



**NEW SOUTH WALES POLICE
FORENSIC SERVICES GROUP
CRIME SCENE PROCEDURES MANUAL - SPECIALIST**



Title: 27.0 Hair Collection, Sampling and Preliminary Examination Procedures

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HAIR COLLECTION, SAMPLING AND PRELIMINARY EXAMINATION PROCEDURES

1. SCOPE

These procedures are designed to assist the Forensic Investigator by outlining the method for the recovery of questioned hairs from a scene or exhibit, and the collection of a known sample of hair from an identified source.

It also outlines the method for a preliminary hair examination to determine if hairs are human or not and the suitability for nuclear DNA testing. Preliminary hair examinations are to be carried out by trained and authorised Forensic Investigators only.

2. ACKNOWLEDGEMENTS

This procedure manual is based on the Australian Federal Police Standard Operating Procedure for Hair Examination and acknowledges this as the primary reference.

3. DEFINITIONS

Anagen: The anagen root is the active growth phase of a hair follicle in the hair growth cycle.

Catagen: The catagen phase is the transitional phase of the hair follicle from the active growth phase (anagen) to the resting growth phase (telogen) in the hair growth cycle.

Characteristic: A characteristic is a microscopic or macroscopic feature or attribute of a hair.

Colour: Colour is the aspect of objects that may be described in terms of hue, lightness and saturation. It should be recognised that the macroscopic and microscopic colours might be distinctly different.

Cortex: The cortex is the primary anatomical region of a hair between the cuticle region and the medullary region composed of elongated and fusiform cells.

Cuticle: The cuticle is the outermost region of a hair and is composed of layers of overlapping scales.

Hair: A hair is cylindrically shaped fibrous outgrowth from the skin of mammals.

Identification: Identification is the process of classifying a given hair as a member of a defined class (e.g. human, animal).

Inconclusive: Inconclusive is a term that refers to a conclusion that is reached due to the

inability to include or exclude a questioned hair as similar to the known hair sample.

Known sample: A known sample is a collected sample intended to be representative of a particular body area of a specific person or animal.

Medulla: The medulla is the core of the hair shaft that is composed of air vacuoles and cells.

Microscopic: Microscopic is a term that describes characteristics too small to be resolved by the unaided eye, but large enough to be resolved with the microscope.

Questioned sample: A questioned sample refers to a sample of unknown origin, usually collected at a crime scene, at an autopsy, and/or during a crime laboratory examination.

Representative sample: A representative sample is a collection of hairs from a specific body area that reflects the range of characteristics as expressed in a subject's hair.

Root: The root is the structure at the proximal end of a hair that resides in the follicle.

Sample: A sample is one or more hairs used for identification, comparison, and/or reference.

Scales: Scales are tiny plate-like structures composed of keratin that form the cuticle.

Telogen: Telogen phase is the last phase of the hair growth cycle when the hair root becomes a bulbous shape, which can be easily shed from the follicle.

Tip: The tip is the most distal end of a hair's shaft.

4. PRINCIPLE

Hairs can be defined as slender outgrowths of the skin of mammals. Each species of animal produces hair with characteristic length, colour, shape, root appearance and internal structure. These features can be used to determine their origin. For most hairs, the main purpose is to identify (as far as possible) the species of animal from which the hairs originated. Little individualisation is normally possible. Human hairs are usually more important in a forensic context; however animal hairs may also be useful in certain cases. The basis of a hair examination is microscopy.

5. COLLECTION OF HAIRS

Wherever possible the location of any visible hairs should be recorded prior to collection. Any special circumstances surrounding the persistence of the hair on the item should also be noted (e.g. sticky tape residue, chewing gum).

Visible hairs are then to be removed by handpicking or tweezers and packaged into a paper boat. Individual hairs can be identified by using Post-It[®] Notes if required. Paper boats of hairs collected from the one item or scene can then be packaged in the one field exhibit bag after labelling the individual paper boats.

Items may then be tape lifted to collect any hairs that may not be visible. Vacuuming is to

only be used as a last resort. If hairs are collected by vacuuming then the Crime Scene officer is to remove any hairs from the vacuumings and package them in paper boats before submitting for further examination.

6. CASE MANAGEMENT

Hairs collected from a scene or exhibit will first need to be assessed to determine the species of origin (i.e. human or non-human) and if it is suitable for nuclear DNA testing or not. Authorised FSG personnel perform this preliminary screening and the procedure for this is at the end of this manual. The CSO should contact the Operations Coordinator, Crime Scene Operations Branch (CSOB) to identify an available authorised person, and then contact them to arrange an examination.

If the results of the preliminary screening are that the hair is not suitable for nuclear DNA and it is human, then a microscopic hair examination may be considered. If this is required then known hair samples need to be collected as soon as possible.

7. KNOWN SAMPLES

In order to perform a microscopic hair examination then known samples of hairs from possible sources must first be obtained. These known samples need to be taken within 6 months of the incident. If the subject has since coloured or otherwise chemically treated their hair, this needs to be documented and relayed to the hair examiner. In most cases, if the colour of the hair has been significantly altered a hair comparison will not be possible.

Known hair samples of human scalp hair need to be taken to represent all variation present. It should include both pulled and combed (shed) hairs. Ideally it should consist of at least 40 hairs taken from all regions of the scalp. The different regions do not have to be packaged separately, but can be packaged in the one paper boat. For other body regions then at least 20 hairs need to be collected. If a pathologist collects the known sample at the post-mortem please request that they collect the known sample in this way.

Known hair samples from suspects or other witnesses need to be collected in accordance with the Crimes (Forensic Procedures) Act. The subject also needs to be informed that the sample is being collected for a microscopic examination and will not be used for nuclear DNA analysis.

8. PRELIMINARY SCREENING

The preliminary screening of hairs is to be performed by authorised FSG personnel only. The Operations Coordinator, CSOB keeps the current list of authorised staff.

The purpose of the preliminary screening is to differentiate between human and non-human hairs and determine if they are suitable for nuclear DNA testing.

8.1 Equipment

- Stereomicroscope
- Glass slides or plates

8.2 Animal Or Human

To determine if a hair is human or animal in origin hairs should be examined under the stereomicroscope. It may be helpful to place the hair between glass plates or slides. The main determining characteristic is the width of the medulla compared to the width of the hair. In animals it will occupy more than $\frac{1}{3}$ the width of the hair. In human hairs it will occupy less than $\frac{1}{3}$. The following table gives a comparison of the features of human and non-human hairs to help in this determination.

Table 1: Comparison of human to non-human animal hair

FEATURE	HUMAN	NON-HUMAN
Colour	Relatively consistent along shaft	Often showing profound colour changes and colour banding
Cortex	Occupying most of the width of the shaft – greater than the medulla	Usually less than the width of the medulla
Pigment distribution	Even and slightly towards the cuticle	Central or denser towards the medulla
Medulla	Less than $\frac{1}{3}$ width of shaft. Mostly not continuous when present	More than $\frac{1}{3}$ width of shaft. Generally continuous with a defined structure
Scales	Similar from root to tip	Often shows variation in structure from root to tip.

8.3 Suitability For Nuclear DNA Testing

To determine this hairs are examined in the same way as in section 8.2, but the focus is on the root of the hair. To be suitable for nuclear DNA the root of the hair must not only be present, but also in the anagen, or growing stage of the hair's development. If the hair root is ribbon in shape then it is suitable to attempt nuclear DNA testing. It is not necessary for sheath material to be present; however this is usually a good indication that it is an anagen hair. If it is club shaped, then it is in the telogen stage and is not suitable.

Hairs that are suitable for nuclear DNA testing are to be conveyed to the Division of Analytical Laboratories, Biology Section, Lidcombe as soon as possible. If in any doubt as to the suitability for nuclear DNA, the hairs should be submitted to DAL.

9. MICROSCOPIC HAIR EXAMINATION

Hairs that are not suitable for nuclear DNA may be considered for a microscopic hair examination. The potential relevance of such an examination has to be assessed on a case-by-case basis. As this type of examination is very time consuming and involved, it will not be pursued in cases where the results will add little to the investigation (for example where the suspected offender is known to have had prior legitimate contact).

10. SUBMISSION OF EXHIBITS

For a microscopic hair examination to be performed the questioned hairs as well as the relevant known hairs need to be submitted along with the following documentation to the Westmead Laboratory, Forensic Services Group. An FSIMS job request with Westmead Laboratory as the completing station will also need to be created. This must be linked to the event and include as much detail as possible.

- A copy of the Exhibit Book entry from the originating LAC
- A copy of the FSIMS job request
- If exhibits are to be returned by TNT Failsafe, a completed consignment note including the LAC's TNT account code.

11. ENQUIRIES

General enquiries about hair examination can be made by contacting the Criminalistics Chemist at Westmead Major Crime laboratory on [REDACTED] or by email ([REDACTED]).