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**Department of Forensic Biology**

**Administrative and Quality Assurance Manual**

**Version 2.0**

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I. Historical

Effective this date, this Quality Assurance manual supersedes all previous QA manuals used in the Department of Forensic Biology.

QA Committee Members:

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## II. Introduction

The Department of Forensic Biology Quality Assurance Manual is designed to provide a program through which all laboratory operations are scrutinized in an effort to provide a reliable laboratory result. The following definitions apply.

### A. Quality Control

Those procedures used to maintain acceptable limits of variation for products and services. More specifically, these are the internal activities or activities according to externally established standards used to monitor the quality of analytical data and to ensure that it satisfies specified criteria.

### B. Quality Assurance

Quality assurance pertains to those procedures used to insure that quality control parameters are appropriate and sufficient measures of variation. These are the planned and systematic actions necessary to provide sufficient confidence that a laboratory's product or service will satisfy given requirements for quality.

### C. An Example

Measuring and recording the pH of a solution is a common quality control to insure that the variation between lots of solutions is maintained within a specified range. But this parameter is a meaningful measure of quality only if the pH meter has been calibrated, the technician making the measurement knows how to operate the pH meter, the water is sufficiently pure, and the technician has added the proper reagents. Quality assurance insures that quality control measures are meaningful measures of variation.

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### III. Planning and Organization

#### A. Goals and Mission

It is the goal of the Department of Forensic Biology to provide users of its laboratory services access to scientific analyses that compare biological evidentiary specimens with known exemplar biological specimens and to insure the quality, integrity, and accuracy of the department's analyses through the implementation of a detailed quality assurance (QA) program.

The Department develops information through the identification and individualization of physiological fluids such as blood, semen and saliva obtained from investigating agencies. Among other benefits, this information can aid in the investigation of a crime or suspected crime, help tie a victim to a crime scene, connect a suspect to a crime, or eliminate a suspect.

The scientific analyses include but are not limited to the following:

1. Sample identification
2. Species identification
3. Genetic marker analysis
4. Report Preparation
5. Testimony to results
6. Crime scene investigation

#### B. QA Objectives

1. Monitor, on a routine basis, the analytical testing procedures for all scientific testing performed in the laboratory by means of Quality Control (QC) standards, proficiency tests, and audits.
2. Verify that all scientific analyses operate within the established performance criteria and that the quality and validity of the analytical data is maintained.
3. Performance criteria are established in Department's QC Manual and Laboratory Methods Manuals for each of the routine scientific procedures performed in the laboratory.
4. The quality and validity of the data is ensured by the quality control (QC) program for both critical



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reagents prepared in the laboratory and those obtained commercially. The reliability of the critical instruments employed in the laboratory's routine testing is guaranteed by the quality assurance (QA) program for instrument use as delineated in the DNA QC Manual.

5. The qualifications of the laboratory staff are ensured by the position requirements of the Department of Personnel of the City of New York and by the proficiency testing program that is an integral part of the overall QA program of the Department of Forensic Biology.
6. The records for in-house reagent manufacture are maintained as are the QC documentation of their acceptability. Outside vendor QC documents (specification sheets, etc.) are retained.
7. The QA program insures that problems are noted and that corrective action is taken and documented. Each problem is recorded in an appropriate log book and the corrective action is noted, dated and signed by the appropriate laboratory supervisor or an appropriate QA committee member.

#### **C. Authority and Accountability for the QA Program**

The organizational structure (Figure 1, see Appendix A.) defines the relationships in the Department of Forensic Biology between individuals and the operational units of the department.

Within the department, a QA/QC committee sets QA/QC policy and is responsible for production and revisions of the QA Manual. A QA Coordinator is appointed by the Department director. The QA committee is comprised of the following members.

1. The chairman of the committee, with overall responsibility for the QA program, is the director of the Department of Forensic Biology.
2. The Assistant Director is the co-chairman and assumes responsibility in the absence of the Director.
3. The Forensic Scientist(s) assigned to both the Forensic Biochemistry and Hematology (FBH) and Forensic Molecular Biology (FMB) laboratory

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subunits, the QA coordinator, and analysts responsible for the preparation of critical reagents are also members of the committee.

Each Forensic Analyst is responsible to ensure that the QA/QC program guidelines, as they relate to their work and responsibilities, are adhered to.

#### D. OCME and Department of Forensic Biology Organizational Structure

The OCME is organized (Figure 2., see Appendix A) such that the director of the Department of Forensic Biology reports directly to the head of the agency, the Chief Medical Examiner.

The organization of the Department of Forensic Biology is organized into two operational units, the Forensic Biochemistry and Hematology Laboratory (FBH) and the Forensic Molecular Biology Laboratory (FMB) (Figure 1., see Appendix A). One Assistant Director reports directly to the departmental Director.

The Department has clerical staff assigned.

The scientific staff in the both laboratories includes Forensic Scientists and Forensic Analysts, the latter reporting to the former.

One laboratory associate (part-time) is assigned to the department.

Each operational unit is allocated one clerical person. The organizational chart of the department defines, generally, the responsibility hierarchy in absences.

1. The Director is responsible for the overall scientific, quality assurance, and administrative operation of the Department.
2. The department's Assistant Director is responsible for the scientific operation of the FMB laboratory, procurement for the Department and, in the absence of the Director, assumes the responsibility for administering the department.
3. In absence of the Assistant Director and the Director, one (or more) Forensic Scientist(s) will be assigned responsibility for administering the department and its quality

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operations.

4. Under no circumstances will the Director, the Assistant Director and all FBH and FMB Forensic Scientists be absent from the laboratory.

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#### IV. Documentation

Laboratory personnel record all significant laboratory activities to create a useable audit trail that documents the department's routine scientific testing. The documentation will be kept for the following topic areas:

##### A. Manuals

###### 1. Scientific Manuals

These documents describe in detail the current protocols used for the analytical testing of biological specimens for all the scientific procedures used in the departmental laboratories. They include the following information before they are certified to be used as acceptable procedural manuals:

- a. Date the procedure was adopted
- b. Revision dates
- c. The director's initials and dates the manuals signifying its official use in the laboratory.
- d. Archives of methods

##### B. Quality Control/Critical Reagent Documents

The QC documents in the departmental laboratories document that all critical reagents (Critical reagents are defined as those reagents which are required for a specific test and which must undergo QC testing prior to use to insure that they meet performance expectations) are prepared according to guidelines established within the department and according to accepted procedures. The documents available for each testing procedure include the following.

###### 1. QC Procedures Manuals

Details the procedures used in determining the quality of reagents prepared either in-house or those purchased from outside vendors. It also details procedures used to calibrate instruments used as a QC monitor, i.e., thermocouples and etc., and the other critical instrumentation used in the department.

The QC Manuals also detail the operating instructions and maintenance of the critical

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instruments.

## 2. Solutions Manual

Details the procedure to be used in the preparation of solutions used in routine testing in the departmental laboratories.

## 3. Reagent Preparation Records

1. Lot and/or Batch Numbers
2. Date of Preparation
3. Initials of Preparer
4. Documentation of QC Pass/Fail and Evaluation
5. Archive of QC Evaluation Data

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### C. Case Files/Case Notes

Case files contain sufficient information for an outside assessment of the laboratory's work product.

1. OCME paperwork such as the autopsy sheet summary.
2. Analytical laboratory work sheets including analyst's notes and original laboratory data (or copies with references to the location of original data if not present in the case file).
3. Police paperwork including copies of evidence control vouchers, request for examinations and etc.
4. Chain-of-custody documentation.
5. Case contact sheets documenting conversations with detectives, attorneys and etc.
6. Documentation of supervisory review through initials and dates.
7. Reports reflecting the results and their interpretation.

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## **D. Data Analysis and Reporting**

### **1. Data Analysis**

All analytical case data are interpreted independently by the Forensic Analyst assigned to the case and another laboratory staff scientist. Each independently observed result is dated and initialed. Discrepancies may be resolved by reanalysis, discussion with either the Forensic Scientist, Director or Assistant Director or by rendering the result inconclusive.

All original data must be archived by one of several acceptable methods (if possible or if applicable), i.e., densitometry, photography, xerox, and digitization, for future retrieval and analysis.

Where identifications are made using DNA profiling, specific matching criteria have been established and are part of the methods manual.

Known standards are recorded and monitored by means of established criteria and are part of the methods manual.

### **2. Reporting**

All reports accurately reflect the data produced and the opinions are based upon objective scientific observations, see FBH Methods Manual version 2.0.

The format of the report allows the reader to identify the following for the administrative review:

- a. The Forensic Biology case number (FB-)
- b. The Medical Examiner case number (if applicable).
- c. Deceased or victim's name (if known).
- d. Police Precinct and Complaint Numbers (if applicable).

### **3. Case Review**

The case review process for laboratory reports takes place in distinct phases and is done for all cases in which reports are generated. The first phase, Phase I, reflects preliminary review and generation of a draft report. Once the draft report is generated, the case file is examined by the Director and/or the Assistant Director and is considered Phase II of the process. In

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this phase both an analytical and administrative review takes place.

The routine review process is illustrated in the tables below.

**Phase I**

Step	Activity
1	A draft, hand written or computer generated, report is prepared by the Forensic Analyst assigned to the case according to the guidelines established for uniform report preparation in either the Forensic Biochemistry and Hematology or Forensic Molecular Biology Laboratories.
2	Review of the draft report by a supervisor. At this point additional work may be required which will necessitate performing additional tests to either provide additional data or to resolve a discrepancy in the data. This will cause a delay in the case being completed. If this occurs, and after the additional work is completed, the reporting process will begin again with Phase I.
3	Correcting the final report and final typing of the report by departmental clerical staff, analyst or scientist.
4	Second review of the report by the supervisor.

Once the supervisor is satisfied that the laboratory has complied with the original request and/or that appropriate laboratory examinations have been completed, the second phase of the review process takes place.

**Phase II**

Step	Activity
1	Final review of the report by the Assistant Director and/or by the departmental Director.
2	Statistical information to obtain departmental and individual productivity data will be obtained at this time by the Director.



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3	The original of the report is sent to the OCME records department, a copy is retained in the case file and copies are sent upon legitimate request to requesting agencies and attorneys.
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In phase II, the Director and/or Assistant Director will review the completed case file. Any discrepancies discovered will be discussed with the supervisor and resolution of the discrepancy will be discussed. The particular procedure used to resolve the discrepancy will be agreed upon by the Director and/or Assistant Director and the supervisor.

At times either a Forensic Scientist or Assistant Director will conduct the scientific investigations on casework. In these instances, the review process begins with the next higher level of authority in the laboratory.

At times, the Director may conduct scientific investigations on casework. In these instances, the Assistant Director will review the case.

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#### E. Court Testimony

Court testimony is the culmination of the work performed by the laboratory's scientists. Each Forensic Analyst or Forensic Scientist will be monitored at least once a year if providing testimony is given. The Director and Assistant Director monitor each other. The Forensic Analysts are monitored by the Departmental Director, Assistant Director or the analyst's supervisor. Forensic Scientists will be observed by either the Director or the Assistant Director. Although monitoring can take different forms, direct court room observation will be the method used by the Department.

Each evaluation will be documented in a written memorandum to the testifying scientist and will include comment on the following areas. The review will also prescribe remedial action that should be taken if the evaluation is less than satisfactory. The following points will be considered.

1. Appearance
2. Poise
3. Performance under cross-examination
4. Effectiveness of presentation (technical knowledge, ability to convey scientific concepts).
5. Interpretation of laboratory results.

A form will be filled out and maintained electronically in a Paradox™ database. A copy of the evaluation will be given to the testifier by the reviewer. Any problems with the testimony will be discussed. Any deficiencies in the testimony presentation will be corrected by having the testifier watch someone who is accomplished at court room presentation and deficiencies in knowledge will be addressed through remedial education.

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## **F. Evidence Handling Protocols**

### **1. Chain-of-Custody (Overview)**

Chain of custody refers to the documentation that allows evidence tracking from receipt of evidence (either post-mortem autopsy specimens or physical evidence obtained through investigations), through the analytical process, until it leaves the control of the laboratory.

#### **a. Evidence Receipt:**

All evidence received in the laboratory must be sealed. Staples are not an acceptable seal.

Evidence, whether received as specimens collected during the autopsy or received from user agencies, are signed into the laboratory by an evidence technician; resident in the Forensic Biology Department. An chain-of-custody form is filled out. At this point the evidence is controlled by the Evidence Unit.

#### **b. Case Number:**

Evidence is assigned a sequential FB--0000 number where FB refers to Forensic Biology, -- refers to the year, i.e., 89, 90, etc, and 0000 identifies a sequential number assigned to one specific investigation.

#### **c. Item Numbers**

Each item is assigned a number that may be associated with a police control or voucher number. Items taken at autopsy are assigned a sequential PM (Post-mortem) number.

For example: Multiple items may be received under one police control or voucher number. Each item is assigned a number, i.e., 1,2,3,4, and etc,. Also multiple police or voucher numbers may be used for a single death investigation. All will be assigned the same FB number.

#### **d. Signatures**

When the police and other outside agencies bring evidence to the laboratory, the date, police precinct, complaint number, and evidence vouchers are listed on the chain-of-custody form. The signatures of courier and OCME evidence technician are also obtained.

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Evidence from autopsies are collected by an assigned evidence technician or laboratory personnel or delivered by OCME personnel. This evidence is recorded on the chain-of-custody form, dated and the signature of the individual retrieving the evidence is recorded.

#### e. Storage

Evidence is stored in the departmental cold room (4 degrees celsius) until it is assigned to the Forensic Analyst who performs the required analyses.

Each analyst is assigned a shelf in the cold room which is used to store evidence in progress.

Retained evidence from casework refers to those specimens which have been chosen for analysis and which have not been consumed. Retained evidence is kept frozen for approximately 6 months, then refrigerated for approximately 2 years and then it is stored at room temperature. After two years it is returned to the Evidence Unit.

Post-mortem bloodstains, cell lysates and serum, are stored frozen for approximately 2 years. The cell lysates and serum are then discarded.

Retained items from casework are kept frozen for 6 months, then refrigerated for one year and then a room temperature.

#### f. Case Assignment

A supervising Forensic Scientist is responsible for deciding what testing must be performed on specific cases. The case is then assigned to a Forensic Analyst, who obtains the case from the OCME's Evidence Unit.

##### 1. Exceptions

- (a). The Director and Assistant Director may assign cases as required to either to themselves or to supervising Forensic Scientists or Forensic Analysts.
- (b). Exceptions may occur when evidence is transferred within the department.

The case is turned over to the Forensic Analyst who, along with the

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evidence technician, dates and signs the chain-of-custody form. At this point the evidence is controlled by the Forensic Biology Department.

Throughout the scientific analysis, the Forensic Analyst documents the evidence according to procedures delineated in the FBH Procedures Manual (Notetaking)

When the analytical work is completed, the evidence is packaged according to protocols accepted by the NYPD and returned to the Evidence Unit. The date and signatures are recorded on the chain-of-custody form and the evidence is now controlled by the Evidence Unit.

## **2. Chain-of Custody Procedures**

### **a. Post-mortem Evidence**

#### **(1). Homicide Cases**

For cases clearly labeled as homicides, as determined by the Medical Examiner, daily case census, autopsy worksheets or by having NYPD submit investigatory evidence, the following procedures are followed.

**Blood:** A stain is prepared on clean cotton cloth or paper, dried, and retained in the laboratory. Cells and serum are separated and frozen from an aliquot of the original sample and retained for two years, then discarded. The remainder of the original sample is discarded after two months. The dried stain is retained indefinitely. After three years, the dried stains are submitted, using appropriate procedures, to the evidence unit.

**Hairs, Fingernails, Swabs, etc.:** These are placed in the cold room. After two years they are vouchered for entry into the NYPD evidence control system and transferred to the Evidence Unit.

**Other specimens (tissues, bone etc.):** These are frozen and retained in the FBH laboratory. After one year, these specimens may be discarded if a dried bloodstain has been retained.

The determination as to whether a case may require future processing by the Department of Forensic Biology is ascertained through conversations with the responsible Medical Examiner or investigating detectives who handled the case.

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## **(2). Non-Homicide Cases**

Those cases which are not homicides, unidentified bodies or those bodies for which the cause of death is not clear but may require an NYPD investigation receive FB numbers and are considered evidentiary specimens. These cases include: sexual assaults, missing persons, hit-and-runs, unidentified bodies, forensic paternities, and cases from other jurisdictions.

### **b. Non-homicides (database samples)**

The Forensic Biology department receives EDTA blood, if available, from all Medical Examiner cases. Most of these do not fall within the mission of the Department of Forensic Biology and are not the subject of an homicide investigation.

While these cases do not receive FB case numbers, the specimens and associated autopsy worksheets are transferred to the Forensic Molecular Biology (DNA) Laboratory and are tracked using a log book. Those which are appropriate for database samples receive an MB number. The DNA is isolated from these latter samples and a dried stain is also prepared if there is sufficient sample. All bloods, whether or not an MB number is assigned, are discarded after two months.

The isolated DNA is retained in the laboratory until it has been consumed.

### **c. Cases For Which Specimens Are Not Received**

Sometimes physical evidence is received on cases for which autopsy specimens are not received. In these instances, appropriate specimens are obtained from the Toxicology Department (if within that department's specimen holding time-frame) or from DNA database specimens (if within that laboratory's holding time-frame). In unusual instances, and if freshly preserved specimens are not available, formalin fixed specimens may be obtained from the Histology laboratory.

### **d. Specimens Received Without Identifying Numbers**

Sometimes autopsy specimens are received with no identifying case numbers, specimen types or other identifying information. These specimens are discarded.

### **e. Physical Evidence**

Physical evidence is received primarily from the NYPD but other

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agencies and jurisdictions submit cases as well.

Physical evidence submitted to the laboratory receives an FB case number. This number serves as the control number while the evidence is in the possession of the laboratory. At the conclusion of the scientific testing, the evidence is transferred to the Evidence Unit, if an NYPD case, or returned to the submitting agency .

#### **f. Miscellaneous**

Instances arise which require the department to send evidence to other agencies or laboratories. Under most circumstances this is accomplished using overnight mail services.

### **3. Security**

The laboratory security is maintained on building and departmental levels.

#### **a. Building Security**

The OCME headquarters building which houses the Department of Forensic Biology has two entrances; one on 30th street and another on First Avenue. The 30th street entrance is used 24 hours for body deliveries and during the day, 6 AM - 6 PM, for other deliveries. The First Avenue entrance is open from 8 AM - 5 PM and is used for employees, visitors, families identifying deceased individuals and professionals and citizens requiring services.

The 30th street entrance is guarded 24 hours a day and the First Avenue entrance is guarded between 6 PM and 6 AM. During operational hours the First Avenue entrance lobby is attended by an OCME employee who screens visitors to the building. No entrance past the lobby is permitted without proper identification or escort. A locked door into the building proper restricts entry through the use of a buzzer controlled at the lobby desk.

#### **b. Laboratory Security**

The Department of Forensic Biology is housed on the sixth and fifth floors of the OCME building.

The sixth floor main office is the main entry point for evidence which is to be stored in the DNA laboratory walk-in cold room. The walk-in cold room is locked at night but is open during normal working hours. During the day the laboratory has limited access. Only OCME Forensic Biology Departmental staff are permitted into

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the laboratory unless escorted. A log is used to document entry into the laboratory.

At night all rooms of the Department are locked.

The Forensic Molecular Biology laboratory is housed on the sixth floor and evidence is stored in freezer #9. This freezer is locked at all times unless evidence is being entered or withdrawn.



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#### G. Equipment Calibration and Maintenance Logs

Each piece of essential scientific apparatus has a log usage book and requires QC monitoring. Critical is defined as equipment which is required for a testing procedure and its malfunctioning will compromise the reliability and accuracy of the results obtained. Such equipment has usage and/or QA/QC records available. Specific equipment QC procedures for critical scientific apparatus are found in the Forensic Molecular Biology QC Manual.

While equipment common to both the FBH and FMB laboratories is used, each laboratory may designate specific equipment critical or not. For example, the FMB laboratory considers micropipettes critical pieces of equipment which must be rigorously calibrated while the FBH laboratory, with the exception of ELISA micropipettes, does not.

The first step for all preventative maintenance is cleanliness. If there is any kind of spill, inside or outside a piece of equipment, it is to be cleaned up IMMEDIATELY (this includes hybridization solution, buffers, salts, and etc.). Some spills may be corrosive to the equipment and cause more damage than necessary. It is easier to clean reagents before they dry rather than to be chiseled off.

The usage log for each item begins with the date of purchase of the piece of equipment. In addition to daily entries in the log, each calibration of the apparatus is also maintained in the usage log.

For equipment purchased before the institution of this manual, if the date of purchase is known, that date will be used, if the date of purchase is not known, then the date the manual was placed into service will be used instead. An approximate date of purchase will be entered into the log beside the date.

Any irregularities observed during routine monitoring or use of all equipment are recorded in the comments section of the log and reported to a the QA Coordinator or a QA Committee member. The irregularity will be investigated and its cause determined, if possible.

A decision whether the equipment is unsuitable for casework use will be made by the QA Coordinator or a QA Committee member and corrective action will be taken and recorded in the appropriate log. If the item of equipment has been taken out of use, for what ever reason, an entry is made into the log book. After appropriate repair or recalibration, the QA coordinator or QA Committee member may re-certify that the equipment may be used for case work.

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Recertification requires that the QA Coordinator or QA Committee member record that the instrument is available for casework in the instrument's log book.

The schedule of equipment maintenance follows:

1. Temperature Maintenance Equipment (refrigerators, freezers, water baths, cooling baths, ovens, and etc).

Temperatures are recorded daily on a temperature log specified for each piece of equipment. This is done by the technician responsible for the preparation of reagents **Or As Assigned By The QA Coordinator Or Laboratory Forensic Scientists**. The log is dated and initialed by the person performing the temperature recording.

Appropriate equipment has its own permissible temperature range. Variations which exceed the permissible range will be evaluated relating to its suitability for continued usage on a per situation basis. Acceptable ranges are related to the type of equipment and its determined use by the Departmental staff.

(a.) Non-Frost-Free Refrigerators/Freezers

These freezers/refrigerators must be defrosted annually. Defrosting of freezers is recorded on the temperature log for that freezer/refrigerator.

2. pH meters

These are calibrated as they are used and are checked for each measurement by scientific staff performing pH measurements.

The technician responsible for preparation of reagents keeps a record of the pH measurements used to prepare critical laboratory reagents.

3. Electrophoresis Equipment

Electrophoresis power supply logs are filled out for each use by the analyst using the equipment and are dated, initialed, purpose, and comments.

Each electrophoresis tank usage is documented on a log sheet as to date, initials, purpose, and comments.

4. Balances

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Balances are checked weekly and are calibrated annually by an outside service. The calibration date is recorded in the usage log.

In the event that an outside service is not available or, for other reasons, cannot be contracted for, the calibration will be performed by laboratory personnel. The usage log will reflect this information.

#### 5. Thermocyclers

Each thermocycler has a usage log which is documented as to date, initials, purpose, and comments.

Thermocyclers are checked weekly by a technician or analyst assigned to perform the calibration. The record of the calibration is recorded in the usage log. If the calibration is not performed, this is noted in the thermocycler log. Individual wells of a thermocycler may be taken out of service if they fail to pass QC.

#### 6. Microtiter Plate Readers

Each microtiter plate reader has a usage log which is documented as to date, initials, purpose, and comments.

Checking is performed monthly by a technician or analyst assigned to perform the calibration. The record of the calibration is recorded in the usage log.

#### 7. Micropipettes

Micropipettes will be checked using either standard calibration kits or gravimetrically. Each pipet will be assigned a control number and the date of calibration and the initials of the person performing the calibration will be recorded in the log. Each pipette will have a piece of tape on the handle indicating the last time a calibration was conducted. Each pipet will be calibrated three times annually.

Micropipettes are not considered a critical piece of equipment in the FBH laboratory. Therefore, with the exception of ELISA procedures, these are not calibrated.

#### 8. Centrifuges

Centrifuges are not considered critical equipment, are not normally used for precise centrifugations, and do not need to be calibrated.

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9. Hoods

Biological hazard and chemical fume hoods are to be inspected and certified annually by an outside contractor.

10. Survey Meters

Survey meters for measuring radioactive contamination of work surfaces are calibrated according to the specifications of the radiation license. A record of the calibration is maintained in a maintenance log.

11. Liquid Scintillation Counter

If the liquid scintillation counter is used routinely, it must be checked monthly with a standard radiation source. A use log is maintained and standard reference anomalies are recorded. The instrument is calibrated as required.

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## H. Proficiency Testing

Proficiency testing is used periodically to demonstrate the quality performance of the scientific service offered by the laboratory and serves as a mechanism for critical self evaluation. This will be accomplished by the analysis and reporting of results from appropriate biological specimens, submitted to the laboratory as open and/or blind case evidence.

All specimens submitted as part of a proficiency test must be analyzed and interpreted according to the analytical protocols being used at the time the proficiency test is taken. All samples of "blind" evidence analyzed will be treated as normal casework.

The scientific staff will be proficiency tested according to guidelines established by regulating agencies. If not regulated or legislated, proficiency tests will be administered twice annually to each scientist; both proficiencies will be open tests. One blind test (if available) will be administered to the laboratory once annually.

Each proficiency test is treated as a case and a case-like file folder is maintained, with all its appropriate reviews, just as with any case submitted to the laboratory. With each proficiency test, a Proficiency Review sheet will be filled out and kept with the file. This review sheet is a check-list which enables the supervisory scientists to evaluate the performance of the analyst/scientist being tested. The review sheet is also a tool by which the departmental Director can evaluate the supervisory performances of the departmental supervisory scientists.

### 1. Types of Proficiency Testing

#### a. Open Proficiency Testing

Open proficiency test specimens are presented to the laboratory staff as proficiency specimens and are used to demonstrate the capability of the laboratory's analytical methods as well as the interpretive capability of the analyst/scientist. This is the primary means by which the quality performance of the laboratory is judged and is an essential requirement prior to being assigned to perform casework.

##### (1). Personnel

Each member of the scientific staff performing routine analyses on casework are required to take proficiency tests.

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(2). Specimens

Each open proficiency test may consist of dried specimens of blood and/or other physiological fluids, either singly or as a mixture. Each sample to be analyzed will contain sufficient sample so that a conclusion can be drawn from the results of the analysis.

(3). Sample Preparation and Storage

All specimens and proficiency tests should be uniformly prepared using materials and methods that ensure their integrity and identity.

All test specimens will be prepared on washed cotton cloth, swabs, or other suitable material.

Each specimen must be labeled with a unique identifier that should be independently verified by at least one other person to ensure proper assignment.

A portion of each specimen used to prepare the test should be retained by the preparing laboratory until sufficient time has passed for all participating individuals to register complaints and referee analysis and comparison is completed.

One person in the laboratory, as assigned by the assistant director or departmental director, should acknowledge receipt of each proficiency test and assign it to the laboratory staff.

**b. Case Retesting**

Reanalysis of case work will permit an estimate to be made regarding the laboratory error rate. Reanalysis will be performed on casework samples at a later time where there is sufficient sample. Each reanalysis will be conducted by a different analyst, i.e., no analyst will analyze the same sample twice.

The results of the reanalysis will be compared with the results of the original analysis. If the results do not correlate, in other words, the results do not agree, a third analysis of the sample might be performed if the reason for the disagreement cannot be determined.

**c. Blind Proficiency Testing**

If a procedure for blind proficiency testing is established, blind proficiency tests will be administered to the laboratory annually and will be presented as a routine case. The samples in the "blind

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case" will be analyzed as a regular case and reported as such.

Specimens will be of the type commonly encountered in routine casework.

## **2. Deficiency and Corrective Action**

It is the responsibility of the QA Coordinator, or designated individual, to assure that deficiencies are acknowledged and that any corrective or remedial action is documented.

### **a. Analytical/Interpretative Error**

Any error of this type, i.e., mistyping or misinterpreting analytical results whether correct or not, will result in the analyst being suspended from performing that specific test in casework until the cause of the error is identified and corrected.

The scientist's supervisor monitors the performance of the specific test until satisfactory performance is obtained. At that time a proficiency test will be administered.

In addition, the QA Coordinator reviews cases signed by the analyst since the last successful proficiency test in order to ascertain whether similar errors have passed the case review process.

### **b. Systematic Error**

Any error found to be the result of equipment, materials, environment, etc., may require a review of all relevant casework since the unit's last successfully completed proficiency test. Once the cause of the error has been identified and corrected, all analysts will be notified in writing of the appropriate corrective action in order to minimize the recurrence of the discrepancy.

Any casework performed during the relevant period will be reviewed and selected samples will be repeated in order to verify that the results are correct.

### **c. Administrative Error**

Administrative errors, i.e., clerical, sample switching, improper storage, documentation, etc., once identified as such, will be corrected by instructing the analyst of the problem. Depending on the nature of the error, the analyst may be required to submit to retraining in the relevant area. For example, if the error is in sample storage, the analyst will be retrained concerning the proper storage of biological specimens.

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Simple clerical errors will be pointed out to the analyst. Subsequent casework will be closely monitored, more than normal checking, for clerical errors.

In the event of an unresolved disagreement between the designated QA individual and the laboratory, the matter will be resolved by the departmental director.

Errors of failing to follow established laboratory QA/QC procedures will result in its being documented on the Proficiency Evaluation sheet. The analyst will be instructed in the appropriate procedures which will be documented on the Proficiency Evaluation sheet.

Each analyst will receive a copy of the Proficiency Evaluation Sheet and their comments will be recorded there.

### 3. Documentation of Open Proficiency Testing Results

Each proficiency test will be documented as follows:

- a. Proficiency Testing Identification Number
- b. Name of analyst
- c. Dates:
  - receipt by analyst
  - completion date (report date)
- d. Copies of all data sheets, notes, photographs and reports
- e. All data will conform to casework standards and include lot numbers, QC numbers, and etc.
- f. The Proficiency Evaluation sheet will be filled out by the supervising scientist.

The results of all proficiency tests will be maintained by the Department.

### 4. Laboratory Analytical Error Rates

Different types of errors occur but those that result in a wrong result being reported must be evaluated in order to assess the laboratory's reliability as an analytical resource.

Errors can occur, theoretically, as a result of simply performing a test incorrectly, inadvertantly switching samples, or misinterpreting testing results. The error can be estimated in a variety of ways, including:



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a. Determination and Meaning of Error Rates

- (1). Measuring the frequency that individual results on external open and/or blind proficiency testing are incorrect.
- (2). Measuring the frequency that sample duplication testing shows discordant results.
- (3). Measuring the frequency that sample re-testing analysis shows discordant results.

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## **I. Personnel Training and Qualification Records**

Personnel training falls into several categories: Courses taken at universities and colleges, workshops designed to educate on specific topics and techniques, on-the-job training where theoretical and practical information and experience is obtained from the scientific staff, seminars and lectures held at local universities where scientists are invited to speak on various topics, scientific literature, and professional meetings. Each of these will be discussed in relation to training requirements in the Department of Forensic Biology.

Records of the training of each member of the scientific staff is a part of the personnel and/or proficiency file maintained for each member of the scientific staff.

### **1. Courses at Universities**

The Scientific professional staff in the department have met the minimum educational requirements necessary to meet the title descriptions. However, continuing education is important and recognized as a mechanism of maintaining a state-of-the-art staff and fostering an academic environment within the service mission of the department.

Because tuition reimbursement through the City of New York is not normally available, the department cannot require staff to attend courses at universities.

Staff will be made aware of the courses available.

### **2. Workshops**

Workshops are routinely offered in the local area by companies on specific topics, i.e., Roche on PCR, and etc., usually as an aid to their marketing functions. Normally there is a charge for these courses. The staff will be made aware of these workshops, but because reimbursement cannot be guaranteed, attendance will not be mandatory.

Workshops are also offered in conjunction with local universities specializing in forensic science training, i.e., John Jay College of Criminal Justice, University of New Haven, as well as through The Northeastern Association of Forensic Scientists for a reasonable cost. Although the staff cannot be guaranteed reimbursement for the workshop costs, recommendations will be made to attend those which are deemed important to the function of the department.

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### 3. On-The-Job-Training

Most training in the department will be of the on-the-job variety. This training will emphasize theory and the practical aspects of the work which is conducted in the department. The philosophical approach has three parts: theoretical, practical and examination or testing ability.

#### a. Theoretical

Theoretical background information required to understand the scientific basis, perform, and interpret the analytical tests performed in the laboratory will be provided to each staff member hired. This training will take place over a number of weeks.

This training will be presented in lecture and/or video tape format. Each member of the scientific staff will have access to literature references and reference books which are maintained by the department. Specific methods used will be referenced to the scientific literature and copies of publications pertaining to in-house methods will be available in a laboratory file.

The OCME has an in-house library service which will obtain original scientific and forensic articles by interlibrary loans. Additionally, OCME professional staff has library privileges at the New York University Medical School library which is next door.

Before testifying in court or grand jury, each analyst will participate in moot court. Supervisory scientific staff will conduct the moot court. The purpose of the moot court is not punitive but for the analyst to learn to appreciate the adversary process. It is also a mechanism for the supervisory staff to identify and correct obvious problems the analyst may have in his/her knowledge or ability to communicate effectively.

#### b. Practical

Each analyst will be trained to perform the tests conducted in the departmental laboratories. This begins with a demonstration which is followed by supervised independent work by the supervisor and concludes with the trainee working alone on prepared specimens.

#### c. Testing Ability

At the conclusion of training in any particular analytical test, the analyst will be asked to successfully complete an open proficiency testing on that analytical procedure. Each analyst being trained in procedures used in the Department must take a

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proficiency test before using the procedure in case work.

**d. Training Outline**

- (1). Laboratory Staff, see Appendix B
- (2). Medical Residents, see Appendix B

**4. Seminars and Lectures**

Seminars and lectures offered at the OCME, at local universities, the Department of Health, and by corporations on selected topics will be announced to staff members.

**5. Scientific Literature**

All scientific staff are required to read the appropriate scientific literature related to the forensic aspects of the analytical work performed in the department.

The supervisory staff will provide copies of articles deemed to enhance the scientific theoretical background necessary for the understanding of current testing procedures or for current research being conducted in the department.

**6. Professional Meetings**

Each staff scientist is permitted to attend one scientific conference per year, depending on the approval of the Chief Medical Examiner and Mayor's Office. Because of budgetary constraints that exist, reimbursement of expenses cannot be guaranteed.

The annual national conference of forensic scientists (AAFS) and the regional association of forensic scientists (NEAFS) are recommended to scientific staff.

Other scientific meetings of interest to the department, i.e., American Society of Human Genetics Meetings, Gene Probe Conference, AAAS conference, Int. Assn. Forensic Scientists, NY Acad. Sci., FEBS and etc., are acceptable substitutions for the forensic conferences.

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## **J. Method Validation Records**

Methods used in the departmental laboratories must be validated using accepted procedures which demonstrate that the methods are capable of providing reliable results using specimens commonly received for analysis.

Procedures used will be approved for use, if appropriate, by any regulating bodies in New York State.

The specific validation protocols for each laboratory procedure must be written and rigorously followed (see J.1 below). Before validation on any procedures are begun, the senior scientific staff and validation staff members will specify the appropriate validation details and the specific steps which will be completed before the procedure can be adopted for routine casework. The approach will become a permanent, written record to be retained with the validation experimental results.

The analytical test results and the validation protocols used for each test must be available and will be kept in a file and/or log book. For data maintained in staff notebooks, the file or log books referred to above will reference the appropriate pages in the research notebooks or will contain photocopies of these notebooks.

### **1. Validation Procedures**

#### **a. Existing Procedures**

For purposes of categorizing which validation procedures to use, existing procedures are classified as follows:

- (1). Those which exist and have been published in peer review journals but have not yet been validated for forensic testing.
- (2). Those which are not published and for which no validation records are known.
- (3). Those which have been published and the validation studies have also been published.

For those procedures in categories J.1.a.1 and J.1.a.2, validation for forensic investigations must be performed. The testing to be performed will be carried out according to validation testing procedures as discussed above. Once the validation work has been completed and all records are available, the work will be incorporated as an analytical procedure and will also be submitted for publication in a peer review journal, if applicable.

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The procedures in category J.1.a.3. do not require extensive validation. However, limited validation, including proficiency testing, will be conducted to insure that the test procedure behaves as published.

**b. New Procedures**

New procedures are those which have been developed as a result of a research project in the Department of Forensic Biology and appear to have potential as analytical tests that might be used in routine testing.

All new procedures must go through an extensive validation process which must include:

- (1). Staff review of process including appropriate experiments
- (2). Testing on all appropriate sample types
- (3). Examination of environmental and aging effects
- (4). Variability in results due to experimental protocol drift
- (5). Proficiency testing
- (6). Collaborative testing
- (7). Publish in peer review journal, if applicable

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**K. Quality Assurance and Audit Records**

Records documenting that the program is implemented and maintained are kept as a normal course of business. The QA coordinator or other QA committee member is responsible for maintaining these records. The departmental director coordinates the departmental quality assurance program.

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## **L. Equipment**

### **1. Inventory**

An inventory of all equipment is maintained in the department. The inventory includes a list of essential equipment and includes the following (if available or known).

- a. manufacturer
- b. model
- c. serial number
- d. agency inventory number (if applicable)
- e. purchase date (if available)

### **2. Operations Manuals**

All equipment operations manuals are kept as a part of a centralized operations manual.

### **3. Calibration/Maintenance Procedures**

Procedures for the calibration and maintenance are part of the QC manual.

### **4. Calibration/Maintenance Logs**

Calibration and Maintenance logs are a part of the usage log.



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## M. Safety

### 1. Manuals

The departmental safety manual is a compendium of manuals maintained at the OCME.

#### a. Chemical Spill and Clean-up

This manual details the OCME guidelines and regulations specifically related to chemical spills and notification procedures.

#### b. Blood Borne Pathogen Standard

This manual provides the regulations regarding blood borne pathogens standard, 29 CFR 1910.1030.

#### c. NYC Department of Health Infection Control Manual

This manual has been prepared to provide DOH employees with the information required to protect their own safety and their patients. It provides specific precautionary techniques and guidelines in order to reduce injury and disease.

#### d. OCME Hazard Communication Plan

This manual is to ensure that OCME is in compliance with the OSHA Hazard Communication Standard (HCS) 29 CFR 1910.1200 and delineates responsibilities regarding chemical hazards.

#### e. OCME Hazard Contingency Plan

This plan applies to all unplanned releases of hazardous waste or hazardous waste constituents at the OCME. Its purpose is to minimize hazards to human health or the environment from an unplanned or sudden release of hazardous waste or its constituents.

#### f. Chemical Hygiene Plan

The chemical hygiene plan delineates responsibilities, procedures and guidelines regarding the handling of chemicals at the OCME.

#### g. NYFD Regulations on Chemical Storage

This manual delineates the fire department's regulations for the storage and use of chemicals, acids and gases in college,

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university, hospital, research and commercial laboratories.

h. OCME Radiation Safety Manual

This manual delineates the responsibility, procedures and training required when handling radioactive substances.

i. Working With Chemicals

This manual provides information for employees on how to use the NYS Right to Know Law.

**2. Right to Know Training**

The OCME has a Right to Know training program which is provided annually. Each OCME employee is required to attend.

**3. Radiation Safety Training**

The Forensic Biology department provides an annual training seminar which is mandatory for those using radiolabeled materials.

**4. Material Safety Data Sheets (MSDS)**

MSDS sheets are kept in a separate file for all reagents and chemicals used in the departmental laboratories. The OCME is also required to have a copy of the most current MSDS sheets for those materials used in the OCME building. The sheets are updated as required.

These are readily available from the departmental safety committee representative.

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**N. Historical or Archival Records**

Records for all laboratory operations are maintained with the case file under the laboratory case number (FBXX-), where XX refers to the year. For years prior to 1990 the records are maintained under a different nomenclature system.

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## O. Quality Audit

The Department is audited annually by an independent evaluator who is not responsible for any official function of the Department. Sheets for audits are filled out by the evaluator and submitted to the Department Director for evaluation by the QA Committee.

### 1. Guidelines

The quality audit is one of the primary tools used to evaluate, confirm or verify activities related to quality. Its purpose is to assess compliance with the operational requirements of the quality system. Periodic audits, coupled with day-to-day review of scientific reports, provide an effective means for ensuring that quality control activities are being implemented and that each forensic examiner performs in a manner consistent with the quality system.

Quality audits will be scheduled and announced well in advance by the Director. A checklist will be used to ensure complete coverage of the important aspects of the audit and will include inspection of the following areas.

- a. Staff's awareness of the quality manual
- b. Analytical procedure selection, control, and validation.
- c. Control of reagents and standards.
- d. Equipment calibration and maintenance records.
- e. Adequacy of case reports and notes and their disposition.
- f. Evidence handling procedures.
- g. Proficiency testing and interlaboratory comparison studies.
- h. Personnel training records.
- i. Handling of deficiencies and remedial action.
- j. Laboratory orderliness and health and safety measures.

The audit's results will be sent to the departmental Director who will reply, in writing, by addressing the auditor's results and discuss corrective action taken or reasons why corrective action will not be taken.

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## **P. Problem Solving**

Problems or difficulties can arise in all phases of laboratory operations and these must be dealt with appropriately. Listing each potential problem would be impracticable and would possibly miss some areas which should be considered. Instead, the topic is being considered in general terms. Nevertheless, the topic of how problems are solved must be addressed so that the laboratory has a mechanism with which to formally address the issues that may arise.

General laboratory problems can be divided into large categories which reflect the laboratory's operations. These include: operations which reflect the laboratory's mission, external influences which reflect the laboratory's proper functioning and those of a specialized nature.

### **1. Problems which affect the laboratory's Mission**

These are problems which directly affect the laboratory's mission and will usually be technical in nature. For example, these may include, among others, a method that has stopped working properly or an error has happened in the testing. These internal laboratory problems are solved using a decision tree which mimics the laboratory's supervisory hierarchy. In such a tree the schematic follows that shown in figure 1. and can be used either top-down or bottom-up.

In the top-down approach toward using the tree, the top management or director of the laboratory makes all decisions without consulting other laboratory supervisory staff. In this method, problem solving becomes unidimensional and most impractical because the director may be absent or for other reasons. The Department of Forensic Biology does not use a top-down mechanism for problem solving.

In the bottom-up approach, problems are solved from the bottom of the hierarchical management scheme toward the top. That is, each layer of supervision becomes the next layer to where problems are brought. Thus in the Forensic Biology laboratory, the Forensic Scientist is the first supervisory layer and the appropriate persons who are first confronted with the problem.

If the problem cannot be solved at this level it moves up the decision tree to the Assistant Director and finally to the Director.

### **2. External Problems Which Affect Laboratory Operations**

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Some problems, i.e., the building's heating, cooling, lighting, etc, are operational problems which are solved using the OCME's support staff. In these instances problems can be directed to the OCME support staff either by the first level supervisory personnel or directly by the person confronted by the problem.

### 3. Problems Which Require Specialized Personnel

There are certain functions within the laboratory that require specialized support. In these instances, i.e., health and radiation safety, there are appropriate personnel designated in the laboratory who are responsible for these functions. For example, there is a laboratory representative on the health and safety committee whom is consulted in these instances. Similarly, there is a resident RSO (Radiation Safety Officer) who is consulted in problems related to radiation.

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## V. Management Information System (MIS)

### A. OCME

The OCME's headquarters and satellite autopsy suites (The Bronx, Brooklyn, Queens and Manhattan) are linked by a computer network. The components of the system include:

1. Software programs for productivity
  - a. Wordperfect and Wordperfect Office
  - b. Quattro Pro
  - c. DataEase
2. Medical Examiner casework database defined in DataEase
3. Procurement database/ordering system defined in DataEase.
4. E-Mail
5. Departmental and individual accounts

### B. Departmental

The Forensic Biology Laboratory is located on the OCME network under H:\users\fbiology\\*.\*. Individuals have access to their own private directory under: H:\users\fbiology\NAME\\*.\*.

Departmental functions are maintained on the network and these include.

1. Reports (defined in Wordperfect).
2. Productivity statistics (defined in Paradox).
3. Current updates of Departmental manuals (defined in Wordperfect).

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#### VI. References

1. Guidelines for a Quality Assurance Program for DNA Restriction Fragment Length Polymorphism Analysis. Crime Laboratory Digest Vol 16(2): 40-59 (1989).
2. Guidelines for a Quality Assurance Program for DNA Analysis. Crime Laboratory Digest Vol 18(2): 44-75 (1991).
3. A guide for Conducting a DNA Quality Assurance Audit. Crime Laboratory Digest Vol 20(1): 8-18 (1993).



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## Appendix A

### Organizational Structure

Figure # 1: Dept. Forensic Biology  
Organizational Structure

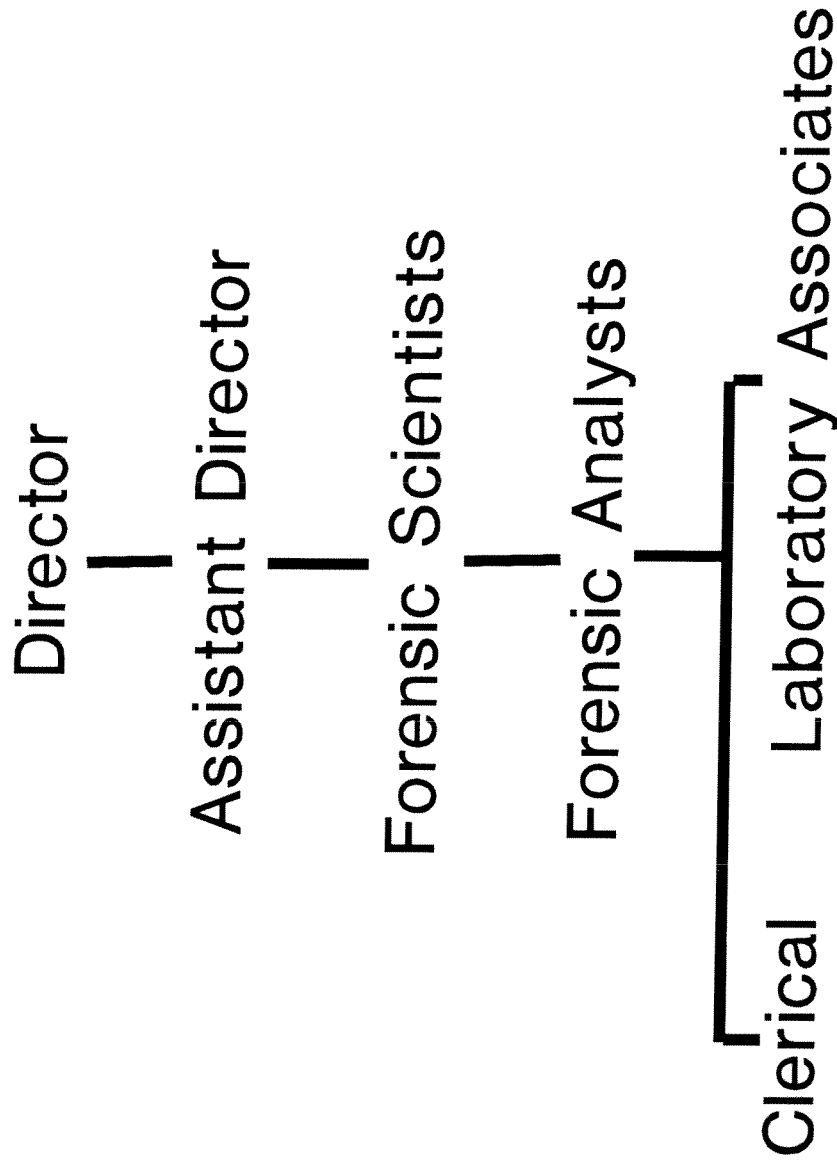
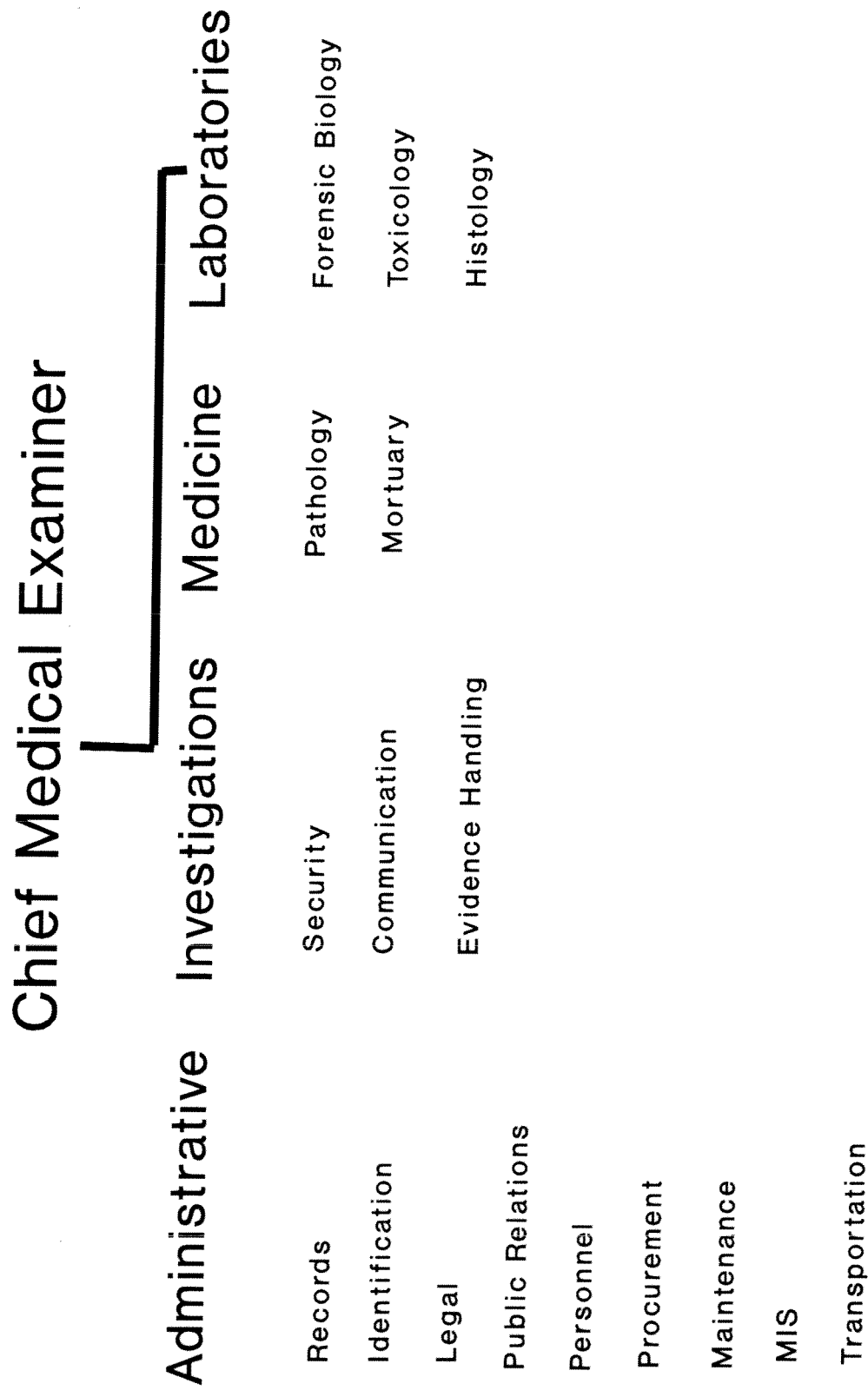


Figure # 2: OCME Organizational Structure



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## **Appendix B**

### **Training**

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## FORENSIC BIOLOGY TRAINING OUTLINE

### I. Notetaking

- A. Read about notetaking in the Forensic Biochemistry and Hematology Laboratory Methods Manual
- B. Take current files from the file cabinets and review the note-taking styles of the analysts. Think about what you like and dislike about the notes you see.
- C. When you run tests or receive samples for proficiency testing, take notes and fill out worksheets as if they were real casework.

### II. Blood

- A. Blood composition
  - 1. Read about blood components
  - 2. Read about hemoglobin
- B. Kastle-Meyer (KM) and leucomalachite green (LMG) presumptive tests
  - 1. read about mechanisms of catalytic tests
  - 2. read about cross-reacting materials
  - 3. be aware of other tests besides KM and LMG
- C. Takayama confirmatory test
  - 1. read about Takayama test for hemoglobin
- D. Do the following:
  - 1. check the KM and LMG presumptive tests for sensitivity by testing serial dilutions of blood (to about 1/1,000,000)
  - 2. check the KM and LMG presumptive tests for specificity by testing various other substances such as sweat, urine, rust, etc.
  - 3. test bloodstains of various ages with the KM and LMG tests

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4. check the Takayama test for sensitivity by testing different amounts of sample
5. check the Takayama test for specificity by testing other substance such as sweat (salt), urine, rust, etc.
6. test various ages of bloodstains with the Takayama test

### III. Species Determination

- A. Immunology
  1. read about antibodies and antigens
  2. read about how anti-sera are made
  3. read about cross-reactivity
- B. Ouchterlony (double-diffusion)
  1. read about diffusion methods in general
  2. understand the "bands of identity"
- C. Crossover electrophoresis
  1. read about crossover theory
  2. think about sensitivity vs. specificity
- D. Do the following:
  1. Ouchterlony's and crossover of:
    - a. anti-human sera against dilutions of human blood
    - b. dilutions of anti-human sera against blood
    - c. anti-human sera against common animals
    - d. animal anti-sera against their corresponding animals
    - e. animal anti-sera against other animals including human
- E. Obtain a bloodstain identification proficiency test and complete it before going on.

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#### IV. Semen

##### A. semen composition

1. read about seminal fluid components
2. read about sperm morphology

##### B. Acid phosphatase presumptive test

1. read about seminal acid phosphatase
2. read about interfering substances
3. read about AP quantitation
4. be aware of different substrates available for the test

##### C. Spermatozoa identification

1. read about Christmas tree stain
2. read about fluorescent staining

##### D. P30 identification

1. read about semen specific proteins
2. read about P30 quantitation
  - a. rocket electrophoresis
  - b. crossover electrophoresis
  - c. ELISA

##### E. Semen quantitation

1. read about the relationship between amounts of AP, spermatozoa, P30

##### F. Do the following:

1. check the presumptive test for sensitivity by testing dilutions of semen extracts
2. check the presumptive test for specificity by testing other substances such as vaginal fluid, urine, and saliva
3. make slides from semen stains, semen-stained

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vaginal swabs, and semen-free vaginal swabs both by:

- a. extracting the stains and pelleting cellular debris
- b. "mashing" the stains/swabs onto a slide
- c. stain using the Christmas tree stain

4. Sensitivity of P30 methods

- a. check the sensitivity of Ouchterlony by testing dilutions of semen
- b. check the sensitivity of crossovers by testing dilutions of semen
- c. check the sensitivity of ELISA by testing dilutions of semen
- d. compare the sensitivity of the different methods of semen testing.

5. Specificity of P30 testing

- a. check the specificity of anti-P30 by testing other substances such as vaginal fluid, urine, and saliva using crossover electrophoresis
- b. review P30 ELISA validation records

V. Saliva

A. read about amylases

B. Detection methods

1. read about various detection methods
2. read publication on AMY1, AMY2 differentiation using lectins

C. do the following:

1. amylase diffusion on dilutions of saliva, semen, semen-stained vaginal swabs, semen-free vaginal swabs and urine
2. perform amylase differentiation test using lectins on samples of saliva, semen, semen-stained vaginal swabs, semen-free vaginal swabs and urine.



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- D. Obtain an amylase identification proficiency test and complete it before going on.

#### VI. Urine

- A. read about urine components
- B. read about various detection methods
- C. do the following:
  - 1. urea diffusion on dilutions of urine, saliva, semen, and serum.
- D. Obtain a urea identification proficiency test and complete it before going on.

#### VII. Typing of liquid blood

- A. ABO
  - 1. read about ABO system
  - 2. read about ABH antigens and structures
  - 3. read about forward and reverse typing
- B. Lewis
  - 1. read about Lewis and secretor systems
  - 2. read about Lewis antigens and structures
  - 3. understand the relationship between secretor/non-secretor and Lewis antigens
- C. Do the following:
  - 1. ABO and Lewis type some PM bloods which have already been typed
    - a. use capillary method for Lewis typing
- D. Obtain an ABO and Lewis typing proficiency test and complete it before going on.

#### VIII. ABO typing of stains

- A. Read about absorption-elution typing

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- B. Read about Lattes typing
- C. Absorption-inhibition (AI)
  - 1. read about soluble antigens
  - 2. read about different techniques for AI
- D. Do the following:
  - 1. AI on known saliva stains
  - 2. AI on known vaginal swabs, semen stains, and semen/vaginal mixes
- E. Obtain an AI proficiency test and complete it before going on.

#### IX. Genetic Marker typing in stains

- A. Methods
  - 1. read about various electrophoresis methods - starch, agarose, cellulose acetate
  - 2. read about various isoelectric focusing methods - thick, thin, ultrathin, agarose, acrylamide
- B. Esterase D/Phosphoglucomutase (modified Group I)
  - 1. read about ESD
    - a. function of enzyme
    - b. protein structure - monomer, dimer, etc
    - c. genetics - alleles and phenotypes
    - d. discrimination potential
    - e. longevity of enzyme in stains
  - 2. read about PGM
    - a. function of enzyme
    - b. protein structure - monomer, dimer, etc
    - c. genetics - alleles and phenotypes
    - d. discrimination potential
    - e. longevity of enzyme in stains
  - 3. read about Group I and modified methods
  - 4. do the following:
    - a. run several plates using blood from lab

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- personnel
  - b. run several plates using recent PM samples
  - c. run several plates using PM samples aged 3, 6, 9, and 12 months
  - d. run a plate using casework samples where there is very large amounts of stain
  - e. compare the differences, i.e., clarity, streaking, extra bands, etc, between isozyme patterns obtained between fresh, PM and stains.
5. obtain an ESD/PGM proficiency test and complete it before going on
- C. ESD by IEF
- 1. read about ESD alleles as revealed by IEF
  - 2. read about various methods available, comparing pH ranges, run times and ability to differentiate types
  - 3. do the following:
    - a. run several plates using blood from lab personnel
    - b. run several plates using recent PM samples
    - c. run several plates using PM samples aged 3, 6, 9, and 12 months
    - d. run a plate using casework samples where there is very large amounts of stain
    - e. compare the differences, i.e., clarity, streaking, extra bands, etc, between isozyme patterns obtained between fresh, PM and stains.
  - 4. obtain an ESD proficiency test and complete it before going on
- D. PGM by IEF
- 1. read about PGM alleles as revealed by IEF
  - 2. read about various methods available, comparing pH ranges, run times and the use of separators
  - 3. do the following:
    - a. run several plates using blood from lab personnel

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- b. several plates using recent PM samples
  - c. run several plates using PM samples aged 3, 6, 9, and 12 months
  - d. run a plate using casework samples where there is very large amounts of stain
4. obtain a PGM proficiency test and complete it before going on

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E. Group specific component

1. read about Gc
  - a. function of protein
  - b. protein structure - monomer, dimer, etc
  - c. genetics - alleles and phenotypes
  - d. review actin-Gc complexes and understand why they can cause typing problems
  - e. discrimination potential
  - f. longevity of protein in stains
3. do the following:
  - a. run several plates using blood from lab personnel
  - b. run several plates using PM samples
  - c. run several plates using PM samples aged 3, 6, 9, and 12 months
  - d. run a plate using casework samples where there is very large amounts of stain
4. obtain a Gc proficiency test and complete it before going on

F. Hemoglobin

1. read about Hb
  - a. function of protein
  - b. protein structure - monomer, dimer, etc
  - c. genetics - alleles and phenotypes
  - d. discrimination potential
  - e. longevity of protein in stains
  - f. review different detection methods, i.e., cellulose acetate, starch gel agarose gel, polyacrylamide gel electrophoretic methods and isoelectric focusing methods.
2. do the following:
  - a. run several plates using the standards and variants available
  - b. find blood samples from 10 recent black PM's and run those
  - c. run several plates using black PM's aged 3, 6, 9, and 12 months
  - d. run a plate using casework samples where there is very large amounts of stain

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3. obtain an Hb proficiency test and complete it before going on

G. Erythrocyte acid phosphatase (ACP1)

1. read about ACP1 (EAP)
  - a. function of enzyme
  - b. protein structure - monomer, dimer, etc.
  - c. genetics - alleles and phenotypes  
review banding patterns of rare phenotypes
  - d. discrimination potential
  - e. longevity of enzyme in stains
  - f. review degradation process of isoenzymes
2. do the following:
  - a. run a few plates using blood from lab personnel
  - b. run a few plates using recent PM samples
  - c. run a few plates using PM samples aged 3, 6, 9, and 12 months
  - d. run a plate using casework samples where there is very large amounts of stain
3. obtain an ACP proficiency test and complete it before going on

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## **DNA Laboratory Training and Proficiency**

### **A. Training Outline**

The goal of training and proficiency testing is to establish consistency of performance between individual analysts and to maintain the highest possible level of performance over time. The DNA training program is monitored by the Director or Assistant Director of Forensic Biology. Training may be performed by either a supervisor or an analyst in the Forensic Molecular Biology with the appropriate level of experience.

#### **1. Theory**

Prior to beginning laboratory exercises, the analyst will be provided with a list of articles or books which will form the basis of his or her theoretical knowledge. The list will change depending on the specific procedure being learned. For PCR procedures, the analyst will receive articles relating to PCR and those specific loci being analyzed. For RFLP procedures, the analyst will receive articles about the procedure as well as information about the loci being analyzed.

#### **2. Demonstration/Practice**

New analysts first observe either the PCR or RFLP procedures being taught. Samples are first typed by the instructor. Each learning stage reflects the step-by-step process involved in performing the actual test. For PCR this involves: extraction, quantitation, amplification and the detection of specific loci. For RFLP this involves: extraction, quantitation (yield gel), endonuclease digestion, test gel, analytical gel, southern transfer, hybridization, and autoradiography.

Each demonstration is performed in steps and is followed by the instructor observing the student performing each one alone. By the end of the demonstrations, the analyst will have hands-on experience with the complete test. During the instruction the student is instructed on the importance of filling out the worksheets used to document sample analyses. Also, the instructor will insure that the student is familiar with the operation of the equipment necessary to perform the test.

By the end of the demonstration period, the analyst will have acquired a theoretical understanding of each step of the test being studied. For example, it is important to understand what is happening to the DNA during the extraction procedures for each test. Likewise, it is important to understand what happens in PCR

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reaction tubes during each step of the amplification cycle. Also, for the RFLP procedure, the specifics of endonuclease digestion and the southern blot. The student should understand the purpose of the various hybridization washing steps for both the PCR and RFLP techniques. Also, the basic mechanism visualization of final results, i.e., color, silver, or autorad development, must be understood.

### 3. Individual Practice

The analyst will then practice each of the procedures under supervision. At first, the analyst will require direct supervision and assistance throughout the entire test. But after sufficient practice, the analyst should be comfortable with the typing procedures. At this point, direct supervision may be limited. Eventually, the analyst will complete the entire test without supervision.

During this phase, the analyst will perform practice runs for each of the methods being learned. Three to six samples are sufficient for each of the practice tests. The results from the analyst's tests will be evaluated in terms of sensitivity, consistency, and contamination. Problems will be addressed at this point and tests repeated if necessary.

Before being certified to perform independent testing, each analyst must complete a clean practice test for each of the methods. For PCR tests, this refers to low-level contamination, for example, results where extra dots are less intense than the 'c' or 's' dots in the HLA-DQ $\alpha$  and PM tests respectively. For RFLP tests this refers to autorads without extra bands.

### 4. Proficiency

At the end of the practice stage, the analyst will take a proficiency test. The test consists of two or more samples for each of the procedures which the analyst has practiced. The final proficiency test is filed in the analyst's folder.

### 5. Supplemental Training

The analysts who have completed their initial round of proficiency testing will be introduced to new procedures as they are amended to the DNA protocol. As before, they will observe a demonstration run, and they will be given time to practice the procedure on their own. In this case, practice samples may be processed at the same time as other samples. Once the analysts are comfortable with the new procedure, they will type unknown samples as an internal proficiency. At least two samples must be successfully typed for each new procedure before the analyst is considered proficient.



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## **Medical Examiner Rotation Training Outline**

### **Medical Examiner Rotation**

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The resident rotation in Forensic Biology is a program of a combination of discussions, laboratory observations and laboratory exercises. The program is designed to acquaint the resident with the practice of forensic biology as it relates to the mission of the Office of the Chief Medical Examiner and the Criminal Justice System of New York City.

The resident will become familiar with departmental policies relating to evidence handling and control, scientific testing procedures, quality assurance and control, and reporting procedures.

Throughout the program, additional discussions will focus on the philosophy of forensic science and its relation to physical evidence collection, recognition and examination in the forensic biology laboratory.

The resident will have the opportunity to observe casework processing and to discuss with forensic analysts and scientists the rationale for taking specific approaches in particular cases.