BRIEF COMMUNICATION

Flora D'Andrea,[1] *B.Sc.; Françoise Fridez,*[1] *B.Sc.; and Raphaël Coquoz,*[1] *Ph.D.*

Preliminary Experiments on the Transfer of Animal Hair During Simulated Criminal Behavior

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ABSTRACT: Hairs from cats and dogs may be extremely important when used as evidence in the investigation of certain crimes and offenses. Certain parameters such as transfer and persistence are likely to be very similar to those encountered with fibers. These two parameters have been examined for dog and cat hair.

The results confirm that hairs cling easily to various surfaces and that they are transferred in large numbers. It is almost impossible to enter a house where a domestic animal lives without being contaminated by its hair.

KEYWORDS: forensic science, criminalistics, cat hairs, dog hairs, transfer, persistence, simulated crimes

Domestic animals, especially cats and dogs, are very frequent in the human environment. In Switzerland, there is about 1 cat for 6 persons and 1 dog to every 12 persons (1,2). Animal hairs that easily cling to various objects can be found on surfaces not entirely smooth, such as clothes, furniture, carpets, and other common objects which are in daily contact with these domestic animals. This type of evidence may become very important in the investigation of crimes and offenses, if it is demonstrated that hair is transferred during a crime. The very similar textile fiber transfer has been quite well studied (3–10) but very little is known about hair transfer. For this reason, we have performed a small-scale study on the transfer and persistence of animal hair in standardized contacts, such as those encountered in ''criminal behavior.''

Materials and Methods

Two types of contacts were simulated: seven burglaries in four apartments where cats and/or dogs live and two assaults on persons having been in recent contact with such animals. The four apartments where the burglaries were simulated had been cleaned with a vacuum cleaner within the last two days before the ''criminal behavior.'' The victim of the first assault did not own an animal nor did she live in contact with an animal. Her coat was cleaned before the experiment. She interacted with a dog only two hours before the assault, and the physical contact with the animal was essentially limited to the trousers.

The victim of the second assault lives with her two cats, and her clothes weren't cleaned before the criminal behavior.

The following parameters were standardized:

—The ''burglar'' or ''aggressor'' wore a cotton pullover with long sleeves, denims and buckskin lace-up shoes with Vibram™ type soles.

—The ''burglar'' searched the apartments when the animals were not present. The ''burglar'' stayed in the apartment for about 4 min and did what a burglar might do: walk in the apartment, search through some wardrobes, linen cupboards and sofas but without causing too much disturbance.

—The ''aggressor'' struggled with the ''victim'' for about 15 s, the arms of the ''aggressor'' being around the ''victim.''

—Between the ''criminal action'' and the sampling, the ''burglar'' remained engaged in a laboratory-type activity.

—For the sampling on the ''burglars,'' adhesive tapes were applied from wrists to elbows, from feet to knees and onto shoes when specified; for the ''aggressors,'' adhesive tapes were applied to the front of the pullover on the sleeves and to the upper back, and the trousers were searched on the legs.

The transferred hairs were counted under a microscope.

Results and Discussion

The results in Table 1 confirm that the transfer of dog/cat hairs occurs, even in apartments that had recently been cleaned. The number of hairs found was so high that it is almost impossible to enter a house where a domestic animal lives without being ''contaminated'' by cat and/or dog hairs, even when the animal possesses very short hairs or when the owner describes his animal as a poor source of hair.

The assault experiments gave similar results. Interestingly, the experiment where the victim met an animal only two hours before being assaulted provided much less transferred hairs than in the other experiment.

The few experiments on persistence in this study show that a large number of hairs were detected even after four hours, and even caught up in the Vibram™ design of the shoe soles. The persistence of this type of trace is a demonstration of its potential. The numbers presented here are consistent with the kinetics of

[1] Institut de Police Scientifique et de Criminologie, University of Lausanne, Bâtiment de Chimie, CH-1015 Lausanne-Dorigny, Switzerland.

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TABLE 1—*Results of the transfer and persistence experiments.*

Type of Offense	Animals Living on Premises	Sampling Carried Out	Number of Hairs Found
1. Burglary	1 Angora cat 1 European cat 1 Poodle dog	Immediately after burglary	311 cat hairs 101 dog hairs
2. Burglary	1 European-Siamese cat	Immediately after burglary	24 cat hairs
3. Burglary	1 English Setter dog	Immediately after burglary	300 dog hairs
4. Burglary	1 English Setter dog	1 h after burglary	179 dog hairs
5. Burglary	1 English Setter dog	Only on shoes, 4 h after burglary	26 dog hairs
6. Burglary	2 half Angora-European cats	Immediately after burglary	610 cat hairs
7. Burglary	2 half Angora-European cats	Only on shoes, 4 h after burglary	109 cat hairs
1. Assault	1 English Setter dog	Immediately after assault	12 dog hairs
2. Assault	2 half Angora-European cats	Immediately after assault	255 cat hairs

disappearance, well studied in the context of textile fibers (3–10). The persistence curves of textile fibers show some kind of logarithmic decrease with the halving time of the initial number of fibers being in the range of one to several hours. Thus, although no experiment was conducted to produce data to build true hair persistence curves, it would have been a surprise to find less than ten hairs in any of the experiments where the sampling was delayed by one or four hours.

Although the experiments presented here are sufficient to demonstrate the potential utility of animal hair as trace evidence, a better knowledge of the transfer and persistence of hairs would require a larger-scale study. To have a more complete view of the significance of these traces, it would also be useful to measure the average background level of animal hairs on clothing.

In this study it is interesting to note that most of the hairs transferred are secondary-type hairs. The reason for this is that the animals possess more secondary hairs than primary, and secondary hairs are more frequently lost and regenerated. Moreover, they are also fine and light, so that they transfer easily.

The evidential value of animal hair depends on our capacity to link them with a single source. Morphological observations alone do not enable individualization and, therefore, DNA typing should be considered. From the experience with human hair, it is known that nuclear DNA is virtually absent from the hair shaft and can be detected only in good-quality hair roots (11). Therefore, the success rate of DNA typing is directly linked to the quality of the roots (12).

Here, most of the roots found were of very poor quality. So it is not expected to get nuclear DNA from such hairs. Any DNA typing would then have to rely on mitochondrial DNA. Indeed, it seems that there is enough of this kind of DNA (13) and that hair shaft mitochondrial DNA typing is a promising solution.

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Additional information and reprint requests:
Raphael Coquoz
Associate Professor in Forensic Science
Institut de Police Scientifique et de Criminologie
UNIL-BCH
1015 Lausanne, Switzerland