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BUILDING A SAFE, JUST AND TOLERANT SOCIETY

Police Scientific Development Branch

Crime Investigation Sector

Fingerprint Development and Imaging Update

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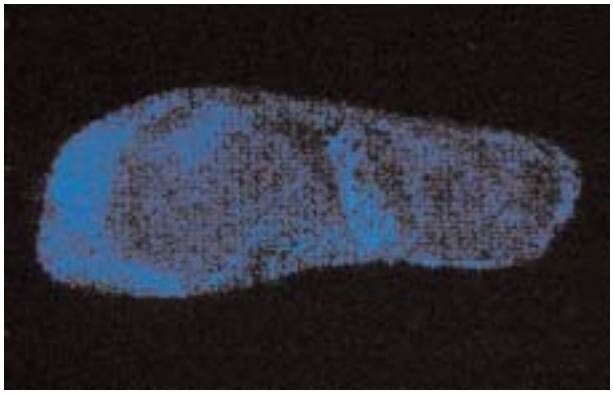


Luminol chemiluminescence

In our last update (April 2003), we expressed concerns over the use of luminol at crime scenes, on the basis of the advice available at the time. We have now received further advice from the Department of Health. They have access to unpublished research carried out by the National Toxicology Programme (NTP) in the USA. This included reports following studies of the possible mutagenicity, rate of skin absorption and metabolism of luminol.

NTP reported that their mutagenicity tests proved negative, except for one, which was only weakly positive and in a less significant test. In the light of this and with proven low rates of skin absorption, NTP concluded that the risk is low and their work complete.

The Department of Health considers that the NTP investigations were far more significant than the study upon which the recent PSDB advice was based, and that 'they indicate that there are no concerns regarding the mutagenicity profile of the chemical [luminol]'.

We accept this recent advice and would not want to deter the use of it in circumstances where it may provide additional evidence to SIOs.

A scene being sprayed with Luminol

Full risk assessment should be carried out, however, as with any chemical process and procedures agreed in advance for protection of staff and site clean-up. Some of the forensic service providers now offer a service to carry out the treatment, and to record and interpret any observed luminescence. Some care and practice in low light imaging is necessary to record the faint and transient luminol luminescence.

On absorbent, porous surfaces, such as dark carpets or walls, even those which have been washed 'clean', the use of luminol is very effective in locating traces of blood, where protein dyes prove less effective because of background staining. On hard, smooth surfaces however some protein dyes, Acid Black 1, Acid Violet 17 and Acid yellow 7 – see 'Blood Enhancement Reagents' below - appear to be at least as sensitive as luminol.

Most importantly, luminol solutions will cause diffusion of fingerprint detail and should not be used if there is any intention of processing the same areas for fingerprints.

If there is the likelihood of footwear evidence, the importance of preserving the evidence cannot be overstated and the use of stepping plates is advisable.

So, as long as the use of luminol does not jeopardise the integrity of other forensic evidence, notably fingerprints, it may prove invaluable for the detection of blood in situations where no other techniques can be of use.

Blood Enhancement Reagents

Our programme of work looking at the performance of blood enhancement reagents is complete. In the course of the investigation, we evaluated over 30 different dyes and reactive techniques, developing many thousands of fingerprints. Our development progress was hindered as two of the most promising fluorescent dyes being withdrawn by the manufacturer. There are however good alternatives and it should not be forgotten that Acid Black 1 (Amido Black) as currently used is extremely sensitive.

In 2004, we plan to publish an update to the Manual to include details of a new Acid Black 1 formulation and formulations for two new dyes, Acid Violet 17 and Acid Yellow 7. While these formulations are flammable, they have relatively high flash points and could be used at scenes if appropriate precautions are taken.

A knife handle treated with Acid Violet 17

The Manual update will also include advice on possible interference between fingerprint processes and DNA profiling, a new Chart 12 with accompanying notes and Appendix II, the list of suppliers.

What is the Oldest Fingerprint You Have Developed?

With recent reviews of a number of very old cases, we were embarrassed to have to say that we were not aware of any reliable data detailimg the performance of fingerprint reagents with fingerprints on paper which may be decades old. A small scale experiment was added to our programme to determine whether any identifiable prints could be developed on old documents.

Two sources of documents were used; cheques dating back to the mid 1980s and a bill spike containing bills and receipts, dating from 1946 to 1948, found discarded following a house clearance. The nature of the latter 'find' gave a strong indication that that the papers had remained untouched for a long time. After a decade of light-tight storage at PSDB twelve of the documents were selected for sequential treatment.

The recommended sequence of DFO, Ninhydrin and Physical Developer was followed.

The performance of DFO and Ninhydrin on the

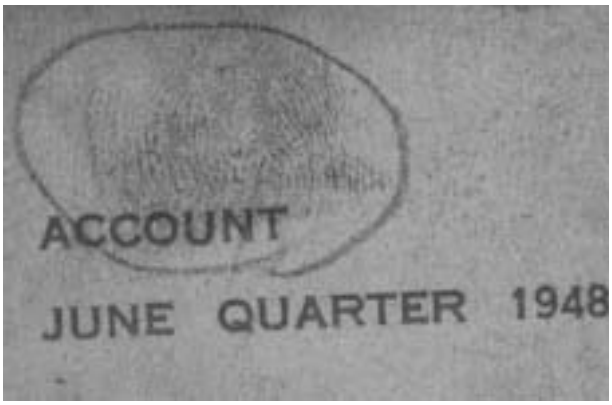
cheque collection is well documented because of our work using them to test the non-CFC formulations in the mid 90s.

Processing further batches recently produced very similar results indicating that amino acids are still present, and have neither deteriorated significantly nor diffused over a period of 17 years.

However, the situation with the documents over 50 years old was very different.

DFO was unsuccessful in developing any ridge detail. Ninhydrin was more successful, developing some faint ridges over a small area. This suggested that the documents had remained dry throughout but that some form of decomposition had occurred.

Physical Developer proved most successful and seven useable prints were developed. Of the documents treated, most ridge detail was found on an electricity bill dated 1948, on which ten separate areas were developed, three of which were potentially identifiable.



Physical Developer on an electricity bill

We should not necessarily draw firm conclusions about the lifetime of amino acids in fingermarks from such a small experiment. It does however indicate the remarkable persistence of whatever components of the latent print are being detected by physical developer. We would be interested to know whether you have successfully retrieved fingerprints from documents, maybe even older than these. If so please let Lesley Fitzgerald or Vaughn Sears have details.

Contrast Enhancement of Physical Developer

Faint fingerprints developed with Physical Developer can quite often be difficult to see and photograph. Soaking the Physical Developer treated paper in 3% sodium hypochlorite in water for approximately 3 minutes and then rinsing with copious amounts of water can improve the contrast. This converts the silver deposit (light grey) into silver oxide (dark grey) and may also lighten the background. The use of bleach is referred to in the Manual but apparently is rarely used.

Physical Developer before (left) and after (right) bleaching

Alternatively, Fotospeed Blue Toner (BT20), available from good photographic suppliers can be used according to the manufacturer's instructions to tone the fingerprints blue. Any silver deposited on the background will also be toned making over-developed papers difficult to treat, but generally there should be good contrast difference between the fingerprint and the background.

Physical Developer before (left) and after (right) blue toning

In both cases, fingerprints MUST be photographed prior to enhancement to avoid possible loss of valuable evidence.

Reducing the Chances for DNA Cross-Contamination

During the last two years PSDB has worked with the FSS on a programme of work to establish the effects of fingerprint development techniques on subsequent DNA recovery and profiling. Guidelines were given in the April 2003 PSDB Update for maximizing the chances of recovering both types of evidence.

Further analysis of the results has shown that in addition to wearing the appropriate level and type of protective equipment; laboratory coats, gloves, hair-covering, facemasks etc. good housekeeping techniques can also help to reduce the chances of DNA cross-contamination. Equipment such as superglue cabinets and dye tanks, should be cleaned on a regular basis and work-surfaces should be washed down with an anti-viral detergent at least every day.

Let There Be Light!

Recently, it has come to our notice that a number of Quasers in operational use have been working well below their optimum output, with some as low as 10% of maximum.

This reduction in performance, along, we suspect, with the number of fingerprints detected, might be expected to be noticeable by longer image capture exposure times than normal. Some users do not seem to have been aware of the much reduced output.

The two main reasons for the reduction in light output are that the light guide may have suffered kinks, bends or irregularly compressed areas or that the lamp may need to be replaced.

Regular replacement of lamps and damaged light guides, which will become gradually less efficient even with careful use, should be part of a regular programme of ensuring all equipment is working at optimum performance. Quaser 40 lamps should be replaced after about 100 hours service and may be done by a competent person in force. Professionally qualified personnel will need to replace Quaser 30, 100 and 2000 lamp after about 500 to 1000 hours.

Filters should be inspected regularly and replaced if found to be damaged.

Superglue on Wetted Surfaces

PSDB, in collaboration with a student at Lincoln University, has studied the effectiveness of the superglue process on articles that have been wetted. This study was triggered by claims that marks could be obtained on such surfaces. The work resulted in the following conclusions:

i) It is sometimes possible to develop fingerprints on articles that have been wetted, although the effectiveness of the process is vastly reduced and the developed prints are ususally of very poor quality.

ii) The effectiveness depends on the age of the fingerprint prior to exposure to water: the older the fingerprint prior to wetting, the greater the chance of developing ridge detail. If it is fresh when submerged the superglue process is unlikely to develop any fingerprints.

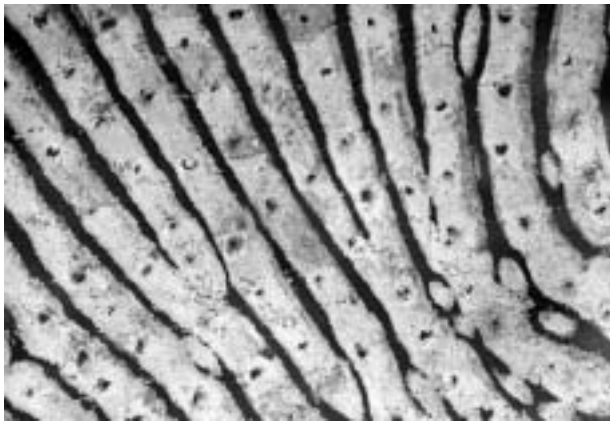
iii) Slightly more fingerprints were developed on surfaces exposed to salt water than fresh water.

iv) The length of time that articles were submerged in water had negligible effect on the development of fingerprints.

Superglue developed split fingerprint. Left half was open to the air, right half dipped briefly into water then left open to the air for a week

Third Level Detail

A collaborative project between PSDB, FSS and Warwick University to study the uniqueness of third level features (pores, ridge edges, scars etc) has started. The project seeks to develop a means of capturing these third level features from images, categorising them and exploring their evidential value through statistical analysis. The project will regularly report to the ACPO Third Level Detail Working Group.



A superglue developed fingerprint showing elements of 3rd level detail

Changes to Chemical Specification and Suppliers Information

Please note the following changes, all of which relate to recommended methods in the PSDB Manual of Fingerprint Development Techniques (MOFDT)

HFE supplier (DFO, Ninhydrin)

Samuel Banner a supplier of 3M HFE 7100 and HFE 71DE have moved. Their new address is – Samuel Banner & Co Ltd. Hampton Court, Tudor Road, Runcorn, Cheshire WA7 1TU. Tel 01928 597 000.

Lumichem Ltd

The code for Belfast changed in 1999 when the telecom industry decided to make more numbers available. The number for Lumichem Ltd is now 028 9068 2321.

Keystone Europe Ltd

There was a typographical error in the last update, the number for Keystone Europe Ltd, suppliers for Basic Yellow 40 (Keyazine Brilliant Yellow10GF) should read Tel 01484 341 466.

Sanyo Gallenkamp plc

Sanyo Gallenkamp plc, suppliers of the Fingerprint Development Chamber (FDC) for ninhydrin, have moved. Their new address is – Sanyo Gallenkamp plc. Monarch Way, Loughborough, Leicester, LE11 5XG. Tel 01509 265 265.

Gold Wire

The supplier number for 0.25mm diameter gold wire given in the Vacuum Metal Deposition section of the Manual is incorrect and should be 13. That is Johnson Matthey plc. Tel 01763 253 000

Magnets

The supplier for magnets given in the Vacuum Metal Deposition section of the Manual is incorrect. The correct supplier, not currently listed, is Magnet Applications Ltd. Northbridge Road, Berkhamsted, Herts, HP4 1EH. Tel 01442 875 081. Part number NB012BM.

IRIS – Update and Link to NAFIS

Operational experience in a number of forces has demonstrated the clear superiority of the IRIS technology in speeding up the process of recording virtually any type of developed fingerprint on exhibits in force fingerprint development laboratories.

Six IRIS systems are currently installed in forces and all are now handling all, or a substantial proportion of the recording of fingerprints developed in the force laboratories.

The last six months has seen substantial additional functionality being provided in the software which is supplied by PSDB. Helpful feedback from users has resulted in more versatile print functions and additional database search tools being added in addition to other planned improvements. The system can now be networked so that fingerprint images may be forwarded to a PC running IRIS software in the fingerprint bureau for vetting prior to forwarding to NAFIS.

One form of the long awaited link to NAFIS is currently being tested in Essex whilst a new generic interface should be available late this year. PSDB is committed to ensuring that once the links are established IRIS software will provide efficient, user friendly, ways of transferring images and case data. Further additional functionality including the capability

of handling images from a variety of installed camera options and importing images from cameras taken to scenes of crime will be released shortly free of charge.

Benchtop IRIS

A benchtop demonstrator system has been built and already loaned to one force. Do contact us if you would like to evaluate this technology.

International Relations

Announced in the April 2003 Update, the biennial meeting of the International Fingerprint Research Group was hosted at PSDB in May. It was an extremely successful conference with representatives attending from organisations involved in fingerprint research from around the world. This included the Australian Federal Police, the RCMP (Canada), the US Secret Service, the Gendarmerie Nationale (France), the Bundeskriminalamt (Germany), the National Forensic Laboratory (Netherlands), the Israel National Police, the Forensic Science Service (UK) and the Universities of Lausanne (Switzerland), Valencia (Spain), the Hebrew University of Jerusalem (Israel), University of Lincoln and King's College London.

A discussion session held in the laboratory

Presentations on current and recent research were given by all organisations. PSDB's involvement in this group ensures that UK forces will benefit from any new techniques and observations from operational and academic teams around the world.

Some of the more important areas discussed included:

i) Techniques for treating polymer-based bank notes such as the new Euro.

ii) New research into the chemical constituents of latent fingerprints and how they interact with substrates.

iii) Comparisons of different formulations of amino acid reagents such as Ninhydrin, DFO and Indandione in different climates.

iv) Techniques for separating and treating adhesive surfaces such as tapes and number plates.

v) Safer techniques for use at crime scenes.

vi) The interaction between fingerprint techniques and subsequent forensic analysis such as handwriting analysis and DNA, including cross-contamination issues.

vii) Forensic examination under adverse conditions such as recovering fingerprints and DNA from scenes exposed to chemical and biological weapons and their subsequent decontamination.

viii) Ways of improving the performance of many techniques including blood reagents, Vacuum Metal Deposition and improving the contrast of Physical Developer developed fingerprints, see Contrast Enhancement of Physical Developer above.

As One Door Closes...

Terry Kent, Head of Crime Investigation, retires in February 2004. He joined the Home Office Police Scientific Development Branch in March 1968. During his 36 years service he has shown unerring dedication to the improvement of crime investigation within the police service, in particular in fingerprint development, imaging and recording.

I suspect that as a student, Terry, with an interest in engineering and photography, did not realise that the foundations were already in place for his later passions. Introducing police forces around the country to the use of a wide range of fingerprint development technologies.

Terry, on the left, demonstrating his commitment to health and safety installing a prototype low light television camera at the site of an expected terrorist attack in 1971

Having started his PSDB career in surveillance and imaging, Terry has worked in the fingerprint team since 1973, taking the position of programme manager in 1979.

During his leadership of the Fingerprint Programme, he has remained faithful to his conscientious approach to the implementation of any new method recommended to the police. Whether it is a new formulation, procedure or piece of equipment, Terry has always encouraged an attention to detail across all aspects of the project. PSDB is committed to ensuring the health and safety of operational staff, and all new techniques and many already in use have been fully scrutinised by Terry and the team and all publications are accompanied by detailed H & S advice.

To ensure effective application in the field, operational casework has always been included in the programme of work at PSDB. While this occasionally proves difficult, it has proved its worth, enabling the smooth effective operational implementation of many new techniques.

Some of the more significant developments of the fingerprint team while he has been associated with it are:

1976 - Vacuum Metal Deposition process introduced into operational use.

1970s – Radioactive Sulphur Dioxide developed and continues to be used effectively against terrorism.

Late 1970s – Strong relationships developed with international fingerprint scientists and operational experts which continue today.

1982 - 1987 – The Quaser 30 and 100, the first high-intensity light-sources commercially available and fluorescence examination training courses given to forces. The Group continues to be involved in the CENTREX FERRT course at Durham.

1986 - The first edition of the Manual of Fingerprint Development techniques published. This exceptional publication immediately became a world-wide standard.

Development of the first superglue treatment system to control the humidity, and hence effectivenes of the process, the Sandridge Superglue Cabinet.

1989 – Development of a specialised humidity oven and introduction of optimized conditions for ninhydrin development.

1990 – Fingerprint Detection by Fluorescence Examination Guide published. This unique report continues to be popular around the globe and was recently reprinted for the third time.

1992 – An easy-to-use, effective DFO formulation and optimal post-treatment conditions introduced.

1998 – Manual of Fingerprint Development

Techniques (second edition) published. This included a non-ozone depleting formulation for ninhydrin as well as a more comprehensive Health and Safety section for each technique.

2000 – Quaser 2000 goes into production.

2001 – A non-ozone depleting formulation of DFO introduced.

2002 – First Integrated Rapid Imaging Systems for the digital capture of fingerprints in operational use in UK Police Forces.

Dr Valerie Bowman joined PSDB in September as Fingerprint Development and Imaging Programme Manager. Having graduated in Biochemistry, her post-graduate studies were funded by the Home Office and World Health Organisation. Her working career has been diverse, including further chemistry research and product development. Most recently, Valerie has been working for Jeyes Ltd, where she worked as Head of Project Management.

Valerie keen to take on the challenges of the fingerprint service

We all wish Terry a happy retirement and remain convinced that we have not seen the last of him!

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