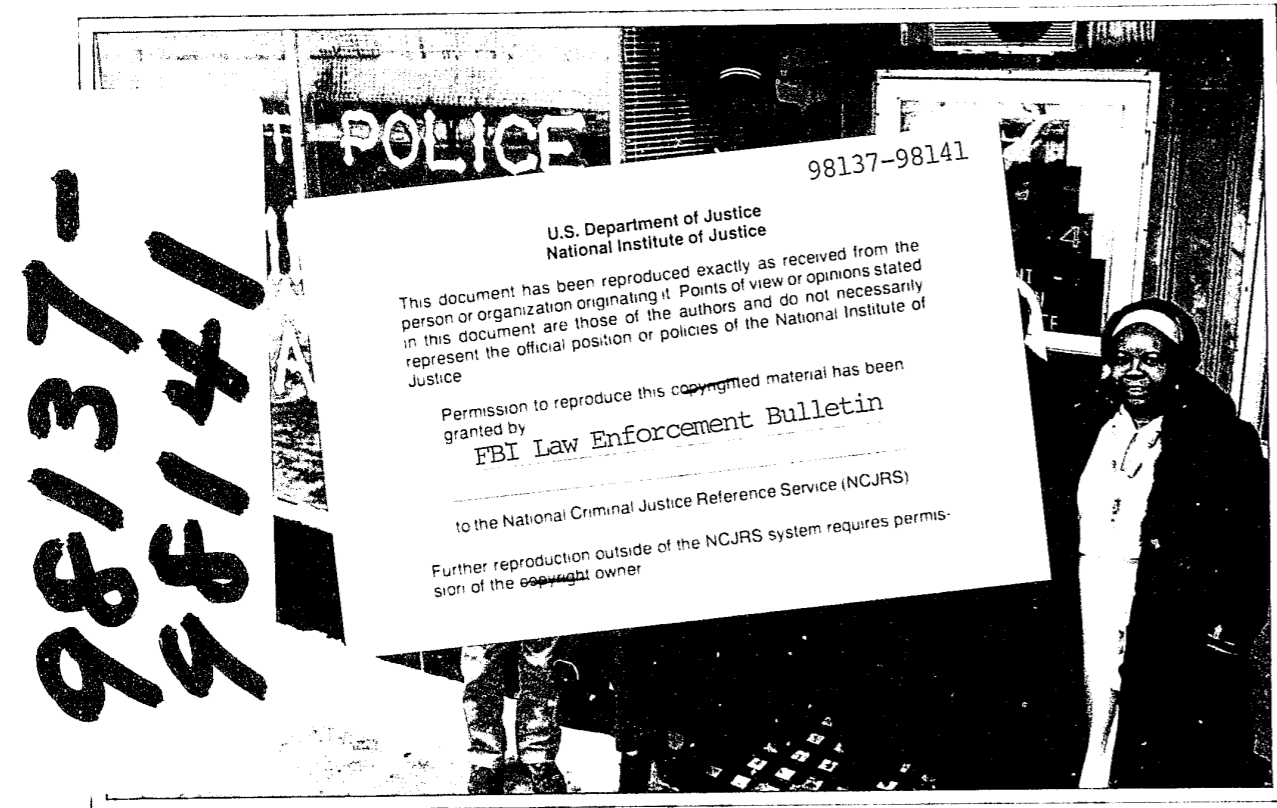


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Chemically Enhanced Bloody Fingerprints

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The Oklahoma City Police Department has been experimenting with different chemicals for enhancing and developing fingerprints which result from coming into contact with blood. Not only have procedures for the use of these chemicals been established, but more importantly, the hazards of using certain chemicals have been recognized.

The chemical *ortho*-toluidine, a possible blood enhancer, was first

used by this department in the investigation of a still unsolved homicide where the suspect left a partial palm print in blood on a plaster wall. After spraying *ortho*-toluidine on this partial print using a technique called layered spraying, the print was greatly enhanced.

The second opportunity to use this chemical occurred in the fall of 1982. An Indian female was found in a 10-foot x 10-foot cinderblock build-

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ing. She had been strangled, raped, and died as a result of her torture. Blood was present on the buttocks, as well as other parts of the body. On one area of the buttocks was a faint ridge detail.

After meeting with the medical examiner, permission was granted to apply *ortho*-toluidine to that area of the buttocks in the hope of enhancing the ridge detail. However, after spraying the area in question, no further ridge

detail appeared. All other bloody areas were also sprayed with the same results. In a gesture of frustration, an area on the small of the back which gave no visible signs of blood was sprayed. Almost instantly, a single latent fingerprint developed containing clear and distinctive points of identification.

The next step was to photograph this single latent print. Approximately 50 photographs were taken. However,

since the special equipment needed to properly complete this task had yet to be delivered, only 1 photograph could be used for comparison purposes. With the assistance of the department's most experienced fingerprint examiner, an identification was made, and the suspect was located, tried, and convicted.

While conducting their examination of the body for latents, the forensic technicians had spent more than 4

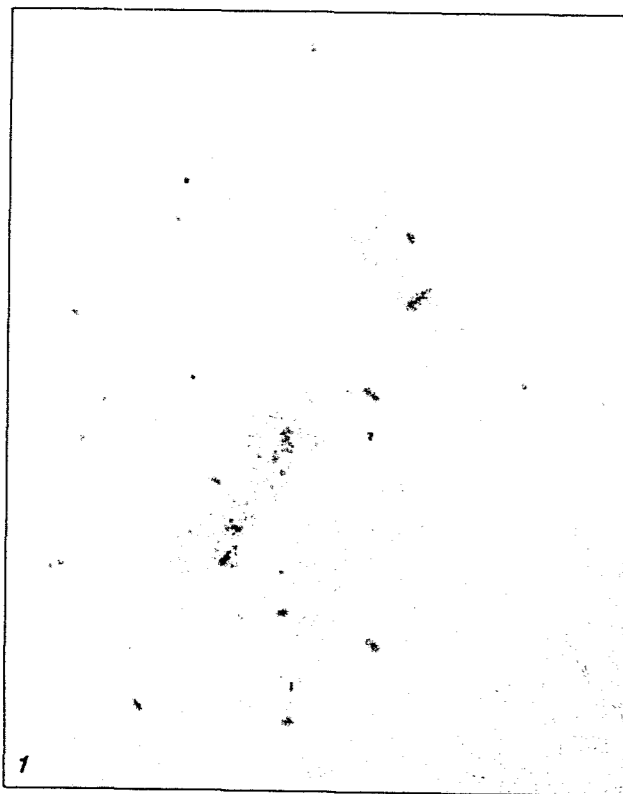
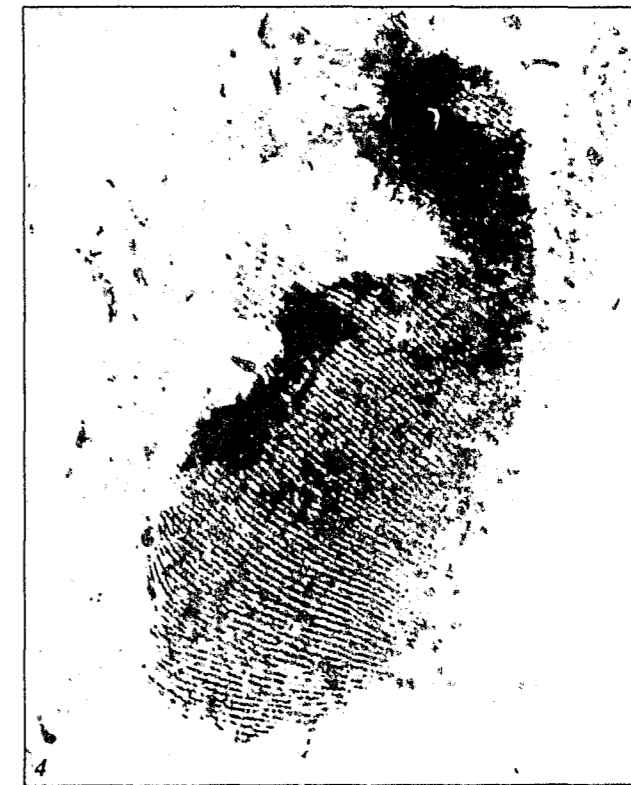


Photo number (1) is of an untreated bloody palm print left on a plaster wall.



Photos (2), (3), and (4) show layered spraying to acquire maximum detail for comparison.





Mr. Nutt



Lloyd Gramling
Chief of Police

hours in the small building. Neither had worn any type of protective clothing or breathing apparatus, nor had they taken any safety precautions while using *ortho*-toluidine, except for removing any possibility of sparks. No one considered the possible hazards this chemical could produce.

Shortly thereafter, both experienced dull headaches, and the portions of their bodies which came into contact with the chemical were burning. Within 1 hour, the headaches became severe and continued for several days.

Early reports listed *ortho*-toluidine as a carcinogenic, requiring the use of this chemical to be suspended until further experiments could be conducted. It was later confirmed that *ortho*-toluidine was a carcinogenic. Its use was allowed, but only when wearing protective clothing and other safety equipment.

As a safety precaution, this department decided to discontinue all use of *ortho*-toluidine. However, there still remained a need to have a chemical for enhancing bloody fingerprints and provide a margin of safety.

In 1983, while attending an advanced laser latent fingerprint and forensic research course at the FBI Academy, Dr. Henry Lee of the Forensic Science Laboratory of the Connecticut State Police proposed the use of tetramethylbenzidine as a replacement for *ortho*-toluidine. His demonstration proved the effectiveness of this chemical for enhancing and developing bloody fingerprints. Also, this chemical was not listed as a carcinogenic.

Tetramethylbenzidine (TMB) has proven to be very effective in blood print enhancement and development. However, extreme caution should be used with TMB or any other chemical, regardless of its safety report.

Formula and Technique

The completed combined solution for TMB consists of mixing 0.5 gm sodium perborate, 6 ml of the TMB solution, and 120 ml of the collodion solution. (See fig. 1.) All ingredients can be prepared individually and stored in an explosive-proof refrigerator for up to 6 months, although final mixing should be done just prior to use. TMB should be sprayed using an air canister and attached bottle.

Before attempting to enhance and develop partial or invisible latents as a result of blood or blood property transfer to a deceased body or object, several factors and rules need to be mentioned:

- 1) If any blood analysis is to be performed, it should be done *before* spraying TMB. TMB coats the blood or area sprayed with a plastic-like film. Attempts to absorb the blood by swabbing have been unsuccessful in some cases, although most serological determinations may still be done. It should be noted, however, that TMB does have a diminishing or retarding effect on the serological results, and good results depend on the concentration of the stain being analyzed. If it is a question of getting good prints for identification purposes or obtaining a bloodstain, I would suggest opting for the blood print and collect a bloodstain afterwards, bearing in mind that the serological results might be limited to analysis involving positive

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Figure 1

Formula presently used to prepare TMB:

TMB solution—Acetate buffer:
Combine 5 gm sodium acetate, 50 ml deionized H₂O, and 43 ml glacial acetic acid.
—Mix or stir 10 ml of acetate buffer with 0.2 gm of TMB (3,3', 5,5' tetramethylbenzidine) for 10 minutes. If any particles remain, filter.

Collodion solution —Combine 30 ml collodion, 15 ml ethanol, and 120 ml ethyl ether. Mix or stir for 10 minutes.

identification of blood, specie determination, and the ABO blood type.

2) Photograph all visible ridge characteristics before spraying. Use of yellow and orange filters in some cases involving deceased bodies aids in contrast.

3) Spray TMB in a well-ventilated area or use a vent hood. Not doing so could result in severe headaches, burning eyes, and difficult breathing.

4) Wear eye protectors, some type of breathing filter, gloves, and protective covering (lab smock).

5) Eliminate any flame or possibility of flame or spark. Ethyl ether is extremely flammable.

6) While spraying, keep observers at least 6 feet from the area. If a fan is used to direct fumes, keep observers from this area. The atomized droplets, as a result of spraying, have bounced off the skin of a deceased body and struck the eyes of an unprotected observer standing several feet away. Although no permanent damage was done, the observer was in pain for several minutes.

7) Until further research is conducted, avoid spraying live skin tissue.

When an area or object is to be sprayed and there are visible ridge characteristics, it is wise to remember that not only will the weaker area be enhanced but the darker area will also be enhanced. Overenhancing to the point of complete loss of ridge characteristics is possible. One way to prevent this is to cover the visible area, or darker area, and spray around the covered area to achieve a color likeness. Photograph each layered spraying until the desired contrast or maximum development is acquired. Spraying should be done by short bursts of the air canister while moving in a back and forth motion, holding the canister approximately 6 to 8 inches from the area.

Where blood is present or the suspicion of blood properties is possible, and the area in question does not reveal visible blood traces, spray the area anyway. TMB reacts to a property of the blood (Heme group) which is invisible, but is made visible by the chemical reaction as a result of the spraying.

Conclusion

No matter how safe a chemical may be at the present time, it may be found tomorrow on a list of hazardous chemicals. All chemicals should be considered dangerous. Before using any chemical, be sure to determine its safety to the extreme. Even if it presents itself as being safe, treat it otherwise for your safety and the safety of others.

FBI

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