**FIGURE 14–11 Using a Reflected Ultraviolet Imaging System with the aid of a UV lamp to search for latent fingerprints.** *Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com*

fingerprint, the light is reflected back to the viewer, differentiating the print from its background surface. The transmitted UV light is then converted into visible light by an image intensifier. Once the print is located in this manner, the crime-scene investigator can develop it in the most appropriate fashion (see Figure 14–11).

## Developing Latent Prints

Several techniques are available to the criminalist to develop latent prints on a variety of surfaces. These range from chemical methods such as powders and iodine fuming to the use of laser light.

**Fingerprint Powders** Fingerprint powders are commercially available in a variety of compositions and colors. These powders, when applied lightly to a nonabsorbent surface with a camel's-hair or fiberglass brush, readily adhere to perspiration residues and/or deposits of body oils left on the surface (see Figure 14–12).

Experienced examiners find that gray and black powders are adequate for most latent-print work; the examiner selects the powder that affords the best color contrast with the surface being dusted. Hence, the gray powder, composed of an aluminum dust, is used on dark-colored surfaces. It is also applied to mirrors and metal surfaces that are polished to a mirrorlike finish, because these surfaces photograph as black. The black powder, composed basically of black carbon or charcoal, is applied to white or light-colored surfaces.

Other types of powders are available for developing latent prints. A magnetic-sensitive powder can be spread over a surface with a magnet in the form of a Magna Brush. A Magna Brush does not have any bristles to come in contact with the surface, so there is less chance that the print will be destroyed or damaged. The magnetic-sensitive powder comes in


**FIGURE 14–12 Developing a latent fingerprint on a surface by applying a fingerprint powder with a fiberglass brush.** *Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com*

black and gray and is especially useful on such items as finished leather and rough plastics, on which the minute texture of the surface tends to hold particles of ordinary powder. Fluorescent powders are also used to develop latent fingerprints. These powders fluoresce under ultraviolet light. By photographing the fluorescence pattern of the developing print under UV light, it is possible to avoid having the color of the surface obscure the print.

**Iodine Fuming** Of the several chemical methods used for visualizing latent prints, **iodine fuming** is the oldest. Iodine is a solid crystal that, when heated, is transformed into a vapor without passing through a liquid phase; such a transformation is called **sublimation**. Most often, the suspect material is placed in an enclosed cabinet along with iodine crystals (see Figure 14–13). As the crystals are heated, the resultant vapors fill the chamber and combine with constituents of the latent print to make it visible.

Unfortunately, iodine prints are not permanent and begin to fade once the fuming process is stopped. Therefore, the examiner must photograph the prints immediately on development in order to retain a permanent record. Also, iodine-developed prints can be fixed with a 1 percent solution of starch in water, applied by spraying. The print turns blue and lasts for several weeks to several months.

The reasons why latent prints are visualized by iodine vapors are not yet fully understood. Many believe that the iodine fumes combine with fatty oils; however, there is also convincing evidence that the iodine may actually interact with residual water left on a print from perspiration.[2]

**iodine fuming**
A technique for visualizing latent fingerprints by exposing them to iodine vapors.

**sublimation**
A physical change from the solid directly into the gaseous state.

**Ninhydrin** Another chemical used for visualizing latent prints is **ninhydrin.** The development of latent prints with ninhydrin depends on its chemical reaction to form a purple-blue color with amino acids present in trace amounts in perspiration. Ninhydrin (triketohydrindene hydrate) is commonly sprayed onto the porous surface from an aerosol can. A solution is prepared by mixing the ninhydrin powder with a suitable solvent, such as acetone or ethyl alcohol; a 0.6 percent solution appears to be effective for most applications.

**ninhydrin**
A chemical reagent used to develop latent fingerprints on porous materials by reacting with amino acids in perspiration.


**FIGURE 14–13 A heated fuming cabinet.** *Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com*

Generally, prints begin to appear within an hour or two after ninhydrin application; however, weaker prints may be visualized after twenty-four to forty-eight hours. The development can be hastened if the treated specimen is heated in an oven or on a hot plate at a temperature of 80–100°C. The ninhydrin method has developed latent prints on paper as old as fifteen years.

**Physical Developer**
A silver nitrate–based reagent formulated to develop latent fingerprints on porous surfaces.

**Physical Developer** Physical Developer is a third chemical mixture used for visualizing latent prints. Physical Developer is a silver nitrate–based liquid reagent. This method has gained wide acceptance by fingerprint examiners, who have found it effective for visualizing latent prints that remain undetected by the previously described methods. Also, this technique is very effective for developing latent fingerprints on porous articles that may have been wet at one time.

For most fingerprint examiners, the chemical method of choice is ninhydrin. Its extreme sensitivity and ease of application have all but eliminated the use of iodine for latent-print visualization. However, when ninhydrin fails, development with Physical Developer may provide identifiable results. Application of Physical Developer washes away any traces of proteins from an object's surface; hence, if one wishes to use all of the previously mentioned chemical development methods on the same surface, it is necessary to first fume with iodine, follow this treatment with ninhydrin, and then apply Physical Developer to the object.

**Super Glue fuming**
A technique for visualizing latent fingerprints on nonporous surfaces by exposing them to cyanoacrylate vapors; named for the commercial product Super Glue.

**Super Glue Fuming** 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


**FIGURE 14–14 Super Glue fuming a nonporous metallic surface in the search for latent fingerprints.**
*Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com*

gained wide popularity for developing latent prints on nonporous surfaces such as metals, electrical tape, leather, and plastic bags.[3] See Figure 14–14.

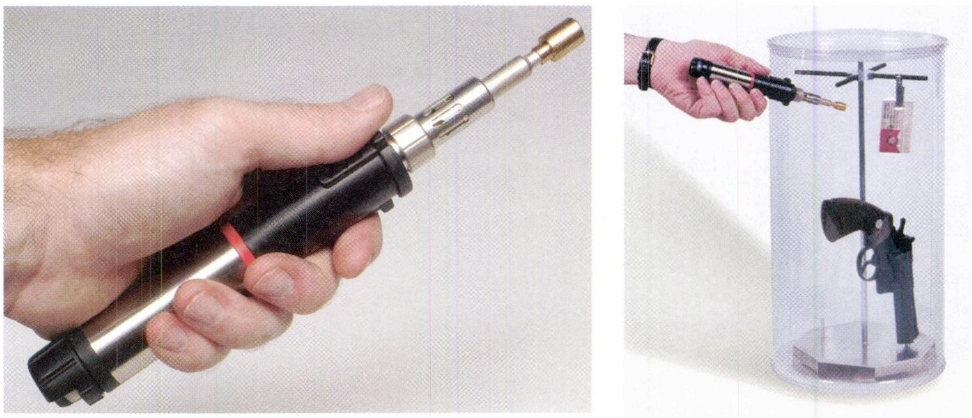
Super Glue is approximately 98–99 percent cyanoacrylate ester, a chemical that interacts with and visualizes a latent fingerprint. Cyanoacrylate ester fumes can be created when Super Glue is placed on absorbent cotton treated with sodium hydroxide. The fumes can also be created by heating the glue. The fumes and the evidential object are contained within an enclosed chamber for up to six hours. Development occurs when fumes from the glue adhere to the latent print, usually producing a white-appearing latent print. Interestingly, small enclosed areas, such as the interior of an automobile, have been successfully processed for latent prints with fumes from Super Glue.

Through the use of a small handheld wand, cyanoacrylate fuming is now easily done at a crime scene or in a laboratory setting. The wand heats a small cartridge containing cyanoacrylate. Once heated, the cyanoacrylate vaporizes, allowing the operator to direct the fumes onto the suspect area (see Figure 14–15).

**Other Techniques for Visualization** In recent years, researchers have explored a variety of new processes applicable to the visualization of latent fingerprints. However, for many years progress in this field was minimal. Fingerprint specialists traditionally relied on three chemical techniques—iodine, ninhydrin, and silver nitrate—to reveal a hidden fingerprint. Then, Super Glue fuming extended chemical development to prints deposited on nonporous surfaces.

Another hint of things to come emerged with the discovery that latent fingerprints could be visualized by exposure to laser light. This laser method took advantage of the fact that perspiration contains a variety of components that fluoresce when illuminated by laser light.

**fluoresce**
To emit visible light when exposed to light of a shorter wavelength.



(a) (b)

**FIGURE 14–15 (a) A handheld fuming wand uses disposable cartridges containing cyanoacrylate. The wand is used to develop prints at the crime scene and (b) in the laboratory.** *Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com*

The next advancement in latent-fingerprint development occurred with the discovery that fingerprints could be treated with chemicals that would induce fluorescence when exposed to laser illumination. For example, application of zinc chloride after ninhydrin treatment or application of the dye rhodamine 6G after Super Glue fuming caused fluorescence and increased the sensitivity of detection on exposure to laser illumination. The discovery of numerous chemical developers for visualizing fingerprints through fluorescence quickly followed. This knowledge set the stage for the next advance in latent-fingerprint development—the *alternate light source*.

With the advent of chemically induced fluorescence, lasers were no longer needed to induce fingerprints to fluoresce through perspiration residues. High-intensity light sources or alternate light sources have proliferated and all but replaced laser lights (see Figure 14–16). High-intensity quartz halogen or xenon-arc light sources can be focused on a suspect area through a fiber-optic cable. This light can be passed through several filters, giving the user more flexibility in selecting the wavelength of light to be aimed at the latent print. Alternatively, lightweight, portable alternate light sources that use light-emitting diodes (LEDs) are also commercially available (see Figure 14–17).

In most cases, these light sources have proven to be as effective as laser light in developing latent prints, and they are commercially available at costs significantly below those of laser illuminators. Furthermore, these light sources are portable and can be readily taken to any crime scene.

Many chemical treatment processes are available to the fingerprint examiner (see Figure 14–18), and the field is in a constant state of flux. Selection of an appropriate procedure is best left to technicians who have developed their skills through casework experience. Newer chemical processes include a substitute for ninhydrin called DFO (1,8-diazafluoren-9-one). This chemical visualizes latent prints on porous materials when exposed to an alternate light source. DFO has been shown to develop 2.5 times more latent prints on paper than ninhydrin.


**FIGURE 14–16 An alternate light source system incorporating a high-intensity light source.** *Courtesy Foster & Freeman Limited, Worcestershire, U.K., www.fosterfreeman.co.uk*


**FIGURE 14–17 Lightweight handheld alternate light source that uses an LED light source.** *Courtesy Foster & Freeman Limited, Worcestershire, U.K., www.fosterfreeman.co.uk*

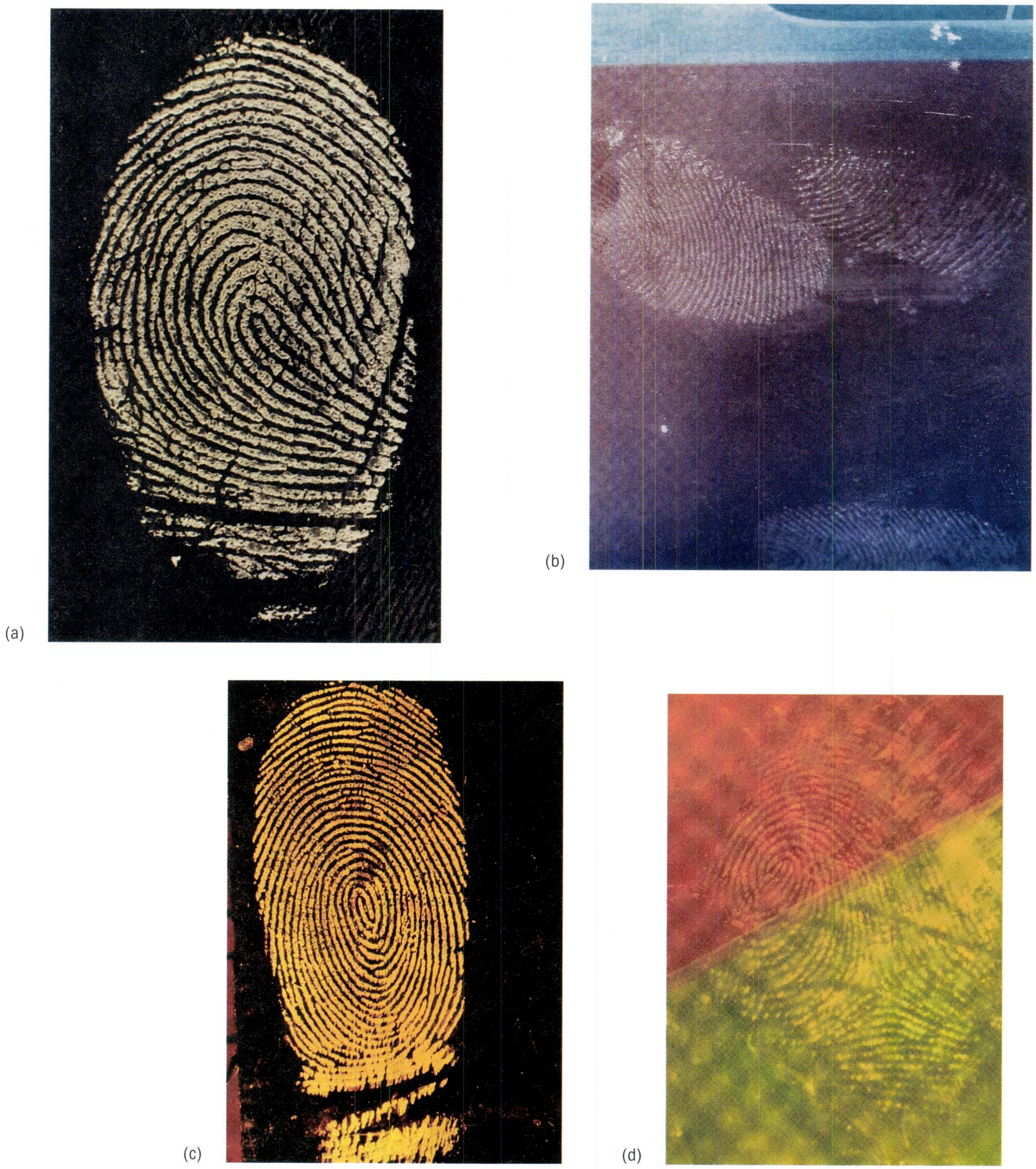
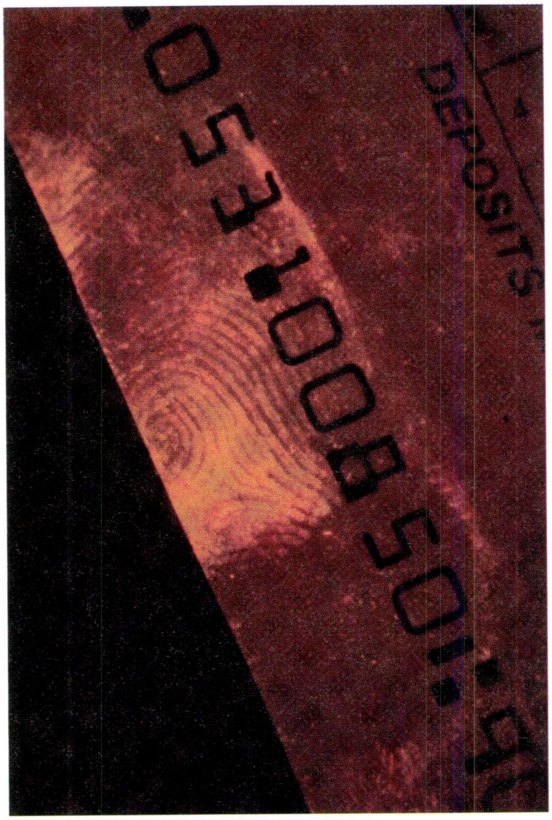
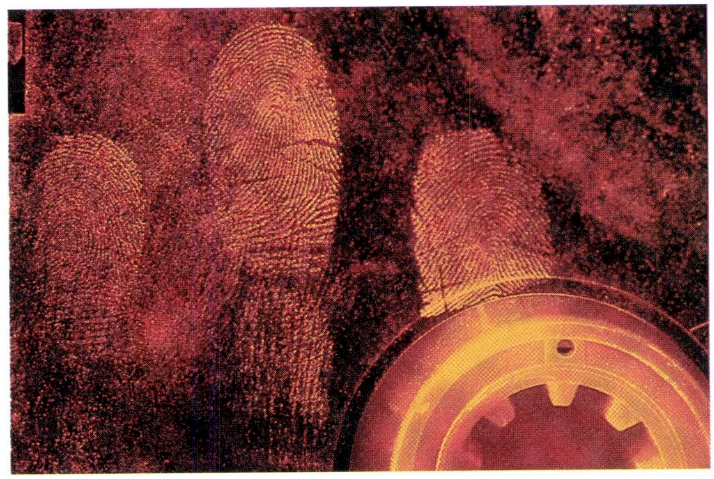


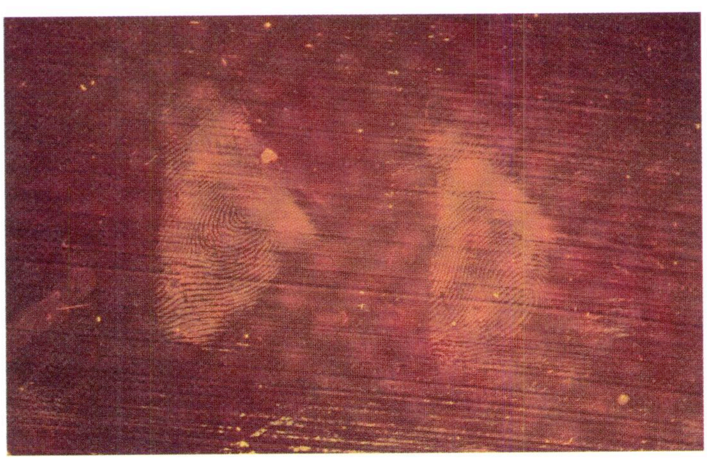

**FIGURE 14–18 (a) Latent fingerprint visualized by cyanoacrylate fuming. (b) Fingerprint treated with cyanoacrylate and a blue/green fluorescent dye. (c) Fingerprint treated with cyanoacrylate and rhodamine 6G fluorescent dye. (d) Fingerprint treated with cyanoacrylate and the fluorescent dye combination RAM. (e) Fingerprint visualized by the fluorescent chemical DFO. (f) Fingerprint visualized by Redwop fluorescent fingerprint powder. (g) A bloody fingerprint detected by laser light without any chemical treatment. (h) A bloody fingerprint detected by laser light after spraying with merbromin and hydrogen peroxide.** *(a) Courtesy North Carolina State Bureau of Investigation, Raleigh, N.C. (b) Courtesy 3M Corp., Austin, Texas (f) Courtesy Melles Griot Inc., Carlsbad, Calif.*



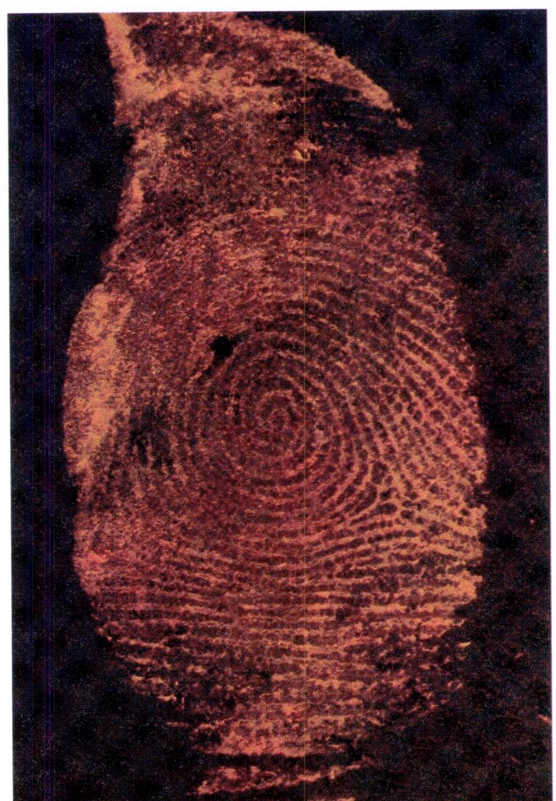

(e)



(f)



(g)



(h)

**FIGURE 14.18** *(continued)*

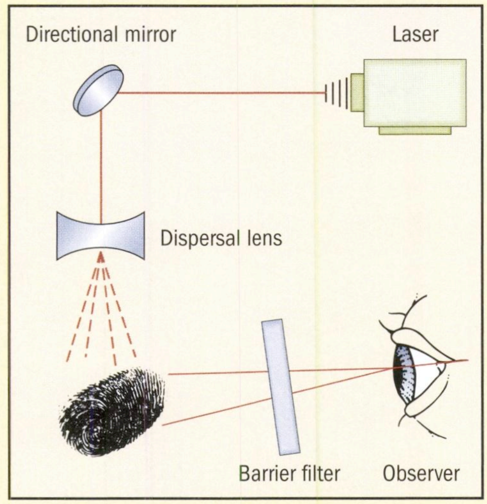
# Closer Analysis

## Fluorescence

Fluorescence occurs when a substance absorbs light and reemits the light in wavelengths longer than that of the illuminating source. Importantly, substances that emit light or fluoresce are more readily seen either with the naked eye or through photography than are non-light-emitting materials. The high sensitivity of fluorescence serves as the underlying principle of many of the new chemical techniques used to visualize latent fingerprints.

The earliest use of fluorescence to visualize fingerprints came with the direct illumination of a fingerprint with argon–ion lasers. This laser type was chosen because its blue-green light output induced some of the perspiration components of a fingerprint to fluoresce (see figure). The major drawback of this approach is that the perspiration components of a fingerprint are often present in quantities too minute to observe even with the aid of fluorescence.

The fingerprint examiner, wearing safety goggles containing optical filters, visually examines the specimen being exposed to the laser light. The filters absorb the laser light and permit the wavelengths at which latent-print residues fluoresce to pass through to the eyes of the wearer. The filter also protects the operator against eye damage from scattered or reflected laser light. Likewise, latent-print residue producing sufficient fluorescence can be photographed by placing this same filter across the lens of the camera. Examination of specimens and photography of the fluorescing latent prints are carried out in a darkened room.




**Schematic depicting latent-print detection with the aid of a laser. A fingerprint examiner, wearing safety goggles containing optical filters, examines the specimen being exposed to the laser light. The filter absorbs the laser light and permits the wavelengths at which latent-print residues fluoresce to pass through to the eyes of the wearer.** *Courtesy Federal Bureau of Investigation, Washington, D.C.*

Studies have demonstrated that common fingerprint-developing agents do not interfere with DNA-testing methods used for characterizing bloodstains.[4] Nonetheless, in cases involving items with material adhering to their surfaces and/or items that will require further laboratory examinations, fingerprint processing should not be performed at the crime scene. Rather, the items should be submitted to the laboratory, where they can be processed for fingerprints in conjunction with other necessary examinations.

### Key Points

- Visible prints are made when fingers touch a surface after the ridges have been in contact with a 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 deposited on hard and nonabsorbent surfaces (such as glass, mirror, tile, and painted wood) are usually developed by the application of a powder, whereas prints on porous surfaces (such as papers and cardboard) generally require treatment with a chemical.
- Examiners use various chemical methods to visualize latent prints, such as iodine fuming, ninhydrin, and Physical Developer.
- Super Glue fuming develops latent prints on nonporous surfaces.
- Latent fingerprints can also be treated with chemicals that induce fluorescence when exposed to a high-intensity light or an alternate light source.

# Preservation of Developed Prints

Once the latent print has been visualized, it must be permanently preserved for future comparison and possible use in court as evidence. A photograph must be taken before any further attempts at preservation. Any camera equipped with a close-up lens will do; however, many investigators prefer to use a camera specially designed for fingerprint photography. Such a camera comes equipped with a fixed focus to take photographs on a 1:1 scale when the camera's open eye is held exactly flush against the print's surface (see Figure 14–19). In addition, photographs must be taken to provide an overall view of the print's location with respect to other evidential items at the crime scene.

Once photographs have been secured, one of two procedures is to be followed. If the object is small enough to be transported without destroying the print, it should be preserved in its entirety. The print should be covered with cellophane so it will be protected from damage. On the other hand, prints on large immovable objects that have been developed with a powder can best be preserved by "lifting." The most popular type of lifter is a broad adhesive tape similar to Scotch tape. Fingerprint powder is applied to the print, and the surface containing the print is covered with the adhesive side of the tape. When the tape is pulled up, the powder is transferred to the tape. Then the tape is placed on a properly labeled card that provides a good background contrast with the powder.

A variation of this procedure is the use of an adhesive-backed clear plastic sheet attached to a colored cardboard backing. Before it is applied to the print, a celluloid separator is peeled from the plastic sheet to expose the adhesive lifting surface. The tape is then pressed evenly and firmly over the powdered print and pulled up (see Figure 14–20). The sheet containing the adhering powder is now pressed against the cardboard backing to provide a permanent record of the fingerprint.

**FIGURE 14–19** **Camera fitted with an adapter designed to give an approximate 1:1 photograph of a fingerprint.** *Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com*

**FIGURE 14–20** **"Lifting" a fingerprint.** *Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com*

# Digital Imaging for Fingerprint Enhancement

When fingerprints are lifted from a crime scene, they are not usually in perfect condition, making the analysis that much more difficult. Computers have advanced technology in most fields, and fingerprint identification has not been left behind. With the help of digital imaging software, fingerprints can now be enhanced for the most accurate and comprehensive analysis.

Digital imaging is the process by which a picture is converted into a digital file. The image produced from this digital file is composed of numerous square electronic dots called pixels. Images composed of only black and white elements are referred to as *grayscale images*. Each pixel is assigned a number according to its intensity. The grayscale image is made from the set of numbers to which a pixel may be assigned, ranging from 0 (black) to 255 (white). Once an image is digitally stored, it is manipulated by computer software that changes the numerical value of each pixel, thus altering the image as directed by the user. Resolution reveals the degree of detail that can be seen in an image. It is defined in terms of dimensions, such as 800 × 600 pixels. The larger the numbers, the more closely the digital image resembles the real-world image.

**digital imaging**
A process through which a picture is converted into a series of square electronic dots known as pixels.

**pixel**
A square electronic dot that is used to compose a digital image.

The input of pictures into a digital imaging system is usually done through the use of scanners, digital cameras, and video cameras. After the picture is changed to its digital image, several methods can be employed to enhance the image. The overall brightness of an image, as well as the contrast between the image and the background, can be adjusted through contrast-enhancement methods.

Color interferences can pose a problem when analyzing an image. For example, a latent fingerprint found on paper currency or a check may be difficult to analyze because of the distracting colored background. With the imaging software, the colored background can simply be removed to make the image stand out (see Figure 14–21). If the image itself is a particular color, such as a ninhydrin-developed print, the color can be isolated and enhanced to distinguish it from the background.

Digital imaging software also provides functions in which portions of the image can be examined individually. With a scaling and resizing tool,

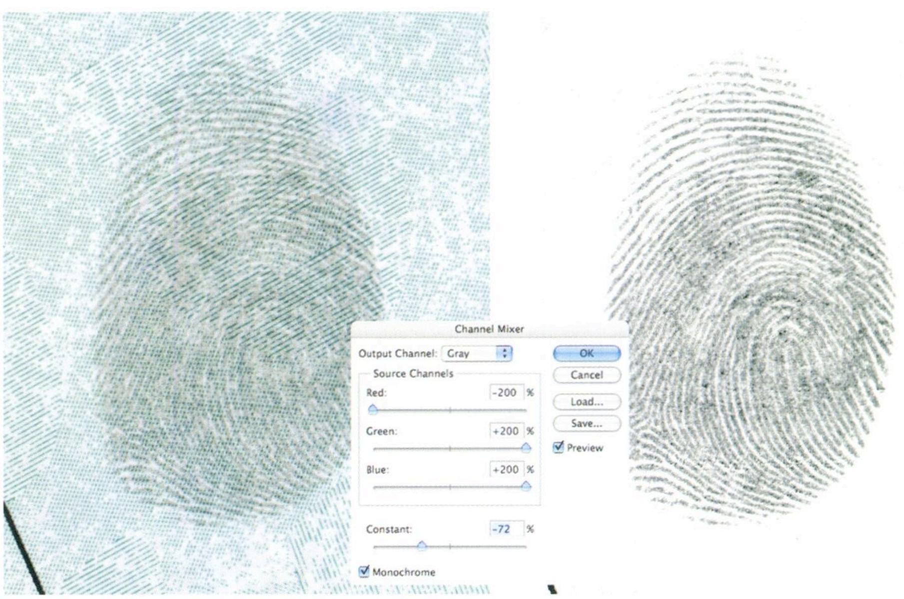



**FIGURE 14–21 A fingerprint being enhanced in Adobe Photoshop. In this example, on the left is the original scan of an inked fingerprint on a check. On the right is the same image after using Adobe Photoshop's Channel Mixer to eliminate the green security background.**
*Courtesy Imaging Forensics, Fountain Valley, Calif., www.imagingforensics.com*

the user can select a part of an image and resize it for a closer look. This function operates much like a magnifying glass, helping the examiner view fine details of an image.

An important and useful tool, especially for fingerprint identification, is the compare function. This specialized feature places two images side by side and allows the examiner to chart the common features on both images simultaneously (see Figure 14–22). The zoom function is used in conjunction with the compare tool. As the examiner zooms into a portion of one image, the software automatically zooms into the second image for comparison.

Although digital imaging is undoubtedly an effective tool for enhancing and analyzing images, it is only as useful as the images it has to work with. If the details do not exist on the original images, the enhancement procedures are not going to work. The benefits of digital enhancement methods are apparent when weak images are made more distinguishable.

## Key Points

- Once a latent print has been visualized, it must be permanently preserved for future comparison and for possible use as court evidence. A photograph must be taken before any further attempts at preservation are made.

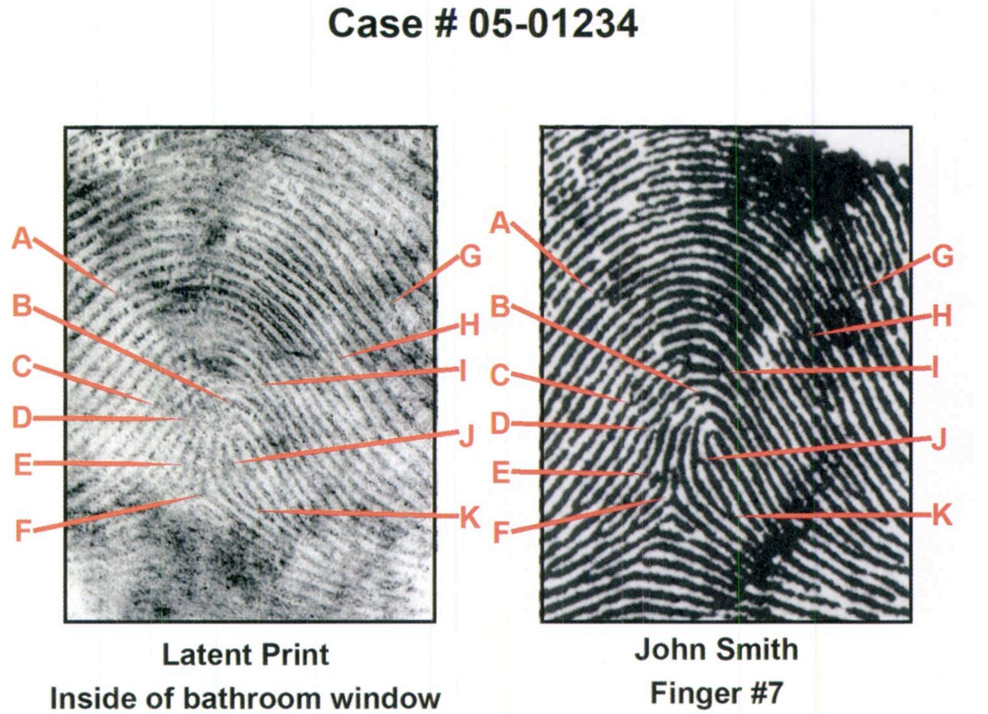



**FIGURE 14–22 Current imaging software allows fingerprint analysts to prepare a fingerprint comparison chart. The fingerprint examiner can compare prints side by side and display important features that are consistent between the fingerprints. The time needed to create a display of this sort digitally is about thirty to sixty minutes.** *Courtesy Imaging Forensics, Fountain Valley, Calif., www.imagingforensics.com*

- A common method for preserving prints developed with a powder is lifting the print with an adhesive tape.
- Digital imaging is a process through which a picture is converted into a series of square electronic dots known as pixels. By using digital imaging, fingerprints can be enhanced.

## Chapter Summary

Fingerprints are a reproduction of friction skin ridges found on the palm side of the fingers and thumbs. The basic principles underlying the use of fingerprints in criminal investigations are that (1) a fingerprint is an individual characteristic because no two fingers have yet been found to possess identical ridge characteristics; (2) a fingerprint remains unchanged during an individual's lifetime; and (3) fingerprints have general ridge patterns that permit them to be systematically classified.

All fingerprints are divided into three classes on the basis of their general pattern: loops, whorls, and arches. Fingerprint classification systems are based on knowledge of fingerprint pattern classes. The individuality of a fingerprint is not determined by its general shape or pattern, but by a careful study of its ridge characteristics. The expert must demonstrate a point-by-point comparison in order to prove the identity of an individual. AFIS aids this process by converting the image of a fingerprint into digital minutiae that contain data showing ridges at their points of termination (ridge endings) and their branching into two ridges (bifurcations). A single fingerprint can be searched against the FBI AFIS digital database of 50 million fingerprint records in a matter of minutes.

Once the finger touches a surface, perspiration, along with oils that may have been picked up by touching the hairy portions of the body, is transferred onto that surface, thereby leaving an impression of the finger's ridge pattern (a fingerprint). Prints deposited in this manner are invisible to the eye and are commonly referred to as latent or invisible fingerprints.

Visible prints are made when fingers touch a surface after the ridges have been in contact with a 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 deposited on hard and nonabsorbent surfaces (such as glass, mirror, tile, and painted wood) are preferably developed by application of a powder; prints on porous surfaces (such as paper and cardboard) generally require treatment with a chemical. Examiners use various chemical methods to visualize latent prints, such as iodine fuming, ninhydrin, and Physical Developer. Super Glue fuming develops latent prints on nonporous surfaces, such as metals, electrical tape, leather, and plastic bags. Development occurs when fumes from the glue adhere to the print, usually producing a white latent print.

The high sensitivity of fluorescence serves as the underlying principle of many of the new chemical techniques used to visualize latent fingerprints. Fingerprints are treated with chemicals that induce fluorescence when exposed to a high-intensity light or an alternate light source.

Once the latent print has been visualized, it must be permanently preserved for future comparison and for possible use as court evidence. A photograph must be taken before any further attempts at preservation are made. If the object is small enough to be transported without destroying the print, it should be preserved in its entirety. Prints on large immovable objects that have been developed with a powder are best preserved by "lifting" with a broad adhesive tape.

# Review Questions

## Facts and Concepts

1. What are fingerprints?
2. What is the first fundamental principle of fingerprints?
3. What imparts individuality to a fingerprint?
4. What are ridge characteristics? What is another name for ridge characteristics?
5. What is the second fundamental principle of fingerprints?
6. What are dermal papillae and how are they related to fingerprints?
7. What is a latent fingerprint? Briefly describe how a latent fingerprint is formed.
8. Why is it pointless to try to obscure or obliterate one's fingerprints by scarring or otherwise damaging the skin?
9. What is the third fundamental principle of fingerprints?
10. What are the three types of fingerprint patterns? Which is most common?
11. Which class of fingerprints includes ridge patterns that are generally rounded or circular and have two deltas?
12. Which type of fingerprint pattern must have at least one delta?
13. Which is the simplest of all fingerprint patterns, formed by ridges entering from one side of the print and exiting on the opposite side?
14. What is the primary classification? What is the basis for this classification?
15. What is an AFIS? What is the heart of AFIS technology?
16. When using AFIS, who makes the final verification of a print's identity?
17. What is livescan? What procedure has livescan largely replaced?
18. Name two main drawbacks to using AFIS.
19. Name the three kinds of crime-scene fingerprints.
20. How are prints from hard and nonabsorbent surfaces preferably developed? How are soft and porous surfaces generally treated?

21. What is RUVIS and how does it work?

22. Name four common chemical methods for visualizing latent prints.

23. Explain how latent prints can be visualized when illuminated by laser light.

24. Name three reasons why alternate light sources have replaced lasers for visualizing latent prints.

25. What is the first thing that the criminalist must do after visualizing a print but before making any further attempts at preserving it?

26. Briefly describe how the criminalist should handle prints on small objects.

27. Describe the basic process used to "lift" a fingerprint. When should this procedure be used?

28. What is digital imaging? How is it useful for analyzing fingerprints?

29. Under what conditions is digital imaging not effective in enhancing latent fingerprints?

(1). ____________

(2). ____________

(3). ____________

(4). ____________

(5). ____________

(6). ____________

## Application and Critical Thinking

1. Classify each of the following prints as loop, whorl, or arch.

2. Following is a description of the types of prints from the fingers of a criminal suspect. Using the FBI system, determine the primary classification of this individual.

| Finger | Right Hand | Left Hand |
|---|---|---|
| Thumb | Whorl | Whorl |
| Index | Loop | Whorl |
| Middle | Whorl | Arch |
| Ring | Whorl | Whorl |
| Little | Arch | Whorl |

3. While searching a murder scene, you find the following items that you believe may contain latent fingerprints. Indicate whether prints on each item should be developed using fingerprint powder or chemicals.
   a. a leather sofa
   b. a mirror
   c. a painted wooden knife handle
   d. blood-soaked newspapers
   e. a revolver

4. Criminalist Frank Mortimer is using digital imaging to enhance latent fingerprints. Indicate which features of digital imaging he would most likely use for each of the following tasks:
   a. isolating part of a print and enlarging it for closer examination
   b. increasing the contrast between a print and the background surface on which it is located
   c. examining two prints that overlap one another

# Web Resources

Averbeck, R., "Super Glue to the Rescue"
www.detectoprint.com/article.htm

The Detection and Enhancement of Latent Fingerprints (Adobe Acrobat article from the 2001 Interpol Forensic Science Symposium)
www.interpol.int/Public/Forensic/IFSS/meeting13/SpecialPresentation.pdf

Fingerprint Patterns (Online article discussing the various types of fingerprint patterns, accompanied by extensive illustrations)
www.policensw.com/info/fingerprints/finger07.html

The Fingerprint System (Online article that traces the history of fingerprinting and discusses the elements of the standard fingerprinting system used by law enforcement)
www.criminaljustice.state.ny.us/ojis/history/fp_sys.htm

Frequently Asked Questions about Fingerprints
www.onin.com/fp/lpfaq.html

The History of Fingerprints (Article that traces the history of the use of fingerprints in crime solving)
www.onin.com/fp/fphistory.html

IAFIS Home Page (FBI Web site for the Integrated Automated Fingerprint Identification System; describes the functions and organization of IAFIS and the fingerprint identification services it provides)
www.fbi.gov/hq/cjisd/iafis.htm

Is Fingerprint Identification a "Science"? (Article written by a fingerprinting expert that examines the criteria that validate the science of fingerprinting; also includes a large list of links to identification evidence)
www.forensic-evidence.com/site/ID/ID00004_2.html

Ridges and Furrows (Site that presents information on fingerprinting history, the anatomy of skin, friction ridge identification, latent print development, AFIS, and more)
www.ridgesandfurrows.homestead.com

Taking Legible Fingerprints (Information from the FBI outlining proper procedures for lifting fingerprints)
www.fbi.gov/hq/cjisd/takingfps.html

# Endnotes

1. A tented arch is also any pattern that resembles a loop but lacks one of the essential requirements for classification as a loop.
2. J. Almag, Y. Sasson, and A. Anati, "Chemical Reagents for the Development of Latent Fingerprints II: Controlled Addition of Water Vapor to Iodine Fumes—A Solution to the Aging Problem," *Journal of Forensic Sciences* 24 (1979): 431.
3. F. G. Kendall and B. W. Rehn, "Rapid Method of Super Glue Fuming Application for the Development of Latent Fingerprints," *Journal of Forensic Sciences* 28 (1983): 777.
4. C. Roux et al., "A Further Study to Investigate the Effect of Fingerprint Enhancement Techniques on the DNA Analysis of Bloodstains," *Journal of Forensic Identification* 49 (1999): 357; C. J. Frégeau et al., "Fingerprint Enhancement Revisited and the Effects of Blood Enhancement Chemicals on Subsequent Profiler Plus™ Fluorescent Short Tandem Repeat DNA Analysis of Fresh and Aged Bloody Fingerprints," *Journal of Forensic Sciences* 45 (2000): 354; P. Grubwieser et al., "Systematic Study on STR Profiling on Blood and Saliva Traces after Visualization of Fingerprints," *Journal of Forensic Sciences* 48 (2003): 733.