

Recovering fingerprints

Few things define our identities as precisely as a fingerprint. But the power of fingerprints as evidence lies not just in their uniqueness, but in their simplicity and familiarity. Collecting and analyzing them at a crime scene does not require costly, complex technology, and juries understand and trust them without explanations from expert witnesses.

The swirling patterns on our fingertips are unique—even identical twins, with identical DNA, can be distinguished from one another by looking at the ridges on their fingers. It is these ridges, and the secretions from the sweat glands that line them, that leave telltale traces on everything we touch.

At a crime scene, finger marks on shiny surfaces may be obvious, but many more may be too indistinct to be seen with the naked eye.

Using a variety of treatments, such as powders, chemicals, and lighting techniques, these latent fingerprints can be revealed and enhanced. Although fingerprints are the most

common marks found at crime scenes, palm prints, bare footprints, and even ear prints can also be recovered using the same methods. However, these additional prints are of limited use, since police only have database records of fingerprints.

Prints on nonporous surfaces

The best-known technique—and still the most widely used—is dusting. Examiners use soft brushes to apply a powder, such as finely ground aluminum, to nonporous surfaces that a suspect might have touched. The powder sticks to the moist, greasy lines left by the sweaty skin ridges. Light, dark, and colored powders can be used to make the prints stand out on different colored backgrounds. Once powdered, the mark can be “lifted” from the surface using low-tack adhesive tape, and mounted on an acetate sheet to be preserved as evidence.



◀ VISIBLE PRINTS
If hands were dirty or bloodstained, or surfaces they touched were dusty, visible fingerprints may have been left at a crime scene. These prints are first photographed, and are then often enhanced to improve contrast and visibility.

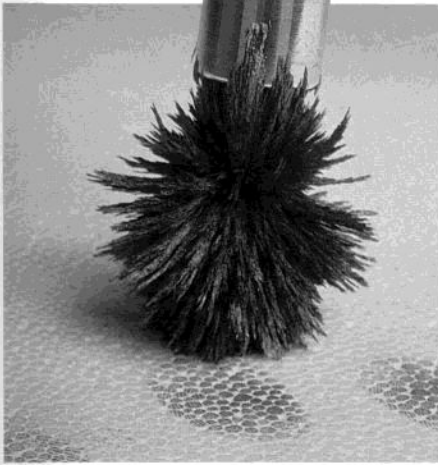
Porous surfaces

If marks are on porous surfaces, such as paper or cardboard, the sweat residue is absorbed by the material. Dusting with most powders does not work, though magnetic powders can achieve results. For most porous surfaces, examiners tend to use chemical reagents, such as ninhydrin and DFO (1,8-Diazafluoren-9-one), that react with the chemicals present in sweat. Porous objects are dipped in, or sprayed with, the solutions, then warmed in an oven. Ninhydrin-treated prints appear purple, and DFO makes fingerprints glow when they are lit by laser or blue-green light.

DUSTING FOR PRINTS

It is impractical to dust every surface at a crime scene, so examiners are guided by information from the victim or the investigating police officer. The examination is restricted to specific areas or objects that may have been touched, and particularly to entry and exit routes. If a window has been broken, investigators also search for and dust missing pieces





◀ MAGNETIC POWDERS

Magnetic "wands" can be used on certain porous surfaces to avoid the need for chemical treatment. They have no bristles, and apply a dust containing iron filings that adheres to the greasy sweat deposits.

semi-transparent mirror in front of the camera lens to reflect a shaft of light at the print, which appears as a dark pattern against a white background.

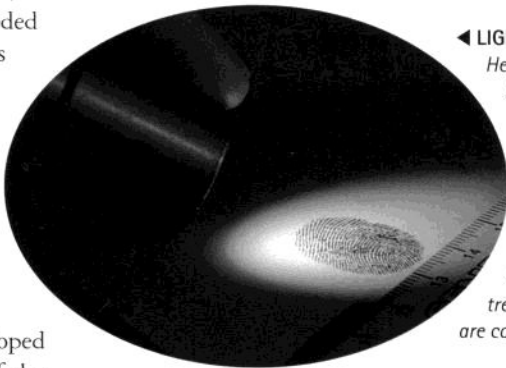
Most of the other photographic techniques for enhancing fingerprints use special illumination rather than white light. Shining brilliantly colored light at a print often makes it stand out, especially if it has been treated with ninhydrin or DFO. Ultraviolet radiation is used in combination with fluorescent dusting powders, and after superglue fuming (see right-hand box). Argon-ion (blue-green) laser light can exceptionally reveal fingerprints that do not respond to other treatments. The FBI used this technique in 1984 to reveal prints left on a postcard sent by war criminal Valerian Trifa to the head of the Nazi SS 42 years earlier.

There are several other widely used chemical treatments. Physical developer (PD), a solution of silver and iron compounds, can reveal prints on porous surfaces that have been soaked in water. Fuming with iodine vapor gives prints a brown color that fades rapidly, so prompt photography is needed to record the image. (Iodine fuming also enhances prints on nonporous surfaces.)

Some enhancement techniques are potentially destructive, and some will not work if preceded by another. Examiners at the crime scene and laboratory technicians use their knowledge and experience in deciding which methods to use. As a precaution, they photograph the developed marks at each stage of the process, before applying further treatments that could obliterate them.

Lighting and photography

Anyone who opens a window to clean it or turns a glass to catch the light will know that doing this can make formerly invisible fingerprints stand out clearly. This is the most basic lighting technique used by forensic photographers to record fingerprint evidence. They train a powerful white light on the mark, and then move the camera or the light until the print appears. Faint prints on very shiny surfaces sometimes stand out with coaxial illumination. This uses a diagonal



◀ LIGHTING TECHNIQUES

Here, monochromatic light is directed at a print using a fiber-optic light guide. Chemical treatments can make prints glow under certain light sources, and sometimes prints can fluoresce without treatment—if the fingers are contaminated with oils.

Elimination and matching

Examination of crime scenes does not just produce the perpetrator's marks. Prints of innocent people, such as the owners of a burgled home, are obviously far more numerous. To eliminate these people from the investigation, their fingerprints are recorded by inking and pressing on cards.

The process of matching prints with those of suspects, and of known criminals, is explained on pages 46–47.

LIFTING PRINTS ▶

Low-tack tape peels up easily but is sticky enough to make a permanent record of fingerprints. Lifting saves photographing the print at the crime scene.

SPECIAL TREATMENTS



In the laboratory, technicians can develop fingerprints with methods that are tricky to use at the crime scene, or that require toxic reagents. The most commonly used technique is superglue (cyanoacrylate) fuming. In moist conditions, the vapor from superglue bonds with the sweat residue of latent prints and makes them visible, even on difficult surfaces such as flexible plastics. Developed marks can then be dyed, and powders and special lighting can improve contrast.

Vacuum metal deposition (VMD) is the most sensitive of all lab techniques. Objects bearing latent prints are enclosed in a pressure vessel, the air is pumped out, and the chamber filled with metal vapor: first gold, then zinc. The metals condense on ridge patterns, making prints visible, though further treatment with superglue is sometimes necessary. VMD is time-consuming and expensive, but can reveal old prints and those exposed to water.

