TRACE EVIDENCE COLLECTION / HAIR-LIKE FIBER EXAMINATION

19.1 PURPOSE:

A. To properly collect trace evidence (a.k.a. trace material), specifically hair-like fibers.

B. To identify human hair(s) in collected trace evidence and prepare human hair(s) for DNA analysis.

19.2 RESPONSIBILITY:

Forensic Science Examiner / Connecticut Career Trainee who has successfully completed training.

19.3 SAFETY:

A. The appropriate measures for the proper handling of biohazard materials, sharps instruments and chemicals will be used according to GL-02.

B. Trace evidence will be collected, examined and retained in such a manner as to prevent the loss or contamination of the evidence.

19.4 DEFINITIONS:

A. OTM: Other Trace Material

B. SEM: Scanning Electron Microscope

C. GSR: Gun Shot Residue

19.5 PROCEDURE: General Guidelines

Questioned trace evidence may be collected in the Forensic Biology Unit or in other units of the Laboratory as necessary and transferred to the Forensic Biology Unit for examination.

A. For homicide cases:

1. Trace material, including hair-like fibers, will be collected, packaged and returned to the packaging of the submission from which the trace material was collected.
2. The collected trace material will not be sub-itemized in LIMS.
3. The presence of hair-like fibers (and/or other trace material) will be documented on the appropriate Quality Record Worksheet.
4. The collection and disposition of hair-like fibers (and/or other trace material) will be specified in the Forensic Biology or DNA report.

B. For other cases:

1. Trace material, including hair-like fibers, will not be collected. (Therefore, no sub-itemization is necessary.)
2. The presence of hair-like fibers (and/or other trace materials) will be documented on the appropriate Quality Record Worksheet.
3. The presence of hair-like fibers (and/or other trace material) will be specified in the Forensic Biology or DNA report.

19.6 PROCEDURE: Trace Evidence Collection and Packaging (when necessary)

19.6.1 Materials:

A. Forceps
B. Paper for Paperfold
C. "Sticky notes"
D. Lint roller
E. Sheet protector
F. Trace scraper (various sizes)
G. White butcher paper (preferred)
H. Blade/scalpel
I. Trace Tins (various sizes)
J. Forensic trace collection vacuum
K. Vacuum filters

19.6.2 Collection by Picking

A. Clean forceps according to FB SOP-1, section 1.5.1 (cleaning utensils and laboratory area).

B. Pick visible hair-like fibers/OTM from the submission with the forceps. Note: Do not collect any hair-like fibers that are interwoven into the fabric since it is a sign that the hair-like fiber was not recently transferred/deposited.

C. Place the collection into a clean paperfold (See paperfold addendum). Label the paperfold with the Lab #, submission #, item #, description and initials.

D. Place the paperfold in a coin envelope and label the envelope similarly to the paperfold.

19.6.3 Collection by Lifting

A. The adhesive side of a "sticky note" can be used to collect hair-like fibers/OTM from a smaller submission.
   1. Fold the note upon itself and place in a paperfold (See paperfold addendum).
   2. Label the paperfold with the Lab #, submission #, item #, description and initials.
   3. Place the paperfold in a coin envelope and label the envelope similarly to the paperfold.

B. A standard lint roller can be used to collect hair-like fibers/OTM from a larger submission.
   1. Remove the cover and set aside.
   2. Clean the roller top and handle according to FB SOP-1, section 1.5.1 (cleaning utensils and laboratory area)
   3. Discard the topmost layer of roller sheets.
   4. Roll the evidence, collecting the topmost removable trace material/debris.
   5. When the tackiness of the roller sheet diminishes, tear off the sheet and continue rolling the submission with the next sheet on the roll. Repeat as necessary.

6. Place the used roller sheet(s) in a sheet protector, maximum two per protector. Sheets must be separate and apart from each other. Heat seal between the two roller sheets in the sheet protector and the sheet protector opening. Initial the heat seal(s). Label the sheet protector with the Lab #, submission #, item #, description and initials.

7. Clean the roller top and handle again according to FB SOP-1, section 1.5.1 (cleaning utensils and laboratory area) and replace the cover.

19.6.4 Collection by Scraping

A. Clean an appropriately-sized scraper or scalpel, according to FB SOP-1, section 1.5.1 (cleaning utensils and laboratory area).

B. In a contained area, hold the evidence above the clean white butcher paper and scrape the trace evidence from the submission onto the paper. Note: White butcher paper is preferred over brown craft paper because it is less likely to shed paper fibers during the scraping process.

C. Use the scraper edge to gather the trace material into a pile on the clean paper and cut the paper to a manageable size with a sharp blade/scalpel. If the amount of collected trace material allows, make a paperfold from this paper. If it does not allow, place the collected trace material in an appropriately sized tin.

D. Label the paperfold with the Lab #, submission #, item #, description and initials. Place the paperfold in a coin envelope and label the envelope similarly to the paperfold.

E. Label the tin with the Lab #, submission #, item #, description and initials. Seal the tin with tape.

19.6.5 Collection by Vacuuming

A. Clean the vacuum unit, hoses and cords according to FB SOP-1, section 1.5.1 (cleaning utensils and laboratory area).

B. Remove an appropriately sized vacuum filter from its sealed integrity packaging and attach it to the vacuum hose.

C. Vacuum an area of the submission for hair-like fibers/OTM, documenting the location. Change the filter as necessary, depending on the capacity of the filter. Continue to vacuum an area and document its location until the entire submission is vacuumed.

D. Place each filter in an evidence bag and seal it. Label the bag with the Lab #, submission #, item #, description, area of collection and initials.

19.6.6 Collection of SEM samples for GSR

Collect samples for SEM analysis according to FLIN SOP-07 (SEM sample collection on clothing for GSR analysis) located under Chemistry/Instrumentation-GSR.

19.7 PROCEDURE: Disposition of Trace Samples in Homicide Cases

A. The samples collected from the evidence will be created in the LIMS computer system according to GL-4 (LIMS/Justice Trax) and FB SOP-1, section 1.5.5 (Examples of evidence/sample itemization in LIMS).

B. Place the properly packaged collected trace material in a larger manila envelope (approximately 9" x 12"), label with the Lab ID#, incident town, item # and examiner's initials. Seal with tape, initial the seal and place in trace storage. (LIMS: Trace storage – retained trace).

C. If the presence of blood-like material or other body fluid-like material is suspected, place in a plastic zip-lock bag, label with the Lab ID# and examiner's initials. Heat seal, initial the seal and place in freezer storage (LIMS: Freezer storage).

19.8 PROCEDURE: Examination of Questioned Trace Evidence / Identifying Human Hairs

19.8.1: Materials:

A. Stereomicroscope
B. Compound microscope
C. Glass microscope slides
D. Cover slips
E. dH_2O
F. Disinfecting solution
G. Digital imaging device

19.8.2: Procedure:

A. Questioned trace evidence may be collected in the Forensic Biology Unit or in other units of the Laboratory as necessary and transferred to the Forensic Biology Unit for examination.

B. Trace evidence will be examined and retained in such a manner as to prevent the loss or contamination of the evidence.

C. Record all written information on the appropriate Quality Record Worksheet.

D. Digital images may be used to aid in the examination/documentation process.

E. Examine the collected trace material stereoscopically, identifying any hair-like fibers. Some animal hairs may be identified at this magnification. Human tissue-like material may be observed at this magnification. Examination at a higher magnification is usually necessary.

F. The appropriate glass microscope slide and cover slip will be used based on the length and morphology of the hair-like fiber evidence and parameters of the microscope.

G. Temporarily mount the chosen hair-like fiber(s) in dH_2O, or other appropriate medium, one per slide. The ends should be easily located.

H. The mounted hair-like fiber(s) will be examined with a compound microscope at ~ 100x magnification.

I. The examiner will determine if the hair-like fiber is indeed a hair and whether the hair is of animal origin or human origin.

J. The examiner will document observations that support the hair identification conclusion.
   1. Examples of this documentation may include descriptions of root features, color features, cortex features, pigment features, cuticle (scale) features, tip features, medulla features or gross morphological features. The examiner will use their knowledge, training and experience to identify and characterize these features.
   2. A digital image (~100x) may be substituted for the written description.

K. The somatic body area and other microscopic characteristics of human hairs may be documented, if deemed appropriate.

L. The presence of tissue-like material on human hairs will be photo-documented using an appropriate digital imaging devise.

M. The hair-like fibers will be removed from the temporary mounting.

19.9 PROCEDURE: Preparing Hairs for DNA Analysis

19.9.1: Materials:

A. Sterile microcentrifuge tube(s)
B. Sterile scalpel(s)

19.9.2: Nuclear DNA (nDNA) Analysis:

A. The examiner will use their experience and training to choose the most suitable hairs for nDNA analysis. These human hairs may be the hairs that possess the greatest amount of tissue-like material at the root and/or possess morphological characteristics of interest in relation to the known hair sample.

B. The examiner will measure and record the length, in centimeters, of the human hair(s) that are chosen for DNA analysis.

C. The examiner will use a sterile scalpel to excise the root portion of the hair. This root portion will be placed in a sterile microcentrifuge tube.
The tube will be labeled with the Lab#, Item # and examiners initials. (See also *Itemizing*, below)

D. The remaining shaft will be retained separately in appropriate packaging for possible future mtDNA analysis. The package will be labeled with the Lab#, Item #, length of hair remaining and examiners initials. (See also *Itemizing*, below).

E. The remaining portion of questioned trace material shall be returned to its packaging, sealed, initialed and retained at the Laboratory.

19.9 3: Mitochondrial DNA (mtDNA) Analysis

A. If the nDNA analysis of a human hair root does not yield significant results, the retained shaft portion of the hair may be forwarded to the DNA Unit, in its entirety, for mtDNA analysis.

B. If a chosen human hair does not possess tissue-like material at the root, the entire hair will be packaged, labeled appropriately and forwarded to the DNA Unit for mtDNA analysis.

19.10 PROCEDURE: Examination of Known Hair Samples

A. Known hair samples may be examined when deemed appropriate for the case scenario or when a biological known is needed for comparison purposes.

B. Hair evidence will be examined in such a manner as to prevent the loss or contamination of the evidence.

C. Record all written information on the appropriate Quality Record Worksheet.

D. Digital images may be used to aid in the examination/documentation process.

E. The approximate number of hairs and their macroscopic morphological characteristics such as length, color and texture will be documented.

19.11 PROCEDURE: Itemizing

A. A trace evidence collection is given a sub-item number and documented in LIMS, according to GL-04 (Example: #1S1).

B. Human hairs that are chosen for DNA analysis from that trace evidence collection are further sub-itemized (example #1S1-1).

C. A root portion that possesses tissue-like material that is chosen for nDNA analysis will be labeled with an asterisk (example: #1S1-1*). The shaft portion from which that root has been removed and retained for potential mtDNA analysis, will remain itemized as above (example: #1S1-1).

19.12 PROCEDURE: Report Writing:

A. General Guidelines: Homicides:

1. The presence or absence of hair-like fibers (and/or other trace material) will be specified in the Forensic Biology or DNA report.
2. The disposition of the collected trace material will be included in the report.

B. General Guidelines: Other Cases:

1. The presence of hair-like fibers (and/or other trace material) will be specified in the Forensic Biology or DNA report.
2. Only when a trace examination is requested on the Request for Analysis form (SOP-ER-02) will the absence of trace material be included in the report.

C. Report Wording: Trace/Hair-like fiber Collection/Disposition

1. The report may include statements such as:
   - *a. Hair-like fibers and other trace material(s) was/were noted on/in [ ].*
   - *b. No hair-like fibers were noted on/in [ ].*
   - *c. No trace material(s) was/were noted on/in [ ].*
   - *d. Trace material(s)/hair-like fiber(s) was/were collected/removed from [ ] and returned to the submission/item packaging.*
   - *e. Trace material/hair-like fibers, designated as item #1S1, was/were retained at the Laboratory.*
   - *f. Trace material/hair-like fibers, designated as item #1S1,was forwarded for further examination.*

D. Report Wording: Hair Identification / Disposition

1. A competent hair examiner from the Laboratory or another ASCLD accredited laboratory may act as the Technical Reviewer of a report which includes hair identifications.

2. The report may include statements such as:
   - *a. Human hairs were observed in item #1S1.*
   - *b. No tissue-like material was observed on these hairs.*
   - *c. Tissue-like material was noted on the root portion of some of these human hairs.*
   - *d. The root portions of these human hairs were forwarded to the DNA Unit for nuclear DNA analysis.*
   - *e. The shaft portions of these human hairs were forwarded to the DNA Unit for mitochondrial DNA analysis.*
   - *f. Animal hairs were observed in item #1S1.*

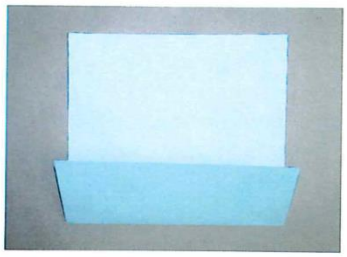
19.13 REFERENCES:

1. Hicks, J. Microscopy of Hairs: A Practical Guide and Manual, FBI Laboratory, 1977.
2. Saferstein, R. Forensic Science Handbook, Prentice Hall, 1982. Chapter 5: The Forensic Identification of and Association of Human Hair.
3. Saferstein, R. Forensic Science Handbook, Prentice Hall, 1982. Chapter 9: Foundations of Forensic Microscopy.

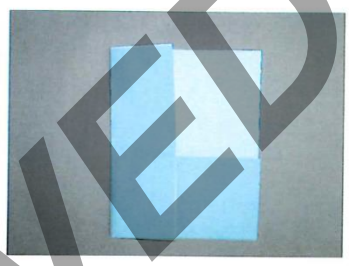
***Additional hair related articles are available.**

FB SOP-19 Trace Evidence Collection / Hair-like Fiber Examination - Addendum

1. Fold 1/3rd of Width

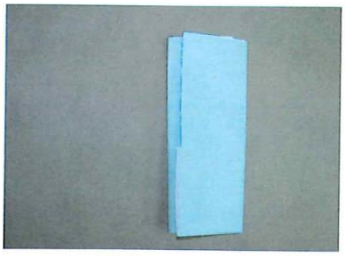


2. Fold 1/3rd of Length



3. Place Trace in Pocket

4. Fold Remaining 1/3rd of Length



5. Fold in Half

6. Fold Corners Under