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	<i>Document Manager: Cheryl Lozen</i>	<i>Approved By: Ryan Larrison</i>

3.11 Fibers Microscopic Comparison

3.11.1 Introduction

The comparison of questioned fibers with fibers from a known source is performed in every step of the examination of the fibers once the questioned fibers are recovered and the standard fibers are collected from a known source. The comparison process can be as simple as visual examination to as complex as an instrumental method.

The examiner can approach the fiber comparison by setting out to show that the samples are not similar. The failure to detect any significant differences, after exhausting the methodology available to the examiner, necessitates the conclusion that the fibers could have the same origin. Often, white (colorless) and "indigo" blue cotton fibers from blue jean material are encountered which have no evidential value due to their prevalence.

Other Related Procedures: All Procedures in this Protocol

A fiber worksheet such as **Appendix 3.3** can be utilized to aid in the comparison and organization of microscopic qualities.

3.11.2 Safety Considerations

Standard Laboratory Precautions - See FSD Health & Safety Manual

3.11.3 Preparations

Standard Laboratory Practices

3.11.4 Minimum Standards & Controls

When an association is made between questioned and known natural fibers, they shall be identified as to generic class. Comparison is performed utilizing polarized light microscopy and/or brightfield microscopy, FTIR if deemed useful, and microspectrophotometry (if applicable).

When an association is made between questioned and known man-made fibers, they shall be identified as to generic class. Comparison is performed using techniques such as polarized light microscopy, fluorescence microscopy, solubility tests (if applicable), refractive index determination, melting point determination (if applicable), microspectrophotometry (if applicable) and FTIR.

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When comparing color utilizing a comparison scope, the scope should be checked for color balance using at least one pair of colored fibers known to be from the same source (one on each side). Adjust the scope as needed to color match these color balancing fibers before comparing the case samples.

3.11.5 Instrumentation

See Trace Procedure Manual 8.0 Trace Microscopy

Stereomicroscope
 Brightfield Microscope
 Polarized light Microscope
 Comparison Microscope
 Fluorescence Microscope

3.11.6 Procedure or Analysis

The comparison of fibers requires a combination of indirect and side-by-side comparison processes. The examiner should compare the questioned to the known at all stages of the examination to determine if there are any unexplained (significant) differences. If these differences are observed at any point in the comparison process, the question fiber has to be considered as not originating from the source represented by the standard.

All destructive testing should be done only after all non-destructive testing is completed.

In general, the microscopic features which are compared are color; shade; fiber diameter and variations along its length; cross-sectional shape; surface features; internal characteristics; refractive index/indices; birefringence; pleochroism; interference; sign of elongation; delustrant, melting point (if applicable) and damage.

All of these features/characteristics must be consistent between the questioned fiber(s) and the known source in order to make the conclusion that the questioned fiber could have originated from that source.

3.11.7 Environmental Conditions

The laboratory should be free of strong breezes that may cause sample movement when mounting fibers.

The fluorescence scope microscopy and photography should be performed in a darkened room.

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3.11.8 References

[ASTM E2228-19 - Standard Guide for Microscopical Examination of Textile Fibers](#)

Gaudette, B. D. In Forensic Science Handbook; Saferstein, R., Ed.; Prentice Hall: Englewood Cliffs, N.J., 1988; Vol. II, Chapter 5.

Robertson, J., Ed. Forensic Examination of Fibers; Ellis Horwood: New York, 1992.