

Scientific Working Group on DNA Analysis Methods

Training Guidelines

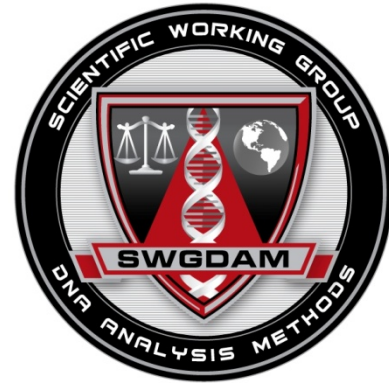


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SWGDAM Training Guidelines

The Scientific Working Group on DNA Analysis Methods, better known by its acronym of SWGDAM, is a group of approximately 50 scientists representing federal, state, and local forensic DNA laboratories in the United States and Canada. During meetings, which are held twice a year, committees discuss topics of interest to the forensic DNA community and often develop documents to provide direction and guidance for the community. This document was presented to the full SWGDAM group and received approval on January 17, 2013.

This document provides guidelines for training of laboratory personnel throughout the forensic DNA community and supersedes the Scientific Working Group on DNA Analysis Methods (SWGDAM) Training Guidelines (2001). The revised guidelines are not intended to be applied retroactively. Laboratories are encouraged to review their standard operating procedures and training programs in light of these guidelines and to

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update their procedures as needed. It is anticipated that these guidelines will evolve further as future technologies emerge.

Introduction

The FBI Director issued Quality Assurance Standards for Forensic DNA Testing Laboratories (effective September 1, 2011) and Quality Assurance Standards for DNA Databasing Laboratories (effective September 1, 2011) that include requirements for laboratory personnel involved in forensic DNA analysis. Specific course requirements, in-house laboratory training and assessment, and the minimum experience for laboratory personnel are further explained in “The FBI Quality Assurance Standards (QAS) Audit for Forensic DNA Testing Laboratories” and “The FBI Quality Assurance Standards (QAS) Audit for DNA Databasing Laboratories”. The Quality Assurance Standards for Forensic DNA Testing and Quality Assurance Standards for Databasing Laboratories have precedence over the QAS Audit documents and these guidelines.

In 2001, SWGDAM prepared guidelines for training new personnel in laboratories performing DNA analysis. Subsequent revisions of the QAS necessitated updating these guidelines to ensure consistency with the most current QAS. These guidelines are based on the QAS and input from members of SWGDAM and the forensic community and are intended to assist forensic and DNA databasing laboratories in developing training programs.

The primary emphasis of the guidelines is to provide a model program of standardized study and training for laboratory personnel throughout the forensic DNA community. The benefits of these guidelines include improving the overall quality and consistency of work in private and public laboratories performing forensic DNA analysis and allowing for confidence in hiring laboratory staff. Another benefit is to provide a guide for universities and laboratories in the development and implementation of educational and practical experiences common to all DNA analysts.

This document should assist laboratories in developing a training program applicable to the analytical methods used by their laboratories. Suggestions and directions are given to

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those involved in curriculum development in forensic science and related course work. Laboratories should consider including the aspects of these guidelines in their training programs when performing their annual reviews. These are guidelines and should be expanded and tailored to meet the needs of individual laboratories and their training requirements.

This training program employs a module system, and successful completion of each module is the goal of the trainee. This program is developed for the new employee (or a current employee with no prior DNA experience). In accordance with the QAS, a trainee with previous experience in forensic or other DNA analysis may not require all modules or steps; it is the responsibility of the DNA technical leader to determine the duration and scope of the training program for a trainee with previous experience and/or training in forensic DNA analysis. Similarly, the module content may be tailored as applicable to various job responsibilities. The module content should be customized to include all aspects of procedures and policies of the laboratory. The laboratory or laboratory system should retain all documentation of the trainee's work according to the laboratory's document retention policy.

The laboratory should develop a documented training program to include the following:

- Training manual covering all DNA analytical procedures that the laboratory personnel will perform
- Training program that defines the technical skills and knowledge required to perform DNA analysis
- Documentation of the completion of the specified tasks and competency test(s). This should include written and/or oral examinations that cover the range of topics specified by the defined tasks. The laboratory shall retain a record of the competency test(s) and documentation of the trainee's successful completion of the test(s).

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A training program should mirror actual procedures used in casework/database analysis whenever possible and also include the use of applicable LIMS, reagent tracking, quality control procedures, evidence handling procedures, and administrative functions.

Any newly validated technology or methodology implemented by the laboratory must be incorporated into the laboratory's training program prior to the training of personnel in the new methodology.

These guidelines reference the “trainee” which is intended to apply to any DNA laboratory personnel. References to the “analyst” are intended to apply specifically to DNA analyst trainees. These guidelines should be tailored to meet the needs of individual laboratories and their laboratory personnel.

1. Laboratory Introduction

1.1 Goal

An introduction to the laboratory and the training program should be developed and provided. Upon completion, the trainee should be familiar with the general operation of the forensic laboratory and the expectations of the training program.

1.2 Tasks

1.2.1 Description of the responsibilities of the trainer and the trainee, including specific job responsibilities

1.2.2 Orientation to the laboratory facility

1.2.3 Description of the organization and management, goals and objectives, code of ethics, chain of command of the forensic laboratory, laboratory administrative policies, and evidence workflow.

1.2.3.1 Familiarization with evidence exams of other laboratory sections

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1.2.3.2 Order of evidence examinations

1.2.4 Description of the security and confidentiality policies/procedures of the forensic laboratory

1.2.5 Introduction to the quality assurance/quality control program

1.2.5.1 Quality Assurance/Quality Control Manual(s)

1.2.5.2 Quality Assurance Standards for Forensic DNA Testing and/or DNA Databasing Laboratories

1.2.5.3 Documentation requirements

1.2.5.4 Non-conformances and Corrective Actions

1.2.5.5 Audits and Accreditation

1.2.5.6 Proficiency Tests

1.2.5.7 Equipment calibration and maintenance

1.2.6 Safety

1.2.6.1 Personal Protective Equipment (PPE)

1.2.6.2 Biohazards

1.2.6.3 Chemical hygiene plan

1.2.6.4 Fire safety

1.2.6.5 Waste management program

1.2.6.6 Bloodborne pathogens procedures

1.2.6.7 Material Safety Data Sheets

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1.2.6.8 Laboratory policy on incident reports

1.2.6.9 Decontamination procedures

1.3 Reading Assignments

1.3.1 Training manual

1.3.2 Quality Assurance/Quality Control manual(s)

1.3.3 Administration manual and operations manual

1.3.4 Safety manual

1.3.5 Quality Assurance Standards for Forensic DNA Testing Laboratories and/or Quality Assurance Standards for DNA Databasing Laboratories

1.3.6 The FBI Quality Assurance Standards (QAS) Audit for Forensic DNA Testing Laboratories and/or The FBI Quality Assurance Standards (QAS) Audit for DNA Databasing Laboratories

1.3.7 DNA Technology in Forensic Science, National Research Council (1992), Chapters 4 and 7

1.3.8 The Evaluation of Forensic DNA Evidence, National Research Council (1996), Chapter 3

1.4 Assessment

1.4.1 Module should be completed by laboratory personnel as applicable by job responsibility and the extent to which the trainee will participate in DNA analysis

1.4.2 Documentation of successful completion of module

2. Fundamental Scientific Knowledge

2.1 Goal

To ensure that an analyst has or is provided the formal education and the working knowledge of the fundamental scientific basis of forensic DNA analysis.

2.2 Tasks

2.2.1 Review and document completion of required education

2.2.1.1 In accordance with the QAS, analysts shall have a bachelor's (or its equivalent) or an advanced degree in a biology-, chemistry-, or forensic science-related area and shall have successfully completed coursework (graduate or undergraduate level) covering the following subject areas:

2.2.1.1.1 Biochemistry (refers to the nature of biologically important molecules in living systems, DNA replication and protein synthesis, and the quantitative and qualitative aspects of cellular metabolism);

2.2.1.1.1.1 Key elements of Biochemistry (may include, but not limited to)

- Structure and function of cellular components such as proteins, carbohydrates, lipids, nucleic acids, and other biomolecules
- Chemistry of enzyme-catalyzed reactions
- Metabolism
- DNA, RNA
- Protein synthesis
- Cell membrane transport
- Signal transduction

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2.2.1.1.2 Genetics (refers to the study of inherited traits, genotype/phenotype relationships, and population/species differences in allele and genotype frequencies);

2.2.1.1.2.1 Key elements of Genetics (may include, but not limited to)

- Heredity
- Function of Genes
- Gene expression
- Recombinant DNA
- Mitosis / Meiosis

2.2.1.1.3 Molecular biology (covers theories, methods, and techniques used in the study and analysis of gene structure, organization, and function);

2.2.1.1.3.1 Key elements of Molecular biology (may include, but not limited to)

- Interrelationship of DNA, RNA, and protein synthesis
- Central Dogma
- Transcription, translation, replication
- Recombinant DNA Techniques
- PCR
- Cloning

The specific subject areas listed above shall be an integral component of any coursework. The key elements listed above should be used as an aide in evaluating course content and should not be considered a definitive list. Analysts appointed or hired after July 1, 2009 shall have a minimum of

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nine cumulative semester hours or equivalent that cover the required subject areas.

2.2.1.2 Coursework and/or training in statistics and/or population genetics as it applies to forensic DNA analysis

Analysts who have completed coursework with titles other than those listed above shall demonstrate compliance through a combination of pertinent materials, such as a transcript, syllabus, letter from the instructor, or other document that supports the course content. The technical leader shall document approval of compliance.

2.2.2 Review and document prior experience

2.2.2.1 The analyst for a caseworking laboratory shall have at a minimum six months of documented forensic human DNA laboratory experience. The analyst for a databasing laboratory shall have at a minimum six months of documented human DNA laboratory experience with at least three months in a forensic or database DNA laboratory.

If prior forensic human DNA laboratory experience is accepted by a laboratory, the prior experience shall be documented and augmented by additional training, as needed, in the analytical methodologies, platforms and interpretations of human DNA results used by the laboratory.

2.3 Reading Assignments

2.3.1 To be determined by the laboratory based upon assessment of education and prior experience.

2.4 Assessment

2.4.1 Module should be completed by analysts

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2.4.2 The laboratory shall assess the degree obtained and coursework completed for an analyst through the review of transcripts and other appropriate documentation, such as course descriptions or syllabus. The analyst should possess an understanding of fundamental scientific knowledge as it applies to forensic DNA analysis, as determined by the technical leader.

3. Applied Scientific Knowledge

3.1 Goal

To educate the analyst on the specific knowledge related to the field of forensic DNA analysis. The level of detail should be applicable to the analyst's job responsibilities.

3.2 Tasks

3.2.1 Develop in-depth theoretical understanding of the technologies, methodologies and platforms appropriate to the work being conducted in the laboratory and basic theoretical understanding of the historical technologies, methodologies and platforms.

3.2.1.1 Extraction

3.2.1.2 Quantification

3.2.1.3 Amplification

3.2.1.4 DNA Typing / Sequencing

3.3 Reading Assignments

3.3.1 Developmental validation studies

3.3.2 Laboratory's validation data

3.4 Assessment

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3.4.1 Module should be completed by analysts

3.4.2 Analyst should possess an understanding of the applied scientific knowledge as it applies to forensic DNA analysis, as determined by the technical leader

4. Sample and/or Evidence Control

4.1 Goal

Develop an understanding of sample and/or evidence control in the forensic laboratory.

4.2 Tasks

4.2.1 The trainee should receive instruction on the following, as applicable:

4.2.1.1 Sample and/or evidence collection, packaging, and storage

4.2.1.2 Chain of custody, receiving, and handling samples and/or evidence

4.2.1.3 Contamination of samples and/or evidence

4.2.1.4 Sample and/or case acceptance policy

4.2.1.5 Consumption of samples and/or evidence

4.2.1.6 Distinction between evidence and work product

4.2.1.7 Laboratory documentation policy (paper and/or electronic)

4.3 Reading Assignments

4.3.1 Laboratory evidence-handling procedure (for forensic laboratory)

4.3.2 Sample inventory and control procedure (for databasing laboratory)

4.3.3 Sample and/or case acceptance policy

4.4 Assessment

4.4.1 Module should be completed by laboratory personnel as applicable by job responsibility and the extent to which the trainee will participate in DNA analysis

4.4.2 Documentation of successful completion of module

5. Laboratory Analysis

5.1 Goal

To provide practical instruction to the trainee on technologies, methodologies and platforms used in the laboratory in accordance with the trainee's job responsibilities and the extent to which the trainee will participate in DNA analysis.

5.2 Tasks

5.2.1 The trainee should receive instruction, training, and demonstrate competence in the following topics as they relate to the laboratory's analytical procedures, as applicable:

5.2.1.1 Extraction

5.2.1.2 Quantification

5.2.1.3 Amplification

5.2.1.4 DNA Typing / Sequencing

The type of samples included in practical exercises should be representative of the range, type, and complexity of casework or database technologies, methodologies and platforms in accordance with the trainee's job responsibilities and the extent to which the trainee will participate in DNA analysis.

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The number of samples analyzed by the trainee should be sufficient to demonstrate the trainee's ability to competently conduct the laboratory's analytical procedures to produce reliable and accurate results.

5.2.2 The trainee should compile records of his/her performance of analytical procedures listed in Section 5.2.1.

5.2.3 The technical leader shall evaluate, approve and document the adequacy of previous training for a trainee who has not otherwise completed the laboratory's formal training program.

5.3 Reading Assignments

5.3.1 Laboratory's analytical procedures

5.3.2 Kit manufacturer's literature

5.3.3 User's Manuals for platforms and kits

5.4 Assessment

5.4.1 Module should be completed by laboratory personnel in accordance with the trainee's job responsibilities and the extent to which the trainee will participate in DNA analysis

5.4.2 Review and approval of records compiled by trainee

6. Interpretation and Analysis

6.1 Goal

To provide practical instruction to the analyst on interpretation of DNA analysis for the technologies, methodologies and platforms used in the laboratory in accordance with the analyst's job responsibilities and the extent to which the analyst will participate in DNA analysis.

6.2 Tasks

6.2.1 The analyst shall receive instruction and training, and demonstrate competence in both analysis and interpretation for the following areas, as applicable, as they relate to the laboratory's analytical procedures:

6.2.1.1 Autosomal STR analysis for single-source and mixed DNA profiles

6.2.1.2 YSTR analysis for single-source and mixed DNA profiles

6.2.1.3 Mitochondrial DNA analysis for single-source and mixed DNA profiles

6.2.1.4 Laboratory's criteria for inclusions, exclusions, and inconclusive profiles

6.2.1.5 Paternity/Kinship analysis

6.2.1.6 Statistical analysis

6.2.1.7 Expert Systems

6.2.1.8 CODIS software

6.2.2 The analyst should compile records of his/her interpretation and analysis of DNA profiles generated from section 5.2.1.4 and/or other practical exercises.

The type of samples included in practical exercises should be representative of the range, type, and complexity of casework or database technologies, methodologies and platforms in accordance with the analyst's job responsibilities and the extent to which the analyst will participate in DNA interpretation and analysis.

6.3 Reading Assignments

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6.3.1 Laboratory's Interpretation Guidelines

6.3.2 Validation Studies

6.3.3 Laboratory's Quality Assurance/Quality Control procedures

6.3.4 SWGDAM Interpretation Guidelines for Autosomal STR Typing for Forensic DNA Testing Laboratories, released January 14, 2010 available at http://www.swgdam.org/Interpretation_Guidelines_January_2010.pdf or the most recent version available at <http://www.swgdam.org>.

6.3.5 SWGDAM YSTR interpretation guidelines (if applicable), Forensic Science Communications, January 2009, Volume 11, Number 1 or the most recent version available at <http://www.swgdam.org>.

6.3.6 SWGDAM Guidelines for Mitochondrial (mtDNA) Nucleotide Sequence Interpretation (if applicable), Forensic Science Communications, April 2003, Volume 5, Number 2 or the most recent version available at <http://www.swgdam.org>.

6.3.7 The Evaluation of Forensic DNA Evidence, National Research Council (1996), Chapters 1-6

6.4 Assessment

6.4.1 Module should be completed by analysts in accordance with the analyst's job responsibilities and the extent to which the analyst will participate in DNA analysis

6.4.2 Review and approval of records compiled by analyst

7. Reports and Notifications

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7.1 Goal

To provide instruction to an analyst on reporting analytical results or issuing written notifications according to the laboratory's policy.

7.2 Tasks

7.2.1 The trainee should receive instruction in the following:

7.2.1.1 Laboratory policy on case or sample file content

7.2.1.2 Report writing, as applicable

7.2.1.3 Written notifications, as applicable

7.2.1.4 Technical and Administrative Review, as applicable

7.2.1.5 Report/Notification issuance according to laboratory policy, as applicable

7.2.1.6 Confidentiality/disclosure of information according to laboratory policy, as applicable

The type of practical exercises should be representative of the range, type, and complexity of casework or database technologies, methodologies and platforms in accordance with the trainee's job responsibilities and the extent to which the trainee will participate in DNA analysis.

The number of practical exercises performed by the trainee should be sufficient to demonstrate the trainee's ability follow the laboratory's procedures.

7.3 Reading Assignments

7.3.1 Laboratory report writing procedures

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7.3.2 The Evaluation of Forensic DNA Evidence, National Research Council (1996)

7.3.3 Qualifying offenses for jurisdiction, as applicable

7.3.4 Technical and administrative review procedures, as applicable

7.3.5 Laboratory report/notification issuance/confidentiality procedures

7.4 Assessment

7.4.1 Module should be completed by the analyst in accordance with the analyst's job responsibilities and the extent to which the analyst will participate in DNA analysis

7.4.2 The analyst should prepare reports/notifications of his/her interpretation and analysis of DNA profiles generated from section 5.2.1.4 and/or other practical exercises according to laboratory policy

7.4.3 The analyst should perform technical and administrative reviews of training reports/notifications to the extent that they perform these as part of casework/database analysis

7.4.4 Review and assessment of reports/notifications for accuracy

8. Legal Issues

8.1 Goal

To instruct the trainee on the legal system in his/her jurisdiction and to prepare the trainee to testify as an expert witness.

8.2 Tasks

8.2.1 The trainee should receive instruction in the following topics:

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8.2.1.1 Courtroom procedures and rules of evidence process

8.2.1.1.1 Court structure (trial and appeals courts)

8.2.1.1.2 Format of hearing or trial

8.2.1.1.3 Discovery and admissibility rules

8.2.1.1.4 Courtroom demeanor and attire

8.2.1.2 DNA analyst qualifications

8.2.1.3 Technical testimony

8.2.1.4 Testimony practice (direct and cross examination)

8.2.1.5 Ethical responsibility of expert witness

8.2.1.6 Evidence/Exhibit presentation

8.2.1.7 DNA Database legal authority (State and Federal)

8.2.1.7.1 Permissible samples/profiles

8.2.1.7.2 Confidentiality/disclosure of information

8.2.2 The analyst should prepare a curriculum vitae and observe expert testimony

8.2.3 The analyst should participate in moot court testimony that includes direct and cross examination as well as the introduction of evidence/exhibits

8.3 Reading Assignments

8.3.1 Relevant and appropriate transcripts or case law

8.3.2 DNA Technology in Forensic Science, National Research Council (1992), Chapters 4, 5, 6, and 7

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8.3.3 The Evaluation of Forensic DNA Evidence, National Research Council (1996), Chapter 6

8.3.4 Committee on Identifying the Needs of the Forensic Science Community; Committee on Applied and Theoretical Statistics, National Research Council, Strengthening Forensic Science in the United States: A Path Forward (2009)

8.4 Assessment

8.4.1 Module should be completed by analysts

8.4.2 Completion of this module should be demonstrated by a minimum of one successful moot court. Documentation of the moot court should contain an evaluation of the analyst's performance and be retained by the laboratory.

9. Final Evaluation

9.1 At the completion of this training program, the trainee shall successfully pass a competency test as applicable by job responsibility and the extent to which the trainee will participate in DNA analysis. This competency test should be comprised of samples representative of those the trainee will be analyzing on the job. The trainee should prepare documentation of the analysis following the laboratory's standard document procedures.

9.2 Assessment

9.2.1 Successful completion of the competency test shall be documented

9.2.2 If at any point re-training is required, portions of these guidelines may be administered as appropriate

Recommended References

The following resources may be helpful to the trainer in defining the breadth and scope of the materials for the trainee's reading. This list is not meant to be all inclusive. The

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laboratory should develop a list tailored to its specific needs. In accordance with the FBI Director's Quality Assurance Standards, the laboratory is responsible for reviewing and updating the training manual annually. Updated references should be added to the laboratory's list during this review period or when new methodologies or technologies are incorporated into the laboratory protocols.

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Informational Web Sites: Additional information may be obtained from the following web sites:

The Federal Bureau of Investigation (FBI) - Combined DNA Index System (CODIS)

www.fbi.gov/about-us/lab/codis

The National Institute of Justice

www.nij.gov

The National Institute of Standards and Technology (NIST) - Short Tandem Repeat DNA Internet Database (STRBase)

www.cstl.nist.gov/strbase

The Scientific Working Group on DNA Analysis Methods (SWGDM)

www.swgdam.org

The U.S. Y-STR Database

<http://usystrdatabase.org>

The Y chromosome Haplotype Reference Database (YHRD)

<http://www.yhrd.org/>

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