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Results from the FBI Colloboration On the Detection of Fingerprints from Human Skin

Dr. Della Wilkinson

TECHNICAL REPORT
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Submitted by:
Dr. Della Wilkinson

NOTE: Further information about this report can be obtained by calling the CPRC information number (613) 998-6343

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EXECUTIVE SUMMARY

Research described in this report was conducted during a week long visit in December 1996 to the Office of the Chief Medical Examiner, Richmond, Virginia. This report describes the work completed for Part II and is divided under two subject headings; results from the collaboration with the FBI, and communicating the information arising from research.

The report addressing the results from Part I will be published at a later date.

RÉSUMÉ

Les travaux de recherche dont il est question dans le present rapport ont été menés en décembre 1996, à l'occasion d'une visite d'une semaine au bureau du médecin légiste en chef de Richmond, en Virginie. Le rapport, qui porte sur les travaux effectués dans le cadre de la partie II, aborde deux sujets : les résultats de la collaboration avec le FBI et la communication des données recueillies.

Le rapport sur les résultats de la partie I sera publié ultérieurement.

The research described in this report was conducted during a week long visit, in December 1996, to the Office of the Chief Medical Examiner, Richmond, Virginia under contract to the Canadian Police Research Centre (CPRC) and the Forensic Research and Review Section (FIRRS) of the Royal Canadian Mounted Police (RCMP). This report describes the work completed for Part II and is divided under two subject headings; Results from the FBI Collaboration of the Detection of Fingerprints on Human Skin; and, Communication of Information Arising from Research.

1) Results from the FBI Collaboration of the Detection of Fingerprints from Human Skin.

(i) Objective

The objective of this study was to observe the survival rate of fingerprints on warm, unwashed human skin and to compare two different techniques (cyanoacrylate fuming/ magna powder and iodine fuming/ α-naphthoflavone) for fingerprint recovery.

(ii) Experiments

During the course of the week seven cadavers were made available to us. One of the cadavers (experiment 02) had not undergone refrigeration and the skin temperature (26°C) was reasonably close to living skin temperature (32°C). Six out of the seven cadavers were anatomical and had been refrigerated to some extent, in addition, one anatomical cadaver (experiment 01) had been stored in a vat of phenol.

The results are summarised in the accompanying table (Table 1) which gives information on the temperature range of the skin's surface at the time of latent deposition, the method of latent recovery and the description of recovered identifiable fingerprints.

Results from experiment 01 should be ignored since the conditions of storage, in a phenol solution, would alter the chemical composition of the skin's surface film dramatically.

Neither technique proved successful for the recovery of fingerprints on the unrefrigerated cadaver (experiment 02) which most closely simulated a murder scenario. It is hoped that in future studies this type of cadaver will be more commonly available to us.

For the remaining anatomical cadavers, the skin ranged in temperature from 13 to 22°C which is significantly lower than living skin temperature. Under these conditions the CA/ magna powder procedure produced much better results than the iodine/ α-naphthoflavone, in terms of the number of latents identified as well as the quality of the ridge detail and contrast against the background skin.

The iodine/ α-naphthoflavone did not give strongly coloured fingerprints. I have observed very good contrasting iodine/ α-naphthoflavone developed latents on skin where the surface temperature ranged from 24 to 31°C during print deposition and 16°C for print recovery. Perhaps there may be a temperature effect which is inhibiting the absorption of iodine. In addition, I have previously observed iodine/ a-naphthoflavone to be much more

Table 1: Experimental Conditions

No.	Skin Temp/ °C	Method	Latent No.	Description of Identifiable Latents
01	12-15	CA/Fluor	1-2R	Heavy background, good ridses
01	12-15	Iodine/ α-Naph.	2-2L	Heavy background, good ridge detail which fades with time
02	19-26			No Identifiable latents
03	13-22	Iodine/ α-Naph.	l-lL,R;l-2R	Good ridge detail which fades
03	13-22	CA/magna	l-2L;l-3La, 3Ra	Good ridges
04	19-20	CA/magna	1-4R	Some background, good ridges
04	19-20	CA/Fluor	l-6Rb	Heavy background, excellent ridges
04	19-20	CA/magna	l-6L,6Ra	Excellent ridges
04	19-20	CA/magna	l-5L,Ra	Excellent ridses but faint
04	19-20	Iodine/ α-Naph.	1-1L,Rb;	Excellent ridge detail but fades with time
04	19-20	Iodine/ α-Naph. soln.	1-1L,Ra	Excellent ridge detail but faint
05	20	CA/magna	1-3Lb	Some background, excellent ridges
06	17-19	CA/magna	2-1Ra,1La	Excellent ridges
06	17-19	CA/magna	2-3L,3Ra	Some background, excellent ridges
06	17-19	CA/magna	2-2R	Heavy spotted background, excellent ridges
06	17-19	CA/magna	2-1Lb	Faint ridges
06	17-19	CA/magna	1-3L,R	Heavy spotted background, faint ridges
07	18-19	CA/magna	Most prints	Excellent ridges

effective than CA/ magna when the skin temperature was higher during print deposition (24-32°C compared to 17-22°C in the current study) which also indicates a temperature effect. The effect of substrate temperature on iodine absorption requires further investigation at the RCMP laboratories.

(iii) Current Recommended Procedure for Testing on Warm Skin

In conclusion of these preliminary experiments a suggested procedure was outlined, to enable willing latent fingerprint examiners from the Forensic Science Division of the Commonwealth of Virginia, to perform further tests on warmer cadavers. The procedure is as follows;

1) Whenever possible perform experiments on warm, unwashed skin if the cadaver is not a' homicide victim (this is very important to establish the survival of latents over the initial cooling period of the skin's surface).
2) Deposit latents onto the skin whilst the skin is warm, noting the surface temperature if possible.
3) Attempt recovery of latents when the skin's surface temperature has reached that of the ambient surroundings.
4) Fume the skin surface for 20 seconds using the old CBC model (25 seconds for the new model), wear an all-in-one face mask fitted with organic vapour cartridges to protect eyes and respiratory system.
5) Apply magna powder to skin's surface for Caucasian skin, and fluorescent magna powder for afro-american skin.

6) Photograph any visible latents.

7) Lift latents.

Hopefully, the members of the division of forensic science will be able to use this technique on murder victims, and if time allows, to have access to fresh anatomical cadavers whose skin is close to 32°C.

(iv) Future Experiments

The cyanoacrylate fuming process accompanied by magna powdering should be tested further by applying greasy latents on to the skin when the temperature is as close as possible to living skin temperatures (32°C). Recovery when the skin has reached that of the ambient surroundings will most closely simulate a murder scenario. It is important to observe the performance of this technique under these conditions.

Further testing of the iodine fuming/ α-naphthoflavone method depends on the results from current experiments into the temperature effects of iodine adsorption.

2) **Communication of Information Arising from Research to Police**

In May 1996, lectures were given for two Fluorescent Techniques Courses (intensive three day course) in Halifax. A morning seminar was also provided for the Canadian Police College to candidates on the senior forensic identification course, in June 1996.

An informal presentation entitled "One Step Fluorescent Detection Method for Lipid Fingerprints" was made to delegates at the International Fingerprint Meeting hosted by the British Home Office, in November 1996.

Several articles have been published in the media which has generated some excellent publicity for both the RCMP (Ottawa Citizen, August 1996) and the National Research Council (NRC) (Financial Post Magazine, March 1997) which provides laboratory space. In addition, the project on human skin was profiled in the RCMP publication, The Pony Express, as well as on the local CJOH news report in February.

Two videos were completed, one is for presentation to the Canadian Association of Chief's of Police (CACP) and explains the various projects that are ongoing in FIRRS, and, the other is a training video for an NRC student program that promotes science to school children.