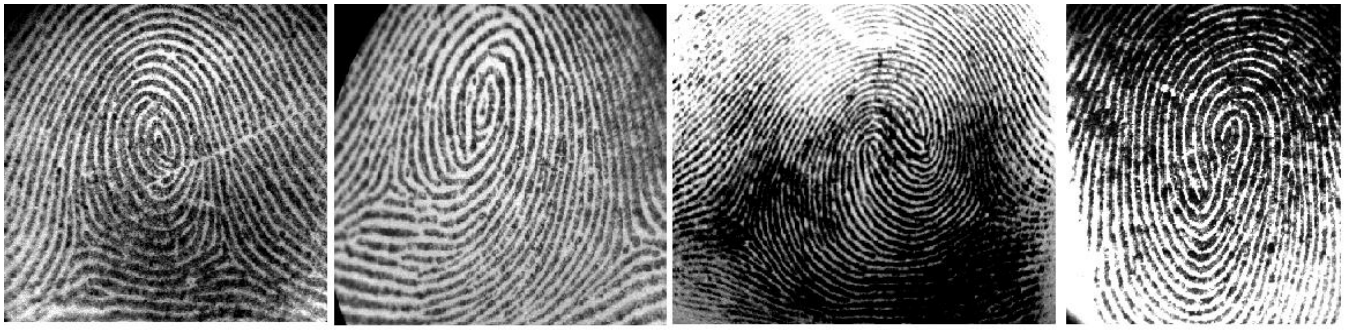
Whorls



Plain | Central Pocket Loop | Double Loop | Accidental

Whorls are divided into four distinct groups, shown above: plain whorl, central pocket loop, double loop, and accidental. All *whorls* contain one or more cores and a minimum of two deltas. A *plain whorl* and a *central pocket loop* have at least one ridge that makes a complete circuit. This ridge may be in the form of a spiral, oval, or any variant of a circle. If an imaginary line is drawn between the two deltas contained within these two patterns, and if the line touches any one of the spiral ridges, the pattern is a plain whorl. If no such ridge is touched, the pattern is considered a central pocket loop. A *double loop* is made up of two loops combined into one fingerprint. This results in a print with two deltas and two cores. Often this results in an "S" shape. Any print classified as an accidental either contains two or more patterns (not including the plain arch) or is a pattern that does not fit any of the normal descriptions. Hence, an accidental may consist of a combination loop and plain whorl or loop and tented arch.

Arches

Plain | Tented

Arches, the least common of fingerprint patterns, contain no deltas or cores. They are divided into two groups: plain arches and tented arches. A *plain arch* is the simplest of all fingerprint patterns; it is formed by ridges entering from one side of the print, rising slightly and exiting on the opposite side. A *tented arch* is similar to a plain arch except that instead of rising smoothly at the center, there is a sharp upward thrust or spike, causing the center of the print to look like a tent. By definition, the angle of the lines on a tented print meets at less than a 90-degree angle.

Automated Fingerprint Identification Systems (AFIS)

The heart of AFIS technology is the ability to scan and digitally encode fingerprints so they can be subject to high-speed computer processing. AFIS uses scanners to convert the image of a fingerprint into digital file. The file contains data showing ridges at their points of termination (ridge endings) and the branching of ridges into two ridges (bifurcations). Basically, the computer scans in a print and then checks every point of a print with numerous other prints at millions of times faster than a human can. Speed of comparison is not the only advantage to AFIS. With the development of high speed internet and large databases of fingerprints, an unknown print can be compared with prints all over the world in a matter of hours. At one time it was nearly impossible to identify an international criminal, but as technology advances these types of matches are becoming commonplace.

Crime-Scene Fingerprints

There are three kinds of crime-scene prints: visible, plastic, and latent. *Visible prints* are made by fingers touching a surface after they have been in contact with colored material such as blood, paint, grease, or ink. *Plastic prints* are ridge impressions left on a soft material such as putty, wax, soap, or dust. *Latent prints* (invisible prints) are impressions caused by the transfer of body perspiration or oils present on the finger to the surface of an object. Visible and plastic prints may simply be photographed and/or preserved with the object on which they are left. Latent prints, however, must be located and developed.

In the past, chemical treatment for fingerprint development was reserved for porous surfaces such as paper and cardboard. However, since 1982, a chemical technique known as "**Super Glue" fuming** has gained wide popularity for developing latent prints on nonporous surfaces like metal, electrical tape, leather, and plastic. "Super Glue" is approximately 98 to 99 percent cyanoacrylate ester, which is the chemical that interacts with a latent fingerprint. Fumes are created when cyanoacrylate ester is placed on absorbent cotton treated with sodium hydroxide. The fumes can also be created by heating the glue. The process is carried out by producing the fumes in an enclosed chamber with the object suspected of containing a fingerprint for up to six hours. The print becomes visible when fumes from the glue adhere to latent oils, usually producing a white-colored print. The fuming technique can be used before or after processing with fingerprint powders, and in fact, subsequent powdering of a fumed print may even further enhance the print's image.

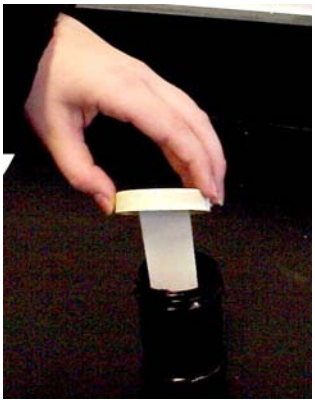
There are over a hundred different methods used to develop fingerprints, depending on the surface being examined. The following are some of the more common methods.

Developing Latent Prints

Dusting

Dusting is the most effective way to obtain a print from a rigid non-porous surface such as glass, plastic, or metal surfaces. Using a camel hair brush, black carbon or aluminum powder is placed over the location of a suspected print. The dust adheres to the sweat and oil left behind by the person who touched the surface. Next, wide transparent tape is smoothed over the dusted area. When the tape is then removed from the surface, the dust and the print will be attached. Finally, the tape is placed onto a white card for display and comparison. Below, the print on the left was developed by dusting with carbon powder; the print on the right, using aluminum powder.

Iodine Fuming



Iodine fuming is an excellent way to develop prints on porous and non-porous surfaces such as paper, index cards, magazines, and cardboard. To fume a suspected latent print, the surface must be placed into a container with solid iodine. The sublimation of iodine in a closed container will cause iodine vapors to concentrate, then be absorbed by the oil and sweat left behind by human skin. The temporarily-developed print will then be visible as an orange/brown outline. Upon development, the print should be photographed for documentation. The iodine will eventually sublime from the surface of the print, allowing the print to return to its latent state. The surface is then returned to its original appearance and can even be exposed to additional developing techniques. At right: a print developed using iodine fuming.