Chapter 9

Evidence Photography— In the Laboratory

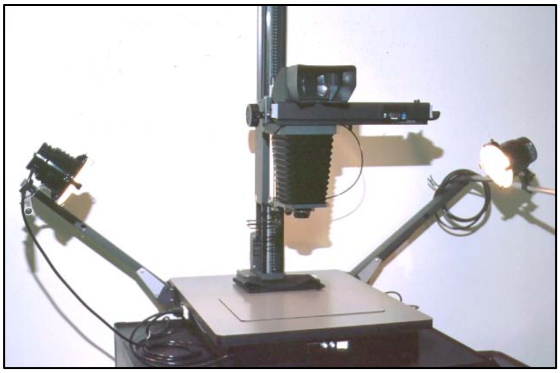
Overview

Often evidence must be transported to the laboratory for processing. The evidence may require scientific analysis. It may require specialized photography requiring controlled lighting or specialized techniques that cannot be accomplished at the crime scene.

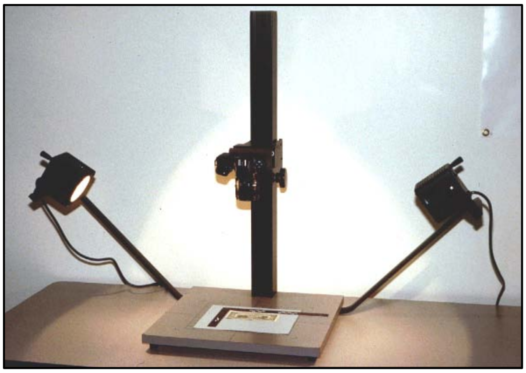
As you study this chapter, be aware that many of the laboratory techniques in this chapter can also be applied at the crime scene. For example, most forensic light sources are portable and are often used for searching for certain types of evidence at the crime scene. It is possible that some forensic light source photography may have to be completed at the crime scene—especially if the evidence cannot be moved (e.g., evidence on a fixed object or surface). Also, some crime scene photographers prefer to set up portable copy stands and use laboratory techniques at the crime scene so they can photograph as much evidence as possible at the scene, reducing the need to collect some items as evidence. For example, during the investigation of a residential burglary blood is found at the point of entry (a broken window). The victim of the burglary points out an antique vase that was moved during the crime. The investigator finds blood on the vase that may have been transferred there from the suspect. The investigator could collect the vase as evidence, but the vase would need to be returned to the victim after photography and blood collection was completed at the laboratory. Instead, the investigator may elect to set up a portable copy stand at the scene, photograph the vase and bloodstain, and collect the bloodstain evidence. The vase can then be left at the scene. It is up to the crime scene investigator to determine the best course of action for each item of evidence.

Laboratory Camera Equipment

Much of the photography done in the laboratory is accomplished with a dedicated copy camera or with a 35 mm camera attached to a camera stand. These devices have lighting attachments and camera height adjustments to facilitate controlled lighting and accurate focusing.



Dedicated copy camera used for evidence photography.



Digital cameras and 35 mm cameras can be attached to simple copy stands for evidence photography.

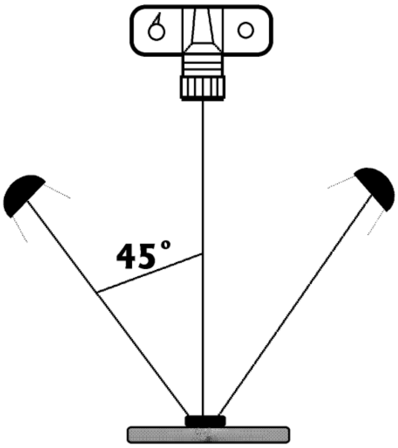
Lighting methods for copy and evidence close–up photography

Since most laboratory photography is made with steady burning lights (quartz lamps, photoflood lamps, fluorescent lamps, etc.) it is relatively easy to choose the best lighting method for photographing a specific item of evidence. All you need to do is try different lighting methods while looking in the camera's viewfinder, and select the method that gives the best results. The following lighting methods are effective for photographing various evidence subjects.

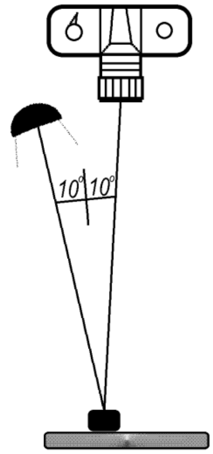
45 degree lighting

45–degree lighting uses one or more lights positioned at 45–degree angles. If only one light is used, a white or silver reflector can be placed on the opposite side of the evidence to reflect some of the light back toward the evidence, reducing shadows.

45–degree lighting is used for photographing the average item of evidence where the objective is to show the item's shape and size.



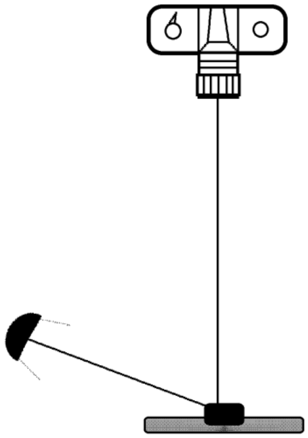
Direct reflective lighting



In direct reflective lighting the light is reflected directly off the subject into the lens. This is done by placing the subject at a 10–degree angle from the lens to film plane and placing the light source at a 10–degree angle from the subject. T he light source reflects at a 20–degree angle into the lens.

Direct reflective lighting is used to minimize shadows within the evidence. However, this method creates very high contrast and does not show the dimensional shape or texture of the evidence. Also, the light source may need to be diffused to prevent hot spots.

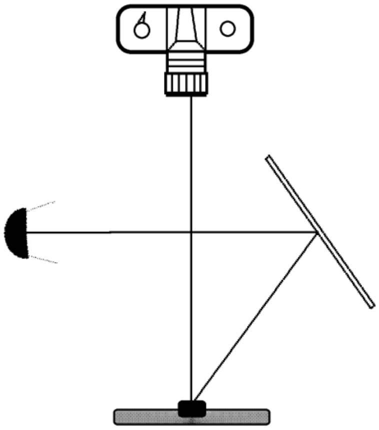
Oblique lighting



Oblique lighting uses a light source positioned at a low angle. Oblique lighting is usually used to show detail by creating shadows on the surface of the evidence.

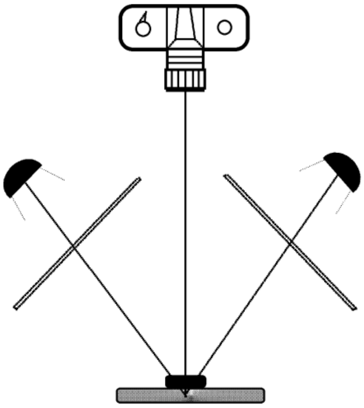
Oblique lighting is commonly used when photographing impressions, tool marks and certain types of fingerprints. A very low oblique angle of lighting can be used to photograph dusty footwear impressions and indented writing.

Bounce lighting



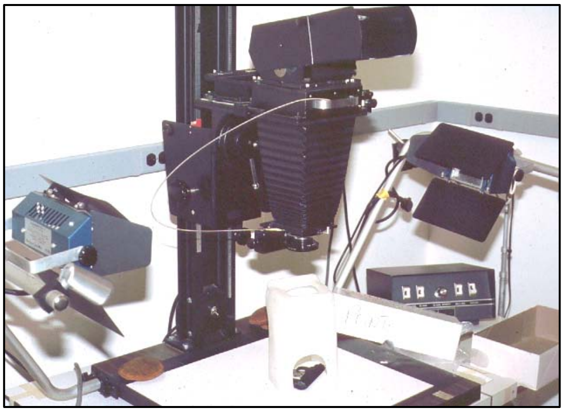
Bounce lighting uses light bounced off a white or reflective surface. The bounce surface may be positioned at different locations (above or to one side of the subject) to create the desired effect. This usually produces even non–glare lighting with low contrast.

Diffused lighting

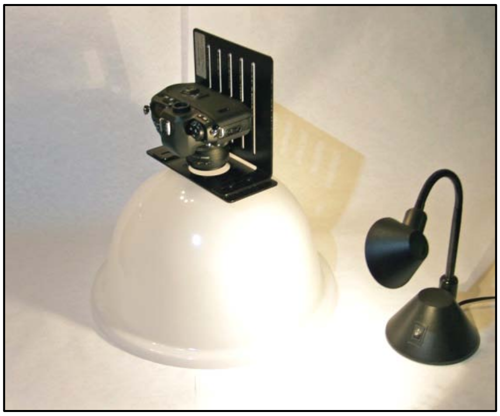


Diffused lighting uses an opaque material placed between the light source and the subject to soften the light. This usually results in even lighting with reduced reflections and hot spots. The opaque material can be as simple as a section of a white bed sheet or an empty water bottle, or can be a commercial device designed for laboratory photography.

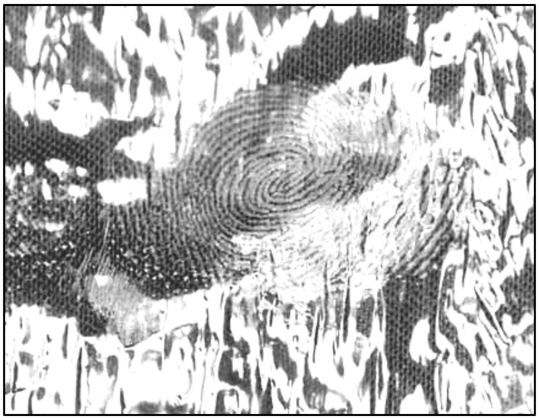
Diffused lighting is usually used for photographing evidence with shiny or reflective surfaces.



A white plastic water bottle was used to diffuse the light and reduce reflections when photographing a fingerprint on a small handgun.



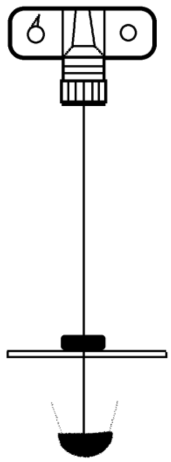
The Cloud Dome, a commercial device designed for laboratory photography, is effective for diffusing light.



This photograph of a fingerprint on plastic wrap was taken with standard 45–degree lighting. Reflections on the plastic wrap obscure the detail in the fingerprint.

This photograph of a fingerprint on plastic wrap was taken using the diffused lighting provided by the Cloud Dome. The diffused lighting eliminates most reflections.

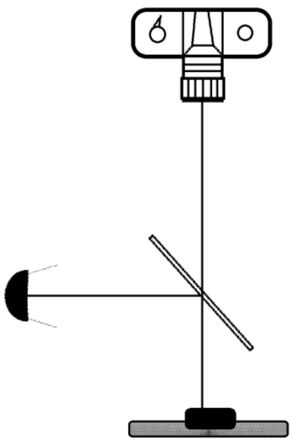
Transmitted lighting



Transmitted lighting uses light that shines through the evidence toward the camera's lens. The background becomes shadow–free. The angle of the transmitted lighting can be adjusted from 90–degrees to 45–degrees for the desired effect.

Transmitted lighting is used for photographing transparent or translucent subjects. It is effective in photographing evidence such as a fingerprint on a drinking glass.

Front directional or axial lighting



Front directional lighting allows you to send light straight down onto the evidence. A clear piece of glass is placed between the subject and lens at a 45–degree angle. The light source is positioned parallel to the film plane and 45–degrees to the glass. While the light is transmitted through the glass, some is reflected downward directly on the subject.

Front directional lighting is effective when photographing into hollow cavities, such as glasses or cups.

Other variations of lighting

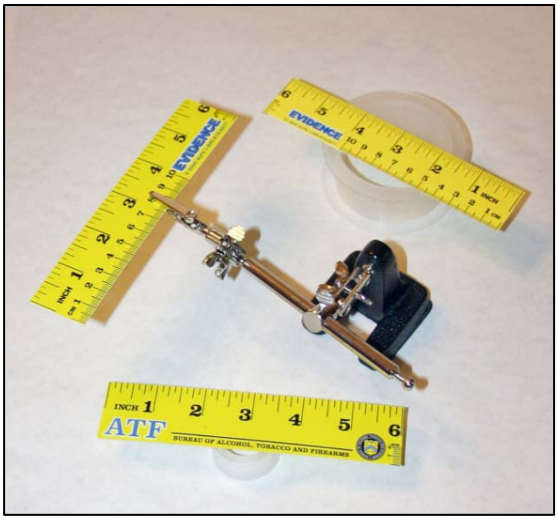
Front directional lighting was used to photograph capsules in a bottle.

Two or more of the lighting methods described above can be used together for lighting evidence. For example, when photographing a broken piece of glass you might use a combination of transmitted lighting and diffused 45–degree lighting.

Also, mirrors and white or silver reflector cards can be used to reflect light into shadow areas when using the lighting methods described above. Other devices, such as small spot lights and fiber optic lighting, can be utilized to light small areas.

Camera and scale orientation for laboratory photographs

When taking photographs of evidence you must position the camera and evidence to minimize distortion in the photograph. This can be accomplished by keeping the camera's film plane parallel with the plane of the evidence. Taking a photograph with the camera positioned at an oblique angle will introduce distortion into the photograph. This becomes extremely important when photographing evidence in which the photograph will be used for comparison purposes, such as tool marks and footwear evidence.



Scales must be positioned on the same plane as the evidence. Scales can be positioned using small stands, blocks of wood, empty tape spools, or other devices.

Scales are used in most laboratory photographs. Scales are required when photographing evidence for comparison purposes (e.g., the sole of a shoe when the photograph will be compared with an impression cast at the scene). When a scale is used in a photograph the scale must be positioned on the same plane as the evidence. Taking a photograph with the scale on a different plane will introduce distortion into the photograph and the scale will be virtually useless. Scales can be positioned using small stands, blocks of wood, empty tape spools, or other devices.

Focusing

When taking close–up photographs one of the most common problems encountered is shallow depth–of–field. Therefore, accurate focusing is critical. One important technique regarding focusing for close–up photography is to avoid focusing on the scale. Instead, be sure to focus on the evidence. While it is frequently easier to focus on the markings or edge of the scale, the scale may not always be on the exact plane of the evidence. It is better to have a sharp image of the evidence and a slightly out of focus scale than to have a sharp image of the scale and the evidence out of focus.

When focusing in the laboratory, it is often easier to move the evidence slightly to bring it into focus than to try to fine focus the lens. A small platform on a scissors jack can be used to raise or lower evidence for focusing.

Exposure

Correct exposure is critical in evidence photography. Incorrect exposures can result in lost detail in a photograph. While electronic flash can also be used in laboratory photography, most evidence photography done in a laboratory setting uses steady burning lamps.

When using steady burning lamps, exposures can be metered either with the camera's internal exposure meter or with an external exposure meter. However, before relying on any reflected light exposure meter, you should determine if the meter will be providing an accurate reading due to the subject or background about to be photographed. Exposure meters use 18 percent reflectance in determining exposure. If you are photographing evidence, or a background that does not have 18 percent reflectance, then the exposure reading can be in error. For example, when the evidence you are photographing is a dusted fingerprint on a white surface, an exposure meter will, as always, base its exposure settings on 18 percent reflectance. Since the subject matter in the photograph is almost all white, the meter will provide exposure settings that result in an underexposed photograph. Much of the detail in the photograph will be lost. A second example would be a dark item, such as a black revolver. The exposure meter will base its settings on 18 percent reflectance and would provide exposure settings that result in an overexposed photograph. Much of the detail in the revolver will be lost.

When using steady burning lamps for laboratory photographs you can insure accurate exposures by metering off an 18 percent gray card. Position the 18 percent gray card in front of the exposure meter, or in front of the camera lens if you are using the camera's exposure meter, to obtain the correct exposure settings. Be sure the light is falling on the 18 percent gray card the same as it is falling on your evidence. Use the settings indicated by the exposure meter for the photograph. In many cases, bracketing should also be considered. Bracketing will provide a series of photographs at different exposures. Later, the best exposures from the series of photographs can be used for the investigation.

Normal electronic flash exposures can be done in either automatic or manual flash when photographing evidence. Through–the–lens (TTL) electronic flash unit exposures will be controlled automatically by the camera's TTL flash metering system. When using electronic flash, bracketing should also be considered. Bracketing will provide a series of photographs at different exposures. Later, the best exposures from the series of photographs can be used for the investigation.

Serial Numbers

When taking close–up photographs of serial numbers use either 45–degree or oblique lighting. If the numbers are printed on a label 45–degree lighting will usually be adequate to document the serial numbers. If the serial numbers are either raised or engraved then oblique lighting would be used to create small shadows in the numbers. The small shadows would make the numbers visible in the photograph.

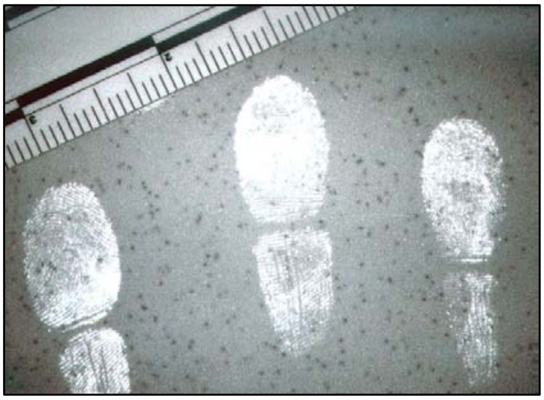

Stamped or engraved serial numbers are photographed using oblique lighting.

Serial numbers that have been obliterated or altered must also be documented photographically. Frequently obliterated numbers, usually serial numbers that have been removed by filing, can be restored by forensic scientists. Photographs of the serial numbers should be taken before and after restoration using oblique lighting.

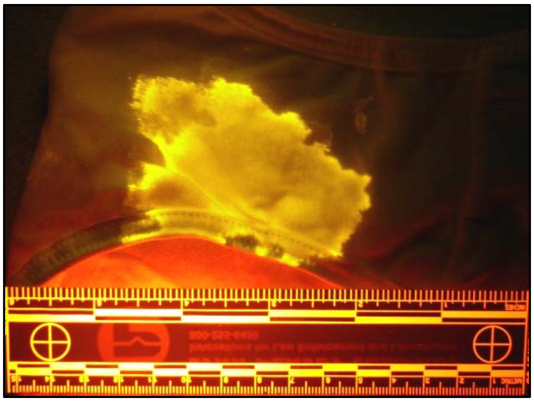
Forensic Light Source Photography

Forensic light sources, also referred to as alternate light sources, are used both at crime scenes and in the laboratory to detect and document various types of evidence. Forensic light sources vary in design, from battery powered portable units that are designed to search for specific evidence, to larger laboratory units with a variety of forensic applications.

Often, evidence is invisible to the naked eye without a forensic light source. Most forensic light sources use interchangeable filters, or a filter wheel, to select the band of light necessary to detect certain evidence. For example, the blue band (approximately 465nm) would be used to detect and document evidence such as saliva, semen, urine, bloodstain, fibers, and fingerprints developed with fluorescent fingerprint powders. A variety of narrow band filters are used for enhancing fingerprints that have been revealed with certain fingerprint powders and chemical methods.


Fingerprints dusted with fluorescent powder and illuminated with a forensic light source. An orange filter was used over the lens.

Semen stain photographed with normal lighting.



Semen stain photographed with a forensic light source and orange filter.

When using a forensic light source, wear colored goggles to view the evidence illuminated by the forensic light source. Orange, red and yellow goggles are used depending on the band filter in use. Photography to document the result is relatively easy. When you see the best result with the forensic light source just duplicate what you see for the camera. If you are wearing orange goggles then shine the forensic light on the evidence and place an orange filter over the camera's lens to take the photograph. Determine a starting exposure with the camera's metering system or a separate light meter. When using a separate light meter, use the filter factor for the band cut off filter to compute the exposure. Bracket exposures by a minimum of two stops.

Ultraviolet Photography

Ultraviolet lighting techniques can be used to illuminate body fluids, fluoresce latent prints that have been dusted with fluorescent powders, and to produce high resolution photographs of skin surfaces. It is a good technique for photographing bite marks, cuts, and scratches. Bruises with blood accumulation close to the skin surface can also be photographed with ultraviolet photography.

To photograph using ultraviolet light you will need a camera, high speed black–and–white film and a lens capable of transmitting light between 320nm and 400nm. (Most lenses are designed to prevent excess ultraviolet transmission. A lens can be tested with a spectrophotometer to determine if it can transmit light between 320nm and 400nm.)

There are two types of ultraviolet photography—fluorescent and reflected. Fluorescent ultraviolet photography is accomplished by getting an object to glow, usually by using a "black light," and then photographing it. Fluorescent ultraviolet photography must be done in a darkened room. A starting exposure setting is determined by metering either with the camera's internal exposure meter or with an external exposure meter. Exposures should be bracketed by two f–stops.

Reflected ultraviolet photography is different in that it can be accomplished without darkening the room. A light source rich in ultraviolet light is necessary. Such light sources include tungsten lights, photoflood lights, fluorescent lights and electronic flash. A Kodak Wratten 18A filter is placed over the camera's lens during the exposure. The 18A filter blocks visible light while allowing ultraviolet light to pass through. Exposure settings are determined by evaluating test photographs. You can find a starting point for exposures by using the exposure settings indicated by the camera's internal exposure meter with the filter in place or with an external exposure meter using a filter factor of 80 (+6.5 f–stops). Exposures should be bracketed by two f–stops.

Some forensic light sources, called Reflected Ultraviolet Imaging Systems (RUVIS) are designed for ultraviolet reflectance viewing and photography. Ultraviolet forensic light sources are frequently used at crime scenes to detect fingerprints on non–porous surfaces prior to any treatment or after a cyanoacrylate (superglue) fuming, footwear impressions on smooth surfaces, explosive residues and for luminol enhancement. Ultraviolet forensic light sources can also be used to enhance injuries including bite marks. A reflected ultraviolet imaging system is a device that consist of an ultraviolet image intensifier, a short–wave ultraviolet bandpass filter, and includes an optical system you look through to see the results. They can be attached to a camera to take ultraviolet photographs.

When taking fluorescent or reflected ultraviolet photographs, be sure to take both white light and ultraviolet light photographs of the evidence. These can be used for comparison and for explaining your technique in court.

Infrared photography

Infrared photography is useful in analyzing and photographing evidence including questioned documents, gunshot residue, stains, and irregularities in cloth.

Infrared films are sensitive to infrared radiation, as well as visible light and some ultraviolet radiation. Infrared films must be handled in total darkness. Cameras must be loaded and unloaded in total darkness to avoid infrared radiation from reaching the film.

To photograph evidence with infrared you will need a camera, lens with an infrared focusing mark, black–and–white infrared film, and a light source.

Infrared focusing mark (indicated by arrow) on a standard lens.

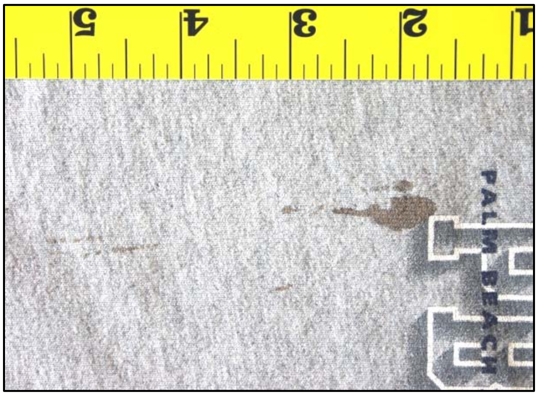
Lenses do not focus infrared radiation on the same plane as visible light. This is because infrared radiation has a longer wavelength than visible light. When focusing for infrared you first focus for visible light without a filter over the lens. Once focused for visible light the lens is adjusted for infrared by aligning the distance on the lens's focusing scale to the infrared focusing mark.

A Kodak Wratten filter #87 is placed over the lens to block all ultraviolet radiation. Tungsten lamps or electronic flash are usually used to light the subject.

Because the ratio of infrared radiation to visible light varies, exposure settings are usually determined by test photographs. When using Kodak high–speed infrared film a starting point for exposures can be determined by setting the ISO on the camera or light meter to ISO 25. If you are using the camera's internal metering system be sure to take the exposure readings before mounting the filter on the lens. Bracketing should be used when taking infrared photographs. Bracketing will provide a series of photographs at different exposures. Later, the best exposures from the series of photographs can be used for the investigation.

Clothing

Clothing is often collected as evidence. It could be a suspect's clothing with glass fragments, gunshot residue, blood, or other evidence adhered to its surfaces. It could be the victim's clothing containing semen, bloodstain or other evidence. Forensic light sources are often used to search for evidence on clothing.



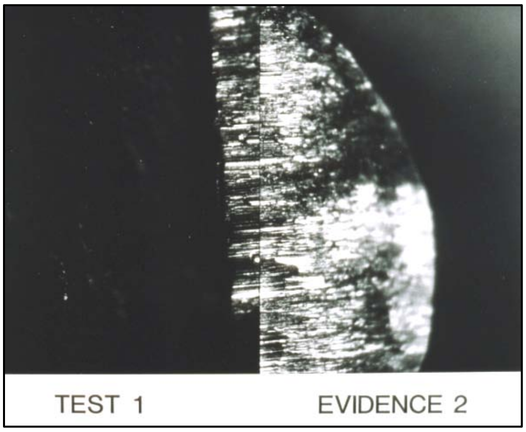
This photograph of bloodstain on a shirt was taken with oblique lighting.

When photographing clothing and evidence found on clothing, lighting will depend on the character of the evidence photographed. Evidence revealed using a forensic light source will be photographed using the forensic light for illumination. Some details in fabrics can be shown with transmitted lighting, others, such as bloodstain, with oblique lighting.

Microscopes

Some kinds of evidence may be analyzed in the laboratory utilizing microscopes. Some microscope systems are designed for making tool mark or ballistics comparisons. Most microscopes in crime laboratories have attachments for cameras. Others have digital cameras designed into the microscope for both viewing and photography.

When photographing evidence through a microscope you can determine a starting exposure with the camera's metering system. Bracketing will provide a series of photographs at different exposures. Later, the best exposures from the series of photographs can be used for the investigation.



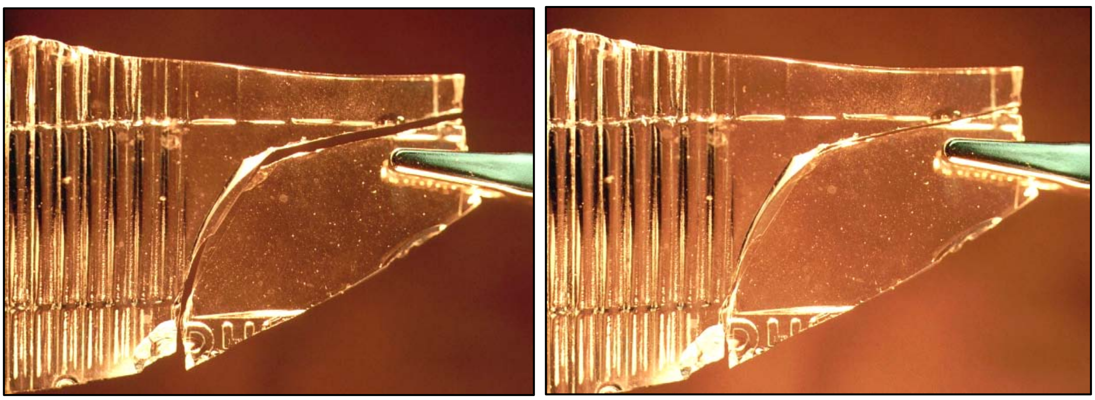
This photograph, taken through a comparison microscope, shows a match between a cut padlock and a test cut made with bolt cutters found in a suspect's possession.

Most microscopes in crime laboratories have attachments for cameras.

Some microscopes have integrated digital cameras both viewing and photography.

Matching Photographs

A common type of laboratory photograph is the “matching photograph.” The purpose of a matching photograph is to visibly illustrate that two pieces of evidence were at one time joined together. For example, a physical match is made with two pieces of headlight glass, one found at the collision scene and one on the hit–and–run suspect’s vehicle. Photographs are made to illustrate the match. Other matches could be two pieces of torn clothing or a paper match torn from a matchbook.



Usually two photographs are taken to illustrate a physical match. One photograph is taken with a space between the two pieces and the second is taken with the two pieces joined.

Another type of matching photograph is an illustration that one object touched or impacted another object. For example, a pry tool in the suspect’s possession is determined to be the tool that made a mark on a door jamb. At some point in the investigation a matching photograph may be taken. However, be certain matching photographs are only taken after trace evidence, if any, is collected from both objects. Otherwise positioning the two pieces of evidence together will cross–contaminate the evidence. In this example wood fibers and paint found on the pry tool could match the door jamb.

Usually two photographs are taken to illustrate a physical match. One photograph is taken with a space between the two pieces and the second is taken with the two pieces joined.

Lighting for the matching photographs will depend on the character of the evidence photographed. A combination of transmitted and diffused lighting was used in the above example photographs of a headlight glass match.

Exhibits

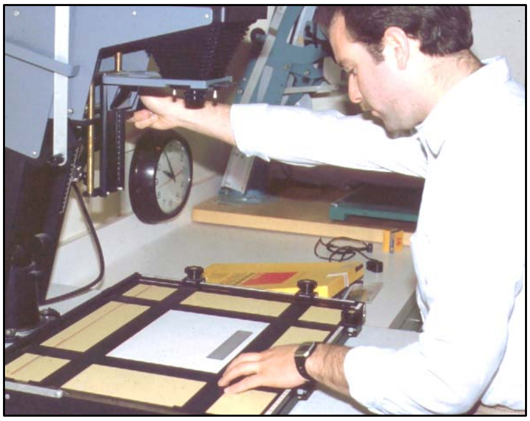
Often exhibits will need to be prepared for illustrating testimony in court. Many exhibits are simply photographs from the crime scene or of evidence. These photographs can be used to help the court and jury understand the crime and the conclusions reached by the investigators.

Another type of exhibit is one that can be used to demonstrate the conclusions regarding evidence. In the series of photographs below, an exhibit is constructed to demonstrate how the suspect's shoe matches a footwear impression found at a crime scene.

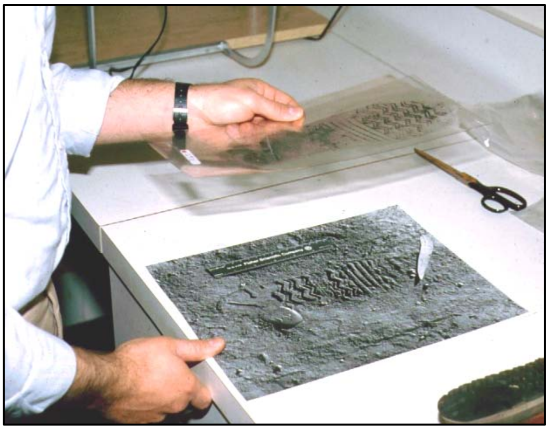
Fingerprint ink is rolled across the sole of the suspect's shoe.

The ink is transferred from the shoe sole to a clear sheet of plastic.

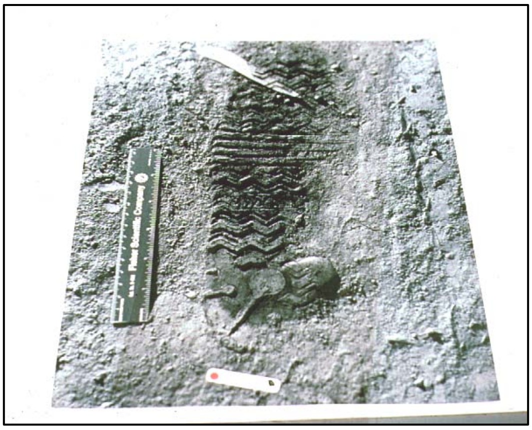
This produces a life–sized (1:1) transparency of the shoe sole.



A life–sized (1:1) photographic print of the shoe impression is made by matching the scale in the photograph with a scale placed on the easel.



The transparency and photograph can be displayed to the court and jury.



The transparency is placed over the photograph to illustrate the match.

Similar exhibits can be constructed with the use of programs such as Adobe® Photoshop.® The sole of the suspect's shoe can be photographed or scanned on a flatbed scanner and then a digital photograph of the footwear impression can be superimposed.

Summary

This chapter has given you a variety of techniques for photographing evidence in a laboratory setting. Photographs are ideal for illustrating an investigator's testimony about evidence. To successfully photograph evidence you must be experienced and knowledgeable in both photography and forensics, be willing to experiment with lighting, be a problem solver, and be creative.