Laboratory Training Manual User Guide

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Introduction

The Laboratory Training Manual is one of two components of a comprehensive training program for new DNA analysts funded by the President's DNA Initiative (PDI). The intent of the Laboratory Training Manual is to ensure that every trainee is provided with the basic practical instruction necessary to develop and demonstrate their competency as a DNA analyst. The other part of the program covers the theory required to give a DNA analyst the knowledge base that forms the foundation for their practical work.

The manual is designed to complement the theoretical instruction provided in the PDI project. However, it also can be a standalone resource for use by laboratories with an established training program. The manual has therefore been structured to provide flexibility in operation and application. Finally, the manual provides core examples of DNA analysis methods used in forensic laboratories, but it is not intended to cover all methods.

In contrast to the theory aspect of the PDI initiative, which is designed for distance delivery and self-paced learning, the Laboratory Training Manual is not suitable for self-directed learning; it is based on a partnership between the trainee and a nominated trainer. The trainer may be a member of the laboratory staff, college faculty member, or a contractor.

The laboratory must arrange access to laboratory facilities for the practical exercises.
This may be implemented in several ways, for example by:

- The individual laboratory
- Regional cooperation of several laboratories
- Partnership with a local training institution

Note: Allow at least 8 weeks prior to start of training of in-house training; this allows adequate time for set up and a preliminary run through. If outsourced, identify the training partner and provide them with the Laboratory Training Manual in advance.

The laboratory DNA Technical Leader has responsibilities under the National Quality Assurance Standards for DNA Testing (QAS) and must be closely involved in the training program. The program incorporates guidelines for the development of an Individual Training Plan and for the Demonstration of Competency. The Technical Leader must meet with the student and develop a binding Individual Training Plan with target dates for completion. The DNA Technical Leader should evaluate the trainee's progress on a regular basis.

Trainees must be able to demonstrate practical competency to the satisfaction of the Technical Leader by completing the practical exercises outlined in the Individual Training Plan. The Laboratory Training Manual includes review questions to facilitate discussion.

The specific requirements outlined for DNA analyst training in the QAS include the laboratory's responsibility to:

- Establish and document a training program that coincides with the procedures used in their facility
- Establish, maintain, and make available for review training records for each trainee
- Establish training records that document a formal recognition of a trainee's successful completion of the training program

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The Laboratory Training Manual uses the SWGDAM Training Guidelines as a reference for the establishment of a training program. This manual provides a minimum benchmark for laboratories; the laboratory may add exercises as prescribed by their procedures and policies.

The laboratory training components are to:

- Review laboratory policies and procedures
    - Standard operating procedures (SOP) review
    - Quality system review, to include procedures for limiting contamination
    - Safety system review
- Review key literature resources
- Develop the trainee's Individual Training Plan, including the specific laboratory protocols to be followed
- Perform laboratory training exercises
- Complete trainee's Demonstration of Competency record

Structure of the Laboratory Training Manual

The Laboratory Training Manual consists of:

1. The Laboratory Training Manual User Guide. This guide provides an introduction to the manual, discussion of global trainer/ trainee responsibilities, and access to the laboratory exercises and related documents for the applicable subjects. It is recommended that first time users of the Laboratory Training Manual review all of program documents.

2. A set of Linked Documents, which contains folders covering:

Folder Name	***Contents***
Laboratory Exercises	**Laboratory exercises** are presented by subject for the areas that require practical exercises. Review questions are included to facilitate discussion.
Sample Protocols	The Laboratory Training Manual assumes that the protocols in the laboratory's SOPs will be used for the practical exercises. Protocols for the exercises are included in the manual for facilities that wish to use them. **Sample protocols** are numbered and linked from the Laboratory Training Manual content for easy reference by the trainee. A table of all protocols is available in this User Guide for easy access to all provided protocols.
Literature Resources	**Literature resources** are provided for the subjects covered in the manual. The resources are organized by category/topic and may cover additional topics. The listing may include works already listed in the Works Cited section of the PDI knowledge base. A link to this global document is provided at the end of this document and at the beginning of each subject laboratory component.
Sample Forms	**Sample forms** for an *Individual Training Plan* and a *Demonstration of Competency* are provided. The forms are designed to assist the Trainer and Trainee to develop a training plan that incorporates the laboratory's SOPs. The trainee completes the practical exercises outlined in the Individual Training Plan form and the trainer/technical leader approves successful completion.

Laboratory Policies and Procedures

Trainer Responsibilities

1. Provide trainee with the appropriate laboratory SOPs, quality system manuals, and safety system manuals
2. Provide trainees with instruction regarding the various services (disciplines) offered by the laboratory and the laboratory's specific evidence handling guidelines (not included in this manual).
3. Determine the assessment criteria for the trainee
4. Review, verify, and document assignment completion

Trainee Responsibilities

1. Read all of the appropriate laboratory SOPs, quality system manuals, and safety system manuals
2. Complete instruction regarding the various services (disciplines) offered by the laboratory and the laboratory's specific evidence handling guidelines (not included in this manual).
3. Document and submit assignment completion as required by the trainer

Protocols

Practical exercises were developed for use this training. The expectation is that the trainee will use their laboratory's established protocols (SOPs) upon return to their workplace.

There may be instances when the laboratory does not have an SOP for one or more method and could use the provided protocols. Most of these have been based on SOPs used by the Illinois State Police (ISP). *This is not an endorsement by ISP of this training nor is it an endorsement by the NFSTC of the ISP protocols.* However, the SOPs are from a well-established operational laboratory that has successfully completed many cycles of accreditation and other review. These SOPs were successfully transferred by the NFSTC into a training environment when a face-to-face version of the DNA analyst training was provided to a group of ISP staff.

Trainer Responsibilities

1. Provide trainee with the laboratory's SOP's (protocols)
2. Determine the assessment criteria
3. Review, verify, and document assignment completion

Trainee Responsibilities

1. Read all of the required protocols, as assigned by the laboratory trainer
2. Document and submit assignment completion as required by the trainer

Literature Resources

The literature resources are provided in a global document that is organized by category. A link to this document is provided at the end of this document and at the beginning of each subject laboratory component. Revisions to this list should be made if the trainee's laboratory resource requirements vary from those provided in the Laboratory Training Manual*.*

Trainer Responsibilities

1. Provide trainee with the laboratory's required reading material (journals, textbooks, product literature, manufacturer training references, user manuals, Internet resources)
2. Determine the assessment criteria

3. Review, verify, and document assignment completion

Trainee Responsibilities

1. Read all of the required readings as assigned by the laboratory trainer
2. Document and submit assignment completion as required by the trainer

Forms

Individual Training Plan

An integral part of this program is the establishment of an Individual Training Plan. This plan provides the trainee with the training expectations and a means for documenting completion of the program.

The trainer and trainee should both participate in the preparation of the Individual Training Plan to ensure that both parties understand their respective duties. The training plan should include established methods for evaluation.

Suggested evaluation methods include the following:

- Summary of the trainee's progress for each exercise
- Evaluation of the trainee's notebook for each exercise
- Documentation of problem areas, as applicable, and their solutions or proposed solutions
- Documentation of trainee's strengths and weaknesses, including suggested remedies
- Documentation of trainee's overall performance

The laboratory protocols provided in this manual are examples of frequently used procedures. These protocols may be useful for laboratories that do not currently have established processes or laboratories that may wish to implement them in addition to their existing procedures.

Each laboratory must demonstrate that analysts are trained in the procedures used by that laboratory. The Individual Training Plan must include the specific laboratory protocols to be followed by the trainee.

The training plan can be adapted for trainees with previous experience who may not need to complete the full scope required of a new DNA analyst trainee.

Demonstration of Competency

Upon completion of the training plan elements, the trainer will complete the trainee's Demonstration of Competency record. The DNA Technical Leader is responsible for verification and final approval.

Trainer Responsibilities

1. Establish and document the training plan for each trainee
2. Determine and document the training plan evaluation methods and assessment criteria
3. Provide trainee with the appropriate laboratory protocols
4. Ensure that the trainee's notebook is reviewed regularly by the DNA Technical Leader and/or designee
5. Review, verify, and document exercise completion

Trainee Responsibilities

1. Review and understand the training plan, evaluation methods, and assessment criteria
2. Read the appropriate laboratory protocols
3. Perform the exercises outlined in the training plan
4. Maintain a notebook to include notes, photographs, worksheets, print-outs of quantitative data, genotyping for each sample, problems/ solutions, etc.
5. Document and submit assignment completion as outlined in the training plan

Navigation of the Laboratory Training Manual

The Laboratory Training Manual User Guide document contains a listing of exercises and protocols (by subject), literature, and forms that is hyperlinked to the related documents.

A hyperlink at the end of each document returns the user to the Laboratory Training Manual User Guide, enabling the user to proceed easily through the entire set of documents.

Links to additional material are found within the exercises allowing access to related external Internet resources.

Using Hyperlinks

Definition: A hyperlink is an element within a document that, when clicked with the mouse, takes the user to a place in a document, on the Internet, or on an Intranet.

Depending on how the computer is setup, the user may be able to use a hyperlink by simply clicking on the hyperlink with your mouse, or it may be necessary to hold down the Control key while clicking on the hyperlink with your mouse.

The various documents may be selected and opened by clicking on hyperlinks displayed in blue, underlined text. The selected document then opens in a separate window for review or print. Unless the hyperlinked, opened document is closed, a potentially large number of documents could be open at one time. This may slow the processing ability of the computer. It is recommended that unless return to a document is planned in the near future, the document should be printed and/or closed.

Links to Laboratory Exercises

Subject	*Laboratory Exercises*
Subject 1: Evidence and DNA	Laboratory Exercises
Subject 2: Forensic Biology	Laboratory Exercises
Subject 3: DNA Extraction and Quantitation	Laboratory Exercises
Subject 4: DNA Amplification	Laboratory Exercises
Subject 5: Amplified DNA Product Separation	Laboratory Exercises
Subject 6: STR Data Analysis and Interpretation	Laboratory Exercises
Subject 7: Population Genetics and Statistics	Laboratory Exercises
Subject 8: Communicating Results	Laboratory Exercises
Subject 9: Other Nuclear DNA Markers & Technology	No Laboratory Exercises

Links to Sample Protocols

Subject	Topic	Protocol	File Link
2	Laboratory Orientation	Quality Assurance	pdi lab_pro 2.01.pdf
2	Laboratory Orientation	Clean Technique	pdi lab pro 2.02.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Semen Stain Identification: Acid Phosphatase Presumptive Chemical Test (Indication)	pdi lab pro 2.03.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Semen Stain Identification: Acid Phosphatase Mapping (Indication)	pdi lab pro 2.04.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Semen Stain Identification: Kernechtrot Picoindigocarmine Stain (KPIC) (Identification)	pdi lab pro 2.05.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Semen Stain Identification: P30 Analysis by ABAcard (Identification)	pdi lab pro 2.06.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Vaginal Secretion Indication: Lugol's Stain	pdi lab pro 2.07.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Saliva Stain Indication: Phadebas Test	pdi lab pro 2.08.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Saliva Stain Indication: Radial Gel Diffusion Test	pdi lab pro 2.09.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Saliva Stain Indication: Amylase Mapping	pdi lab pro 2.10.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	SALIGaE® Test for the Presence of Saliva	pdi lab pro 2.11.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Urine Stain Indication: Creatinine Test	pdi lab pro 2.12.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Fecal Matter Indication: Urobilinogen	pdi lab pro 2.13.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Bloodstain Indication: Luminol Test	pdi lab pro 2.14.pdf

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Subject	Topic	Protocol	File Link
2	Basic Biology & Testing of Bodily Fluids & Tissues	Bloodstain Indication: Kastle-Meyer Test	pdi lab pro 2.15.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Bloodstain Indication: Ouchterlony Test	pdi lab pro 2.16.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Hemastix Presumptive Test for Blood	pdi lab pro 2.17.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Leucomalachite Green Presumptive Test for Blood	pdi lab pro 2.18.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Tetramethylbenzidine Presumptive Test for Blood	pdi lab pro 2.19.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	ABAcard® Hematrace® Test for the Identification of Human Hemoglobin	pdi lab pro 2.20.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Evaluation of Hair for DNA Analysis	pdi lab pro 2.21.pdf
2	Basic Biology & Testing of Bodily Fluids & Tissues	Flowchart for Analysis of Potential Semen Stains	pdi lab pro 2.22.pdf
Subject	**Topic**	**Protocol**	**File Link**
3	Extraction- DNA Analysis Considerations	DNA Isolation: General Information on DNA Isolation	pdi lab pro 3.01.pdf
3	Organic Extraction	DNA Isolation: Differential Isolation of DNA from Semen Stains	pdi lab pro 3.02.pdf
3	Organic Extraction	DNA Isolation: Isolation of DNA from Non-Semen Samples	pdi lab pro 3.03.pdf
3	Organic Extraction	DNA Isolation: Isolation of DNA from Bone	pdi lab pro 3.04.pdf
3	Quantitation	Chelex® 100 Non-Differential Extraction	pdi lab pro 3.05.pdf
3	Quantitation	Chelex® 100 Differential Extraction	pdi lab pro 3.06.pdf
3	Quantitation	Slot Blot (Chemiluminescence)	pdi lab pro 3.07.pdf

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Subject	Topic	Protocol	File Link
3	Quantitation	Slot Blot Worksheet	pdi lab pro 3.08.pdf
3	Quantitation	Slot Blot Colorimetric Procedure	pdi lab pro 3.09.pdf
3	Quantitation	Slot Blot Colorimetric Worksheet	pdi lab pro 3.10.pdf
3	Quantitation	Quantifiler Quantitation Procedure	pdi lab pro 3.11.pdf
Subject	**Topic**	**Protocol**	**File Link**
4	Multiplexing	PCR: Amplification and Electrophoresis of STRs	pdi lab pro 4.01.pdf
4	Multiplexing	Worksheet	pdi lab pro 4.02.pdf
Subject	**Topic**	**Protocol**	**File Link**
5	Sample Prep & Handling	Calculations and Dilutions Procedure	pdi lab pro 5.01.pdf
5	Capillary Electrophoresis	PCR: Amplification and Electrophoresis of STRs	pdi lab pro 5.02.pdf
5	Amplification Setup	Amplification Setup: Worksheet	pdi lab pro 5.03.pdf
Subject	**Topic**	**Protocol**	**File Link**
6	STR Data Analysis & Interpretation Software	PCR: Amplification and Electrophoresis of STRs	pdi lab pro 6.01.pdf
6	Data Interpretation & Allele Calls	PCR: Interpretation	pdi lab pro 6.02.pdf
Subject	**Topic**	**Protocol**	**File Link**
7	Statistics	Interpretation	pdi lab pro 7.01.pdf
7	Statistics	Allele Frequency Data	pdi lab pro 7.02.pdf
Subject	**Topic**	**Protocol**	**File Link**
8	Report Writing	Forensic Biology Report Wording	pdi lab pro 8.01.pdf
8	Report Writing	DNA Report Wording	pdi lab pro 8.02.pdf
8	Report Writing	Worksheets	pdi lab pro 8.03.pdf
8	Report Writing	Technical Review	pdi lab pro 8.04.pdf

Link to Literature Resources

Links to Sample Forms

- Individual Training Plan
- Demonstration of Competency