Washington State Patrol
Crime Laboratory Division
Biochemistry and STR Training Program Manual

April 2023

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1. Introduction and Quality

Welcome to the Washington State Patrol Crime Laboratory Division (WSP CLD). This training manual is intended for candidates who have been successful in obtaining employment in a DNA Unit or CODIS Laboratory and for existing staff who are undergoing additional training in biochemistry and/or DNA STR analysis within the WSP CLD. Unless otherwise specified, the trainee's immediate supervisor is the trainer. The time needed to complete the training program will be determined by the trainer and DNA Technical Leader. (CODIS, HT, Tech)

1.1. Goals

1.1.1. The training manual is to guide the trainee to become sufficiently knowledgeable and proficient in forensic biochemistry and DNA analysis to perform the role for which they have been employed.

1.1.2. Depending on the trainee's prior education, experience, and background, demonstration of competency in each of the major areas may be all that is required to complete many of the modules.

1.1.2.1. The DNA Technical Leader shall be responsible for assessing the previous training of analysts/technicians with outside experience and ensuring it is adequate and documented. Modification to the training program may be appropriate and shall be approved by the DNA Technical Leader.

1.1.3. CODIS DNA Analyst trainees are only required to complete the sections and readings that are relevant to their work duties. Introductory paragraphs and assessment of all assigned modules should be read.

1.1.3.1. Modules 1, 2, 13, 14, 17, 21, 22, 23, and 25

1.1.3.2. Portions of Modules 3, 15, 16, and 19 (marked with "CODIS")

1.1.3.3. Associated readings (marked with "CODIS")

1.1.4. High Throughput Laboratory Casework DNA Analyst trainees are only required to complete the sections and readings that are relevant to their work duties. Introductory paragraphs and assessment of all assigned modules should be read.

1.1.4.1. Modules 1, 2, 3, 5, 7, 8, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, and 25

1.1.4.2. Associated readings (marked with "HT")

1.1.5. Laboratory technicians are only required to complete the sections and readings that are relevant to their work duties. Introductory paragraphs and assessment of all assigned modules should be read.

1.1.5.1. Modules 1, 2, and 21

1.1.5.2. Portions of Modules 3, 5, 7, 8, 9, 14, 15, 20, and 22 (marked with "Tech")

1.1.5.3. Associated readings (marked with "Tech")

1.1.6. Analysts serving as screeners may need to repeat portions of this training manual (with adjustments), depending on the goals of the training plan at the time.

1.1.7. At the completion of this module, the trainee should be able to:

1.1.7.1. Understand the expectations of the training program.

1.1.7.2. Understand the general operation and quality assurance of the laboratory.

1.1.7.3. Be familiar with the laboratory facility.

1.1.7.4. Understand the organizational structure, code of ethics, and chain of command.

1.1.7.5. Understand security and confidentiality.

1.2. Tasks

1.2.1. The trainer will provide the trainee with the necessary instruction and reading materials to complete the training module. Not all trainees will be instructed in all modules.

1.2.2. The trainee will get instruction from a variety of secondary trainers, which may include spending time at another WSP laboratory. Alternatively, the training may be outsourced to an accredited vendor, such as the National Forensic Science Technology Center (NFSTC). All outsourced training will follow the guidelines set forth in this training manual with some modifications allowed. Any modifications to the training manual must be approved by the DNA Technical Leader and be documented in the trainee's training file.

1.2.2.1. The method of instruction will include reading, lectures, discussions, demonstrations, observing others perform casework, and observation of others in court.

1.2.2.2. The practical training will include assigned practice exercises and moot court.

1.2.3. Training will include written tests, oral tests, competency tests, and/or a final qualifying test prior to casework assignment. A single test and/or competency can be used to cover multiple modules. Refer to the CLD Quality and Operations Manual (QOM) for further specifications on competency testing.

1.2.4. The trainee shall keep a training record, which shall include at minimum: notes from the discussions and summary discussions, any completed supplemental practical exercises or readings, the results of competency tests, and documentation of court observations.

1.2.5. The trainer will consult with the DNA Technical Leader to plan, schedule, and report the progress of each trainee's program. At the conclusion of each module the primary trainer will assess the trainee's depth of understanding of the material covered and ensure the required readings have been read before documenting the trainee's qualification in that module. An interoffice communication (IOC) may be prepared, addressed to the trainee's supervisor, and forwarded through the appropriate chain of command to the Division Manager upon the employee's successful completion of various phases in the training program. The approval documentation shall also include the DNA Technical Leader. Alternatively, one IOC can be written upon the completion of all modules. Once all members of the appropriate chain of command have signed the IOC, the trainee's supervisor will make arrangements for the trainee to initially perform supervised casework with experienced, qualified forensic scientists for a period of time to be determined by the supervisor. At the end of the training period, the effectiveness of the training actions shall be evaluated and documented.

1.2.6. If required, the trainee will complete the new employee orientation modules on the training division iWSP website as required by the New Employee Orientation Supervisor Checklist.

1.2.7. The trainee will be introduced to quality assurance and quality control practices of the laboratory.

1.3. Assessment

No practical exam or competency is provided for this module. The trainer will assess the trainee's knowledge of the subject areas through discussion and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 1 – Introduction and Quality

Evaluation Form

☐ WSP New Employee Orientation

☐ Orientation to laboratory facility

☐ Organizational structure, code of ethics, and chain of command

☐ Security and confidentiality

☐ Introduction to quality assurance/quality control

The trainee has completed the above checked sections and is able to:

Understand the expectations of the training program
Explain the general operation of the laboratory

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 1 INTRODUCTION AND QUALITY READING ASSIGNMENTS

CODIS HT Tech

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD Quality and Operations Manual: 1 Introduction		
WSP CLD Quality and Operations Manual: 2 Scope		
WSP CLD Quality and Operations Manual: 3 Definitions		
WSP CLD Quality and Operations Manual: 4 Quality Assurance Program		
WSP CLD Quality and Operations Manual: 5 Structure, Services and Functions		
WSP CLD Quality and Operations Manual: 6 CLD Management and Personnel		
WSP CLD Quality and Operations Manual: 7 Personnel Qualifications and Training		
WSP CLD Quality and Operations Manual: 8 Document Control Policy and Procedures		
WSP CLD Quality and Operations Manual: 9 Quality System Records: Access, Filing, Storage, Retention and Disposal		
WSP CLD Quality and Operations Manual: 12 Nonconforming Work and Corrective Actions		
WSP CLD Quality and Operations Manual: Appendix 1: Root Cause Analysis Guidelines and Procedures		
WSP CLD Quality and Operations Manual: 14 Acquisition of Services, Supplies and Equipment		
WSP CLD Quality and Operations Manual: 15 Inventories and Reference Collections		
WSP CLD Quality and Operations Manual: 16 Audit Program and Management System Review		
WSP CLD Quality and Operations Manual: 17 Assuring the Quality of Test Results		
WSP CLD Quality and Operations Manual: 18 Technical Procedures and Methods		
WSP CLD Quality and Operations Manual: 22 Research Projects, Publications and Presentations		
WSP CLD Quality and Operations Manual: 23 Laboratory Facilities and Security		
WSP CLD DNA Quality Assurance Manual: 1 Goals and Objectives		
WSP CLD DNA Quality Assurance Manual: 2 Organization and Management		
WSP CLD DNA Quality Assurance Manual: 3 Personnel Qualifications and Training		
WSP CLD DNA Quality Assurance Manual: 4 Facilities		
WSP CLD DNA Quality Assurance Manual: 8 Analytical Procedures		
Federal Bureau of Investigation. Quality assurance standards for forensic DNA testing laboratories. Identify significance as related to audits and accreditation. Current version.		
Federal Bureau of Investigation. Audit document for forensic DNA testing laboratories. Current version. Review the laboratory's most recent audit findings and responses.		
Federal Bureau of Investigation. Quality assurance standards for databasing laboratories. Identify significance as related to audits and accreditation. Current version. CODIS **only**		
Federal Bureau of Investigation. Audit document for DNA databasing laboratories. Current version. Review the laboratory's most recent audit findings and responses. CODIS **only**		

National Research Council Committee on DNA Forensic Science. 1992. DNA Technology in Forensic Science. Washington, D.C.: National Academies Press. Chapter 4 Ensuring High Standards: 97-110.		
National Research Council Committee on DNA Forensic Science. 1996. The Evaluation of Forensic DNA Evidence. Washington, D.C.: National Academies Press. Chapter 3 Ensuring High Standards of Laboratory Performance: 75-88.		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 7 Quality Assurance and Validation: 167-201.		
Epstein DM, et al. Eliminating sources of pipetting error in the forensic laboratory. Forensic Sci Communications 2003; 5(4): 1-7.		

2. Safety

The purpose of this module is to familiarize the trainee with general safety precautions and procedures throughout the laboratory. Additional detailed safety precautions (e.g., specific chemical safety) will also be addressed in the applicable sections of the procedures manuals.

2.1. Goals

At the completion of this module, the trainee should be able to:

2.1.1. Understand general laboratory safety procedures.

2.1.2. Successfully explain the safety precautions that should be taken when handling biological evidence.

2.2. Tasks

Instruction, demonstration, and practical training will be provided. The trainee will be oriented to safety within the laboratory.

2.2.1. General laboratory safety topics

2.2.1.1. Fire evacuation plan

2.2.1.2. Earthquake evacuation plan

2.2.1.3. Use of emergency equipment

2.2.1.3.1. First aid kit

2.2.1.3.2. Eye wash

2.2.1.3.3. Emergency shower

2.2.1.3.4. Fire blanket (if applicable)

2.2.1.3.5. Fire extinguisher

2.2.1.4. Use and cleaning of glassware and other equipment

2.2.1.5. Use of electrical equipment

2.2.2. Personal protective equipment (PPE)

2.2.2.1. Gloves

2.2.2.2. Laboratory coat (general wear vs. PCR-dedicated)

2.2.2.3. Eye wear

2.2.2.4. Face masks

2.2.2.5. Disposable sleeves

2.2.2.6. Plastic shield

2.2.2.7. Chemical fume hood

2.2.2.8. Biological safety cabinet

2.2.3. Chemical safety topics

2.2.3.1. Material Data Safety Sheets (MSDS)

2.2.3.2. Universal safety measures for use of acids and bases

2.2.3.3. Universal safety measures for use of carcinogenic and toxic materials

2.2.3.4. Overview of hazards associated with specific chemicals used in reagents

2.2.3.5. Chemical storage

2.2.3.6. Spill kits

2.2.4. Biohazard safety

Instruction and practical training will be provided on proper handling of liquid and/or wet samples (e.g., liquid blood) and on proper procedures to be used in the event of a biohazard spill (e.g., use of 10% bleach solution). Prevention of transmission of the following infectious diseases during evidence handling, and availability of vaccines, will also be discussed:

2.2.4.1. Hepatitis (vaccine available for HVB)
2.2.4.2. HIV
2.2.4.3. Tuberculosis

2.2.5. Hazardous waste materials and other lab-generated waste
2.2.5.1. Chemical
2.2.5.2. Biological
2.2.5.3. Sharps

2.3. Assessment

No practical exam or competency is provided for this module. The trainer will assess through discussion the trainee's knowledge of the subject areas as per the goals stated above and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 2 – Safety

Evaluation Form

☐ Laboratory safety orientation

☐ Personal Protective Equipment – PPE

☐ Chemical safety topics

☐ Biohazard safety

☐ Hazardous waste materials and other lab generated waste

The trainee has completed the above checked sections and is able to:

Understand the lab-specific emergency and safety procedures

Successfully explain the safety precautions that should be taken when handling biological evidence

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date

MODULE 2 SAFETY READING ASSIGNMENTS

CODIS HT Tech

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD Quality and Operations Manual: 24 Health and Safety		
WSP CLD Safety Manual		
WSP Safety and Wellness Manual		
Emergency Procedures (lab specific)		
Biochemical Analysis Procedures: 19.0 Glossary		
Biochemical Analysis Procedures: 17.0 Safety		
Biochemical Analysis Procedures: 18.0 Reagent Preparation		
WSP CLD DNA Casework STR Procedures Manual: Reagent Preparation		

3. Evidence Control, Preservation, and Examination

The purpose of this module is to familiarize the trainee with procedures to preserve the integrity of submitted evidence items as well as the use of a documented chain of custody. General principles and standard practices of examining evidence for the presence of biological material and other types of evidence will be explained to the trainee. The trainee will also be introduced to the ideas of contamination and DNA transfer.

3.1. Goals

At the completion of this module, the trainee should be able to:

3.1.1. Describe the precautions that must be taken when handling and preserving evidence within the DNA section and for evidence that will be shared between any of the following sections: Biochemistry/DNA, Trace Evidence, Chemistry, Firearms, Toxicology, Questioned Documents, Latent Fingerprints, and Crime Scene Reconstruction.

3.1.2. Describe the order of examinations between the DNA Units, Trace Evidence Section, Chemistry Section, Firearms Section, Toxicology Section, Document Section, and Latent Fingerprints.

3.1.3. Explain the administrative process for evidence receipt and maintaining Chain of Custody. (Tech)

3.1.4. Determine the relevance of an examination given supporting documentation and the characteristics of the evidence itself.

3.1.5. Recognize and minimize any potential for evidence to be compromised or contaminated during examination. (CODIS) (Tech)

3.1.6. Adopt standards of case management and documentation of examinations.

3.1.7. Successfully explain the administrative process for convicted offender sample receipt as well as their handling and preservation. (CODIS **only**)

3.2. Tasks

Instruction, demonstration and practical training will be provided.

3.2.1. Storage of biological evidence and preventative steps to minimize degradation (Tech)

3.2.1.1. Refrigeration of liquid blood

3.2.1.2. Preparation and storage of dried reference bloodstains

3.2.1.3. Body fluid stains - dried and frozen (including special circumstances such as knives, rocks, etc.)

3.2.1.4. Sexual assault evidence – dried and frozen

3.2.1.5. Other biological evidence (e.g., hairs, condoms, etc.)

3.2.1.6. Safety

3.2.2. Sample collection, examination, and contamination prevention

3.2.2.1. Sample collection for biological trace evidence in conjunction with other laboratory analytical services, crime scene reconstruction and latent fingerprint analysis.

3.2.2.2. Cleanliness of work area and examination tools (Tech)

3.2.2.3. Preserving the integrity of the evidence (prevention of contamination and sample loss) (Tech)
3.2.2.4. Casework approach - relevance and thoroughness of examinations
3.2.2.5. Documentation of examinations
3.2.2.5.1. Notetaking
3.2.2.5.2. Digital photos
3.2.2.5.3. Sketches
3.2.2.5.4. Scanning
3.2.2.6. Minimizing the risk of contamination at a PCR level of sensitivity for detection. (CODIS) (Tech)
3.2.3. Maintaining the chain of custody (Tech)
3.2.3.1. LIMS
3.2.3.2. Request for Laboratory Examination (RFLE) completion and discrepancies on RFLE
3.2.3.3. Accepting and releasing evidence
3.2.3.4. Creating a new item of evidence
3.2.3.5. Marking and sealing evidence
3.2.3.6. Evidence retained in the laboratory
3.2.3.7. Interlab evidence transfers
3.2.3.8. Convicted offender sample receipt, handling and LIMS data entry. (CODIS **only**)
3.2.4. Preservation of evidentiary value of items shared between sections
3.2.4.1. Using magnification to identify evidence (stereomicroscope and compound microscope)
3.2.4.2. Collection of trace evidence
3.2.5. Conservation of sample
3.2.5.1. Stain collection and substrate control collection
3.2.5.2. Sample collection using the M-Vac® System (if applicable)
3.2.5.3. Saving half the sample
3.2.5.4. Requirement of a letter of consumption of a sample
3.2.6. Evidence storage during analysis (Tech)
3.2.6.1. Temperature of storage during analysis
3.2.6.2. Items stored at laboratory

3.3. Assessment

Casework Analysts are responsible for sample collection and evidence handling to prevent contamination and cross-contamination. CODIS DNA Analysts are responsible for evidence handling to prevent contamination and cross-contamination, Convicted Offender Form entry, and receipt and handling of convicted offender samples. All material in this module should be reviewed by experienced staff training in this area to ensure their knowledge is current. No practical exam or competency is provided for this module. The trainer will assess the trainee's knowledge of the subject areas through discussion and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 3 – Evidence Control, Preservation, and Examination

Evaluation Form

☐ Sample collection for biological trace evidence in conjunction with other laboratory analytical services and latent fingerprint analysis

☐ Storage of biological evidence and preventative steps to minimize degradation (Tech)

☐ Maintaining chain of custody (Tech)

☐ Conservation of sample

☐ Evidence storage during analysis (Tech)

☐ Minimizing the risk of contamination at a PCR level of sensitivity for detection (Tech)

☐ Cleanliness or work area and examination tools (Tech)

☐ Documentation and thoroughness of examinations

☐ Casework approach

☐ Convicted offender administrative process including: sample receipt, handling, and Convicted Offender Form data entry (CODIS **only**)

The trainee has completed the above checked sections and is able to:

- Successfully explain the proper procedures and precautions to be taken when handling and preserving evidence for DNA and latent fingerprint analysis
- Describe the order of examinations between the DNA Units, Trace Evidence Section, Chemistry Section, Firearms Section, Toxicology Section, Document Section, Latent Fingerprints, and Crime Scene Reconstruction
- Explain the administrative process for evidence receipt and maintaining chain of custody
- Determine the relevancy of an examination given characteristics of the evidence and supporting documentation
- Recognize and minimize potential for evidence to be compromised during examination
- Adopt standards of case management and documentation of examinations
- Understand Convicted Offender Form data entry (CODIS **only**)

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 3 EVIDENCE CONTROL, PRESERVATION, AND EXAMINATION READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP Forensic Services Guide HT Tech		
WSP CLD Quality and Operations Manual: 11 Evidence Management HT		
WSP CLD Quality and Operations Manual: 20 Sampling and Sample Selection HT		
LIMS Manual: Sections 1-10, 14-17, 18-18.05, 18.07-18.09, 19, 22, 23.05, 24-24.05, 24.07-24.08, 26 HT Tech		
ASTM International Committee E-30.11. Standard Guide for Physical Evidence Labeling and Related Documentation. 2018: E1459-13. HT		
ASTM International Committee E-30.11. Standard Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Laboratory. 2017: E1492-11. HT		
Lee HC, Ladd C. Preservation and collection of biological evidence. Croatian Med J 2001; 42(3): 225-228. HT		
National Institute of Standards and Technology. The Biological Evidence Preservation Handbook: Best Practices for Evidence Handlers. 2013: 9-24. HT		
Szkuta B, et al. Potential degrading effect of sodium hypochlorite on exhibits containing DNA. Forensic Sci Int Genet Supp Ser 2015; 5: E52-E54.		
Forensic Science Regulator. 2015. The Control and Avoidance of Contamination in Laboratory Activities Involving DNA Evidence Recovery and Analysis. Issue 1 (FSR-G-208): Sections 8.4 Control of Bench Environment, 8.5 Use of DNA Laboratories for Activities Other Than Casework, 8.6 Cleaning Processes, and 8.7 Environmental Monitoring. 22-32. HT		
Gill P. The utility of 'substrate controls' in relation to 'contamination'. Forensic Sci Int 1997; 85(2): 105-111. HT		
WSP CLD DNA summary for the potential cross-contamination between packaged samples (shipping contamination study). HT		
Sullivan K, et al. New developments and challenges in the use of the UK DNA database: addressing the issue of contaminated consumables. Forensic Sci Int Supp Ser 2004; 146S: S175-S176. HT Tech		
Gill P, Kirkham A. Development of a simulation model to assess the impact of contamination in casework using STRs. J Forensic Sci 2004; 49(3): 485-491. HT		
Sundquist T, Bessetti J. Identifying and preventing DNA contamination in a DNA-typing laboratory. Profiles in DNA 2005; Sept: 11-13. HT Tech		
Ladd C, et al. A systematic analysis of secondary DNA transfer. J Forensic Sci 1999; 44(6): 1270-1272.		
Wickenheiser RA. Trace DNA: a review, discussion of theory, and application of the transfer of trace quantities of DNA through skin contact. J Forensic Sci 2002; 47(3): 442-450. HT		
Fonneløp AE, et al. Secondary and subsequent DNA transfer during criminal investigation. Forensic Sci Int Genet 2015; 17: 155-162.		
Phipps M, Petricevic S. The tendency of individuals to transfer DNA to handled items. Forensic Sci Int 2007; 168(2-3): 162-168.		
Wiegand P, et al. Transfer of biological stains from different surfaces. Int J Legal Med 2011; 125(5): 727-731.		
Taylor D, et al. Helping to distinguish primary from secondary transfer events for trace DNA. Forensic Sci Int Genet 2017; 28: 155-177.		

van Oorschot RAH, et al. DNA transfer in forensic science: a review. Forensic Sci Int Genet 2019; 38: 140-166.		
Toothman MH, et al. Characterization of human DNA in environmental samples. Forensic Sci Int 2008; 178(1): 7-15.		
Amick J, et al. Integrating DNA collection into the latent print section. J Forensic Identification 2004; 54(2): 170-177.		
California Criminalistics Institute. Summary of experiments investigating the impact of fingerprint processing and fingerprint reagents on PCR-based DNA typing profiles.		
WSP CLD Latent Prints Technical Manual. Items with Additional Requests for DNA or Biochemical Examination section. HT		
Biochemical Analysis Procedures: Introduction and 1.0 General Exam Procedures HT read all, Tech read 1.3 **only**		
Biochemical Analysis Procedures: 15.0 Whole Blood Processing		
WSP CLD CODIS Laboratory STR Procedures Manual: Processing of Convicted Offender Samples CODIS **only**		
WSP CLD DNA Quality Assurance Manual: 5 Casework Evidence and Sample Control CODIS Tech		
WSP CLD DNA Casework STR Procedures Manual: DNA Extract and Work Product Transfer/Return HT		
WSP CLD DNA Quality Assurance Manual: 6 Convicted Offender Sample Control CODIS **only**		
WSP JusticeTrax W2 to LIMS-plus Interface User Guide CODIS **only**		
WSP CLD in-house study for Testing the Effectiveness of the Stratalinker UV Crosslinker in Eliminating Contaminating DNA from Laboratory Consumables CODIS **only**		

4. Alternate Light Source

The purpose of this module is to familiarize the trainee with the proper use of the Alternate Light Source (ALS) for examining evidence for the presence of biological material.

4.1. Goals

At the completion of this module, the trainee should be able to operate the ALS safely to locate possible biological material.

4.2. Tasks

Instruction, demonstration and practical training will be provided.

4.2.1. Safety of operation of the ALS
4.2.2. Appropriate wavelengths and filters
4.2.3. Procedure for examination of evidence
4.2.4. Materials that fluoresce
4.2.5. Documentation of examination
4.2.6. Interpretation and conclusions

4.3. Assessment

Examine a variety of both known and unknown materials from biological, chemical, and physical sources to familiarize the trainee with a range of materials that may be encountered in casework. The substances should be examined on various substrates. No competency exam is provided for this module. The trainer will assess through discussion the trainee's knowledge of the subject areas as per the goals stated above and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 4 – Alternate Light Source

Evaluation Form

☐ Safety of operation of the ALS

☐ Appropriate wavelengths and filters

☐ Procedure for examination of evidence

☐ Materials that fluoresce

☐ Documentation

☐ Interpretation and conclusions

The trainee has completed the above checked sections and is able to:

Operate the ALS to locate possible biological material on items similar to what would be encountered in casework

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date

MODULE 4 ALTERNATE LIGHT SOURCE READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Alternate Light Source User's Manual (lab specific)		
Biochemical Analysis Procedures: 2.0 Alternate Light Source		

5. Identification of Blood

The purpose of this module is to familiarize the trainee with accepted protocols for the presumptive and confirmatory testing for the presence and identification of blood.

5.1. Goals

At the completion of this module, the trainee should be able to:

5.1.1. Test stains using proper procedures for Kastle Meyer (phenolphthalein), and Hematrace, tests, as applicable.

5.1.2. Interpret test results and draw appropriate conclusions.

5.1.3. Be familiar with other presumptive testing methods.

5.1.4. Know the components of blood and their functions

5.2. Tasks

Instruction, demonstration and practical training will be provided.

5.2.1. Physical and chemical characteristics of blood

5.2.1.1. Components of blood and their function

5.2.1.2. Visual appearance (overall)

5.2.1.3. Stereomicroscopic appearance

5.2.1.4. Effects of degradation and aging

5.2.2. Reagent preparation (Tech)

5.2.2.1. Phenolphthalein

5.2.2.2. Stock and working solutions

5.2.2.3. Quality control testing of reagents and documentation

5.2.3. Presumptive testing

5.2.3.1. Phenolphthalein

5.2.3.1.1. Biochemical basis, procedure, and the value of a two-step test

5.2.3.1.2. Control samples

5.2.3.1.3. Potential false positives

5.2.3.1.4. Documentation

5.2.3.1.5. Interpretation and conclusions

5.2.3.2. Other catalytic tests

5.2.3.2.1. Leucocrystal violet

5.2.3.2.2. Tetramethyl Benzidine (TMB, Hemastix®)

5.2.3.2.3. Ortho-Tolidine

5.2.3.3. Blood enhancement

5.2.3.3.1. Leucocrystal violet

5.2.3.3.2. Luminol and other luminescent reagents as available

5.2.4. Confirmatory testing

5.2.4.1. Abacus OneStep Hematrace® cards

5.2.4.1.1. Biochemical basis and procedure

5.2.4.1.2. High dose hook effect

5.2.4.1.3. Specificity and sensitivity

5.2.4.1.4. Documentation
5.2.4.1.5. Interpretation and conclusions
5.2.5. Effects of presumptive and confirmatory reagents on additional (e.g., STR) testing

5.3. Assessment

Test samples of known blood, rust, plant material, and other materials reported in the literature to give false positive presumptive tests. Create and test dilutions of blood up to 1:1000. Use various collection methods (i.e., moistened swab, filter paper, etc.). Test serum and whole blood, if possible. Prepare serial dilutions and laundered stains and test with phenolphthalein and all applicable confirmatory tests.

COMPETENCY: A minimum of ten correctly characterized stains with the properly reported conclusions (five stains for HT trainees). This competency may be performed in concert with competencies for other body fluids.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 5 – Identification of Blood

Evaluation Form

☐ Physical and chemical characteristics of blood

☐ Reagent preparation (Tech)

☐ Presumptive testing

☐ Confirmatory testing

☐ Effects of presumptive and confirmatory reagents on additional testing

☐ Documentation

☐ Interpretation and conclusions

☐ Competency

The trainee has completed the above checked sections and is able to:

Test stains using proper procedures for phenolphthalein and Hematrace, as applicable
Interpret test results and draw appropriate conclusions
Be familiar with other presumptive testing methods
Know the components of blood

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 5 IDENTIFICATION OF BLOOD READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Gaensslen RE. 1983. Sourcebook in Forensic Serology, Immunology, and Biochemistry. Washington, D.C.: U.S. Department of Justice. Sections 4.2.4 Hemochromogen crystal test: 85-87 and 6 Catalytic Tests: 101-116. HT		
Lee HC. 1982. Forensic Science Handbook. Identification and Grouping of Bloodstains. Englewood Cliffs (NJ): Prentice Hall. 272-279. HT		
Spalding RP, Cronin WF. 1984. Technical and Legal Aspects of Forensic Serology: A Laboratory Manual. Washington, D.C.: U.S. Department of Justice. Part I, Chapter I Blood – A General Facts Sketch, Sections I-III A; 1-3. HT		
Spalding RP, Cronin WF. 1984. Technical and Legal Aspects of Forensic Serology: A Laboratory Manual. Washington, D.C.: U.S. Department of Justice. Part I, Chapter II Chemistry of Tests used for the Identification of Blood, Section II B; 10. HT		
Spalding RP, Cronin WF. 1984. Technical and Legal Aspects of Forensic Serology: A Laboratory Manual. Washington, D.C.: U.S. Department of Justice. Part I, Chapter II Chemistry of Tests used for the Identification of Blood, Section III B; 14-15. HT		
Spalding RP, Cronin WF. 1984. Technical and Legal Aspects of Forensic Serology: A Laboratory Manual. Washington, D.C.: U.S. Department of Justice. Part I, Chapter III Testing Methods for the Identification of Blood, Sections I and II B; 16, 18-19. HT		
Spalding RP, Cronin WF. 1984. Technical and Legal Aspects of Forensic Serology: A Laboratory Manual. Washington, D.C.: U.S. Department of Justice. Part I, Chapter III Testing Methods for the Identification of Blood, Section IIIB; 22-24. HT		
Higaki RS, Philp WMS. A study of the sensitivity, stability and specificity of phenolphthalein as an indicator for blood. Can Soc Forensic Sci J. 1976; 9(3): 97-102. HT		
Blake ET, Dillon DJ. Microorganisms and the presumptive tests for blood. J Police Sci and Admin. 1(4): 395-400. HT		
Cox M. A study of the sensitivity and specificity of four presumptive tests for blood. J For Sci. 1991; 36(5): 1503-1511. HT		
Cox M. Effect of fabric washing on the presumptive identification of bloodstains. J For Sci. 1990; 35(6): 1335-1341.		
Biochemical Analysis Procedures: 3.0 Phenolphthalein Test (Modified Kastle-Meyer Test) Presumptive Test for Blood HT Tech		
Abacus HemaTrace® package insert HT Tech		
Biochemical Analysis Procedures: 4.0 Abacard HemaTrace® Human Blood Test Tech		
Hochmeister MN, et al. Validation studies of an immunochromatographic 1-step test for the forensic identification of human blood. J Forensic Sci. 1999; 44(3): 597-602. HT		
Rowley B. Commentary on Hochmeister MN, et al. "Validation studies of an immunochromatographic 1-step test for the forensic identification of human blood." J Forensic Sci. 1999; 44(6): 1323-1324. HT		

6. Bloodstain Pattern Interpretation

The purpose of this module is to familiarize the trainee with typical bloodstain patterns encountered in casework. This will not result in the trainee becoming proficient in bloodstain pattern analysis. However, the expectation is that they will be able to recognize when this analysis may be necessary.

6.1. Goals

6.1.1. Recognize when consultation with a qualified bloodstain pattern interpretation analyst would be beneficial.

6.2. Tasks

Instruction, demonstration and practical training will be provided.

6.2.1. Theory
6.2.2. Recognition of bloodstain patterns
6.2.3. Documentation of bloodstain patterns
6.2.4. Descriptive vocabulary

6.3. Assessment

Use liquid human blood (if possible) to create bloodstain patterns (e.g., dripping, contact transfer). Examine blood drops on various substrates, dropped from various angles, and in varying amounts. No competency exam is provided for this module. The trainer will assess through discussion the trainee's knowledge of the subject areas as per the goal stated above and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 6 – Bloodstain Pattern Interpretation

Evaluation Form

☐ Theory

☐ Recognition of bloodstain patterns

☐ Documentation of bloodstain patterns

☐ Descriptive vocabulary

The trainee has completed the above checked sections and is able to:

Recognize typical bloodstain patterns and determine when further analysis is necessary

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 6 BLOODSTAIN PATTERN INTERPRETATION READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Bevel T, Gardner RM. 2008. Bloodstain Pattern Analysis. CRC Press. Chapter 1 Bloodstain Pattern Analysis: Its Function and a Historical Perspective: 1-15.		
Bevel T, Gardner RM. 2008. Bloodstain Pattern Analysis. CRC Press. Chapter 2 Bloodstain Pattern Terminology: 17-36.		
Bevel T, Gardner RM. 2008. Bloodstain Pattern Analysis. CRC Press. Chapter 3 Bloodstain Classification: 37-87.		
Bevel T, Gardner RM. 2008. Bloodstain Pattern Analysis. CRC Press. Chapter 5 The Medium of Blood: 111-133.		
Bevel T, Gardner RM. 2008. Bloodstain Pattern Analysis. CRC Press. Chapter 10 Understanding and Applying Characteristic Patterns of Blood: 231-259.		
Bevel T, Gardner RM. 2008. Bloodstain Pattern Analysis. CRC Press. Chapter 11 Bloodstained Clothing Issues: 261-274.		
Bevel T, Gardner RM. 2008. Bloodstain Pattern Analysis. CRC Press. Chapter 13 Documenting Bloodstains: 297-317.		

7. Identification of Saliva

The purpose of this module is to familiarize the trainee with accepted protocols used to determine the presence of amylase, an enzyme found in elevated levels in saliva.

7.1. Goals

At the completion of this module, the trainee should be able to:

7.1.1. Test stains using proper procedures for Rapid Stain Identification (RSID)™ cards and Phadebas® paper.

7.1.2. Interpret test results and draw appropriate conclusions.

7.2. Tasks

Instruction, demonstration and practical training will be provided.

7.2.1. Relevance of examination in casework

7.2.2. Examination approach

- 7.2.2.1. ALS
- 7.2.2.2. Amylase mapping
- 7.2.2.3. Swabbing
- 7.2.2.4. Sampling

7.2.3. Phadebas® paper (Tech)

- 7.2.3.1. Biochemical basis and procedure
- 7.2.3.2. Potential false positives
- 7.2.3.3. Documentation
- 7.2.3.4. Interpretation and conclusions

7.2.4. RSID™ cards (Tech)

- 7.2.4.1. Biochemical basis and procedure
- 7.2.4.2. Potential false positives
- 7.2.4.3. Documentation
- 7.2.4.4. Interpretation and conclusions

7.3. Assessment

Use ALS amylase mapping to identify potential saliva stains. Using RSID™ and Phadebas® paper, create and test dilutions of saliva up to 1:1000 and test at least one potential false positive.

COMPETENCY: A minimum of five correctly characterized stains with the properly reported conclusions. This competency may be performed in concert with competencies for other body fluids.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 7 – Identification of Saliva

Evaluation Form

☐ Relevance of examination in casework

☐ Examination approach

☐ RSID™ cards (Tech)

☐ Phadebas® paper (Tech)

☐ Documentation

☐ Interpretation and conclusions

☐ Competency

The trainee has completed the above checked sections and is able to:

Test stains using proper procedures for Rapid Stain Identification (RSID)™ cards and Phadebas® paper

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 7 IDENTIFICATION OF SALIVA READING ASSIGNMENTS

HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
Nelson DF, Kirk PL. The identification of saliva. J Forensic Med. 1963; 10(1): 14-20.		
Gaensslen RE. 1983. Sourcebook in Forensic Serology, Immunology, and Biochemistry. Washington, D.C.: U.S. Department of Justice. Sections 11.3 Amylase: 184-187 and 11.4 Immunological Methods: 187-189.		
Stiefel DJ, Keller PJ. Preparation and some properties of human pancreatic amylase including a comparison with human parotid amylase. Biochem Biophys Acta. 1973; 302(2): 345-361.		
Auvdel MJ. Amylase levels in semen and saliva stains. J Forensic Sci 1986; 31(2): 426-431.		
Keating SM, Higgs DF. The detection of amylase on swabs from sexual assault cases. J Forensic Sci Society 1994; 34(2): 89-93.		
Phadebas product insert Tech		
Biochemical Analysis Procedures: 10.0 Phadebas® Paper Amylase Diffusion Tech		
Willott GM, Griffiths M. A new method for locating saliva stains – spotty paper for spotting spit. Forensic Sci Int 1980; 15(1): 79-83.		
Meyers JR, Adkins WK. Comparison of modern screening techniques for saliva screening. J Forensic Sci 2008: 53(4): 862-867.		
Rapid Stain IDentification™ (saliva) product insert Tech		
Biochemical Analysis Procedures: 11.0 Rapid Stain Identification of Human Saliva (RSID™) Cards Tech		
Ricci U, et al. False-positive results with amylase testing of citrus fruits. J Forensic Sci 2014; 59(5): 1410-1412.		

8. Identification of Semen

The purpose of this module is to familiarize the trainee with the accepted protocols for the presumptive and confirmatory identification of semen.

8.1. Goals

At the completion of this module, the trainee should be able to:

8.1.1. Describe the physical and chemical characteristics of semen and the morphology of spermatozoa.

8.1.2. Test evidence items either directly or with a mapping technique to determine the location of possible semen stains by detecting acid phosphatase.

8.1.3. Produce a cell pellet, prepare a slide, stain the slide, and positively identify spermatozoa under a microscope. Characterize other material that may be present on the slide.

8.1.4. Test swabs and other material for the possible presence of semen using a p30 card.

8.1.5. Interpret results and draw appropriate conclusions.

8.2. Tasks

Instruction, demonstration and practical training will be provided

8.2.1. Physical and chemical characteristics of semen

8.2.1.1. Components of semen

8.2.1.2. Spermatozoa morphology

8.2.1.3. Typical volume of ejaculate

8.2.1.4. Typical number of spermatozoa per volume

8.2.1.5. Azoospermia

8.2.1.6. Persistence of semen

8.2.2. Acid Phosphatase (Tech)

8.2.2.1. Reagent preparation

8.2.2.2. Quality control testing of reagents and documentation

8.2.2.3. Mapping

8.2.2.4. Sample swabbing and/or evidence swab testing

8.2.2.5. Controls

8.2.2.6. Biochemistry of reaction and time to color development

8.2.2.7. Interpretation and conclusions

8.2.2.8. False positives

8.2.3. Identification of spermatozoa and sample extraction (Tech)

8.2.3.1. Cell pellet preparation

8.2.3.2. Slide preparation

8.2.3.3. Christmas tree staining, reagent preparation (if applicable)

8.2.3.4. Sperm search, tails vs. no tails

8.2.3.5. Sperm identification and epithelial cell identification, familiarity with commonly encountered organisms and substances (e.g., bacteria, yeast, lubricant, etc.)

8.2.3.6. Interpretation and conclusions

8.2.4. p30 protein (Tech)

8.2.4.1. Abacus OneStep p30 cards, biochemistry of reaction
8.2.4.1.1. Sample preparation
8.2.4.1.2. Controls
8.2.4.1.3. Specificity and sensitivity
8.2.4.1.4. High-dose hook effect
8.2.4.1.5. False positives
8.2.4.1.6. Interpretation and conclusions
8.2.5. Documentation
8.2.5.1. Slide disposition
8.2.5.2. Sperm search observations (including p30 and AP)
8.2.5.3. Documentation of controls

8.3. Assessment

Create and test dilutions of semen up to 1:1000. Use a variety of substrates (clothing and swabs) with a variety of stains (e.g., semen, urine, vaginal secretions, etc.) using a combination of ALS, acid phosphatase reagent (spot test and mapping), microscopic examination for sperm, and Abacus OneStep p30 cards, as appropriate. Use different dilutions and mixtures of body fluids in the above testing. A minimum of five satisfactory Christmas tree-stained slides must be prepared from mixed body fluids (e.g., semen/vaginal secretions, semen/saliva, etc. at various dilutions). Examine slides from various species to compare and contrast spermatozoa morphology.

COMPETENCY: A minimum of ten correctly characterized samples with the properly reported conclusions (five stains for HT trainees). This competency may be performed in concert with competencies for other body fluids.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 8 – Identification of Semen

Evaluation Form

☐ Physical and chemical characteristics of semen

☐ Acid phosphatase (Tech)

☐ Identification of spermatozoa and sample extraction (Tech)

☐ p30 protein (Tech)

☐ Documentation

☐ Interpretation and conclusions

☐ Competency

The trainee has completed the above checked sections and is able to:

Describe the physical and chemical characteristics of semen and the morphology of spermatozoa

Test evidence items either directly or with a mapping technique to determine the location of possible semen stains by detecting acid phosphatase

Produce a cell pellet, prepare a slide, stain the slide and positively identify spermatozoa under a microscope. Characterize other material that may be present on the slide

Identify possible semen with the use of a p30 card

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date

MODULE 8 IDENTIFICATION OF SEMEN READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Baechtel F. 1988. Forensic Science Handbook. The Identification and Individualization of Semen Stains. Englewood Cliffs (NJ): Prentice Hall. 347-368. HT		
Gaensslen RE. 1983. Sourcebook in Forensic Serology, Immunology, and Biochemistry. Washington, D.C.: U.S. Department of Justice. Section 10.3 Seminal (Prostatic) Acid Phosphatase and Vaginal Acid Phosphatase: 155-169.		
Serological Research Institute. 2002. Serological Research Institute Methods Manual. Doc. MM I-B, rev.2. The Brentamine Reaction. 1-3.		
Biochemical Analysis Procedures: 7.0 Acid Phosphatase Test Tech		
Enos WF, Beyer JC. Spermatozoa in the anal canal and rectum and in the oral cavity of female rape victims. J Forensic Sci 1978; 23(1): 231-233. HT		
Davies A, Wilson E. The persistence of seminal constituents in the human vagina. Forensic Sci 1974; 3(1): 45-55. HT		
Willott GM, Allard JE. Spermatozoa – their persistence after sexual intercourse. Forensic Sci Int 1982; 19(2): 135-154. HT		
Allard JE. The collection of data from findings in cases of sexual assault and the significance of spermatozoa on vaginal, anal and oral swabs. Sci Justice 1997; 37(2): 99-108. HT		
Joshi UN, et al. Effect of water immersion on seminal stains on cotton cloth. Forensic Sci Int 1981; 17(1): 9-11. HT		
Kafarowski E, et al. The retention and transfer of spermatozoa in clothing by machine washing. Canadian Society of Forensic Sci J 1996; 29(1): 7-11. HT		
Oppitz E. A new staining method for the detection of sperm in sexual offenses. Arkiv Fur Krimin 1969; 144: 145-148. HT		
Serological Research Institute. 2002. Serological Research Institute Methods Manual. Doc. MM II-C, rev.2. A Gram Modified Christmas Tree Stain. 1-2. HT		
Biochemical Analysis Procedures: 8.0 Sperm Search/Christmas Tree Stain HT Tech		
Sensabaugh GF. Isolation and characterization of a semen-specific protein from human seminal plasma: A potential new marker for semen identification. J Forensic Sci 1978; 23(1): 106-115. HT		
Denison SJ, et al. Positive prostate-specific antigen (PSA) results in semen-free samples. Canadian Society of Forensic Sci J 2004; 37(4): 197-206. HT		
Seratec®. PSA in Body Fluids. 1-19. HT		
Sippel H, Lunetta P. Positive prostate-specific antigen (PSA) reaction in rectal samples from deceased males. Promega International Symposium on Human Identification, October 2004. HT		
Lunetta P, Sippel H. Positive prostate-specific antigen (PSA) reaction in post-mortem rectal swabs: A cautionary note. J Forensic Leg Med 2009; 16(7): 397-399. HT		
Hochmeister MN, et al. Evaluation of prostate-specific antigen (PSA) membrane test assays for the forensic identification of seminal fluid. J Forensic Sci 1999; 44(5): 1057-1060. HT		
Abacus Diagnostics p30 card product insert HT Tech		
Biochemical Analysis Procedures: 9.0 Abacard® p30 Semen Test HT Tech		

9. Identification of Feces and Urine

The purpose of this module is to familiarize the trainee with the accepted protocols for presumptive testing for fecal material and urine.

9.1. Goals

At the completion of this module, the trainee should be able to:

9.1.1. Describe the physiological basis of testing for urobilinogen and microscopic examination as presumptive indicators for the presence of fecal material.

9.1.2. Test biological stains for urobilinogen and perform microscopic examination for the presence of fecal material.

9.1.3. Successfully describe the physiological basis of testing for Tamm-Horsfall protein (THP) and urea as presumptive indicators for the presence of urine.

9.1.4. Test biological stains for THP and urea as presumptive indicators for the presence of urine.

9.1.5. Interpret results and draw appropriate conclusions.

9.2. Tasks

Instruction, demonstration and practical training will be provided

9.2.1. Presumptive fecal material testing

9.2.1.1. Physical characteristics of fecal material

9.2.1.2. Testing for presence of urobilinogen

9.2.1.2.1. Physiology of urobilinogen and relative levels in other body fluids

9.2.1.2.2. Biochemical basis of urobilinogen test

9.2.1.2.3. Reagent preparations

9.2.1.2.4. Preparation of sample

9.2.1.2.5. Interpretation and conclusions

9.2.1.3. Testing for presence of microscopic elements

9.2.1.3.1. Physiology of fecal components

9.2.1.3.2. Preparation of sample

9.2.1.3.3. Interpretation and conclusions

9.2.1.4. Testing for species of origin (discussion only)

9.2.1.5. Documentation

9.2.2. Presumptive urine testing

9.2.2.1. Physical characteristics of urine (odor and pH)

9.2.2.2. Testing for presence of THP

9.2.2.2.1. Physiology of THP

9.2.2.2.2. Biochemical basis and procedure

9.2.2.2.3. Interpretation and conclusions

9.2.2.3. Documentation

9.3. Assessment

Test known urine and feces stains at neat concentration and dilutions up to 1:1000. Also test stains of other body fluids at neat concentration.

COMPETENCY: A minimum of ten correctly characterized samples with the properly reported conclusions. This competency may be performed in concert with competencies for other body fluids.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 9 – Identification of Feces and Urine

Evaluation Form

Feces

☐ Physical characteristics of fecal material

☐ Testing for presence of urobilinogen

☐ Testing for presence of microscopic elements

☐ Documentation

☐ Interpretation and conclusions

☐ Competency

Urine

☐ Physical characteristics of urine

☐ Testing for presence of THP

☐ Testing for presence of urea by radial diffusion

☐ Documentation

☐ Interpretation and conclusions

☐ Competency

The trainee has completed the above checked sections and is able to:

Describe the physiological basis of testing for urobilinogen and by microscopic examination as presumptive indicators for the presence of fecal material

Test biological stains for the presence of urobilinogen and by microscopic examination

Describe the physiological basis of testing for THP and urea as presumptive indicators for the presence of urine

Test biological stains for the presence of THP and urea

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 9 IDENTIFICATION OF FECES AND URINE READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Gaensslen RE. 1983. Sourcebook in Forensic Serology, Immunology, and Biochemistry. Washington, D.C.: U.S. Department of Justice. Section 13 Identification of Fecal Material: 197-198.		
Metropolitan Police Forensic Science Laboratory. Biology Methods Manual. London: Commissioner of Police of the Metropolis. 1978. 4-6 – 4-8.		
Biochemical Analysis Procedures: 12.0 Identification of Fecal Material Tech		
Gaensslen RE. 1983. Sourcebook in Forensic Serology, Immunology, and Biochemistry. Washington, D.C.: U.S. Department of Justice. Section 12 Identification of Urine: 191-196.		
Bedrosian JL, et al. Development of a radial gel diffusion technique for the identification of urea in urine stains. J Forensic Sci 1984; 29(2): 601-606.		
U.S. Department of Justice. Federal Bureau of Investigation Laboratory. Serology Unit Protocol Manual. 1989. 10-3 – 10-5.		
Akutsu T, et al. Specificity, sensitivity, and operability of RSID™-urine for forensic identification of urine: comparison with ELISA for Tamm-Horsfall protein. J Forensic Sci 2012; 57(6): 1570-1573.		
Independent Forensics. Developmental Validation of RSID™-Urine. https://ifi-test.com/rsid-urine Tech		
Biochemical Analysis Procedures: 13.0 Urine Tech		

10. Evaluation of Apparent Hairs

The purpose of this module is to teach the trainee how to evaluate root material on apparent hairs for the suitability of DNA analysis.

10.1. Goals

At the completion of this module, the trainee should be:

10.1.1. Familiar with differences between a fiber, an animal hair, or a human hair.
10.1.2. Able to determine if an apparent human hair is suitable for DNA analysis.
10.1.3. Able to determine when to consult a Materials Analysis hair analyst.

10.2. Tasks

Instruction, demonstration and practical training will be provided by a qualified Materials Analysis hair analyst.

10.2.1. Relevance of examination in casework
- 10.2.1.1. Transference theory
- 10.2.1.2. Persistence theory

10.2.2. Examination methods
- 10.2.2.1. Handling loose hairs
- 10.2.2.2. Handling hairs on sticky notes
- 10.2.2.3. Stereomicroscope
- 10.2.2.4. Illumination source and direction
- 10.2.2.5. Background color and material
- 10.2.2.6. Oblique light test
- 10.2.2.7. Phase contrast microscope
- 10.2.2.8. Glass slide preparation

10.2.3. Morphology of hairs and fibers
- 10.2.3.1. Hair anatomy
- 10.2.3.2. Human hair growth stages
- 10.2.3.3. Tissue on human hairs
- 10.2.3.4. Visual and microscopic features of strands
  - 10.2.3.4.1. Features used for categorization
    - 10.2.3.4.1.1. Human hair
    - 10.2.3.4.1.2. Animal hair
    - 10.2.3.4.1.3. Hair fragment
    - 10.2.3.4.1.4. Fiber
    - 10.2.3.4.1.5. Other
  - 10.2.3.4.2. How to identify these features
    - 10.2.3.4.2.1. Side view – length, width, general form, surface, color
    - 10.2.3.4.2.2. End of view – cross sectional shape
    - 10.2.3.4.2.3. Interior features – delustrant, pigmentation, layers
- 10.2.3.5. Features for recommendation of DNA analysis

10.2.4. When to consult a Material Analysis hair analyst

10.2.4.1. Trace recovery
10.2.4.1.1. Tape lifts
10.2.4.1.2. Vacuumings
10.2.4.1.3. Large items
10.2.4.1.4. Large quantity of hairs
10.2.4.2. Investigative information – case scenario
10.2.4.2.1. Postmortem roots (necrotic, putrid)
10.2.4.2.2. Dyed/bleached hairs
10.2.4.2.3. Hair diseases
10.2.4.2.4. Somatic origin
10.2.4.2.5. Forcibly removed hairs
10.2.4.2.6. Acquired damage (crushed, burned, insect, fungal)
10.2.4.3. Assessment difficulty
10.2.4.3.1. Damage to features
10.2.4.3.2. Atypical features
10.2.4.4. Photography
10.2.5. Examination of known animal hairs

10.3. Assessment

Examine visually and with a stereomicroscope a set of known samples (loose and adhered to sticky notes). Samples must include human hairs, dog hairs, cat hairs, manufactured clothing fibers, manufactured carpet fibers, cotton fibers, and wool fibers. Perform an oblique light test on a dark, heavily delustered fiber and a dark, heavily pigmented human hair. Prepare a temporarily mounted human hair from a sticky note and observe with phase contrast microscopy. Examine known human hairs mounted in Permount slides with phase contrast microscopy and evaluate their roots. Practice identification of strands on a set of unknowns provided by your trainer using any of the methods taught.

COMPETENCY: The trainee will examine a sample set consisting of at least 10 hairs and fibers. For each sample, the trainee will identify whether the sample is suitable for STR DNA analysis.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 10 –Evaluation of Apparent Hairs

Evaluation Form

☐ Theory and relevance of examination in casework

☐ Illumination methods and using the stereomicroscope

☐ Examination of known fibers

☐ Examination of known human head, pubic, and body hairs

☐ Examination of known animal hairs

☐ Practical examination of tape lifts from clothing and/to car seats

☐ Documentation

☐ Interpretation and conclusions

☐ Competency

The trainee has completed the above checked sections and is:

Familiar with differences between a fiber, an animal hair, or a human hair.
Able to determine if an apparent human hair is suitable for DNA analysis.
Able to determine when to consult a Materials Analysis hair analyst.

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date

MODULE 10 IDENTIFICATION AND EVALUATION OF HAIR READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Bisbing RE. 2002. Forensic Science Handbook. Volume 1, second edition. Upper Saddle River (NJ): Prentice Hall. The forensic identification and association of human hair. 392-393.		
Ogle RR, Fox MJ. 1999. Atlas of Human Hair – Microscopic Characteristics. CRC Press. Visual resource: Examine Chapter 5 Human hair microscopic characteristics: photographs and drawings of variate archetypes and examples: 37-48 and plates.		
Petraco N, Kubic T. 2003. Color Atlas and Manual of Microscopy for Criminalists, Chemists, and Conservators. New York: CRC Press. Visual resource: Examine images in Identification and Comparison of Human Hair: 57-67.		
Petraco N, Kubic T. 2003. Color Atlas and Manual of Microscopy for Criminalists, Chemists, and Conservators. New York: CRC Press. Visual resource: Examine images in Animal Hair Identification: 69-76.		
Petraco N, Kubic T. 2003. Color Atlas and Manual of Microscopy for Criminalists, Chemists, and Conservators. New York: CRC Press. Visual resource: Examine images in Appendix A: Human Hair Atlas: 217-237.		
Petraco N, Kubic T. 2003. Color Atlas and Manual of Microscopy for Criminalists, Chemists, and Conservators. New York: CRC Press. Visual resource: Examine images in Appendix B: Animal Hair Atlas: 239-255.		
Moore TD, et al. 1974. Identification of the Dorsal Guard Hair of Some Mammals of Wyoming. Cheyenne: Wyoming Game and Fish Department. Glossary: 3-17.		
Linch CA, et al. Evaluation of the human hair root for DNA typing subsequent to microscopic comparison. J Forensic Sci 1998; 43(2): 305-314.		
Pettenati MJ, Rao PN. Commentary on “Linch CA, Smith SL, Prahlow JA. Evaluation of the human hair root for DNA typing subsequent to microscopic comparison. J Forensic Sci. 1998; 43(2): 305-314”. J Forensic Sci 1999; 44(6): 1329-1330.		
Dachs J, et al. The persistence of human scalp hair on clothing fabrics. Forensic Sci Int 2003; 138(1): 27-36.		
Chewning DD, et al. Persistence of fibers on ski masks during transit and processing. Forensic Sci Comm 2008; 10(3).		
Exline D. Frequency of pubic hair transfer during sexual intercourse. J Forensic Sci 1998; 43(3): 505-508.		
Gaudette BD, Tessarolo AA. Secondary transfer of human scalp hair. J Forensic Sci 1987; 32(5): 1241-1253.		
Siegel JA, Mirakovits K. 2010. Forensic Science: The Basics. Boca Raton (FL): CRC Press. Textile Fibers, Typical Fibers, and Fiber Morphology: 410-412.		
Biochemistry Analysis Procedures: 14.0 Hair		

11. Species of Origin

The purpose of this module is to familiarize the trainee with the theory behind species of origin identification and to introduce some of the tests available to accomplish that task.

11.1. Goals

At the completion of this module, the trainee should be able to:

11.1.1. Explain the purpose of a species of origin test.
11.1.2. Describe the biochemistry behind species identification testing.
11.1.3. Describe the species of origin tests performed by the WSP crime lab.
11.1.4. Test biological stains to determine species of origin (as permitted by laboratory resources).
11.1.5. Interpret results and draw appropriate conclusions.

11.2. Tasks

Instruction, demonstration and practical training will be provided

11.2.1. Biochemistry
- 11.2.1.1. Antibody formation
- 11.2.1.2. Antibody-antigen reaction
- 11.2.1.3. Preparation of antisera
- 11.2.1.4. The occurrence of cross-reactivity

11.2.2. Ouchterlony double-diffusion
11.2.3. Use of controls
11.2.4. Coomassie staining
11.2.5. Interpretation of precipitation patterns and conclusions
11.2.6. Species specificity of DNA markers
11.2.7. Documentation of results

11.3. Assessment

Extract samples of known human and non-human bloodstains with various extractants (ammonia, DTT, PBS, water). Make various dilutions and run Ouchterlony.

COMPETENCY: Six to twelve correctly identified samples (depending upon laboratory resources, as determined by trainers). Refer to the Forensic Services Guide for species covered by WSP.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 11 – Species of Origin

Evaluation Form

☐ Biochemistry

☐ Ouchterlony double-diffusion

☐ Use of controls

☐ Coomassie staining

☐ Species specificity of DNA markers

☐ Documentation

☐ Interpretation of precipitation patterns and conclusions

☐ Competency

The trainee has completed the above checked sections and is able to:

Explain the purpose of a species of origin test
Describe the biochemistry behind species identification testing
Describe the tests performed by the WSP Crime Laboratory
Test biological stains to determine species of origin

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date

MODULE 11 SPECIES OF ORIGIN READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Culliford BJ. 1971. The Examination and Typing of Bloodstains in the Crime Laboratory. National Institute of Law Enforcement and Criminal Justice. Section 1.4 Precipitin reactions: 59-66.		
Sensabaugh GF. Molecular evolution and the immunological determination of species. Int Microform J Leg Med 1976; 11(2): article 219.		
Metropolitan Police Forensic Science Laboratory. Biology Methods Manual. London: Commissioner of Police of the Metropolis. 1978. 2-93 – 2-94.		
Lee HC. 1982. Forensic Science Handbook. Identification and Grouping of Bloodstains. Englewood Cliffs (NJ): Prentice Hall. 283-287.		
Gaensslen RE. 1983. Sourcebook in Forensic Serology, Immunology, and Biochemistry. Washington, D.C.: U.S. Department of Justice. Section 16 Immunological Tests with Bloodstains: 221-241.		
Brown BL, Baechtel FS. Application of immunologic methods to forensic science. Crime Lab Digest 1984; 11(1): 3-9.		
Biochemistry Analysis Procedures: 6.0 Species of Origin Determination		

12. Cellular DNA Collection Techniques

The purpose of this module is to teach the knowledge and techniques required for successful collection of cellular DNA from various items.

12.1. Goals

At the completion of this module, the trainee should be able to:

12.1.1. Identify the locations on a given item that will yield the most successful DNA results.

12.1.2. Demonstrate proper documentation of the collection process and subsequent sample.

12.2. Tasks

Instruction, demonstration and practical training will be provided

12.2.1. Observation of qualified analysts collecting cellular material (including the M-Vac, if applicable)

- 12.2.1.1. Documentation
- 12.2.1.2. Collection considerations
- 12.2.1.3. Proper labeling
- 12.2.1.4. Storage/preservation of collected samples prior to DNA analysis

12.2.2. Review of 3-5 completed case files with cellular collection (including the M-Vac, if applicable)

- 12.2.2.1. Documentation
- 12.2.2.2. Sampling techniques
- 12.2.2.3. Sampling areas

12.2.3. Hands-on training in DNA collection from various sources and observation of the trainee's techniques (including the M-Vac, if applicable)

12.3. Assessment

COMPETENCY: The trainee will use collection techniques on five mock items (including use of the M-Vac, if applicable), which will be subsequently analyzed by a qualified DNA analyst for evaluation. The trainer will document the successful use of cellular collection methods using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 12 – Cellular DNA Collection Techniques

Evaluation Form

☐ Single and double-swab techniques

☐ Safety of operation of the M-Vac

☐ Procedure for examination of evidence

☐ Documentation

☐ Interpretation and conclusions

☐ Competency

The trainee has completed the above checked sections and is able to:

Successfully use DNA collection techniques to attain DNA profiles of item seen in casework
Properly operate the M-Vac

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date

MODULE 12 CELLULAR DNA COLLECTION TECHNIQUES READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Sweet D, et al. An improved method to recover saliva from human skin: the double swab technique. J Forensic Sci 1997; 42(2): 320-322. HT		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 1 Sample Collection, Storage, and Characterization: 1-19. HT		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 1 Sample Collection, Storage, and Characterization: 1-10. CODIS		
MSI M-Vac Systems® System. SEC Series 100 and 150 User Guide (if applicable)		
WSP CLD DNA internal validation for the M-Vac System® (if applicable)		
Biochemistry Analysis Procedures: 16.0 MSI M-Vac System®		
WSP CLD DNA Casework STR Procedures Manual: Recovering Slide-Mounted Hairs or Semen Smears		

13. Fundamental Scientific DNA Knowledge

The purpose of this module is to ensure the trainee has the formal education and understanding of the fundamental scientific basis of forensic DNA analysis as required by national standards (see FBI QAS Standards).

13.1. Goals

At the end of this session the trainee should be able to:

13.1.1. Document college level course work covering the fundamental principles of genetics, biochemistry, population genetics/statistics, and molecular biology.

13.1.2. Understand fundamental scientific knowledge as it applies to forensic DNA analysis.

13.1.3. Pass a written exam as part of Module 25 on in-depth knowledge appropriate to their duties.

13.1.4. Discuss forensic DNA topics in depth, appropriate to their duties.

13.2. Tasks (Tech)

13.2.1. All trainees must produce a curriculum vitae stating their education, work experience, and professional activities.

13.2.2. All trainees must also provide a copy of their college transcripts.

13.3. Assessment

College level coursework must have been successfully completed by the Casework DNA Analyst and CODIS DNA Analyst trainees in genetics, biochemistry, population genetics/statistics and molecular biology. The trainer will document the approval of the trainee's education by the DNA Technical Leader using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 13 – Fundamental Scientific Knowledge

Evaluation Form

☐ Produce curriculum vitae stating education, work experience, and professional activities (Tech)

☐ Provide a copy of college transcripts (Tech)

The trainee has completed the above checked sections and has shown:

College level coursework covering the fundamental principles of genetics, biochemistry, population genetics/statistics and molecular biology which provide a foundation for understanding forensic DNA analysis

An understanding of fundamental scientific knowledge as it applies to forensic DNA analysis

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 13 FUNDAMENTAL SCIENTIFIC DNA KNOWLEDGE READING ASSIGNMENTS

HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
Butler JM. 2005. Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers. New York: Elsevier Academic Press. Chapter 1 Overview and History of DNA Typing: 1-13.		
Butler JM. 2005. Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers. New York: Elsevier Academic Press. Chapter 2 DNA Biology Review: 17-30.		
National Research Council Committee on DNA Forensic Science. 1992. DNA Technology in Forensic Science. Washington, D.C.: National Academies Press. Summary: 1-26.		
National Research Council Committee on DNA Forensic Science. 1996. The Evaluation of Forensic DNA Evidence. Washington, D.C.: National Academies Press. Executive Summary: 1-8 (compare to 1992 Summary).		
Shutler GG. 2005. Forensic Botany: Principles and Applications to Criminal Casework. Boca Raton: CRC Press. Chapter 8 An Overview of Historical Developments in Forensic DNA Analysis: 117-135.		
Gill P, et al. Forensic application of DNA 'fingerprints'. Nature 1985; 318(6046): 577-579.		

14. Applied Scientific DNA Knowledge and Lab Work

The purpose of this module is to provide practical instruction to the trainee on the analytical procedures used in the laboratory. This module builds on the foundation of the fundamental scientific knowledge relating to the study of forensic DNA analysis and includes lab work using this applied knowledge. The Casework DNA Analyst trainee will perform analysis on biological samples that would be normally encountered in forensic casework. The CODIS DNA Analyst trainee will perform analysis on reference samples normally encountered in convicted offender submissions. The methods detailed in the WSP CLD STR Analysis Procedures manual or the WSP CLD CODIS Laboratory STR Procedures manual, as appropriate, will be employed.

14.1. Goals

At the end of this session the trainee should be able to:

14.1.1. Discuss forensic DNA topics in depth, appropriate to their duties.

14.1.2. Competently perform DNA STR analysis on biological samples similar to what would be encountered in forensic DNA casework or convicted offender samples.

14.1.3. Demonstrate good laboratory technique for DNA STR analysis.

14.2. Tasks

There will be instruction and demonstration of the procedures that relate to the trainee's work place duties.

14.2.1. Trainers will discuss with trainees subject matter and published references (Tech)

- 14.2.1.1. Casework Direct
- 14.2.1.2. DNA extraction and purification (organic and EZ1)
- 14.2.1.3. DNA quantification
- 14.2.1.4. Polymerase chain reaction (PCR) based DNA typing methodology.
- 14.2.1.5. Direct amplification (DA)
- 14.2.1.6. Short tandem repeat polymorphisms

14.2.2. Casework DNA Analyst trainees will be assigned a number of samples sufficient to demonstrate their ability to competently conduct the laboratory's analytical procedures and produce reliable and accurate results. The following is a typical assignment: at least 25 single source samples followed by ten single source competency samples, at least seven samples for differential extraction and analysis, five contact/touch DNA samples (e.g. for wearer DNA), ten hair samples, and three non-probative cases. These three non-probative cases may serve as the competency/mock cases for Module 25. These samples will reflect the variability, range, type and complexity of casework analysis.

- 14.2.2.1. Samples will be processed using organic extraction, Qiagen EZ1 robotic protocols, and/or AutoLys robotic protocols. Assignment of samples for use with direct amplification of reference samples are optional. If direct amplification of reference samples is used for some of the single source samples, at least ten will be done using this procedure

14.2.3. CODIS DNA Analyst trainees will be assigned

14.2.3.1. A practice set of five samples to be processed manually via extraction in the laboratory under direct observation of the trainer
14.2.3.2. A GeneMapper® ID-X data set containing different types of contamination
14.2.3.3. At least two training sets of ten samples (eight buccal and two blood) to process manually via extraction
14.2.3.4. At least two training sets of ten samples to process manually via direct amplification
14.2.3.5. At least two 96-well plate training sets of about 40 samples each to process with the BSD600 Duet Puncher and direct amplification
14.2.3.6. CODIS DNA Analyst trainees will also be assigned five manual competency samples (extraction), five manual competency samples (direct amplification), and a set of 30 samples to process using the BSD600 Duet puncher and direct amplification

14.2.4. The following materials are available for further study should the trainer or trainee deem additional practice is necessary
14.2.4.1. GeneMapper® ID-X data sets for data analysis practice
14.2.4.2. PowerQuant runs for standard curve and/or quantitation value evaluation
14.2.4.3. Example case files for worksheets and workflow practice

14.2.5. Laboratory analysis is to be performed for:
14.2.5.1. DNA extraction (lysis) and purification
14.2.5.2. DNA quantification
14.2.5.3. Polymerase chain reaction (PCR) based DNA typing methodology
14.2.5.4. Short tandem repeat DNA typing profiles

14.2.6. The trainer will discuss with the trainee the Sample Switch Detection Procedure

14.3. Assessment

All trainees must be able to generate reliable genotype data in a proficient manner. The trainer will document the achievement of the trainee's lab work using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 14 – Applied Scientific DNA Knowledge

Evaluation Form

☐ Casework Direct (7 samples and a reagent blank done manually) (4 samples and a reagent blank for HT) (7 samples and a reagent blank done using automation, if applicable)

☐ DNA extraction and purification

☐ DNA quantitation

☐ Polymerase chain reaction

☐ Direct amplification

☐ Short tandem repeat polymorphisms

Casework DNA Analyst

☐ Single source stains (≥25 – if using DA, at least 10 will be done using DA) (20 for HT) (5 using the EZ1 and 5 DA for Tech)

☐ Differential extraction and analysis (≥7) (20 for HT) (2 for Tech)

☐ Contact/touch (3)

☐ Hair (10)

☐ Non-probative cases (3) (HT)

CODIS DNA Analyst

☐ Manual extraction of practice samples (5)

☐ Contamination data set

☐ Manual extraction of training samples (2 sets of 10)

☐ Direct amplification of training samples (2 sets of 10)

☐ 96-well plate processing of training samples (2 sets of ~40)

☐ Fill out paperwork for CODIS access

The trainee has completed the above checked sections and is able to:

Discuss and display an in-depth knowledge appropriate to their duties (Tech)

Prepare for laboratory analysis work assignments

Competently perform PCR STR analysis on biological samples similar to what would be encountered in forensic DNA casework or forensic databases

Demonstrate good laboratory technique for PCR STR analysis

Operate the following instruments: general laboratory equipment and instruments associated with the procedures used in STR analysis such as autoclaves, heat blocks, pipettes, vortex mixers, centrifuges, etc.; real-time PCR instruments; thermal cyclers; genetic analyzers; applicable robots (EZ1, QIAgility, STARlet, AutoLys, BSD600 Duet Puncher etc.) (Tech)

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 14 APPLIED SCIENTIFIC DNA KNOWLEDGE AND LAB WORK READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD DNA Casework STR Procedures Manual: Introduction HT Tech		
WSP CLD CODIS Laboratory STR Procedure Manual Introduction, Fusions 6C Kit Loci, and CODIS Case Approach CODIS **only**		
Y-screening		
Graham EK, et al. Developmental validation of the casework direct kit, custom: a method for the rapid processing of casework samples. 2018. HT		
Promega. 2019. Casework Direct Kit application note. AN300. HT		
WSP CLD DNA internal validation summary for the Promega Casework Direct Kit HT		
WSP CLD DNA lab-specific internal validation summary for the Promega Casework Direct Kit HT		
WSP CLD DNA Casework STR Procedures Manual: Y-Screening for Sexual Assault Swabs HT Tech		
WSP CLD DNA Internal Validation Summary for the Hamilton Microlab AutoLys STAR for Y-Screening and Quantification Set-up (if applicable)		
WSP CLD DNA Casework STR Procedures Manual: Automated Sample Processing Using the Hamilton AutoLys (if applicable)		
Extraction		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 2 DNA Extraction Methods: 29-40. HT		
WSP CLD DNA Casework STR Procedures Manual: Non-Differential Lysis Procedure HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Differential Lysis Procedure for Semen Stains HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Lysis Procedure for Hair		
WSP CLD DNA Casework STR Procedures Manual: Qiagen EZ1 Pretreatment Protocols HT Tech		
Purification		
Shutler GG, et al. Removal of a PCR inhibitor and resolution of DNA STR types in mixed human-canine stains from a five year old case. J Forensic Sci 1999; 44(3): 623-626. HT		
Montpetit SA, et al. A simple automated instrument for DNA extraction in forensic casework. J Forensic Sci 2005; 50(3): 555-563. HT		
Anslinger K, et al. Application of the BioRobot® EZ1 in a forensic laboratory. Leg Med 2005; 7(3): 164-168. HT		
Kishore R, et al. Optimization of DNA extraction from low-yield and degraded samples using the BioRobot® EZ1 and BioRobot® M48. J Forensic Sci 2006; 51(5): 1055-1061. HT		
Qiagen. EZ1 DNA Investigator® handbook CODIS HT Tech		
Promega. 2012. DNA IQ™ System technical manual: small sample casework protocol. TB296. HT		
Promega. 2012. DNA IQ™ System technical manual: database sample protocol. TB297. HT		
WSP CLD DNA internal validation summary for the EZ1 HT		
WSP CLD CODIS lab validation summary for the EZ1 CODIS **only**		

WSP CLD CODIS lab supplemental internal validation for the EZ1 Advanced XL CODIS **only**		
WSP CLD CODIS lab internal validation reports for the DNA IQ™ System CODIS **only**		
WSP CLD DNA Casework STR Procedures Manual: Qiagen BioRobot® EZ1 Workstation HT Tech		
WSP CLD DNA Casework STR Procedures Manual: EZ1 DNA Purification: Trace Protocol HT Tech		
WSP CLD DNA Casework STR Procedures Manual: EZ1 DNA Purification: Large Volume Protocol HT Tech		
WSP CLD DNA Casework STR Procedures Manual: EZ1 DNA Purification: Tip Dance Protocol HT Tech		
BSD600 DUET automated punch instrument user manual CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: BDS600 Duet Puncher Protocol CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: EZ1 DNA Investigator® Kit Extraction CODIS **only**		
Quantitation		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 3 DNA Quantitation: 49-64. HT		
Ewing MM, et al. Human DNA quantification and sample quality assessment: developmental validation of the PowerQuant® system. Forensic Sci Int 2016; 23: 166-177. HT		
Promega. 2020. PowerQuant® System technical manual. TMD047. HT Tech		
Bode and WSP supplemental validation summary reports and lab binders for the PowerQuant® system HT		
WSP CLD DNA Casework STR Procedures Manual: DNA Quantification: PowerQuant® System Standards Preparation HT Tech		
WSP CLD DNA Casework STR Procedures Manual: DNA Quantification: PowerQuant® System Reaction Preparation HT Tech		
WSP CLD DNA Casework STR Procedures Manual: DNA Quantification: PowerQuant® System Starting a Run HT Tech		
WSP CLD DNA Casework STR Procedures Manual: DNA Quantification: PowerQuant® System Data Analysis HT Tech		
WSP CLD DNA Casework STR Procedures Manual: DNA Quantification: Using the PowerQuant® Results Report HT Tech		
WSP CLD DNA Casework STR Procedures Manual: DNA Quantification: PowerQuant® System Data Interpretation HT Tech		
WSP CLD CODIS lab performance verification reports for the AB 7500 Sequence Detection system CODIS **only**		
Green RL, et al. Developmental validation of the Quantifiler™ real-time PCR kits for the quantification of human nuclear DNA samples. J Forensic Sci 2005; 50(4): 809-825. CODIS **only**		
Applied Biosystems. Quantifiler™ user manual CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Quantifiler™ Template Setup CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Quantifiler™ - Reaction Preparation and 7500 Setup CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Quantifiler™ Data Analysis and Interpretation CODIS **only**		
Concentration		
Millipore. 2005. Concentrating and desalting DNA or RNA with Microcon or Centricon centrifugal filters. HT		

WSP CLD DNA Casework STR Procedures Manual: Microcon Concentration of DNA HT		
Biomatrica. 2013. DNAstable®/DNAstable® LD Handbook. HT		
WSP CLD DNA Casework STR Procedures Manual: Vacufuge Procedure – Concentration, Preservation, and Recovery of DNA Extracts/Work Product HT Tech		
WSP CLD CODIS Laboratory STR Procedures Manual: Microcon® Concentration of DNA CODIS **only**		
Amplification		
Saiki RK, et al. Primer-directed enzymatic amplification of DNA with a thermostable DNA polymerase. Science 1988; 239(4839): 487-491. HT		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 4 PCR Amplification: 69-91. HT		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 5 Short Tandem Repeat (STR) Loci and Kits: 99-132. HT		
Butler JM. 2005. Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers. New York: Elsevier Academic Press. Chapter 7 Forensic Issues: 152-154 only. HT		
WSP CLD DNA summary for the evaluation of expanded loci amplification kits HT		
Ensenberger MG, et al. Developmental validation of the PowerPlex® Fusion 6C system. Forensic Sci Int Genet 2016; 21: 134-144. HT Tech		
Promega. PowerPlex® Fusion 6C System technical manual. TMD0045. HT		
WSP CLD DNA internal validation summary for the PowerPlex® Fusion 6C system HT		
WSP CLD DNA lab-specific internal validation summary for the PowerPlex® Fusion 6C system HT		
WSP CLD DNA Casework STR Procedures Manual: Amplification of STR Loci: Fusion 6C HT Tech		
Promega. 2016. SwabSolution™ Kit technical manual. TMD037. HT Tech		
WSP CLD DNA validation of buccal cotton swab direct amplification using the PowerPlex® Fusion 6C system and 3500 genetic analyzer HT		
WSP CLD DNA Marysville lab PowerPlex® Fusion 6C direct amplification of DNA reference samples supplemental validation HT		
Federal Bureau of Investigation. Quality assurance standards for forensic DNA testing laboratories. Standard 9.4 including discussion. Current version. HT		
WSP CLD DNA Casework STR Procedures Manual: Direct Amplification of STR Loci: Fusion 6C HT Tech		
Promega. PunchSolution™ Kit technical manual. TMD038. CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Fusion 6C Direct Amplification CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Fusion 6C Extract Amplification CODIS **only**		
Capillary Electrophoresis/Data Collection		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 6 Capillary Electrophoresis: 141-162. HT		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 2 Data, Models, and Thresholds: 25-44. HT		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 3 STR Alleles and Amplification Artifacts: 47-68 only. HT		

Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 8 Troubleshooting Data Collection: 183-207. HT		
Applied Biosystems. 3500/3500xL user manual, product enclosures and/or manual (as applicable) HT Tech		
Applied Biosystems. 2012. Technical Note. Considerations for evaluating carryover on Applied Biosystems capillary electrophoresis platforms in a HID laboratory. HT		
WSP CLD DNA validation summary for direct amplification using the PowerPlex® Fusion 6C system and 3500 genetic analyzer HT		
WSP CLD DNA Casework STR Procedures Manual: Amplification Product Preparation: Fusion 6C HT Tech		
WSP CLD CODIS lab internal validation reports for the 3500xL CODIS **only**		
Bode validation of direct amplification using the PowerPlex® Fusion 6C system, 3500xL genetic analyzer, and BSD600 DUET automated punch instrument. 2016. CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Amplification Product Preparation for the 3500XL CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Running Plates on the 3500XL Genetic Analyzer CODIS **only**		
DNA Analysis of Various Sample Types		
Wegel JG, Jr, Herrin G, Jr. Deduction of the order of sexual assaults by DNA analysis of two condoms. J Forensic Sci 1994; 39(3): 844-846. HT		
Wiegand P, Kleiber M. DNA typing of epithelial cells after strangulation. Int J Legal Med 1997; 110(4): 181-183. HT		
Lorente M, et al. Dandruff as a potential source of DNA in forensic casework. J Forensic Sci 1998; 43(4): 901-902.		
Sweet D, Shutler GG. Analysis of salivary DNA evidence from a bite mark on a body submerged in water. J Forensic Sci 1999; 44(5): 1069-1072. HT		
Abaz J, et al. Comparison of the variables affecting the recovery of DNA from common drinking containers. Forensic Sci Int 2002; 126(3): 233-240.		
Primorac D. The role of DNA technology in identification of skeletal remains discovered in mass graves. Forensic Sci Int Supp Ser 2004. 146S: S163-S164.		

15. DNA Interpretation and STRmix

The purpose of this module is to provide practical instruction on how to interpret and report analytical results as designated by laboratory policy. The Casework DNA Analyst trainee will receive instruction on how to use GeneMapper™ ID-X, STR interpretation guidelines, the interpretation of mixtures, the use of the STRmix™ program, STRlite, basic report writing, and wording of conclusions. A brief introduction to the laboratory's CODIS program will also be provided. There will be a set of mixture data (~ 20 mixtures to demonstrate competency) representative of casework provided to the Casework DNA analyst trainee on which to conduct interpretation according to laboratory policy.

15.1. Goals

At the end of this session the trainee should be able to:

15.1.1. Utilize GeneMapper™ ID-X correctly interpret casework STR data, deconvolute DNA profiles using STRmix™, use STRlite to summarize STRmix™ data, and write interpretation results in accordance with laboratory policy

15.2. Tasks

Instruction, demonstration, and practical training will be provided

15.2.1. GeneMapper™ ID-X set-up and use (CODIS) (Tech)
15.2.2. STR interpretation guidelines (Tech)
15.2.3. Use of the STRmix™ program for deconvolution
15.2.4. Use of the STRlite workbook
15.2.5. Deducing profiles for CODIS, MME, and a brief overview of CODIS eligibility
15.2.6. Wording of interpretation conclusions in reporting of results
15.2.7. Work assigned to complete
  15.2.7.1. Interpretation of ~20 sets of mixture data representative of casework will be assigned
  15.2.7.2. The Casework DNA Analyst trainee is to provide a written interpretation according to laboratory policy
15.2.8. The trainee must complete paperwork to be approved for CODIS access.
15.2.9. CODIS DNA Analyst trainees will be assigned
  15.2.9.1. A GeneMapper™ ID-X training data set
  15.2.9.2. A GeneMapper™ ID-X training data set composed of anomalies

15.3. Assessment

Interpretation results and associated paperwork of the ~20 mixtures will be evaluated by experienced Casework DNA STR analysts. The trainer will document the completion of the module using the trainer's evaluation form. The practical portions of modules 16 and 18 should be worked on in tandem with the mixtures to be completed for this module.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 15 – DNA Interpretation and STRmix

Evaluation Form

☐ GeneMapper™ ID-X (CODIS) (Tech)

☐ STR interpretation guidelines (Tech)

☐ Use of STRmix™ and deconvolution

☐ Interpretation of mixture data sets (~20)

☐ Casework DNA Analyst trainees fill out paperwork for CODIS access

CODIS DNA Analyst

☐ GeneMapper® ID-X data training set

☐ GeneMapper® ID-X advanced data training set (anomalies)

The trainee has completed the above checked sections and is able to:

Correctly interpret casework STR data compatible with laboratory policy

Use STRmix™ and STRlite to assist in deconvolution and determining CODIS eligibility

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 15 DNA INTERPRETATION AND STRMIX READING ASSIGNMENTS

HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD DNA Casework STR Procedures Manual: GeneMapper™ ID-X Setup Tech		
WSP CLD DNA Quality Assurance Manual: 16 Appendix I – Extraneous DNA Guidelines		
WSP CLD DNA Quality Assurance Manual: 17 Appendix II – Extraneous DNA Guidelines – CODIS CODIS **only**		
Meldgaard M, Morling N. Detection and quantitative characterization of artificial extra peaks following polymerase chain reaction amplification of 14 short tandem repeat systems used in forensic investigations. Electrophoresis 1997; 18(11): 1928-1935.		
Walsh PS, et al. Sequence analysis and characterization of stutter products at the tetranucleotide repeat locus vWA. Nucleic Acids Research 1996; 24(14): 2807-2812.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 3 STR Alleles and Amplification Artifacts: 68-80 only.		
Rolf B, et al. Somatic mutations at STR loci – a reason for three-allele pattern and mosaicism. Forensic Sci Int 2002; 126(3): 200-202.		
Hendrickson BC, et al. Accurate STR allele designations at the FGA and vWA loci despite primer site polymorphisms. J Forensic Sci 2004; 49(2); 250-254.		
Jiang W, et al. Identification of dual false indirect exclusions on the D5S818 and FGA loci. Leg Med 2011; 13(1): 30-34.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 1 Data Interpretation Overview: 3-22.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 4 STR Genotypes: 87-105.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 5 STR Profiles: 109-123.		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 10 Degraded DNA: 293-304.		
Applied Biosystems. 2009. Investigations to assist in the interpretation of DNA profiles.		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 11 Low-Level DNA Testing: 311-341.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 6 DNA Mixtures: 129-154.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 7 Low-Level DNA and Complex Mixtures: 159-177.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Appendix 4 Worked Mixture Example: 537-548 only.		
Butler JM, et al. NIST interlaboratory studies involving DNA mixtures (MIX05 and MIX13): Variation observed and lessons learned. Forensic Sci Int Genet 2018; 37: 81-94.		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Evaluating DNA Profile Data Tech		
WSP CLD DNA Casework STR Procedures Manual: Interpretation of STR Profiles		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Paternity/Kinship: Interpretation of STR Profiles – Paternity, Parentage, and Kinship Determinations		

Perlin MW, Szabady B. Linear mixture analysis: a mathematical approach to resolving mixed DNA samples. J Forensic Sci 2001; 46(6): 1372-1378.		
Bright J, et al. Developmental validation of STRmix expert software for the interpretation of forensic DNA profiles. Forensic Sci Int Genet 2016; 23: 226-239.		
STRmix™ support solutions. 2018. Why do I have unintuitive genotypes at vWA (involving allele 14)?		
WSP CLD DNA estimation of STRmix™ parameters for Fusion 6C within STRmix™ v2.5		
WSP CLD DNA internal validation summary for STRmix™. Presentations at the DNA Functional Area Meeting. Seattle. 2018.		
WSP CLD DNA internal validation summary for STRmix™ v2.8 probabilistic genotyping software for PowerPlex® Fusion 6C and the 3500 genetic analyzer		
WSP Estimation of STRmix v2.8 Parameters for the Washington State Patrol Crime Laboratory Division		
WSP CLD DNA Casework STR Procedures Manual: Probabilistic Genotyping Using STRmix™		
Wagner M. Simplifying the STRmix™ workflow with a custom software solution. Poster presentation at the International Symposium on Human Identification, Phoenix. 2018.		
WSP CLD DNA STRlite performance check plan and performance check summary		
WSP CLD DNA STRlite PowerPoint and demo. Presentation at the DNA Functional Area Meeting. Seattle. 2019.		
WSP CLD DNA Casework STR Procedures Manual: STRlite		
WSP CLD CODIS Laboratory STR Procedures Manual: Guidelines for Evaluating DNA Profile Data – Fusion 6C CODIS **only**		

16. Population Genetics and Statistics

The purpose of this module is to give detailed background information on the different statistics used in forensic DNA testing (focusing on likelihood ratios), the considerations that need to be taken into account when calculating each statistic, the use of STRmix™ to calculate likelihood ratios, and statistics dealing with kinship and paternity.

16.1. Goals

At the end of this session the trainee should be able to:

16.1.1. Understand the principles and mathematics behind population statistics, including the use of theta.

16.1.2. Perform likelihood ratio calculations in STRmix™.

16.1.3. Conduct statistics for kinship and paternity using CODIS PopStats.

16.2. Tasks

Instruction, demonstration, and practical training will be provided

16.2.1. Population genetics and statistics pertaining to forensic DNA analysis (CODIS)

16.2.2. Use of the STRmix™ program for statistical calculations

16.2.3. Use of CODIS PopStats for statistical calculations involving kinship

16.3. Assessment

Trainees will incorporate STRmix™ and PopStats statistics in their work with the ~20 mixtures assigned in module 15. The trainer will document the completion of the module using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 16 – Population Genetics and Statistics

Evaluation Form

☐ Population genetics and statistics in forensic DNA analysis (CODIS)

☐ Statistical calculation

☐ Paternity/kinship

The trainee has completed the above checked sections and is able to:

Understand the principles behind various statistical calculations

Perform likelihood ratios using STRmix™ and kinship statistics using PopStats in accordance with laboratory policy

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 16 POPULATION GENETICS AND STATISTICS READING ASSIGNMENTS

HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 9 Statistical Interpretation Overview: 213-236.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 10 STR Population Data Analysis: 239-270.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 11 DNA Profile Frequency Estimates and Match Probabilities: 281-305.		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 12 DNA Mixture Statistics: 309-329.		
Lander ES, Budowle B. DNA fingerprinting dispute laid to rest. Nature 1994; 371: 735-738.		
National Research Council Committee on DNA Forensic Science. 1992. DNA Technology in Forensic Science. Washington, D.C.: National Academies Press. Chapter 3 DNA Typing: Statistical Basis for Interpretation: 74-96.		
National Research Council Committee on DNA Forensic Science. 1996. The Evaluation of Forensic DNA Evidence. Washington, D.C.: National Academies Press. Chapters 4 Population Genetics and 5 Statistical Issues: 89-165.		
Evett IW, Weir BS. 1998. Interpreting DNA Evidence: Statistical Genetics for Forensic Scientists. Sunderland (MA): Sinauer Associates. Chapter 4 Population Genetics: 79-131.		
Evett IW, Weir BS. 1998. Interpreting DNA Evidence: Statistical Genetics for Forensic Scientists. Sunderland (MA): Sinauer Associates. Chapter 5 Statistical Genetics: 132-162.		
Evett IW, Weir BS. 1998. Interpreting DNA Evidence: Statistical Genetics for Forensic Scientists. Sunderland (MA): Sinauer Associates. Chapter 8 Calculating Match Probabilities: 206-216.		
Evett IW, Weir BS. 1998. Interpreting DNA Evidence: Statistical Genetics for Forensic Scientists. Sunderland (MA): Sinauer Associates. Chapter 9 Presenting Evidence: 217-246.		
Adams C. 2010. Essential Mathematics and Statistics for Forensic Science. Hoboken (NJ): John Wiley & Sons. Chapter 11 Statistics and the significance of evidence. 279-311.		
Budowle B, et al. CODIS STR loci data from 41 sample populations. J Forensic Sci 2001; 46(3): 453-489.		
Moretti T, et al. Population data on the expanded CODIS core STR loci for eleven populations of significance for forensic DNA analyses in the United States. Forensic Sci Int Genet 2016; 25: 175-181.		
Gettings KB, et al. STRSeq: a catalog of sequence diversity at human identification short tandem repeat loci. Forensic Sci Int Genet 2017; 31: 111-117.		
Bright J, et al. A guide to forensic DNA interpretation and linkage. Promega Corporation website. 2014. http://www.promega.com/resources/profiles-in-dna/2014/a-guide-to-forensic-dna-interpretation-and-linkage/		
Taylor D, et al. Testing likelihood ratios produced from complex DNA profiles. Forensic Sci Int Genet 2015; 16: 165-171.		

Slooten K. Likelihood ratio distributions and the (ir)relevance of error rates. Forensic Sci Int 2019. https://doi.org/10.1016/j.fsigen.2019.102173		
WSP CLD DNA Casework STR Procedures Manual: Statistical Interpretation of STR DNA Typing		
WSP CLD DNA Casework STR Procedures Manual: Calculation of a Likelihood Ratio in STRmix		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 14 Relationship Testing: 349-387.		
Chakraborty R, Stivers DN. Paternity exclusion by DNA markers: Effects of paternal mutations. J Forensic Sci 1996; 41(4): 671-677.		
Gunn PR, et al. DNA analysis in disputed parentage: The occurrence of two apparently false exclusions of paternity, both at short tandem repeat (STR) loci, in the one child. Electrophoresis 1997; 18(9): 1650-1652.		
Panke ES, et al. DNA paternity tests: Technology is outpacing the law. Family Law Newsletter 2001.		
Shutler G. Basic parentage stats training PowerPoint. 2016.		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Paternity/Kinship: Calculating the Probability of Paternity and/or Parentage Using FBI PopStats		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Paternity/Kinship: Calculating the Probability of Kinship or Single Parentage Using FBI PopStats		

17. CODIS

The purpose of this module is to provide instruction on CODIS uploads, searches, further CODIS eligibility guidelines, and report wording of CODIS-related conclusions.

17.1. Goals

At the end of this session the trainee should be able to:

17.1.1. Explain the laboratory's CODIS program including eligibility guidelines and how samples are searched and/or uploaded.

17.1.2. Use CODIS to determine the MME/MRE of a forensic specimen.

17.1.3. Understand the relationship of CODIS between the local, state, and national levels.

17.2. Tasks

Instruction and demonstration will be provided

17.2.1. Observe the calculation of the MME/MRE of a sample

17.2.2. Observe the entry of a CODIS profile into LDIS

17.2.3. Complete the assigned training modules in the CODIS software

17.3. Assessment

No practical exam or competency is provided for this training section. The trainer will assess through discussion of the trainee's knowledge of the subject matter and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 17 – CODIS

Evaluation Form

☐ CODIS sample eligibility, sample entry, search, and upload

☐ Use of CODIS PopStats Moderate Match Estimate and Match Rarity Estimate (MME and MRE)

The trainee has completed the above checked sections and is able to:

Explain the laboratory's CODIS program including eligibility guidelines and how samples are searched and/or uploaded

Use CODIS to enter a DNA profile and determine MME and/or MRE

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 17 CODIS READING ASSIGNMENTS

HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 8 DNA Databases: 213-264.		
Hares D. Selection and implementation of expanded CODIS core loci in the United States. Forensic Sci Int Genet 2015; 17: 33-34.		
WSP CLD CODIS SOP Manual		
Federal Bureau of Investigation. A Guide to Determining What is Allowable in the Forensic Index at NDIS.		
WSP CLD CODIS Training PowerPoints: CODIS New Analyst Training		
WSP CLD CODIS Training PowerPoints: CODIS Eligibility		
WSP CLD CODIS Training PowerPoints: CODIS Forensic Mixture Eval		
CODIS software modules. CODIS CJIS-SEN LMS.		
WSP CLD DNA Casework STR Procedures Manual: CODIS and CODIS Match Prediction		
WSP CLD DNA Casework STR Procedures Manual: CODIS Export		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Appendix 2 Familial DNA Searches: 603-609.		
Butler JM. 2005. Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers. New York: Elsevier Academic Press. D.N.A. Box 18.1 The business case for using forensic DNA technology: 436-437.		
Steinberger E, Sims G. Finding criminals through the DNA of their relatives – familial searching of the California offender DNA database. Prosecutor's Brief 2008; 31(1-2): 28-32.		
Myers S, et al. Searching for first-degree familial relationships in California's offender DNA database: validation of a likelihood ratio-based approach. Forensic Sci Int Genet 2011; 5(5): 493-500.		
WSP CLD CODIS Laboratory STR Procedures Manual: Reporting Profiles & CODIS Database CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Appendix A: Administrative Procedures for Processing Offender Samples CODIS **only**		

18. Case Files, Report Writing, and Review

The Casework DNA Analyst trainee will receive instruction on requirements for report writing, wording of conclusions, and organization of the case file. Trainees will also become familiar with the technical and administrative review process.

18.1. Goals

At the end of this session the trainee should be able to:

18.1.1. Correctly report conclusions of serological and DNA analysis.

18.1.2. Understand the required components of a report.

18.1.3. Organize a complete case file.

18.1.4. Explain the review process through both technical and administrative reviews, including LIMS milestone and activities.

18.2. Tasks

18.2.1. Review at least five completed case files representing the scope of expected casework, focusing on their organization and contents

18.3. Assessment

Trainees will demonstrate report writing and case file preparation in their work involving the ~20 mixtures assigned in module 15. The trainer will document the completion of the module using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 18 – Case Files, Report Writing, and Review

Evaluation Form

☐ Organization and contents of case files

☐ Report writing and LIMS

The trainee has completed the above checked sections and is able to:

Correctly write reports compatible with laboratory policy

Explain the steps taken in LIMS to complete the drafting and reviewing of reports

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 18 CASE FILES, REPORT WRITING, AND REVIEW READING ASSIGNMENTS

HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD Quality and Operations Manual: 10 Case Management, Sections 10.1-10.9		
WSP CLD DNA Casework STR Procedures Manual: STR Case File Content		
WSP CLD DNA Quality Assurance Manual: 10.1 Reports		
WSP CLD DNA Quality Assurance Manual: 11 Review		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Report Writing		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Conclusion Statements		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Paternity/Kinship: Guidelines for Report Writing – Paternity, Parentage, and Kinship		
WSP CLD DNA Casework STR Procedures Manual: Guidelines for Paternity/Kinship: Guidelines for Conclusion Statements – Paternity, Parentage, and Kinship		
WSP CLD DNA Casework STR Procedures Manual: Reports Involving CODIS		
WSP CLD CODIS Laboratory STR Procedures Manual: CODIS Case File Content CODIS **only**		
DNA Case Review Checklist E-Form		
WSP CLD DNA Casework STR Procedures Manual: STR Case File Review		
WSP CLD CODIS Laboratory STR Procedures Manual: Manual CODIS Case File Review with GeneMapper® ID-X v1.6 CODIS **only**		

19. Additional DNA Sources, Automation, and Trends

This purpose of this module is to introduce trainees to other types of DNA used for forensic purposes, along with their advantages and drawbacks. Also, trainees will learn about automation in the forensic laboratory and other trends regarding forensic DNA testing. This is to educate the trainee in areas of DNA testing that may not be part of their specific workflow, but exist in the field of forensic DNA testing.

19.1. Goals

At the end of this training session, the trainee should be able to:

19.1.1. Explain the difference between SNP, Y-STR, and mitochondrial DNA, and how they differ from autosomal STRs (Tech understand Y-STR typing).

19.1.2. Feel familiar with the use of robotics in the forensic laboratory.

19.1.2.1. Expert system software (CODIS)

19.1.2.2. Rapid DNA systems (CODIS)

19.1.2.3. Massively parallel sequencing (CODIS)

19.2. Tasks

Trainers will familiarize trainees with automation specific to their job duties (CODIS)

19.3. Assessment

No practical examination or competency is provided for this training section. The trainer will assess through discussion of the trainee's knowledge of the subject matter and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 19 – Additional DNA Sources, Automation, and Trends

Evaluation Form

☐ Single nucleotide polymorphisms

☐ Y chromosome DNA typing (Tech)

☐ Mitochondrial DNA

☐ Automation in the forensic DNA laboratory (CODIS)

☐ Expert systems software (CODIS) (Tech)

☐ Rapid DNA systems (CODIS)

☐ Massively parallel sequencing (CODIS)

The trainee has completed the above checked sections and is able to:

Explain the types of DNA used in forensic analysis other than autosomal STRs

Understand the trends in forensic DNA analysis, including the use of automation (CODIS)

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 19 ADDITIONAL DNA SOURCES, AUTOMATION, AND TRENDS READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
Additional DNA Sources		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 12 Single Nucleotide Polymorphisms and Applications: 347-362. HT		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 13 Y-Chromosome DNA Testing: 371-396. HT		
Butler JM. 2015. Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapter 15 Lineage Marker Statistics: 403-425. HT		
Gill P, et al. DNA Commission of the International Society of Forensic Genetics: recommendations on forensic analysis using Y-chromosome STRs. Int J Legal Med 2001; 114(6): 305-309. (also Forensic Sci Int 2001; 124(1): 5-10) HT		
Jobling MA, Tyler-Smith C. The human Y chromosome: an evolutionary marker comes of age. Nature Reviews Genetics 2003; 4: 598-612. HT		
Butler JM. Recent developments in Y-short tandem repeat and Y-single nucleotide polymorphism analysis. Forensic Sci Review 2003; 15(2): 92-100. HT		
Gusmão L, et al. DNA Commission of the International Society of Forensic Genetics (ISFG): an update of the recommendations on the use of Y-STRs in forensic analysis. Int J Legal Med 2006; 120(4): 191-200. (also Forensic Sci Int 2006; 157: 187-197) HT		
Isenberg AR. Forensic mitochondrial DNA analysis: a different crime-solving tool. FBI Law Enforcement Bulletin 2002; 71(8): 16-22. HT		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 14 Mitochondrial DNA Analysis: 405-444. HT		
Automation		
WSP CLD DNA internal validation summary for the Qiagen QIAgility™ (if applicable)		
WSP CLD DNA Casework STR Procedures Manual: Qiagen QIAgility™ Instructions (if applicable)		
WSP CLD DNA internal validation summary for the Hamilton Microlab STARlet (if applicable)		
WSP CLD DNA Casework STR Procedures Manual: Hamilton Microlab STARlet(if applicable)		
De Jong, B et al. Hamilton AutoLys developmental validation: Successful validation of a fully automated sample lysis workstation. Forensic Sci Int Genet 2013; 4: e93-e94.		
Hamilton AutoLys Operator's manual.		
Baron, L et al. Breakthrough in forensic workflow automation, eliminating the sample preparation and lysis bottlenecks with the AutoLys STAR: Technology and validation study. Netherlands Forensic Institute Poster. EAFS 2012.		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 17 New Technologies and Automation: 497-509. HT		
WSP CLD CODIS lab internal validation summary for GMID-X as an NDIS-approved expert system CODIS **only**		
Trends		
Heger M. Early adopters say NGS-based forensic testing could lead to more precise identification. Genomeweb 2012. HT		

Budowle B. Typing megaplex human identity marker panels on multiple CGS platforms. Presentation at the International Symposium on Human Identification, Atlanta. 2013. HT		
Tan E, et al. Fully integrated, fully automated generation of short tandem repeat profiles. Investigative Genetics 2013; 4(1): 16. HT		

20. Y-STR DNA Typing for Casework

The analysis of STRs on the Y chromosome utilizes the same technology and principles as autosomal STRs. The Y-STR trainee must be currently or previously qualified in autosomal STR analysis before undergoing the Y-STR training module. This module will provide the in-depth scientific knowledge relating to the application of Y-STRs to forensic DNA analysis. This module will provide practical instruction to the trainee on the analytical protocols used in the laboratory for Y-STR amplification and analysis. This module will also provide instruction on how to interpret and report Y-STR analytical results with established laboratory policy.

20.1. Goals

At the end of this training session, the trainee should be able to:

20.1.1. Pass a test (oral or written) on the basic concepts of the Y-chromosome and forensic Y-STR analysis.

20.1.2. Competently perform Y-STR analysis on biological samples that would normally be encountered in forensic casework and issue properly reported conclusions.

20.1.3. Demonstrate the understanding and use of a haplotype database and statistical interpretation.

20.2. Tasks

Trainers will discuss with trainees subject matter and published references

20.2.1. Evolution, molecular biology, and properties of the Y-chromosome

20.2.2. Forensic applications of Y-STR analysis

20.2.3. Amplification with the currently validated Y-STR amplification kit (Tech)

20.2.4. Typing of Y-STR amp product on a genetic analyzer (Tech)

20.2.5. Interpretation and reporting of Y-STR results (Tech)

20.2.6. Population databases and Y-STR statistics

20.2.7. Testimony, practice, and observation

20.2.8. Analysis of three single source male DNA extracts (Tech)

20.2.9. Trainee will be provided with 6 sets of Y-STR data. The data sets will include one of each of the following types of samples: single source, partial profile, mixture with a major component, mixture with a deducible minor component, mixture with a known contributor, and an indistinguishable mixture.

20.3. Assessment

Completion of a competency exam is required to complete this module of training regardless of prior Y-STR analysis experience. The exam will consist of 50% written questions and 50% oral questions. The trainee will complete a competency test consisting of one non-probative case and will prepare full documentation of the analysis and interpretations in the format used for regular casework following the established WSP Y-STR, STR, and quality assurance casework procedures. (Tech)

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 20 – Y-STR DNA Typing for Casework

Evaluation Form

☐ Y chromosome: evolution and biology

☐ Forensic application of Y-STRs

☐ Y-STR amplification kit/typing on the genetic analyzer (Tech)

☐ Interpretation of Y-STR data (Tech)

☐ Y-STR statistics and population databases

☐ Y-STR testimony practice and observation

☐ Single source male extracts (3) (Tech)

☐ Interpretation of Y-STR data (6 sets)

☐ Y-STR non-probative competency test (Tech)

☐ Written exam (passing grade of 80% or higher)

The trainee has completed the above checked sections and is able to:

Discuss and display an in-depth knowledge of forensic Y-STR analysis

Competently perform Y-STR analysis on biological samples similar to what would be encountered in forensic DNA casework

Correctly interpret Y-STR data and write reports compatible with laboratory policy

Comments:

Trainee Printed Name + Initials Date

Trainer Printed Name + Initials Date

MODULE 20 Y-STR DNA TYPING FOR CASEWORK READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD DNA Casework STR Procedures Manual: Y-STR Casework Tech		
WSP CLD DNA Casework STR Procedures Manual: Y-STR Amplification Tech		
WSP CLD DNA Casework STR Procedures Manual: Y-STR Amplification Product Preparation Tech		
Genescan™ 600 LIZ® size standard product insert		
Thompson J, et al. Developmental validation of the PowerPlex® Y23 system: a single multiplex Y-STR analysis system for casework and database samples. Forensic Sci Int Genet 2013; 7(2): 240-250.		
Promega. 2021. PowerPlex® Y23 technical manual. TMD035. Tech		
WSP CLD DNA validation summary for the Promega PowerPlex® Y23 system using the AB® 3500		
WSP CLD DNA supplemental internal validation summary for the Promega PowerPlex® Y23 system		
WSP CLD DNA PowerPlex® Y23 training day presentations		
Moore D, et al. Description of artefacts in the PowerPlex® Y23 system associated with excessive quantities of background female DNA. Forensic Sci Int Genet 2016; 24: 44-50.		
Lee E, et al. Off-ladder alleles due to a single nucleotide polymorphism in the flanking region at DYS481 detected by the PowerPlex® Y23 system. Forensic Sci Int Genet 2016; 24: e7-e8.		
Butler JM, et al. Chromosomal duplications along the Y-chromosome and their potential impact on Y-STR interpretation. J Forensic Sci 2005; 50(4): 853-859.		
SWGDAM Interpretation Guidelines for Y-Chromosome STR Typing. 2014.		
WSP CLD DNA Casework STR Procedures Manual: Y-STR Guidelines for Evaluating GeneMapper Data Tech		
WSP CLD DNA Casework STR Procedures Manual: Y-STR Mixture Deconvolution		
Budowle B, et al. Basic principles for estimating the rarity of Y-STR haplotypes derived from forensic evidence. Presentation at the 18th Annual International Symposium on Human Identification. 2007.		
Willuweit S, Roewer L. The new Y chromosome haplotype reference database. Forensic Sci Int Genet 2015; 15: 43-48.		
WSP CLD DNA Casework STR Procedures Manual: Y-STR Statistical Calculations		
WSP CLD DNA Casework STR Procedures Manual: Y-STR Guidelines for Report Writing		

21. Validation and Quality Assurance

The purpose of this module is to inform trainees of the processes and requirements of validation and performance checks, and to give them a detailed explanation of the quality assurance program as related to DNA testing, instrumentation, and procedures.

21.1. Goals

At the end of this session the trainee should be:

21.1.1. Familiar with the requirements of WSP CLD's internal validation program as it applies to procedures and instrumentation

21.1.2. Able to recognize the importance of the calibration and maintenance of equipment

21.1.3. Understanding the proficiency testing program

21.1.4. Know what is required for accreditation

21.1.5. Aware of the audit process

21.2. Tasks

Trainers will familiarize trainees with quality assurance systems specific to their job duties. (CODIS)

21.2.1. Validation

21.2.2. Instrument calibration and maintenance

21.2.3. Proficiency testing

21.2.4. Accreditation and auditing

21.3. Assessment

No practical examination or competency is provided for this training section. The trainer will assess through discussion of the trainee's knowledge of the subject matter and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 21 – Validation and Quality Assurance

Evaluation Form

☐ Validation, calibration, and maintenance of instrumentation

☐ Accreditation and auditing

The trainee is able to:

Understand the validation process and is familiar with the maintenance required for applicable instruments

Explain accreditation, auditing, and the proficiency program

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 21 VALIDATION AND QUALITY ASSURANCE READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD Quality and Operations Manual: 13 Traceability and Quality Control HT		
WSP CLD Quality and Operations Manual: 19 Method Validation HT		
WSP CLD DNA Quality Assurance Manual: 7 Methods Validation CODIS HT Tech		
WSP CLD DNA Quality Assurance Manual: 9 Equipment Calibration and Maintenance CODIS HT Tech		
WSP CLD DNA Quality Assurance Manual: 12 Proficiency Testing CODIS HT Tech		
WSP CLD DNA Quality Assurance Manual: 13 Non-Conforming Work CODIS HT Tech		
WSP CLD DNA Quality Assurance Manual: 14 Audits and Quality Review CODIS HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Sample Switch Detection Procedure HT		
WSP CLD DNA Casework STR Procedures Manual: Quality Assurance/Quality Control HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Reagent Quality Control HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Reagent Lot Numbers and Expiration Dates HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Reagent Preparation HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Calibration of Instruments HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Tempgenius – Setup and Maintenance HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Qiagen BioRobot® EZ1 Workstation – Maintenance HT Tech		
WSP CLD DNA Casework STR Procedures Manual: AB 7500 Real Time PCR Systems Instrument – Setup HT Tech		
WSP CLD DNA Casework STR Procedures Manual: AB 7500 Real Time PCR Systems Instrument – Maintenance HT Tech		
WSP CLD DNA Casework STR Procedures Manual: Hamilton Microlab STARlet – Maintenance		
WSP CLD DNA Casework STR Procedures Manual: Biotek® Plate Reader – Instrument Maintenance		
WSP CLD DNA Casework STR Procedures Manual: Qiagen Qiagility™ – Maintenance		
WSP CLD DNA Casework STR Procedures Manual: AB 3500 Genetic Analyzer – Setup and Maintenance HT Tech		
Autoclave User's Manual (lab specific) HT Tech		
DNA QC Forms. SharePoint: DNA Forms & Templates HT Tech		
WSP CLD CODIS Laboratory STR Procedures Manual: Quality Assurance/Quality Control CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Performance Check and Calibration of Instruments CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Tempgenius Wireless Data Acquisition & Monitoring System CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Reagent Preparation CODIS **only**		

WSP CLD CODIS Laboratory STR Procedures Manual: Tempgenius Wireless Data Acquisition & Monitoring System Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: UV Irradiator Operating Instructions CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: BSD600 Duet Puncher Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Qiagen EZ1 Advanced XL Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: ABI 7500 Real Time PCR System Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: 9700 Thermal Cycler Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: ProFlex PCR System Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: 3500XL Genetic Analyzer Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: GeneMapper® ID-X v.1.6 Server Maintenance CODIS **only**		
WSP CLD CODIS Laboratory STR Procedures Manual: Tuttnauer Tabletop Autoclave – Instrument Maintenance CODIS **only**		

22. Testimony, Legal Issues, and Ethics

The purpose of this module is to provide instruction and prepare the Casework DNA Analyst trainee for court presentation in the State of Washington. Unless the Casework DNA Analyst trainee has previous DNA typing testimony experience, at least one moot court session must be conducted in preparation for giving testimony. The trainee should be encouraged to attend court and observe experienced forensic scientists testify.

22.1. Goals

At the end of this session the trainee should be:

22.1.1. Familiar with the legal system for Washington State as it pertains to expert witnesses

22.1.2. Able to provide unbiased, clear, and easy to understand expert testimony on forensic DNA analysis

22.1.3. Aware of legal issues surrounding DNA testing and testimony

22.1.4. Confident in their ability to meet the ethical standards expected of an expert witness

22.2. Tasks

Instruction will be provided

22.2.1. Courtroom procedures and rules of evidence processes

- 22.2.1.1. Court structure or both trial and appeals courts
- 22.2.1.2. Format of hearing or trial
- 22.2.1.3. Discovery and admissibility rules
- 22.2.1.4. Courtroom demeanor and attire

22.2.2. DNA analyst qualifications

22.2.3. Technical testimony

22.2.4. Testimony practice of direct and cross examination

22.2.5. Ethical responsibility of expert witnesses

22.2.6. Evidence and exhibit presentation

- 22.2.6.1. Handling of evidence
- 22.2.6.2. Exhibit continuity

22.2.7. State and federal DNA database legal authority

- 22.2.7.1. Permissible samples and profiles
- 22.2.7.2. Confidentiality and disclosure of information

22.2.8. Review curriculum vitae of trainee (Tech)

22.2.9. Observation of witness testimony (Tech)

22.2.10. Legal issues (NAS, PCAST reports; successful legal challenges)

22.2.11. Ethical responsibility of expert witnesses

22.3. Assessment

Participation in a minimum of one successful moot court is required to complete this module. The results of the moot court performance evaluation will be retained by the laboratory as part of the trainee's file. The trainer will document completion of this module using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 22 – Testimony, Legal Issues, and Ethics

Evaluation Form

☐ Courtroom procedures and process of rules of evidence

☐ DNA analyst qualifications

☐ Technical testimony

☐ Testimony practice (direct and cross examination)

☐ Ethical responsibility of expert witnesses

☐ Evidence/exhibit presentation

☐ State and federal DNA database legal authority

☐ Review curriculum vitae and observe expert witness testimony (Tech)

☐ Moot court (Tech - oral board)

☐ Legal issues

The trainee has completed the above checked sections and is able to:

Understand the legal system for Washington State as it pertains to expert witnesses
Provide unbiased, clear and easy to understand expert testimony on forensic DNA analysis

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date

MODULE 22 TESTIMONY, LEGAL ISSUES, AND ETHICS READING ASSIGNMENTS

HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD Quality and Operations Manual: 10 Case Management, Sections 10.10-10.12		
A Citizen's Guide to Washington Courts. http//www.courts.wa.gov. Organization of WA courts.		
WSP CLD DNA Quality Assurance Manual: 10.2 Discovery and Public Disclosure CODIS Tech		
Coleman H, Swenson E. 1994. DNA in the Courtroom: A Trial Watcher's Guide. Seattle: Genelex Press. Chapter 5 DNA in the Courtroom: 75-92.		
Matson JV, et al. 2004. Effective Expert Witnessing: Practices for the 21st Century. Boca Raton (FL): CRC Press. Chapter 1 The Legal Environment: 1-11.		
Matson JV, et al. 2004. Effective Expert Witnessing: Practices for the 21st Century. Boca Raton (FL): CRC Press. Chapter 2 Key Cases and Precedents Affecting Expert Witnessing: 13-22.		
Matson JV, et al. 2004. Effective Expert Witnessing: Practices for the 21st Century. Boca Raton (FL): CRC Press. Chapter 4 The Pre-Trial Process: 35-57.		
Matson JV, et al. 2004. Effective Expert Witnessing: Practices for the 21st Century. Boca Raton (FL): CRC Press. Chapter 5 Preparing for Trial: 59-66.		
Matson JV, et al. 2004. Effective Expert Witnessing: Practices for the 21st Century. Boca Raton (FL): CRC Press. Chapter 6 The Courtroom Drama: 71-87.		
Matson JV, et al. 2004. Effective Expert Witnessing: Practices for the 21st Century. Boca Raton (FL): CRC Press. Chapter 7 The Art of Expert Witnessing: 89-101.		
Butler JM. 2012. Advanced Topics in Forensic DNA Typing: Methodology. San Diego: Elsevier Academic Press. Chapter 18 Legal Aspects of DNA Testing and the Scientific Expert in Court: 515-543.		
National Judicial College and Justice Speakers Institute. 2020. Science Bench Book for Judges. Section 6.2 Pre-Trial Discovery: 209-218.		
National Judicial College and Justice Speakers Institute. 2020. Science Bench Book for Judges. Section 7 Trial: 219-243.		
National Judicial College and Justice Speakers Institute. 2020. Science Bench Book for Judges. Section 9 The Expert Witness: 261-278.		
National Research Council Committee on DNA Forensic Science. 1992. DNA Technology in Forensic Science. Washington, D.C.: National Academies Press. Chapters 6 Use of DNA Information in the Legal System and 7 DNA Typing and Society: 131-164.		
National Research Council Committee on DNA Forensic Science. 1996. The Evaluation of Forensic DNA Evidence. Washington, D.C.: National Academies Press. Chapter 1 Introduction: 47-59 and Chapter 6 DNA Evidence in the Legal System: 166-211. Note significant changes between the two NRC reports.		
Holmgren J. DNA evidence and jury comprehension. Canadian Society of Forensic Sci J 2005; 38(3): 123-141.		
Eldridge H. Juror comprehension of forensic expert testimony: a literature review and gap analysis. Forensic Sci Int: Synergy 2019; 1: 24-34.		
Donnelly P, Friedman RD. DNA database searches and the legal consumption of scientific evidence. Michigan Law Review 1999; 97(4): 931-984.		
Robertson J. Integrity issues impacting on the provision of forensic services. Australian J Forensic Sci 1999: 31(2): 87-97.		

National Research Council. 2009. Strengthening Forensic Science in the United States: A Path Forward. Washington, D.C.: The National Academies Press.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Executive Summary: 1-20.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Chapter 1 Introduction: 21-24.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Chapter 2 Previous Work on Validity of Forensic-Science Methods: 25-39.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Chapter 3 The Role of Scientific Validity in the Courts: 40-43.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Chapter 4 Scientific Criteria for Validity and Reliability of Forensic Feature-Comparison Methods: 44-66.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Chapter 5 Evaluation of Scientific Validity for Seven Feature-Comparison Methods: Introduction, Section 5.1 DNA Analysis of Single-source and Simple-mixture Samples, Section 5.2 DNA Analysis of Complex-mixture Samples, and Conclusion: 67-75, 122-123.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Chapter 6 Recommendations to NIST and OSTP: 124-130.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Chapter 10 Scientific Findings: 146-150.		
President's Council of Advisors on Science and Technology. 2016. Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Appendix A Statistical Issues: 151-154.		
ANAB. 2018. Guiding principles of professional responsibility for forensic service providers and forensic personnel. GD 1350: 1-3.		

23. Cognitive Bias

This training will provide the DNA analyst with an introduction to cognitive bias and its role in forensic science.

23.1. Goals

At the end of this session, the trainee should be:

23.1.1. Familiar with the different types of bias that can affect forensic science.

23.1.2. Recognize and minimize bias during the testing process.

23.2. Tasks

Trainers will discuss with trainees subject matter on the following topics:

23.2.1. Cognitive, contextual, and confirmation bias

23.2.2. Steps to minimize cognitive bias

23.2.3. Analysts should participate in a cognitive bias discussion annually in conjunction with the ASCLD Guiding Principles review.

23.3. Assessment

No practical examination or competency is provided for this training section. The trainer will assess through discussion of the trainee's knowledge of the subject matter and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 23 – Cognitive Bias

Evaluation Form

☐ Types of bias

☐ Ways to minimize cognitive bias

The trainee has completed the above checked sections and is able to:

Recognize the different types of cognitive biases and how to minimize them

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 23 COGNITIVE BIAS READING ASSIGNMENTS

CODIS HT

TRAINEE:_____

REFERENCE	INITIALS	DATE
CLD cognitive bias PowerPoint presentation		
Dror I, Hampikian G. Subjectivity and bias in forensic DNA mixture interpretation. Sci and Justice 2011; 51(4): 204-208.		
Biedermann A. Prediction in forensic science: a critical examination of common understandings. Frontiers in Psychology 2015; 6: 1-4.		

24. Outsourcing

This module outlines the outsourcing program used by the CLD to send DNA work to laboratories outside the Washington State Patrol Crime Laboratory system. Training specific to the review of outsourced casework will be dependent on the outsourcing laboratory and will be done separately.

24.1. Goals

At the end of this session, the trainee should be:

24.1.1. Able to describe the outsourcing process, including in-house review

24.2. Tasks

Trainers will briefly discuss when outsourcing is used by the laboratory and how the process of outsourcing works

24.3. Assessment

No practical examination or competency is provided for this training section. The trainer will assess through discussion of the trainee's knowledge of the subject matter and will document the training using the trainer's evaluation form.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 24 – Outsourcing

Evaluation Form

☐ Outsourcing process

The trainee is able to:

Explain the process of outsourcing cases, including in-house review

Comments:

Trainee Printed Name + Initials	Date	Trainer Printed Name + Initials	Date

MODULE 24 OUTSOURCING READING ASSIGNMENTS

TRAINEE:_____

REFERENCE	INITIALS	DATE
WSP CLD Quality and Operations Manual: 21 Subcontracting of Tests		
WSP CLD DNA Quality Assurance Manual: 15 Outsourcing CODIS		
WSP CLD DNA Casework STR Procedures Manual: Outsourced Ownership Review		

25. Final Evaluations

25.1. Goals

25.1.1. Pass a written exam on in-depth knowledge appropriate to their duties

25.1.2. Each Casework DNA Analyst trainee (optional for experienced staff training in this area) will prepare and give a lecture presentation of ~20-30 minutes in length to WSP CLD scientific staff on a topic in which in-depth knowledge is required.

25.1.2.1. This will be followed by a brief question and answer period

25.1.2.2. A written dissertation of the presentation is also required

25.1.3. Successfully complete competency consisting of mock case(s).

25.2. Tasks

25.2.1. Take written exams for biochemistry and DNA (HT trainees will also take two written tests, one for Phase I and one for Phase II)

25.2.2. Present a lecture presentation and written dissertation

25.2.3. Complete competency consisting of mock case(s)

25.3. Assessment

A passing score (≥80%) on the written exam is required to complete training. Successful completion of the lecture presentation and written dissertation is required for all Casework DNA Analyst trainees. Competency samples in the form of a mock case (or non-probative case) will be provided to the Casework DNA Analyst trainee (samples from Module 14 work may be used). The Casework DNA Analyst trainee will prepare full documentation of the analysis and interpretations in the format used for regular casework. The CODIS DNA Analyst trainee will be provided with competency samples representative of what will be encountered in performing regular work duties. The CODIS DNA Analyst trainee will prepare full documentation of the analysis as required for convicted offender database entry.

WSP DNA BIOCHEMISTRY AND STR TRAINING PROGRAM

MODULE 25 – Final Evaluations

Evaluation Form

☐ Written exam (passing grade of 80% or higher)

☐ Lecture presentation and written dissertation*

Casework DNA Analyst

☐ Competency test

CODIS DNA Analyst

☐ Competency test (manual extraction and direct amplification)

*Passing meets the following criteria: presented/stated material in a clear and understandable manner, shows good comprehension of subject, able to answer questions (from lecture) to the satisfaction of the trainer, sufficient scientific detail provided to explain subject. Trainee may pass on condition of successful completion of further specified work or in the instance of one or two of the preceding criteria not being fully met (additional work assigned by trainer to meet criteria in consultation with DNA Technical Leader).

The trainee has completed the above checked sections and is able to:

Show complete understanding of the principles and knowledge involved in forensic DNA casework, shown through written examination and/or an oral presentation

Successfully perform forensic DNA laboratory procedures in accordance with the laboratory protocols

Comments:

_____ _____

Trainee Printed Name + Initials Date Trainer Printed Name + Initials Date