changes to policies, procedures, and infrastructure. During this time, staff are trained to comply with new standards. The application submission phase typically takes a few weeks to a few months.

After the application is submitted, the accrediting body conducts a pre-assessment review, which can take one to three months. This review involves assessing the application and supporting documentation, possibly through a preliminary visit to identify major issues before

the formal assessment. The formal on-site assessment, where the accrediting body's assessors visit the lab to evaluate compliance with standards, usually takes one to two weeks.

Post-assessment corrections, where the lab addresses any findings or deficiencies identified during the on-site assessment, can take up to six months. The final review and decision phase, where the accrediting body reviews the lab's response to any findings, typically takes one to three months. If all standards are met, the lab is granted accreditation; if not, additional corrective action may be required.[53] The entire process typically takes between 1.5 to 3 years from the initial preparation to receiving accreditation. Labs that are already close to meeting accreditation standards, have previously been accredited, or have fewer units might complete the process more quickly.

Continuous Compliance

Once a forensic laboratory achieves accreditation, maintaining that status requires ongoing compliance with the accreditation standards. Continuous compliance involves regular audits, updates to procedures, and potentially re-accreditation every few years. This process ensures that the laboratory continues to meet the high standards of quality and reliability expected in forensic science.

Accredited labs are subject to regular surveillance audits conducted by the accrediting body. These audits may occur annually or biennially, depending on the accrediting body's requirements. The purpose of these audits is to verify that the lab continues to comply with accreditation standards and to identify any areas needing improvement. Accredited labs must

[53] Niland, R. (2013, January 10). *Part 2: The lab accreditation process*. Forensic Resources. https://forensicresources.org

stay current with the latest developments and incorporate new methodologies and best practices into their operations.

Many accrediting bodies require labs to undergo a formal re-accreditation process every few years, typically every five years. This process is similar to the initial accreditation and includes a comprehensive review of the lab's procedures, personnel, and quality control measures.

Overview of costs

The cost of obtaining and maintaining accreditation can vary widely based on several factors, including the size of the lab, the scope of services offered, and the specific requirements of the accrediting body. Cost will also include any recommended changes in the organization or implementation of procedures requested by the accrediting body. The following is a general estimate of costs associated with the accreditation process:

- **Initial Application Fees:**
  - **Small to Medium Labs:** Initial application fees typically range from $3,000 to $8,000.
  - **Large Labs:** For larger labs with more extensive services, initial fees can range from $8,000 to $15,000.
- **On-Site Assessment Fees:**
  - **Daily Rates:** Assessors charge daily rates of approximately $1,200 to $1,500.
  - **Travel Expenses:** Additional costs for travel, lodging, and meals for assessors can range from $1,000 to $3,000 depending on the location and duration of the assessment.
- **Annual Maintenance Fees:**
  - **Surveillance Audits:** Annual surveillance audits typically cost between $5,000 and $8,000. These fees cover the assessors' time and travel expenses for conducting the audits.

- **Corrective Action Reviews:** Fees for reviewing corrective actions taken to address any nonconformities identified during audits can range from $500 to $2,000 per review.

- **Re-accreditation Fees:**
  - **Small to Medium Labs:** Re-accreditation costs can range from $4,000 to $10,000, depending on the scope of the re-assessment.
  - **Large Labs:** For larger labs, re-accreditation fees can be higher, ranging from $10,000 to $20,000.

- **Training and Preparation Costs:**
  - **Workshops and Training:** Labs may choose to invest in workshops and training sessions offered by accrediting bodies. These sessions typically cost between $500 and $1,500 per participant.
  - **Internal Preparation:** Labs might also incur costs for internal preparation, such as hiring consultants or dedicating staff time to ensure readiness for accreditation. These costs can vary widely based on the lab's needs.

Safety Regulations and Security

Successful accreditation is often related to developing proper policies and protocols are in place. Ensuring security in a forensic crime lab is vital for maintaining the integrity of evidence and preventing contamination or tampering. This encompasses various aspects, including physical security, personnel security, evidence handling, cybersecurity, environmental controls, emergency preparedness, and continuous monitoring through audits and reviews. Crime labs are vulnerable to various threats, including physical, cyber, and insider threats. Implementing robust security measures is crucial to safeguard evidence, personnel, and the integrity of forensic processes.

The physical security of a crime lab begins with stringent access control measures.[54] Only authorized personnel can enter sensitive areas, utilizing secure methods such as key cards, biometric scanners, or PIN codes. Surveillance is another critical component, with security cameras strategically placed in key areas to monitor and record activities. This not only provides accountability but also serves as a deterrent to potential intruders. The perimeter of the lab is often secured with fencing, gates, and checkpoints, ensuring controlled entry and exit. Personnel security starts with thorough background checks for all employees. Comprehensive training which covers security protocols, evidence handling, and security awareness must be provided for staff.

Evidence handling should be governed by strict protocols to ensure its integrity from the point of collection to its presentation in court. A well-documented chain of custody is maintained, detailing every instance of evidence transfer and access. This documentation is

[54] International Association for Property and Evidence. IAPE. (2024, September 26). https://iape.org/

crucial for establishing authenticity and unaltered state of the evidence. Employing secure storage solutions, with designated areas accessible only to authorized personnel, further preventing unauthorized handling or tampering.

Comprehensive digital security procedures safeguard digital evidence and case files with robust data protection measures, including encryption, secure servers, and regular backups.[55] Network security is also paramount, with firewalls, antivirus software, and continuous monitoring tools in place to protect against unauthorized access, malware, and other cyber threats.

Environmental conditions such as temperature and humidity must be meticulously controlled to preserve the integrity of physical evidence. This is particularly important for biological samples and other sensitive materials that can degrade under adverse conditions. Additionally, contamination control procedures must be implemented to minimize the risk of cross-contamination from chemicals, biological materials, or external sources.

Crime labs must also be prepared for various emergency scenarios, including fires, natural disasters, and security breaches. Comprehensive emergency response plans are developed and regularly practiced through drills and exercises. These preparations ensure that staff can respond quickly and effectively, minimizing potential damage and maintaining the integrity of the lab and its contents.

There are a number of threats that can impact crime labs, including:

[55] Mukasey, M., Sedgwick, J., & Hagy, D. (2008). *Electronic Crime Scene Investigation: A Guide for First Responders*, Second Edition.

- Crime labs face several physical threats, such as unauthorized access, natural disasters, and targeted attacks.[56] Intrusion and unauthorized access by external parties or unauthorized personnel can lead to tampering, theft, or destruction of evidence. Natural disasters like fires, floods, and earthquakes can damage or destroy facilities and evidence.

- Data breaches can expose sensitive information and compromise investigations. Malware and ransomware can disrupt operations, corrupt data, or hold digital assets hostage.[57] Phishing and social engineering tactics can deceive employees into revealing confidential information or granting unauthorized system access.

- Internal sabotage by employees or contractors with access to the lab can result in altered or destroyed evidence.[58] Negligence and mismanagement, due to poor practices or failure to adhere to protocols, can inadvertently compromise evidence or data.

To protect against these threats, crime labs must implement security measures, including comprehensive strategies to identify and mitigate threats. Threat mitigation involves planning to anticipate threats when they occur, containing the threat to minimize loss and disruption, and rectifying any damage done to internal or external systems or processes. Threat mitigation should include all the following:

- **Physical Security Measures:** Advanced access control systems, such as biometric scanners and key card systems, restrict entry to authorized personnel. Comprehensive video surveillance and alarm systems monitor activities within the lab premises. Physical security is reinforced with robust locks, reinforced windows and doors, and secure storage for sensitive materials and evidence. Regularly updated emergency response plans and staff training ensure preparedness for natural disasters and other emergencies.

- **Cybersecurity Measures:** Network security is enhanced with firewalls, intrusion detection systems, and secure network architecture. Strong encryption protocols protect forensic data during storage and transmission. Regular security audits and system updates address vulnerabilities. Employee education on cybersecurity best practices helps them recognize phishing attempts and securely handle data.

---

[56] Stephenson, P. (2004). Forensic analysis of risks in enterprise systems. *Information Security Journal*, *13*(4), 11.
[57] Federal Bureau of Investigation. 2021. Cyber Crime: Protecting yourself Against Cyber Threats. FBI. https://www.fbi.gov/investigate/cyber
[58] National Institute of Justice. (n.d.). *Forensic laboratory management: A guide for managers and administrators*. U.S. Department of Justice. https://nij.ojp.gov/library/publications/forensic-laboratory-management-guide-managers-and-administrators

- **Managing Insider Threats:** Thorough background checks on all employees and contractors before granting access to the lab ensure only trustworthy individuals are involved. Policies ensuring that no single individual has control over all aspects of sensitive processes or data help prevent malicious actions. Auditing and monitoring tools detect and investigate suspicious activities within the lab. Clear policies regarding the handling of evidence and data, coupled with rigorous training and enforcement, minimize risks.

Workplace Hazards and Promoting Safety

The nature of forensic work involves exposure to chemicals, biological materials, and other hazards that can pose significant health risks if not properly managed. This next section highlights the primary health concerns in crime labs and provides recommendations for mitigating these risks.

- **Chemical Hazards:** Many forensic processes involve the use of toxic, corrosive, or reactive chemicals such as solvents, acids, and reagents used in DNA analysis, fingerprint development, and drug testing. Exposure to volatile organic compounds (VOCs) from solvents can lead to respiratory issues, skin irritation, and long-term health effects.[59] Some chemicals, like formaldehyde and benzene, are known carcinogens, increasing the risk of cancer with prolonged exposure.

- **Biological Hazards:** Handling evidence such as blood, tissues, and other bodily fluids can expose personnel to bloodborne pathogens like HIV, hepatitis B and C, and other infectious agents. Additionally, crime labs may encounter microbiological agents in biological evidence, such as bacteria, viruses, or fungi.

- **Physical Hazards:** Sharp objects, including needles, broken glass, and other instruments used in evidence collection and processing, pose risks of injury and infection. Ergonomic issues such as repetitive tasks, prolonged standing, and awkward postures can lead to musculoskeletal disorders.

- **Radiological Hazards**: Some forensic procedures, particularly in trace evidence analysis or material identification, involve radioactive substances. Exposure to ionizing radiation can have serious health consequences.

[59] *Volatile Organic Compounds' Impact on Indoor Air Quality | US EPA.* (2024, August 13). US EPA. https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality

- **Nanomaterials:** The use of nanomaterials in forensic analysis, such as enhancing fingerprints or detecting trace substances, can pose inhalation risks and other unknown health effects.

- **Psychosocial Hazards**: High workloads, tight deadlines, and the nature of forensic work can contribute to workplace stress and mental health issues. Handling and analyzing graphic and violent crime scene evidence can lead to psychological distress or secondary trauma.

Crime labs conduct forensic analyses on a range of evidence from crime scenes, involving substances that can be hazardous to health. Addressing these health concerns is vital to protect lab personnel and maintain a safe working environment. Developing and implementing comprehensive safety programs that address all potential hazards in the lab is crucial. Regular training sessions on safety protocols and emergency procedures, including fire drills and spill response, ensure preparedness. Clear labeling and communication of hazards through Safety Data Sheets (SDS) and signage help maintain awareness. Health surveillance programs monitor the health of personnel and identify early signs of occupational illnesses, contributing to a safer working environment. Continuous improvement, based on new research, technologies, and feedback from lab personnel, ensures that safety practices and procedures remain effective and up to date. Mitigation strategies for health and safety hazards are as follows:

- **Chemical Safety:** Proper ventilation and the use of fume hoods minimize inhalation of harmful chemicals. Providing and enforcing the use of personal protective equipment (PPE) such as gloves, lab coats, safety goggles, and respirators is essential. Safe chemical storage and handling procedures, along with proper labeling, help minimize exposure.

- **Biological Safety:** Universal precautions, such as treating all biological samples as potentially infectious, and using appropriate PPE and containment procedures are crucial. Furthermore, regular biohazard safety training and proper disposal of shapes in designated containers minimize risks.

- **Physical Safety:** Ergonomic workstations with adjustable seating, equipment at appropriate heights, and anti-fatigue mats reduce ergonomic strain. Safe handling practices and tools for dealing with sharp or hazardous materials further enhance safety.

- **Radiological Safety:** Implementing radiation protection measures such as shielding, distance, and time management strategies reduces exposure to ionizing radiation. Using dosimeters and other monitoring devices ensure exposure levels remain within safe limits.
- **Nanomaterial Safety:** Using containment systems and PPE reduces exposure to nanoparticles. Training personnel in potential risks and safe handling practices is also important.
- **Psychosocial Safety:** Providing access to mental health resources, counseling, and stress management programs supports psychosocial well-being. Monitoring workloads and ensuring adequate staffing helps prevent burnout, while debriefing sessions and support for personnel dealing with distressing cases mitigate psychological risks.

Immediate Actions

After considering discussions and the present data there are several options that can be considered. The purpose of the following section is to explore potential solutions that may play a role in improving outcomes. While other options may exist, the solutions listed below were frequently suggested during interviews with local officials, investigators, and analysts. These are options available that could provide remedies more quickly, while also providing some groundwork for the development of a local crime lab. This section outlines potential short-term solutions that could be implemented to enhance the development of a local forensic crime lab in the Memphis-Shelby County area. Previous chapters of this study have discussed options for each type of forensic evidence, providing tools that can improve current activities, personnel, and policies. This section offers various options that could address local needs and impact several processes. These are presented as potential actions rather than specific recommendations. The options include (1) implementing Rapid DNA, (2) enhancing evidence transport and increasing criminalist capacity within investigations, and (3) dedicating personnel specifically for forensic evidence analysis for Memphis/Shelby County at the Tennessee Bureau of Investigation (TBI).

Immediate Action: Rapid DNA

Introduction to RapidDNA

Rapid DNA technology is a transformative innovation that enables swift analysis of DNA samples, typically within a short period, often in less than two hours. Unlike traditional DNA analysis methods, which require samples to be sent to a laboratory and processed over days or weeks, rapid DNA technology allows for on-site or near-site analysis, providing real-time or near real-time results.

Traditional DNA testing methods can take weeks or even months to produce results, based on current backlogs. Rapid DNA technology significantly reduces this turnaround time, allowing for quick identification of individuals at the time of booking. This expedited process helps law enforcement agencies quickly determine if the individual has any outstanding warrants, prior offenses, or other relevant information. The swift identification capability is particularly beneficial in cases where timely information is crucial for ongoing investigations.

By quickly identifying individuals through their DNA profiles, law enforcement agencies can better ensure public safety. Rapid DNA technology can help identify suspects who may pose a threat to the community, have a history of violent behavior, or are wanted for serious crimes. This immediate identification can prevent potentially dangerous individuals from being released back into the community.

In addition, Rapid DNA technology helps to verify the identity of individuals at the time of booking, reducing the likelihood of false identities or aliases being used to avoid detection or escape legal consequences. This can help prevent individuals with criminal records from evading capture or prosecution. Accurate identification at the booking stage enhances the integrity of the criminal justice process.

One option is to set up Rapid DNA testing at booking stations; here there is less need for lengthy delays in processing individuals through the criminal justice system. This can lead to more efficient legal processes, including faster arraignments, trials, and sentencing procedures. The reduction in processing time not only speeds up the legal proceedings and potentially increases public safety. While the initial investment in Rapid DNA technology may be

significant, the long-term cost savings can be substantial. The operational efficiency gained through rapid DNA testing can offset the initial costs over time.

Implementation Considerations

The implementation of Rapid DNA technology can significantly improve the efficiency and effectiveness of law enforcement efforts, leading to safer communities and more streamlined legal processes. However, it is crucial to ensure proper training, quality control, and adherence to ethical and legal guidelines in its implementation and use. Law enforcement agencies must address concerns related to privacy, data security, and the potential for misuse of genetic information. Establishing robust protocols and oversight mechanisms will help mitigate these risks and ensure that rapid DNA technology is used responsibly and ethically

There are also limits to Rapid DNA technology as it is primarily designed for single-source samples, such as a cheek swab or a single individual's DNA from a crime scene. It struggles with mixed-source samples, where DNA from multiple individuals may be present. This limitation can reduce its effectiveness in complex cases where DNA from several people needs to be analyzed simultaneously. Rapid DNA analysis may not always match the quality and accuracy of traditional laboratory methods. The speed of the process can sometimes lead to errors or less reliable results, particularly if the sample quality is poor. Traditional DNA analysis methods have more rigorous quality control procedures that can be difficult to replicate in rapid, on-site testing environments.

The rapid development and deployment of Rapid DNA technology has outpaced the establishment of comprehensive regulatory standards. This lack of oversight can lead to inconsistent practices and results across different jurisdictions. Without standardized guidelines,

the reliability and admissibility of rapid DNA results in court can be questioned. It is expected that in 2025 the FBI will provide policy and/or standards for Rapid DNA testing.

Errors in Rapid DNA processing can lead to misidentification, which can have severe consequences, including wrongful accusations or convictions. The technology's reliance on quick results can sometimes sacrifice the thoroughness needed to ensure absolute accuracy, increasing the risk of such errors. Despite the technology's promise of speed, it requires resources to operate effectively. This includes not just financial investment but also a need for highly trained personnel to manage and interpret results correctly. The ongoing need for maintenance and updates to the technology can also strain resources. Additionally, access to local and regional databases is also needed for comparison.

Sample Collection and Preparation

The first step in Rapid DNA processing involves the collection and preparation of biological samples, such as cheek swabs. The consumables and kits used in this phase are designed to simplify sample collection and ensure the integrity of the sample is maintained for analysis. Basic DNA collection kits, such as simple buccal swab kits, can cost between $3.78 to $12.63 per unit. More specialized kits for forensic or medical applications range from $15 to $60 per kit. These kits include tools not only for sample collection but also for preservation, preventing contamination, and maintaining the sample’s integrity during transport.

Tools and Costs in Rapid DNA Sample Collection:

- Sterile Swabs with Transport Tubes: Used for collecting and securely transporting DNA samples, a set of 500 swabs costs approximately $705, while a smaller box of 50 swabs costs around $76.
- Flocked Swabs: These swabs offer superior sample collection and release compared to traditional swabs, costing about $64.50 for a pack of 500.

- Sample Collection Cards: Used for collecting and storing biological samples, prices range from $100 to $300 per pack, depending on the brand and quantity.
- Evidence Collection Envelopes: Securely store collected samples, with costs typically between $20 to $50 per pack of 100.
- Sterile Gloves: Essential for preventing contamination, a box of 100 pairs costs between $10 and $30, depending on quality and brand.
- Sterile Water or Saline: Used for moistening swabs when collecting dry samples, usually costing around $10 to $20 per bottle.
- Evidence Labels and Tape: For labeling and sealing evidence, these items cost between $10 to $50 per pack.

The frequency of ordering these items varies based on lab size, case volume, and specific forensic needs. For instance, a lab handling 500 cases per month may require multiple swabs per case, particularly in sexual assault cases. Estimating that 1,500 swabs are used monthly, the annual usage would be around 18,000 swabs. With swabs costing about $1.52 each, the yearly expense for swabs alone could total approximately $27,360.

DNA Extraction and Analysis

The second step in rapid DNA processing is DNA extraction. The Rapid DNA System is an automated technology designed to accelerate DNA analysis, reducing what traditionally takes several days in a lab to an on-site process completed in about 90 minutes. These systems handle DNA extraction, amplification, and analysis to generate profiles that can identify suspects or victims. Once extracted, the DNA is amplified using Polymerase Chain Reaction (PCR) technology to create sufficient material for profiling. Integrated software processes the data, generating a DNA profile that can be compared against databases, such as the Combined DNA Index System (CODIS), for matches.

Rapid DNA Systems and Legal Landscape

One notable system is the RapidHIT ID System, designed for field deployment by law enforcement and other agencies. It allows for quick DNA analysis outside traditional lab settings. Leading suppliers of Rapid DNA systems include Thermo Fisher Scientific and ANDE Corporation. The cost for a single Rapid DNA system, such as the RapidHIT ID System, typically ranges from $250,000 to $300,000, though prices may vary based on configurations and additional features.

The introduction of Rapid DNA technology at jail booking stations can significantly influence various aspects of the judicial process, including bail or bond decisions. In Tennessee, as in many other jurisdictions, the determination of bail or bond is influenced by multiple factors, and the introduction of a Rapid DNA hit can play a role in setting a higher bond under certain circumstances. Currently, there are no comprehensive federal or state regulations specifically addressing the use of Rapid DNA technology in bail determinations. Most legal guidelines focus on the general use of DNA technology in criminal investigations and trials but do not explicitly cover its role in the pre-trial phase, including bail hearings. The existing legal framework governing DNA analysis primarily focuses on ensuring the accuracy, reliability, and ethical use of DNA evidence in criminal proceedings. These regulations often include standards for the collection, processing, and storage of DNA samples, as well as protocols for maintaining the chain of custody and protecting individuals' privacy rights.

The Rapid DNA Act of 2017 allowed the integration of Rapid DNA technology into the booking process at police stations and other locations. However, this legislation mainly targets the identification and processing of arrestees, rather than explicitly regulating its use in bail determinations. Some states have begun to explore the use of Rapid DNA technology in their criminal justice systems, but policies and practices vary widely. State regulations often need to

catch up with technological advancements, resulting in a patchwork of guidelines that can lead to inconsistent applications of Rapid DNA in the bail process. Legal guidelines need to be established to define how Rapid DNA technology can be used in bail determinations. These guidelines should outline the specific circumstances under which Rapid DNA results can be considered and ensure that the technology is used to support, rather than replace, other forms of evidence. To maintain the integrity of the judicial process, it is essential to establish standards for the accuracy and reliability of Rapid DNA results. This includes setting protocols for quality control, regular calibration of equipment, and proper training for personnel handling DNA samples. Given the sensitive nature of genetic information, comprehensive guidelines are needed to protect individuals' privacy rights and ensure the ethical use of DNA data. This includes safeguards against unauthorized access, misuse of genetic information, and ensuring informed consent for DNA collection and analysis.

Latent Impacts

If a Rapid DNA hit links a suspect to a serious crime, it may suggest a higher risk of flight. The more serious the crime, such as violent offenses, the greater the likelihood that the suspect might attempt to avoid prosecution, potentially leading to a higher bond being set. At the same time, a suspect who knows they have DNA hit after use of Rapid DNA may be more influenced to flea after bond.

Judges consider the likelihood of conviction when setting bail. Strong forensic evidence, such as a Rapid DNA hit, increases the probability of conviction, which could result in a higher bond to ensure the suspect appears in court. The type of crime connected to the Rapid DNA hit is crucial. For instance, if the DNA links the suspect to a minor offense, it might not significantly impact the bond. However, if it connects the suspect to a serious or violent crime, it will likely

lead to a higher bond. If a suspect is arrested for a relatively minor charge but a Rapid DNA hit during booking ties them to a violent crime such as assault or homicide, this new information can lead to a reassessment of the suspect's risk and potential for a higher bond.

Rapid DNA Application in other Jurisdictions

Rapid DNA technology has seen implementation across various locations in the United States and internationally. The Arizona Department of Public Safety has integrated Rapid DNA technology into its booking stations, expediting suspect identification and accelerating case resolutions. In California, the counties of Sacramento and Los Angeles have adopted Rapid DNA for booking purposes, drastically reducing DNA processing times and aiding in the swift resolution of crimes, predominately through guilty pleas. Similarly, the Las Vegas Metropolitan Police Department employs Rapid DNA technology in its booking stations, leading to quicker suspect identification and expedited investigations, which bolsters public safety.

The Florida Department of Law Enforcement (FDLE) has incorporated Rapid DNA technology in booking stations, improving the efficiency of criminal processing and case resolution statewide. The Richland County Sheriff's Department in South Carolina uses Rapid DNA technology in its booking stations to swiftly process DNA samples and assist in ongoing investigations. In Texas, law enforcement agencies, including the Houston Police Department, have adopted Rapid DNA technology to expedite suspect identification and enhance public safety. Improving the speed and efficiency of criminal investigations and an enhanced ability to quickly link suspects to crimes or clear them from suspicion.

In 2023, a county jail in California implemented Rapid DNA technology as part of its booking process, aiming to quickly and accurately identify individuals entering the jail system and potentially link them to unsolved crimes through DNA matches. Rapid DNA instruments

were installed in the jail's booking area, and upon booking, a cheek swab was taken from the individual and processed using Rapid DNA technology. Within 90 minutes, a DNA profile was generated and automatically compared against the FBI's Combined DNA Index System.

Despite its success, the implementation of Rapid DNA faces challenges such as ensuring the accuracy of DNA matches, maintaining the privacy of individuals, and integrating the technology with existing law enforcement databases.

Immediate Action: Transportation and Criminalist Capacity Building

Transportation Evidence: Current Process

As previously discussed, forensic evidence is either picked up by or delivered to TBI. Currently, for homicide and sex crimes cases a criminalist delivers evidence to TBI or drops it off to the local field office. The criminalist currently uses an older small city vehicle to transport evidence from Memphis to Jackson's TBI Forensic Crime Lab. The criminalist is charged with signing out evidence and signing in evidence once on site at TBI, which is a lengthy process. Evidence may include sexual assault kits (SAKs), blood samples, firearm evidence, drugs, etc. Security or current procedures that decrease any potential liability concerns in this type of transportation are needed, such concerns are related to safety of the driver and the evidence during transport and loading and unloading. The criminalist who transports this evidence is trained on the proper handling of evidence and works as a liaison between TBI and MPD on proper procedures in processing the evidence. This is important as the criminalist can work as a connection between the lab and investigators to ensure proper evidence collection and processing. Criminalists are best placed to transport evidence from property and evidence to needed locations.

Transporting evidence to a crime lab is a critical process that demands meticulous attention to detail to ensure the integrity and chain of custody of the evidence. Proper packaging is essential and is currently done by MPD's CSI unit. The process includes selecting the right containers for the type of evidence being transported which is crucial. For instance, paper bags, plastic bags, boxes, or evidence envelopes are commonly used, but plastic should be avoided for biological samples to prevent degradation. Each container must be sealed with tamper-evident tape and initialed by the person sealing it. Clear labeling is also vital, including the case number, item number, description, date, and the name of the officer handling the evidence, along with any necessary biohazard or warning labels.

Maintaining the chain of custody is another fundamental aspect of evidence handling. Each piece of evidence requires a completed chain of custody form, documenting every individual who has handled it from collection to transport. Utilizing evidence tracking software or logs can help monitor the location and status of the evidence at all times, further ensuring its security.

Transportation Vehicle

The transportation process itself must be secure. Using dedicated evidence transport vehicles minimizes the risk of contamination or tampering. These vehicles should be clean, secure, and equipped with lockable containers or evidence lockers to prevent unauthorized access. For biological evidence or other temperature-sensitive materials, coolers or refrigerated containers may be necessary to maintain appropriate temperatures during transport. To minimize handling, it's best to limit the number of times evidence is transferred. Ideally, the same individual or team should manage the evidence from collection to delivery. Training personnel

involved in the transport process in proper evidence handling and chain of custody procedures is crucial to maintaining the integrity of the evidence.

Upon delivery to the crime lab, the evidence should be inspected and verified by both the delivering officer and the receiving lab personnel. Any observations or issues noted during transport, such as changes in the condition of the evidence or incidents that occurred, should be meticulously documented. Compliance with all relevant laws, regulations, and agency policies is essential, as is maintaining confidentiality to protect sensitive information related to the evidence. These best practices ensure that evidence is transported securely, preserving its integrity and admissibility in court. Proper packaging, secure handling, thorough documentation, and trained personnel are key components in the effective transport of evidence to a crime lab.

Police vehicles can also be adapted for evidence transport by outfitting them with secure evidence lockers or lockboxes. These vehicles provide the advantage of rapid transport from crime scenes to the lab while ensuring that evidence is securely stored during the journey. Specialized SUVs offer versatility, combining space, security, and mobility, making them suitable for various terrains and urban environments. These vehicles can also be equipped with secure compartments and climate control if needed. Communication and tracking systems are also essential. GPS tracking allows for real-time monitoring of the vehicle's location, ensuring the security of the evidence during transport. Reliable communication systems enable continuous contact with the crime lab and dispatch, further securing the transport process.

Mobile crime scene units are another option, particularly useful for on-site processing of evidence. These units are equipped with the necessary tools and storage to collect and transport evidence directly to the lab, containing a range of forensic tools and secure storage areas for

immediate evidence handling and transportation. Currently, MPD utilized the CSI transportation vehicle locally only.

Safety and compliance are paramount. Personnel must be trained in safety protocols specific to the transport vehicle, including how to handle accidents or emergencies. Additionally, the vehicle and transport process must comply with all relevant laws, regulations, and agency policies.

Evidence Transport Vehicle Costs

The cost of a vehicle specifically equipped for transporting evidence can vary widely based on the type of vehicle, the extent of customization, and the specific features required. Dedicated evidence transport vans, such as a Ford Transit or Mercedes-Benz Sprinter, typically range from $35,000 to $50,000 for the base vehicle. Customizations, such as secure storage compartments, climate control systems, and alarm systems, can add an additional $20,000 to $40,000 or more, bringing the total estimated cost to between $55,000 and $90,000 or higher.

For police vehicles equipped with evidence lockers, the base cost of standard models like the Ford Police Interceptor Utility ranges from $30,000 to $50,000. Adding secure evidence lockers or lockboxes and additional security features can increase the cost by $5,000 to $15,000, resulting in a total estimated cost of $35,000 to $65,000 or more.

Specialized SUVs, such as the Chevrolet Tahoe or Dodge Durango, typically range from $40,000 to $60,000. Customizations, including secure compartments and climate control, can add an additional $10,000 to $20,000, bringing the total estimated cost to between $50,000 and $80,000 or more. Mobile crime scene units, which are larger vehicles like customized box trucks or specialized mobile units, have a base cost ranging from $60,000 to $100,000. Outfitting these

vehicles with forensic tools, secure storage, climate control, and other features can add $40,000 to $100,000 or more, leading to a total estimated cost of $100,000 to $200,000 or higher. The CSI unit currently has these types of vehicles, however it is unclear if these vehicles can or should be used for the transportation of evidence to TBI.

In addition, to the initial purchase and customization costs, agencies must consider ongoing expenses such as maintenance and upkeep, insurance, and training. Regular maintenance and any repairs to the vehicle or its specialized equipment will add to the ongoing costs. Insurance for a specialized vehicle may be higher than for standard vehicles due to the value of the modifications and the sensitive nature of the cargo. Training personnel to properly use and maintain the vehicle and its equipment is also an important consideration.

The total cost for a vehicle to transport evidence depends heavily on the vehicle chosen and the extent of the customizations required to meet specific needs. Agencies should budget not only for the initial purchase and customization but also for ongoing maintenance, insurance, and training to ensure the vehicle remains secure and functional for evidence transport.

Criminalist Capacity Building

Criminalists embedded within police units would work closely with detectives and officers to assess the evidentiary value of items collected at crime scenes. Their expertise would help prioritize submissions that are most likely to impact case outcomes, reducing the submission of unnecessary evidence and focusing on items that could strengthen prosecutions. These criminalists would also be responsible for transporting evidence, ensuring that it reaches the appropriate crime lab or field office efficiently and securely. This includes handling the evidence from the moment it leaves the scene until it is signed over at the destination, maintaining the chain of custody throughout.

Acting as liaisons between investigators and crime labs, criminalists would facilitate communication to ensure evidence is processed according to protocol, reducing delays and errors. This role enhances collaboration, ensuring that the labs are aware of case priorities and that investigators understand lab capabilities and constraints. Criminalists would adhere to stringent security protocols during evidence transport, including using department vehicles equipped with secure storage, implementing safety measures to protect both the evidence and them, and following guidelines for loading, unloading, and transferring evidence.

Criminalists should possess at least a bachelor's degree in forensic science, biology, chemistry, criminal justice, or a related field. Advanced certifications in forensic analysis, crime scene investigation, or evidence management are highly desirable. Criminalists embedded within police units must undergo specialized training to ensure their effectiveness and adherence to best practices in evidence management. This training includes comprehensive instruction on evidence handling and maintaining the chain of custody, a critical component to preserving the integrity of evidence from the crime scene to the courtroom.

They will also be trained in proper packaging and labeling techniques, emphasizing the importance of using appropriate containers and clear labeling to prevent contamination or misidentification of evidence. Safety protocols are another crucial aspect of their training, equipping criminalists with the knowledge to safely transport evidence, including hazardous materials, while minimizing risks to themselves and others. Potential certifications may include Certification as Certified Evidence Specialist (CES) and Certified Crime Scene Analyst (CCSA).

Communication and liaison skills are essential, enabling criminalists to bridge the gap between investigators and forensic lab personnel, ensuring that evidence is processed efficiently

and according to priority. Additionally, training covers the legal and ethical considerations in evidence management, emphasizing the importance of adhering to the law and ethical standards to uphold the integrity of the investigative and judicial processes.

The salary for criminalists embedded within police units will vary depending on experience, education, and specific responsibilities. Typically, the salary range would be between $55,000 and $75,000 annually, with potential for additional benefits such as hazard pay, overtime, and professional development allowances. Salary adjustments may also consider the complexity of the cases handled and the level of responsibility assumed in coordinating evidence transport and prioritization. In interviews it was suggested that an additional 3-4 total criminalists could be assigned to units, which investigate crimes with a high volume of forensic evidence.

Impact on Evidence Management

Embedding criminalists within MPD units would not only optimize evidence prioritization but also significantly improve the speed and accuracy of forensic processing. This model ensures that the most critical evidence reaches the lab promptly, enhancing the overall effectiveness of investigations and potentially increasing successful case resolutions. Furthermore, dedicated personnel for evidence transport reduce the burden on investigators, allowing them to focus more on case development and less on logistics.

Immediate Action: Dedicated Memphis Crime Lab Staff Embedded at TBI

Leveraging Current Partnerships

The presence of an MOU allows the newly added staff to prioritize cases from the specified jurisdiction. Dedicated resources can be allocated more effectively, leading to faster processing and testing times. The MOU provides a clear framework for responsibilities and

priorities, enabling the crime lab to allocate resources more efficiently and minimize delays when handling evidence from the jurisdiction. This agreement helps streamline workflows and enhances overall lab efficiency.

The MOU also enables the crime lab to focus more effectively on the jurisdiction's specific needs. New staff can be trained to concentrate on the types of crimes and evidence most prevalent in that jurisdiction, allowing for more efficient and targeted analysis. Moreover, the MOU may facilitate faster communication between the lab and the jurisdiction, allowing for prompt responses to queries and quicker case resolutions.

Enhanced collaboration is another key benefit of this arrangement. The MOU sets clear expectations and guidelines, which can help improve coordination between the crime lab and the jurisdiction's law enforcement agencies. This clarity can result in more efficient workflows and reduced testing times. Regular updates and feedback, as stipulated in the MOU, allow the lab to adjust resources and priorities based on the jurisdiction's needs, further optimizing testing times.

Dedicating crime lab staff within a state crime lab to focus solely on one jurisdiction presents a blend of potential benefits and drawbacks that need careful consideration. Having staff dedicated to a single jurisdiction can result in faster turnaround times for case processing. When personnel are focused on a particular area, cases from that jurisdiction often receive priority, reducing delays in both investigations and judicial proceedings. This approach also streamlines workflow by allowing staff to become familiar with the common types of cases and evidence originating from their designated jurisdiction, ultimately enhancing efficiency.

Furthermore, local expertise is significantly enhanced when staff members are focused on one jurisdiction. They develop a deep knowledge of local crime patterns, common evidence

types, and the specific investigative needs of their area, which can lead to more accurate and effective forensic analysis. This tailored support allows the staff to offer more relevant and timely assistance to law enforcement, directly addressing the unique challenges faced by their jurisdiction. One potential option for this strategy is hiring a firearm examiner at TBI to work on solely MPD/Shelby County cases.

Improved communication and collaboration are also key advantages. When crime lab staff are dedicated to one area, they can build closer, more consistent relationships with local law enforcement agencies, fostering a smoother exchange of information and collaborative problem-solving on cases. This proximity allows for a quicker feedback loop, where any issues or clarifications required during the forensic process are promptly addressed, accelerating case resolution. A team devoted to a single jurisdiction is often more accountable for its performance, potentially driving higher standards of work. Resources can also be allocated more effectively, ensuring that the most pertinent tools, training, and technologies are available to meet the specific needs of the jurisdiction.

In the short term, the addition of new staff can lead to a significant increase in the lab's capacity. With more personnel available, the lab can handle a greater volume of cases, reducing any existing backlog and improving turnaround times for processing evidence. This immediate boost in capacity allows for more efficient management of current cases, thereby enhancing overall laboratory performance.

Moreover, the period before the new lab opens offers a valuable training opportunity for the new staff. By working in the existing lab, these individuals can gain hands-on experience, become familiar with the lab’s procedures, equipment, and best practices, and develop the skills

needed to maintain or even improve testing times. This ensures that when they eventually transition to the new lab, they will be well-prepared and fully operational, minimizing any potential disruptions during the move.

Focused expertise is another short-term benefit. Staff can receive specialized training tailored to the types of cases commonly encountered in high-crime areas, allowing them to develop the specific skills and knowledge needed for their future roles. This targeted preparation enhances their effectiveness both now and in their eventual work at the new lab, making them more valuable assets to the forensic process.

There are some challenges with this option. Staff dedicated to a single jurisdiction may lack the flexibility to respond to changing needs across the state, particularly during crises or when other areas experience surges in crime. Additionally, in situations where crimes span multiple jurisdictions, having staff assigned to just one area might hinder coordination and slow down the forensic process. This could lead to higher operational costs. Supporting dedicated staff for one jurisdiction within a state lab may require additional funding for personnel, equipment, and specialized training, which could escalate operational expenses. If additional jurisdictions demand dedicated teams, there is a risk of duplicating efforts and resources, which might be more effectively managed through a centralized or more flexible model.

If a local lab is developed and analysts are moved from TBI to Memphis/Shelby County resource balance would need to be immediate. The transition period itself may also pose difficulties. Moving staff to open a new lab could cause temporary disruptions in both locations. Effective planning and phased implementation are critical to minimize any negative impacts on testing times and to ensure continuity of service.

Cost and logistics represent further considerations. Training new staff and preparing them for the opening of a new lab involves significant costs but is balanced by anticipated long-term benefits. Additionally, managing the logistics of moving staff and possibly recruiting new members to fill any gaps in the new lab requires careful oversight to avoid operational inefficiencies.

Looking to the long term, the addition of staff has the potential to bring about sustained improvements in testing times, provided the transition is managed effectively. Once the new lab becomes operational, it can help alleviate some of the workload from the original lab, leading to more balanced and efficient forensic services across jurisdictions. Furthermore, the establishment of a new lab in a high-crime area can enhance local crime-fighting capabilities by offering localized forensic services, reducing the time and complexity involved in processing evidence from that jurisdiction. Sustained funding is also crucial to support the additional staff and uphold the prioritization outlined in the MOU. The lab must secure adequate and continuous funding to ensure that the benefits promised by the MOU are realized and maintained over time.

The scope and flexibility of the MOU is also significant. The effectiveness of the added staff in improving testing times will depend largely on how well the MOU is structured. The agreement should be flexible enough to accommodate changes in crime rates or shifts in the types of cases coming from the jurisdiction, allowing for adjustments as necessary.

Current Examples of this Practice Nationwide

State crime labs are increasingly dedicating staff to specific jurisdictions to manage high caseloads, improve the efficiency and accuracy of forensic services, reduce backlogs, speed up investigations, and enhance the quality of forensic analysis. This approach is particularly common in areas with high crime rates or significant demands on forensic resources. Several

states have adopted this strategy, tailoring their efforts to the unique needs of their high-need jurisdictions.

The Maryland State Police Forensic Sciences Division (MSPFSD) operates as the primary forensic service provider in Maryland, supporting law enforcement agencies statewide with several regional laboratories specializing in various forensic disciplines, such as DNA analysis, drug chemistry, firearms examination, and latent prints. In response to the high crime rate in Baltimore, Maryland's largest city, the MSPFSD has strategically allocated resources and personnel to prioritize cases from Baltimore, where the demand for forensic services is particularly high. To address this demand, the division dedicates specific staff members to expedite cases from the city, supporting law enforcement with timely evidence analysis. Additionally, Maryland's crime labs have embraced technology and automation to increase efficiency, and they collaborate with local and federal agencies to ensure that critical cases receive the necessary attention.

The Virginia Department of Forensic Science (VDFS) operates four regional laboratories in Richmond, Norfolk, Roanoke, and Manassas, providing comprehensive forensic services across the state. In high-crime areas like parts of Richmond and Northern Virginia, the VDFS has adapted its operations to ensure these regions receive adequate resources. This may involve dedicating specific teams or staff to manage the workload more effectively and implementing specialized case management strategies to expedite evidence processing in violent or serious crime cases. Efforts to reduce forensic backlogs, particularly in DNA analysis, have been a priority in Virginia. The state has focused on hiring additional staff, streamlining processes, and using technology to increase throughput. The VDFS works closely with local law enforcement to provide targeted support and ensure prompt responses to their needs.

Other state crime labs across the U.S. have implemented similar strategies to address the unique demands of high-crime areas:

- **Illinois:** The Illinois State Police (ISP) Forensic Services Command maintains regional laboratories across the state, with a significant focus on Chicago due to its high crime rate. The Chicago Forensic Laboratory frequently dedicates teams to handle cases from the city to ensure timely processing. To address backlogs, the state has reallocated resources and hired additional staff to focus on this high-demand area.
- **California:** The California Department of Justice (Cal DOJ) Bureau of Forensic Services divides its crime labs into regional centers, with labs in Los Angeles and San Francisco managing substantial caseloads. Specific teams or staff are dedicated to handling cases from these major metropolitan areas, supporting local law enforcement with timely forensic analysis.
- **Florida:** The Florida Department of Law Enforcement (FDLE) Crime Laboratory serves various regions, with Miami and Tampa being key high-crime areas. The FDLE has allocated specific resources and personnel to focus on these regions, including dedicated teams for DNA analysis, firearms, and drug chemistry, to manage the heavy forensic workload.
- **New York:** The New York State Police Forensic Investigation Center (FIC) provides forensic services to the entire state, with particular attention to New York City and its surrounding regions. Given the large number of cases generated by these areas, the FIC dedicates staff or units to ensure efficient processing and support for local law enforcement.
- **Michigan:** The Michigan State Police Forensic Science Division operates several regional forensic laboratories, with a significant focus on Detroit due to its high crime rate. The Detroit lab often has staff dedicated to processing evidence from the city, providing timely and accurate forensic support to local law enforcement.
- **Texas:** The Texas Department of Public Safety (DPS) Crime Laboratory Service operates labs across the state, with specific labs in Houston and Dallas focusing on the high volume of cases from these metropolitan areas. Dedicated staff and resources are allocated to manage workloads effectively, particularly in DNA analysis, toxicology, and firearms examination.

Conclusion

In Summary

MPD currently manages various units focused on different forensic disciplines, such as latent prints, crime scene investigations, digital forensics, and parts of ballistics analysis. However, the existing structure of these services is often under-resourced and fragmented, resulting in challenges in handling a growing volume of cases. The inefficiencies in these processes lead to delays in evidence processing, contributing to case backlogs and potentially hindering criminal investigations.

While TBI assists with various types of forensic analysis for local agencies, its resources are also stretched due to the high demand regionally. The current model has limitations in terms of workflow efficiency, security of evidence, and the timeliness of analysis results. A centralized crime lab for Memphis/Shelby County could potentially address these challenges by integrating forensic services under one roof, reducing dependence on external resources, and streamlining processes.

Lab Structure, Accreditation, and Validation

Designing a new crime lab requires careful consideration of its structure and operations to meet national accreditation standards. Throughout our study, the importance of adhering to accreditation criteria was emphasized. Accreditation, provided by entities such as the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB), ensures that the lab meets specific standards of quality, reliability, and security. Achieving and maintaining accreditation is not only a marker of professional competence but also critical for upholding the integrity of forensic evidence used in the judicial process.

A significant of ensure accurate results is validating laboratory methods and equipment to ensure the accuracy and reliability of forensic analyses. In the context of Memphis/Shelby County, establishing a lab would necessitate the acquisition of modern equipment, which requires validation before use. The process of validation is both time-consuming and resource-intensive, involving meticulous testing and documentation to demonstrate that the equipment performs correctly and consistently under expected conditions. Proper validation processes are essential to gaining and maintaining accreditation, which, in turn, provides credibility to the lab's findings in court proceedings. In short, Memphis/Shelby County would likely be budgeting a forensic crime lab for potentially a year or two, while still training and validating equipment.

The structural design of the lab must also accommodate specific forensic disciplines, including DNA analysis, toxicology, firearm toolmark analysis, and digital forensics. Each of these disciplines has unique spatial, security, and equipment requirements. For example, DNA analysis demands contamination-free environments with strict protocols for evidence handling and storage. Digital forensics require secure servers and controlled access to safeguard sensitive digital evidence. Proper planning of these spaces is crucial to ensure operational efficiency, safety, and compliance with forensic standards.

Potential Actions for Process Improvement

The study identified several immediate actions and recommendations to enhance the forensic processes in Memphis/Shelby County, even before the establishment of a new facility. During the discussion of current processes there were gaps that were pointed out that need review. A significant concern highlighted was the need to improve communication between agencies. This could be achieved by introducing a liaison role that a criminalist team could

fulfill. Such a role would facilitate better information sharing and coordination between different entities, streamlining processes and reducing isolation of case knowledge and responsibilities.

Another area for improvement involves the handling and transportation of evidence. With slight modifications, these processes could become more efficient, having a considerable impact on the overall system. Additionally, the introduction of a RapidDNA machine during the booking process would allow for the quick identification of violent histories, provided that the necessary databases are accessible. This would speed up identification and aid law enforcement in making timely decisions.

To address staffing and training needs, the study also recommends developing agreements with current forensic labs and universities. These agreements would not only help with training purposes but also establish a potential workforce for a future lab, reducing turnaround times and improving overall efficiency.

Considerations for Future Lab Development

The construction of a new crime lab represents a long-term solution that would significantly improve forensic services in Memphis/Shelby County. However, the study underscored that building such a facility is not merely about creating physical space but involves careful planning of workflows, integration of digital infrastructure, and alignment with forensic best practices. The proposed lab must be designed to adapt to evolving technologies and methods in forensic science, ensuring that it remains functional and compliant with accreditation standards over time.

The prospective crime lab would need to include dedicated units for DNA analysis, toxicology, digital forensics, and other specialized services. Forensic science is an ever-evolving

field, and the facility must incorporate flexible spaces that can be adapted to changes in technology and practices. For example, digital forensics is increasingly playing a pivotal role in investigations, requiring secure digital storage, data analysis capabilities, and facilities for handling electronic evidence. Proper allocation of space, including secure evidence storage areas, contamination-controlled environments for DNA analysis, and climate-controlled storage for toxicology, is necessary to create an effective and future-proof crime lab.

Balancing Costs and Long-Term Benefits

While the establishment of a centralized crime lab requires significant investment, it also offers potential long-term benefits in terms of enhanced forensic capabilities, the potential for improved case processing times, and reduced outsourcing costs. Previous discussions indicated that while purchasing and equipping new facilities can be expensive, these investments can lead to greater self-sufficiency and operational efficiency over time. The cost of new equipment, training for forensic analysts, and annual operational expenses must be weighed against the benefits of quicker, more accurate forensic analyses and the potential to clear case backlogs more efficiently.

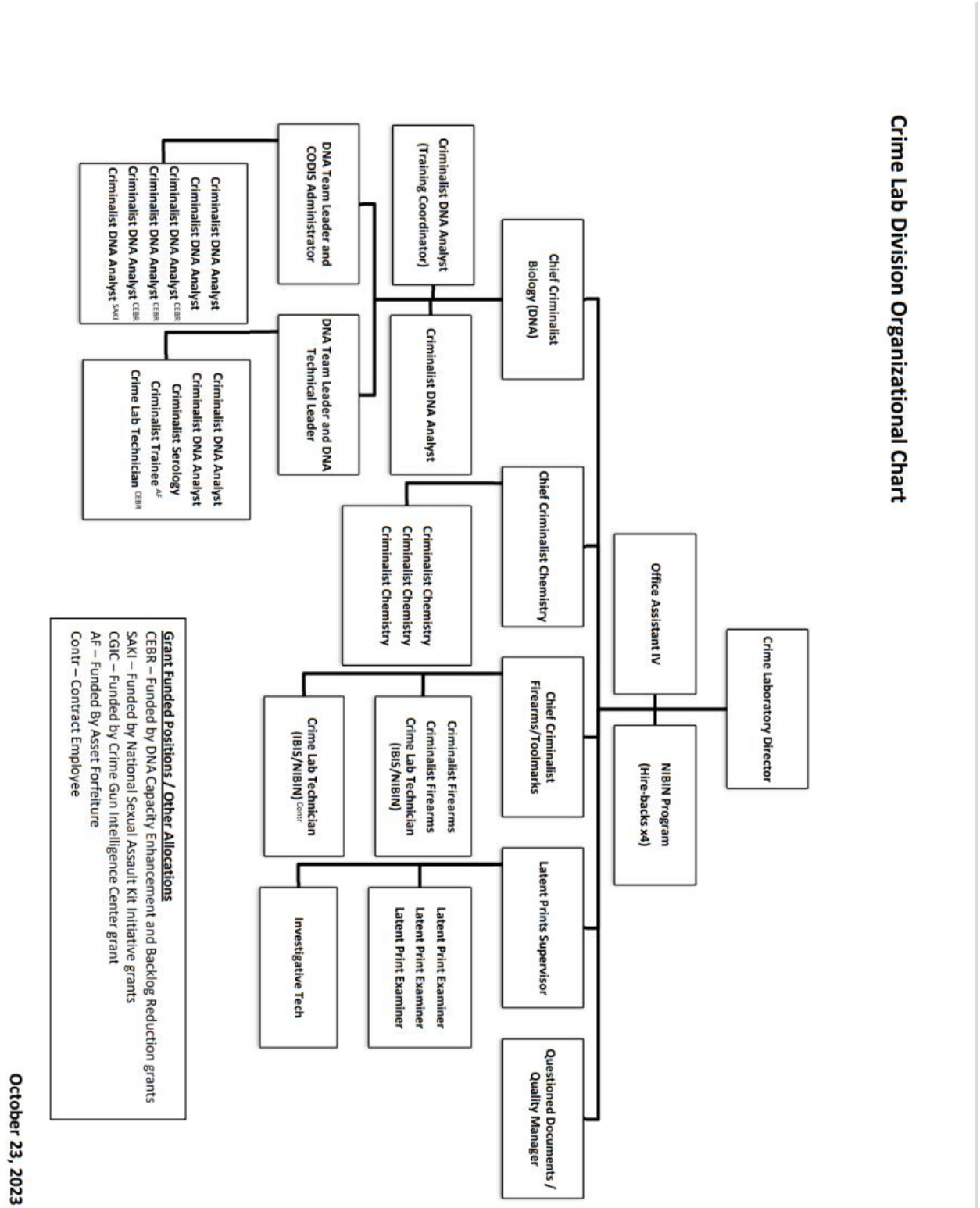
A phased approach could be beneficial, starting with immediate actions, suggested here or by other stakeholder or experts in the community, to improve current operations while planning for a larger, more integrated facility. Building the lab with the foresight to accommodate future expansions and technological advances would be a prudent strategy. This phased approach allows for immediate gains in efficiency and sets a solid foundation for a fully functional crime lab that serves the needs of Memphis/Shelby County in the long term.

The establishment of a centralized crime lab in Memphis/Shelby County has the potential to address current inefficiencies, improve forensic processing times, and support more effective

law enforcement investigations. This study has explored the multifaceted requirements of such a project, including the integration of current processes, space planning, accreditation, equipment validation, and immediate actions to enhance existing operations. The insights gained from examining other crime labs underscore the importance of thoughtful planning, robust digital infrastructure, and adherence to best practices in forensic science.

The long-term benefits of an efficient, centralized forensic operation could greatly enhance the city and county's ability to process evidence, reduce case backlogs, and support justice, but also introduce liability concerns and a new budget item with the expectation of continued growth. This feasibility study lays the groundwork for future discussions and planning, providing an objective assessment of what it would take to make a new crime lab in Memphis/Shelby County a reality. The next steps involve addressing immediate gaps, providing detailed cost-benefit analysis based on the potential structure of the crime lab, securing local funding, and engaging stakeholders in the planning process.

Appendix A: Charolette-Mecklenburg Crime Lab Division Organizational Chart



Appendix B: Charolette-Mecklenburg Forensic Biology Budget

Crime Lab – Equipment

Equipment	Estimated Cost (each)	Notes
Genetic Analyzer AB 3500 - Life Technologies	$ 120,000.00	Genetic analyzer
7500 PCR Quant System - Life Technologies	$ 60,000.00	Quantitation instrument
Veriti - Life Technologies	$ 15,000.00	Amplification instrument
QIAgen - QIAgility System	$ 60,000.00	Optional - for automated DNA testing processes (Quant/Amp setup)
QIAgen - EZ1 Advanced XL	$ 65,000.00	Optional - for automated DNA extraction process
QIAgen - EZ2 Connect Fx	$ 76,000.00	Optional - for automated DNA extraction process
QIAgen - QIAcube	$ 35,000.00	Optional - for automated DNA testing processes
QuantStudio	$ 66,700.00	Quantitation instrument
Automate Express - Life Technologies	$ 50,000.00	Optional - for automated DNA extraction processes
Genemapper IDX Site License/server	$ 15,000.00	DNA interpretation software - site license
Genemapper IDX User License	$ 8,000.00	Copy of software for each user - DNA interpretation software
Armed Xpert software user license	$ 9,500.00	Copy of software for each user - DNA mixture interpretation software
STRmix Probabilistic Genotyping Software - NicheVision	$ 10,000.00	Copy of software for each user - DNA Probabilistic Genotyping software
CODIS Server	$ 11,000.00	Optional - for qualifying LDIS labs
Laboratory Freezer - standalone	$ 10,000.00	Storage of DNA extracts/work product
Laboratory Refrigerator	$ 8,000.00	Storage of chemicals and reagents
Stereoscope (microscope)	$ 10,000.00	Serology
Maxwell 16 extraction system	$ 20,000.00	Extraction system for buccals/known samples
Centrifuge	$ 6,000.00	extraction preparation
Balance	$ 1,200.00	reagent preparation
Pipettes (x8) @ $250 each	$ 2,000.00	Pipettes of varying size for extractions
Autoclave	$ 2,000.00	Sterilizer
Thernal mixer	$ 2,500.00	used in extraction process

Biological Safety cabinet (hood) - extraction area	$ 10,000.00	Safety hood for extraction area of lab
Biological Safety cabinet (hood) - post amp area	$ 10,000.00	Safety hood for post amp area of lab
Vortexer	$ 1,000.00	used in extraction process
Estimated large equipment costs	**$ 683,900.00**	

Equipment - Annual Service and Maintenance	**Estimated Cost (annually)**	**Notes**
Genetic Analyzer AB 3500	$ 13,600.00	Annual service and maintenance contract
7500 PCR Quant System	$ 9,000.00	Annual service and maintenance contract
Veriti Thermocycler	$ 1,200.00	Annual service and maintenance contract
QIAgility System	$ 6,300.00	Annual service and maintenance contract
QIAgen EZ1 Advanced XL	$ 5,400.00	Annual service and maintenance contract
QIAgen EZ2 Connect Fx	$ 6,500.00	Annual service and maintenance contract
QIAcube System	$ 4,300.00	Annual service and maintenance contract
Automate Express	$ 8,400.00	Annual service and maintenance contract
Pipette calibration	$ 900.00	Annual calibration fees
Genemapper IDX Annual Maintenance Fees	$ 500.00	Annual Software Maintenance & Upgrade Fees (for each license)
Armed Xpert software Annual Maintenance Fees	$ 1,000.00	Annual Software Maintenance & Upgrade Fees (for each license)
STRmix Probabilistic Genotyping Software Annual Fees	$ 3,850.00	Annual Software Maintenance & Upgrade Fees (for each license)
Estimated Annual Service and Maintenance (equipment)	**$ 60,950.00**	

Test kits, Chemicals and Lab Supplies

Supplies	**Estimated Cost (annually)**	**Notes**
QuantFiler Trio kit	$ 8,400.00	$2,100 per kit - 400 reactions per kit (based on 4 kits)
GlobalFiler kit	$ 38,400.00	$4,800 per kit - 200 reactions per kit (based on 8 kits)
PrepFiler Express kit	$ 9,200.00	$575 per kit - 50 reactions per kit (based on 16 kits)
3500 capillary array	$ 6,400.00	$1,600 each - 500 injections per array (based on 4 arrays)

Qiagen Investigator kit - QIAgility	$ 2,400.00	$300 per kit - 50 reactions per kit (based on 8 kits)
EZ1 Investigator kit - QIAgen EZ1	$ 4,600.00	$575 per kit - 48 reactions per kit (based on 8 kits)
Various other chemicals (annual costs)	$ 30,000.00	DNA buffer, POP-4, LIZ, DNA Away, etc.
Various other non-chemical supplies (annual costs)	$ 20,000.00	gloves, scalpels, pipette tips, swabs, wipes, etc.
Estimated Annual Chemicals and Lab Supplies	**$ 119,400.00**	

Crime Lab - Personnel*

* Salaries reflect midpoint of range based on City of Charlotte compensation survey in 2021

Personnel - minimum of 2 DNA analyst required	**Estimated Cost (annually)**	**Notes**
DNA Analyst - salary	$ 92,000.00	Annual salary - midpoint of salary range for Criminalist DNA Analyst, City of Charlotte 2024
DNA Analyst - benefits	$ 27,000.00	Benefits (FICA - 7.65%, insurance - $7,800, retirement - 10.15%, 401k - 3%)
DNA Analyst - salary	$ 92,000.00	Annual salary
DNA Analyst - benefits	$ 27,000.00	Benefits (FICA - 7.65%, insurance - $7,800, retirement - 10.15%, 401k - 3%)
Estimated Personnel Costs	**$ 238,000.00**	

Personnel (Optional)

Optional Supervisory and Support Positions	**Estimated Cost (annually)**	**Notes**
Chief Criminalist Biology/DNA (Section Supervisor) - salary	$ 123,300.00	Annual salary
Chief Criminalist Biology/DNA - benefits	$ 33,500.00	Benefits (FICA - 7.65%, insurance - $7,800, retirement - 10.15%, 401k - 3%)
DNA Team Leader (1st line supervisor) - salary	$ 111,900.00	Annual salary
DNA Team Leader - benefits	$ 31,100.00	Benefits (FICA - 7.65%, insurance - $7,800, retirement - 10.15%, 401k - 3%)
Crime Lab Technician - salary	$ 56,000.00	Annual salary
Crime Lab Technician - benefits	$ 19,500.00	Benefits (FICA - 7.65%, insurance - $7,800, retirement - 10.15%, 401k - 3%)
Estimated Personnel Costs (optional)	**$ 375,300.00**	

Personnel Training

Training/Travel	**Estimated Cost (annually)**	**Notes**
DNA Analyst annual training/travel (per analyst)	$ 2,000.00	FBI QAS requires minimum of 8 hours per year of continued education specific to DNA

$ 2,000.00

Accreditation/Certification

Training/Travel	Estimated Cost (annually)	Notes
Individual Certification Fees	$ 500.00	Personal certification fees depend on the discipline and certifying organization (IAI, AFTE, ABC, etc). Costs include annual fees and associated tests and proficiencies required to maintain certifications.
Accreditation Fees (per analyst)	$ 500.00	Accreditation fees determined by number of analysts, fees are specific to accrediting organization. Does not include annual assessment fees.
Annual Laboratory Accreditation Assessment Fees	$ 2,000.00	Annual Accreditation Assessment fees vary based on size of lab, number of accredited lab services and type of assessment. Annual assessment fees will range from approximately $2000 per year for smaller lab assessments to $10,000 for the on-site re-accreditation assessment (every 4 years). The FBI QAS audit may be charged separately for DNA assessments.
Annual QAS Assessment Fees - FBI's Quality Assurance Standards (QAS) for DNA Testing Laboratories	$ 6,000.00	Annual Assessment fees vary based on size of lab. Annual assessment fees for an external assessment team will range from approximately $4000 per year to $10,000 for the on-site assessment. Assessment by an external group is require at a minimum of every other year.

$ 9,000.00

Appendix C: DUI and Special Traffic Identification Squad (STIS) Forensic Services

DUI and STIS Forensic Services			
DUI Tox Reports	Total	Sourced	Turn-around Time
2023	64	Outsourced *	4-12 months
2022	115	Outsourced *	6-12 months
DUI Blood Draws	Total	Sourced	Turn-around Time
2023	64	Outsourced	4-12 months
2022	115	Outsourced	6-12 months
STIS Tox Reports	Total	Sourced	Turn-around Time
2023	247	Outsourced *	4-12 months
2022	233	Outsourced *	6-12 months
STIS Blood Warrants	Total	Sourced	Turn-around Time
2023	64	Outsourced *	4-12 months
2022	51	Outsourced *	6-12 months
STIS DNA Profiles	Total	Sourced	Turn-around Time
2023	43	Outsourced *	4-12 months
2022	39	Outsourced *	6-12 months
STIS CDR Downloads	Total	Sourced	Turn-around Time
2023	345	In-house	1 week
2022	315	In-house	1 week
RTC360 Scans	Total	Sourced	Turn-around Time
2023	223	In-house	1 week
2022	213	In-house	1 week

* All outsourced items listed were to TBI.
All blood draws were outsourced to Nurse Clinician Services. The cost per contract varied and would need to be obtained from Finance.