

CASE REPORT

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Significant Fiber Evidence Recovered from the Clothing of a Homicide Victim After Exposure to the Elements for Twenty-Nine Days

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ABSTRACT: An adhesive tape lint removal roller was used to isolate fibers from a homicide victim's clothing that had been exposed to the elements for twenty-nine days. Comparison microscopy, microspectrophotometry, and infrared analysis were used to compare recovered fibers to known fibers obtained from the suspect's shirt and the car in which it was believed the homicide occurred. Fibers recovered from the victim's clothing included specimens that were indistinguishable from fibers constituting the suspect's shirt, and others that were indistinguishable from the three distinct types of fibers comprising the upholstery, carpeting, and trunk liner of the car. The distribution of fibers on the various garments helped corroborate the crime scenario.

KEYWORDS: criminalistics, fibers, homicide, criminal investigation

Case History

A 13-year-old girl was reported as missing by her mother. A search of the vacant industrial area near her residence yielded a pair of athletic shoes and a pair of underpants identified as belonging to the victim. Twenty-nine days later her body was found about a mile away in an overgrown area on the edge of a parking lot. The body was supine with the arms raised, concealed by tall vegetation, and partly suspended from the ground by parts of a bicycle and brush beneath it. The body was clothed except for underpants and shoes. The shorts and socks were on the body inside-out.

The cause of death was listed as asphyxiation by strangulation.

She had been last seen in a car driven by a man who was known to the family. He thereby became a suspect. Investigators obtained a black and purple shirt thought to be worn by the suspect on the night of the deceased's disappearance from a member of the

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suspect's family. The investigators obtained known specimens of upholstery, carpeting, and trunk lining from the car suspected to be involved, and sent them to the laboratory.

Methods

The victim's clothing consisted of white and blue denim, which is composed of cotton fibers which are of little evidential importance. To preclude contamination this clothing was examined first while the suspect's shirt and the fibers from the car remained in sealed packages.

Trace lifts were performed on the victim's clothing using a "Lint Pic-up," which is sold in retail stores as a device for cleaning fabric. It consists of a handle attached to a cylindrical roller with removable low adhesive sheets. The four by five inch adhesive sheets were removed from the roller after the lifting process and pressed adhesive side onto a clear sheet of plastic. The edges were sealed on all sides with clear adhesive tape.

Known exemplars were prepared by mounting fibers from the car fabrics and the suspect's shirt on standard glass microslides using Permout as the mounting medium.

The trace lifts were scanned at 20 to 30 times magnification, and questioned fibers sealed in the trace lifts were compared to known fibers mounted on the microslides. Questioned fibers similar in appearance to knowns were circled with a fine tip marker.

Fibers selected for microspectrophotometric analysis were removed from the trace lift with a fine forceps after cutting through the plastic sheet cover and softening the adhesive with a few microliters of xylene. The fibers were mounted on standard microslides with Permout. The tip of the forceps holding the fiber was kept in the field of view of the stereoscope as the microslide was slid under the fiber for mounting so that visual custody of the evidence was maintained at all times.

Questioned fibers were compared with known specimens using the comparison microscope at 100 and 400 times magnification. Cotton fibers, except for those originating from denim, were compared as to dye type and color. Synthetic fibers were compared as to color, cross-section, diameter, tip morphology, shaft bends, and presence and appearance by any adhering soil.

Color comparison of the dyes in the fibers was performed on a Zeiss UMSP-50 microspectrophotometer by measuring transmission in the 400-800 nanometer range. The transmission values were plotted versus wavelengths on the monitor along with the first derivatives of the spectra ($d\%T/dnm$). Color spectra were considered to match only if displacement in corresponding curve inflections was within five nanometers or less.

The chemical composition of a representative specimen of each of the synthetic fiber types was determined using an Analect AQS-20, coupled with an XAD microscope. Transmission measurements were taken from 4398 to 700 wavenumbers and computed using the Fourier-transform (F.T.I.R.).

Results

One hundred fibers were recovered from the victim's clothing that matched fibers from the suspect's shirt and automobile based on comparison microscopy and microspectrophotometry. These results are tabulated in Table 1.

The number of automobile upholstery fibers actually observed on the trace lifts is greater than shown in Table 1. Fibers observed to be similar, but not confirmed by comparison microscopy and microspectrophotometry were not included in Table 1. The numbers of these fibers, observed by stereoscope alone were: deceased's jacket, 231; midriff top, 12; shorts, 131; underpants, 21; and socks, 80.

Similarly, 32 fibers similar to those from the suspect's shirt were found on the lifts from the victim's jacket when searched with the stereoscope. Of these, 17 were selected

TABLE 1—Numbers of fibers found on victim's clothing that match fibers from four sources associated with the suspect.

	Suspect's shirt	Auto seats	Auto carpet	Auto trunk
Jacket	16	17	1	0
Midriff	9	10	3	1
Bra	0	3	0	0
Shorts	5	9	1	0
Panties	3	7	0	0
Socks	0	10	4	1

as appearing representative for comparison microscopy and microspectrophotometry. Sixteen could be shown to match and are tabulated in Table 1.

One upholstery type fiber was isolated from the deceased's fingernail scrapings, which were obtained during the autopsy.

The evidential value of the purple cotton fibers making up the suspect's shirt is enhanced by the uncommon nature of the colorant. They are colored by a pigment dye that adheres to the surface of the fiber only in some areas. This gives them a mottled appearance when viewed microscopically (Fig. 1). Most cotton fibers encountered in our casework are dyed to a uniform color.

Pile fabric consists of cut fibers of a similar length, fastened to the fabric base, standing on end, oriented in a perpendicular direction [1]. Fibers shed from the automobile seat upholstery have microscopic structural features peculiar to their origin from a pile fabric. They are of similar length (400 to 600 microns), typically with a splintered proximal end and a club-shaped distal end under which soil has accumulated (Fig. 2). They are a light blue color and bean-shaped in cross-section. Microscopic measurement showed

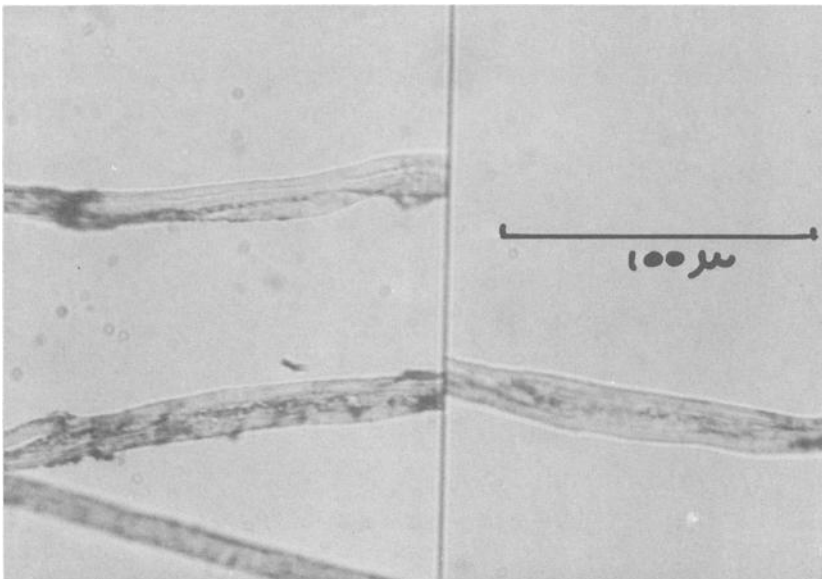


FIG. 1—Comparison photomicrograph of known fibers from the fabric of the suspect's shirt (left) and fibers isolated from the victim's midriff top (right). (Approximate magnification $\times 450$).



FIG. 2—Comparison photomicrograph of known fibers from the upholstery in the suspect's vehicle (left) and fibers isolated from the victim's underpants (right). (Approximate magnification $\times 450$).

these fibers to be 23 microns in diameter. They are composed of Nylon 6/6 as shown by F.T.I.R. analysis.

The automobile's interior carpeting is made up of light blue trilobal Nylon 6/11 measuring 54 microns in diameter (Fig. 3). The trunk liner is composed of black olefin fibers, oval in cross-section, measuring 60 microns in the major diameter, and 42 in the minor diameter (Fig. 4).

Discussion

The simultaneous presence of four different fiber types in significant numbers on the deceased's clothing which can be associated with a particular suspect provides strong evidence of contact between that suspect and the deceased.

The presence of large numbers of transferred fibers is consistent with a lack of activity on the part of the recipient after transfer since it is reported that most adherent fibers are shed in the course of a few hours, assuming that the recipient remains active [2]. The numbers of fibers transferred is suggestive that the pressure between the fabrics was not inconsequential, since greater pressure results in greater transfer of fibers [3], perhaps up to a maximum level [4]. Future documentation of transfer numbers encountered in casework may allow more accurate assessments.

An informant supplied information that the victim was sexually molested before being killed. The particular items of clothing from which fibers were recovered does suggest contact of a sexual nature. Suspect's shirt type fibers and seat upholstery fibers were recovered from the deceased's underpants. Upholstery type fibers were found on the brassiere.

Only two trunk liner fibers were recovered, which supports the informant's assertion that the body was transported in the trunk. It has been reported that contact between

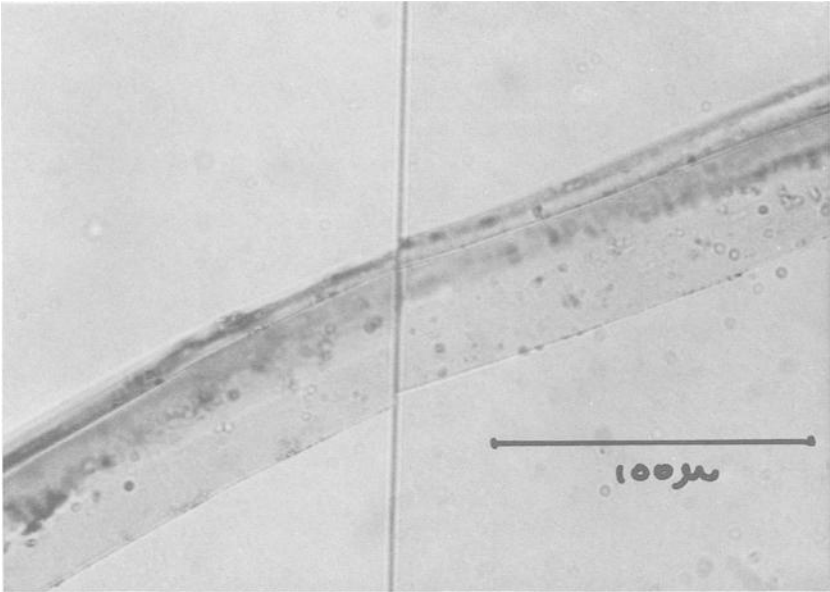


FIG. 3—Comparison photomicrograph of known fibers from the interior carpeting in the suspect's vehicle (left) and fibers from the victim's midriff top (right). (Approximate magnification $\times 450$).

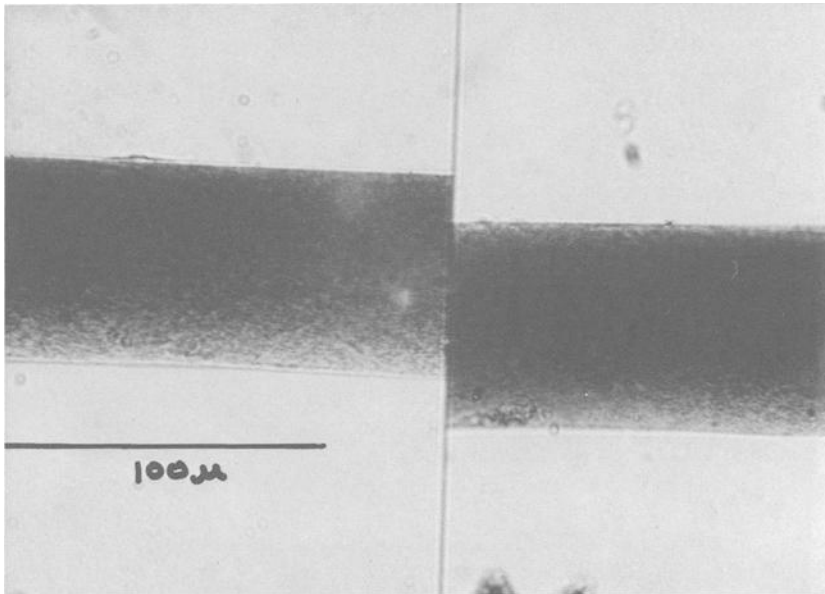


FIG. 4—Comparison photomicrograph of known fibers from the trunk liner in the suspect's vehicle (left) and fibers from the victim's midriff top (right). (Approximate magnification $\times 450$).

fabrics with movement results in the transfer of far greater numbers of fibers than contact without movement [5]. Lack of movement by the body could be one of the factors resulting in so few fibers being collected.

Meteorological observations for the area are made at the airport, which is 7.5 miles from the site where the body was found. These records indicate that during the 29 day period that the body and clothing was exposed, the wind speed averaged more than 10 m.p.h. on 13 days with a peak gust of 73 m.p.h. at the airport during a thunderstorm that crossed the area. The exposed area of the airport would be expected to experience higher windspeeds than the urban site where the body was found. The precipitation for the period was 3.92 inches, which can be assumed to be similar at both places on the average. It can be concluded therefore, that exposure of clothing to wind and precipitation does not necessarily obliterate all transferred fiber evidence.

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