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Standard for Forensic DNA Analysis Training Programs



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Foreword

This standard was revised, prepared and finalized as a standard by the DNA Consensus Body of the AAFS Standards Board (ASB). The initial draft document was developed by the Biological Methods Subcommittee of the Organization of Scientific Area Committees.

A quality training program is critical for forensic DNA testing and databasing laboratories. The purpose of the training program is to ensure DNA testing procedures are correctly performed, the DNA data obtained are appropriately analyzed and interpreted, and statistics, reports, and testimony provided are accurate and properly communicated.

This standard is intended for all DNA laboratory personnel. It is a foundational training program standard upon which more specific standards will be based. Additional standards will provide more specific requirements for training in various stages of the DNA analysis and reporting process, such as training in DNA isolation and purification methods, data interpretation, statistical analysis, report writing, and courtroom testimony.

It is the intent that this standard be applied to a laboratory's existing forensic DNA analyst training program. Laboratories are advised to review their current training program for compliance with these requirements and to supplement or modify the existing training program accordingly. If no suitable training program exists within the laboratory for a forensic DNA analyst then the laboratory must develop a forensic DNA analysis training program to ensure that this standard is sufficiently met.

All hyperlinks and web addresses shown in this document are current as the publication date of this standard.

Keywords: *forensic DNA training, DNA training program, forensic DNA competency testing*

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Standard for Forensic DNA Analysis Training Programs

1 Scope

This standard provides the general requirements for a forensic DNA laboratory's training program in DNA analysis including data interpretation.

2 Normative References

The document contains no normative references. See Annex A, Bibliography for other references.

3 Terms and Definitions

For purposes of this document, the following definitions apply.

3.1 competency

The demonstration of technical skills and knowledge necessary to perform forensic DNA analysis successfully.¹

3.2 competency test(s)

A test designed to establish that an individual has demonstrated achievement of technical skills and met minimum standards of knowledge necessary to perform forensic DNA analysis.¹

3.3 DNA analysis

The process of identification and evaluation of biological evidence in criminal matters using DNA technologies, including DNA isolation and purification methods, data interpretation, statistical analysis, report writing, and courtroom testimony.

3.4 DNA technical leader (or equivalent role, position, or title as designated by the laboratory director)

An employee who is accountable for the technical operations of the laboratory and who is authorized to stop or suspend laboratory operations.¹

3.5 method

A combination of procedural steps used to perform a specific technical process. The method includes the validated steps, reagents, and critical instruments needed to perform the process or portion of a process. The same method may be conducted using different equipment (automated vs manual) when appropriately validated.¹

¹ FBI, *Quality Assurance Standards for Forensic DNA Testing Laboratories*

3.6**Mitochondrial DNA****mtDNA**

A small (~16,500 base pairs), circular DNA molecule located in eukaryotic mitochondria that is typically maternally inherited; the resistance to degradation and presence of multiple copies of mtDNA in each cell makes it useful with samples originating from limited or damaged biological material;² variations in the DNA sequence may be used for distinguishing individuals, and in biological relationship and ancestry testing.

3.7**multi-laboratory system**

An organization that has more than one laboratory performing forensic DNA analysis.¹

3.8**protocol**

An established practice to be followed in performing a specified task or under specific circumstances.

3.9**qualified**

An adjective used to describe an individual who meets the requirements for the position, has successfully completed the laboratory's applicable training requirements, and is authorized to perform a specific task or role.¹

3.10**short tandem repeats****STR**

Multiple copies of an identical (or similar) DNA sequence arranged in direct succession where the repeat sequence unit is 2 base pairs (bp) to 6 bp in length; because STRs generally occur in the DNA outside of the constraints (i.e., selective pressure) of genes, the number of repeat units can vary between individuals;² variations in STRs may be used for distinguishing individuals, and in biological relationship and ancestry testing.

3.11**single nucleotide polymorphism****SNP**

DNA sequence variations that occur when a single nucleotide (A, T, C, or G) in the genome sequence is altered; these variations may be used for distinguishing individuals, and in biological relationship and ancestry testing.

3.12**technology**

Used to describe the type of forensic DNA analysis performed in the laboratory, such as SNP, STR, Y-STR, or mitochondrial DNA.¹

² Butler, John M. *Fundamentals of Forensic DNA Typing*. Amsterdam: Academic Press/Elsevier, 2010

3.13**training program**

A written description of activities to be performed for the purpose of establishing and maintaining competency and job-related knowledge, skills or abilities.

3.14**validation**

The process of performing a set of experiments that establish the efficacy, reliability, and limitations of a method, procedure or modification thereof; establishing recorded documentation that provides a high degree of assurance that a specific process will consistently produce an outcome meeting its predetermined specifications and quality attributes. May include developmental and/or internal validation.

3.15**Y-STR**

Short tandem repeat markers found on the Y-chromosome that enable male-specific DNA testing and can be useful in cases involving sexual assault; variations in Y-STRs may be used for distinguishing individuals, and in biological relationship and ancestry testing.

4 Requirements**4.1 Personnel****4.1.1 General**

All DNA laboratory personnel shall have successfully completed training prior to participating in DNA analysis and data interpretation.

4.1.2 Training Program Coordinator

The laboratory or multi-laboratory system may have an individual to oversee the DNA training program under the direction of the DNA technical leader. The DNA technical leader is responsible for the administration of the training program.

4.1.3 Personnel with Previous DNA Experience

Individuals with documented previous experience and training in forensic DNA analysis may be exempted from portions of the training program. The DNA technical leader shall be responsible for assessing an individual's previous training and ensuring that it is adequate and documented.

4.1.4 New DNA Processing, Data Interpretation, and Statistical Analysis Methods

When a new DNA processing, data interpretation, or statistical analysis method is incorporated into the laboratory's protocols, all personnel responsible for performing the method shall successfully complete training and competency testing prior to performing DNA analysis, data interpretation or statistical analysis.

NOTE For DNA personnel who had an integral role in the validation sufficient to master the technical skills, concepts, and knowledge pertaining to the validation, the technical leader may allow the validation to serve as the competency test in this method of DNA analysis. The DNA technical leader shall document the level of

involvement of the individual in the validation to indicate how it applies to the individual's job responsibilities.

4.2 Training Program

4.2.1 General

The laboratory shall have a written training program that provides trainees with the appropriate knowledge, technical training, and practical experience to perform their job responsibilities as they apply to DNA analysis (as previously defined) performed by the laboratory. Prior to implementation, the DNA training program shall be approved by the DNA technical leader and any management staff required by laboratory policy.

4.2.2 Content

At a minimum, the training program shall include the following topics as they apply to the work conducted by the laboratory and by the individual in training.

- a) Expectations for satisfactory progression through the training program and performance on competency test(s).
- b) General operation of the forensic laboratory.
- c) The laboratory's quality management program.
- d) Laboratory safety.
- e) Applicable validations (developmental and/or internal validations to include the design and scope).
- f) Applicable software.
- g) Lectures and practical exercises of evidence handling and chain of custody.
- h) Lectures and literature review on the theoretical and scientific basis of forensic DNA analysis.
- i) Practical instruction and observation of the technologies, methodologies, and platforms used in the laboratory.
- j) Practical exercises in the technologies, methodologies, and platforms used in the laboratory on samples representative of the range, type and complexity analyzed by the laboratory.
- k) Lectures and practical exercises in data interpretation and statistical analysis.
- l) Lectures and practical exercises in report writing.
- m) Lectures and practical exercises in technical and administrative reviews.
- n) Lectures on cognitive bias in decision-making processes associated with forensic DNA analysis.
- o) Lectures on all applicable laws and regulations.

- p) Lectures including limitations of methods and selection of methods.
- q) Lectures and practical exercises in testimony as an expert witness.
- r) Lectures on ethics.
- s) Lectures on how to conduct a validation.

4.2.3 Documentation of Required Portions of the Training Program

The training program shall be tailored, as applicable, to the trainee's specific job responsibilities and the extent to which the trainee will participate in DNA analysis and data interpretation. The DNA technical leader shall document which portions of the training program are specific to the trainee's job responsibilities.

4.2.4 Administration of the Training Program

The training program shall be administered by the DNA technical leader. Internal training shall be performed by the DNA technical leader or a qualified analyst(s) or technician(s) designated by the DNA technical leader. External training shall be pre-approved by the DNA technical leader. External training activities shall be documented in the trainee's training records. The documentation shall include the DNA technical leader's review of the external training.

4.2.5 Revisions to the DNA Training Program

Any revision to the DNA training program shall be approved by the DNA technical leader and any management staff required by laboratory policy, prior to implementation by the laboratory.

4.2.6 New DNA Analysis, Data Interpretation, and Statistical Analysis Methods

Any new DNA processing, data interpretation, or statistical analysis method approved and implemented by the laboratory shall be incorporated into the laboratory's training manual.

4.2.7 Re-training of Previously Qualified Laboratory Personnel

In the event that a previously qualified individual requires re-training, the DNA technical leader shall evaluate the knowledge-based or technical areas requiring improvement and determine the appropriate re-training and competency testing to be completed. The individual shall successfully complete the re-training and assigned competency test(s) in order to resume the applicable job responsibilities.

4.3 Competency Testing

4.3.1 General

Prior to performing work in any area of the knowledge-based or technical areas of the training program, the trainee shall successfully complete the competency test(s). The assigned competency testing shall be based on the individual's job responsibilities and the extent to which they will participate in DNA analysis or data interpretation. The competency test(s) shall establish that the trainee has the knowledge, skill, and ability required to perform the assigned job responsibilities.

4.3.2 Required Testing

Prior to performing DNA analysis or data interpretation, the trainee shall successfully complete the following knowledge-based and technical competency tests, as they apply to the assigned job responsibilities.

- a) Written and/or practical competency test(s) as indicated below covers, at a minimum, the following areas:
 - 1) theoretical and scientific basis of forensic DNA analysis – written test;
 - 2) laboratory’s analytical procedures performed on samples representative of the range, type, and complexity typically analyzed by laboratory – practical test;
 - 3) data interpretation – written and practical tests;
 - 4) statistical analysis – written and practical tests;
 - 5) report writing – written and practical tests;
 - 6) technical review – practical test;
 - 7) ethics – written test;
 - 8) cognitive bias – written test.
- b) An oral competency test(s) to demonstrate an understanding of ethics and the scientific basis of forensic DNA analysis. The oral competency test shall be designed to demonstrate that the trainee can explain the DNA analysis and data interpretation procedures and statistics used by the laboratory to both a layman and a scientific expert for positions where testimony may be required. The oral assessment shall include a mock trial exercise in addition to any other laboratory-specified requirements.

4.3.3 Administration of Competency Tests

Competency tests may be administered as individual tests for each assigned area of the training program or combined into more comprehensive tests. Competency tests shall be assembled, issued, and assessed internally. The DNA technical leader shall approve all competency tests prior to administration to the trainee.

4.3.4 Assessment of Competency

All competency tests shall be graded as either satisfactory or unsatisfactory according to laboratory policy. The laboratory shall maintain written criteria for passing a competency test. Personnel cannot perform tasks related to casework or databasing until they achieve a satisfactory rating on their corresponding competency test. The DNA technical leader shall evaluate and document the results of all competency tests. Competency test results shall be reviewed with the trainee, the trainer(s), and the trainee’s supervisor.

4.3.5 Re-testing Within a Training Program

In the event that an individual needs to be re-tested to demonstrate competency, the DNA technical leader shall evaluate the knowledge-based or technical areas requiring improvement and determine the appropriate additional training necessary for the individual to demonstrate competency. Following completion of that training, the individual shall demonstrate competency in order to initiate or resume the applicable job responsibilities.

4.3.6 Acknowledgement of Competency

Prior to the trainee performing casework or databasing, the DNA technical leader shall document that the trainee has successfully completed the training program and the competency test(s).

5 Conformance

In order to demonstrate conformance with this standard, the laboratory shall have the following.

- a) A documented training program which includes the following.
 - 1) A written training manual covering all validated technologies and methodologies currently used by laboratory as well as all of the DNA analytical procedures to be performed by laboratory personnel.
 - 2) Documentation of the knowledge and technical skills required to perform DNA analysis.
 - 3) Documentation of the training activities and competency testing to be completed prior to performing DNA analysis.
- b) Documented approval of the training program by the DNA technical leader and any other laboratory management staff as required by laboratory policy prior to implementation by the laboratory.
- c) Records of successful completion of training activities and competency test(s) for each trainee prior to performing DNA analysis and data interpretation. The records shall be specific as to the individual's job function and the extent to which they will participate in DNA analysis and data interpretation. The records shall include any modifications made to the individual's training plan and documented approval of the modifications by the DNA technical leader. All training activities for each trainee shall be documented and records retained. The DNA technical leader and laboratory management, as applicable, shall review and approve the training records for completeness.
- d) Documented acknowledgement from the DNA technical leader that each individual has demonstrated the knowledge, skills, and ability to perform the assigned job responsibilities as they apply to DNA analysis or data interpretation.

Annex A

(informative)

Bibliography

The following information provides a list of the literature resources that may assist the DNA technical leader in defining the breadth and scope of the materials to be reviewed by the trainee. This list is not meant to be all-inclusive. The laboratory shall develop a list tailored to its specific needs. Updated references shall be added to the laboratory's list as new methods or technologies are incorporated into the laboratory's protocols.

- 1] FBI, *Quality Assurance Standards for DNA Databasing Laboratories*. It is available at <https://www.fbi.gov/file-repository/quality-assurance-standards-for-dna-databasing-laboratories.pdf/view>.
- 2] FBI, *Quality Assurance Standards for Forensic DNA Testing Laboratories (QAS)*. It is available at <https://www.fbi.gov/file-repository/quality-assurance-standards-for-forensic-dna-testing-laboratories.pdf/view>.
- 3] SWGDAM. *SWGDAM Training Guidelines*. It is available at http://media.wix.com/ugd/4344b0_87b2b4a150aa433f9490b7113b1aa4a6.pdf.



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