FIGURE 6-8
"Daylight" style tanks incorporate a two-part top that permits solutions to be poured in and drained without allowing the film to be exposed by light.

FIGURE 6-9
Two-gallon storage tanks with spigots. These allow solutions to be easily poured into measuring containers by simply opening the valve. The labels are created with self-stick black vinyl lettering. Be sure to follow OSHA labeling guidelines for hazardous substances.

refilling the container with its labeled contents. If you use a label-making machine to identify these containers, avoid red labeling tape, since it cannot be read under safelight illumination.

5. *Graduates, beakers, funnels*. Assorted measuring devices are required when processing film. Although photographic supply houses offer a variety of these items, try discount stores that sell them inexpensively as houseware items. Before use, verify their accuracy by comparing their marked volumes with a laboratory-grade graduate. Plastic is preferred over glass because of its durability and break-resistance. Translucent plastic allows the fluid level to be readily ascertained. (Although measuring utensils are also available in

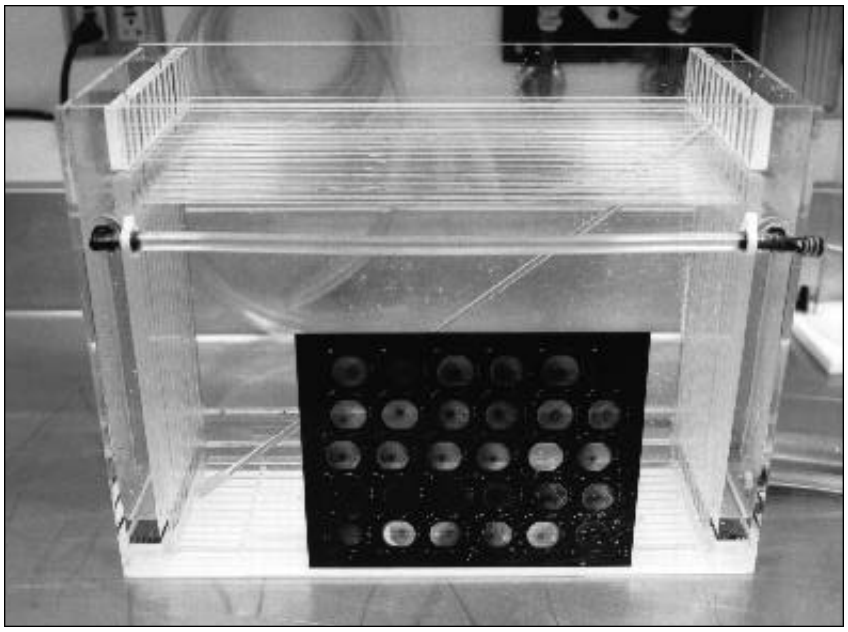


FIGURE 6-15
Plexiglass print washer. Properly designed print washers continually bathe both surfaces of prints with fresh water to remove processing chemistry.

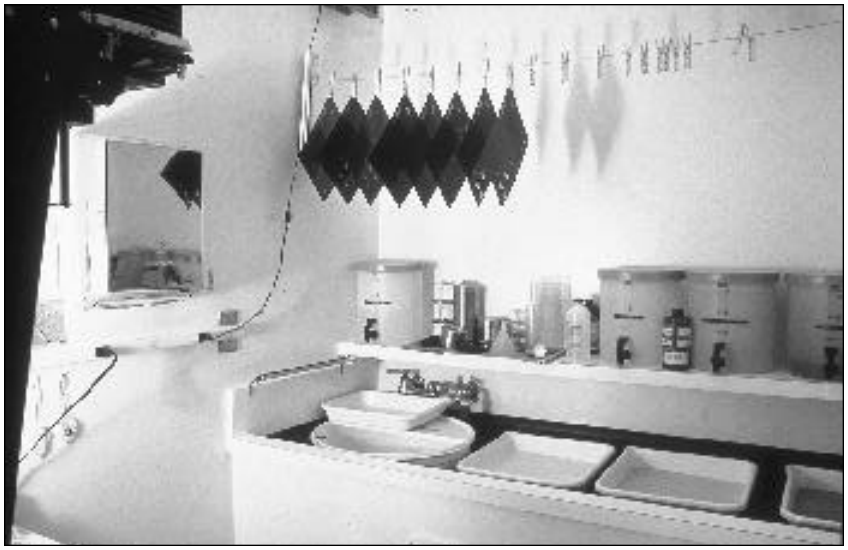


FIGURE 6-16
Printout drying. One of the simplest methods for drying sheet film or resin-coated paper prints is to hang them up to dry. This darkroom has been equipped with a sturdy metal wire line above the darkroom sink. Regular wooden spring clothespins are drilled and threaded onto the line and securely grasp each print for air drying. Note the tray line set up in the sink.

The Advanced Darkroom

The advanced ophthalmic darkroom has the capability of producing enlargements on paper. The following items are required for this assignment (see the sidebar on machine processing options for film and positive printouts).

1. *Enlarger.* The enlarger projects the image of the negative onto photographic paper to produce a positive print. Component parts of this device include a light source, negative carrier, lens board with an enlarging lens, support column, and baseboard. Condenser enlargers collimate the light and direct it evenly over the negative,

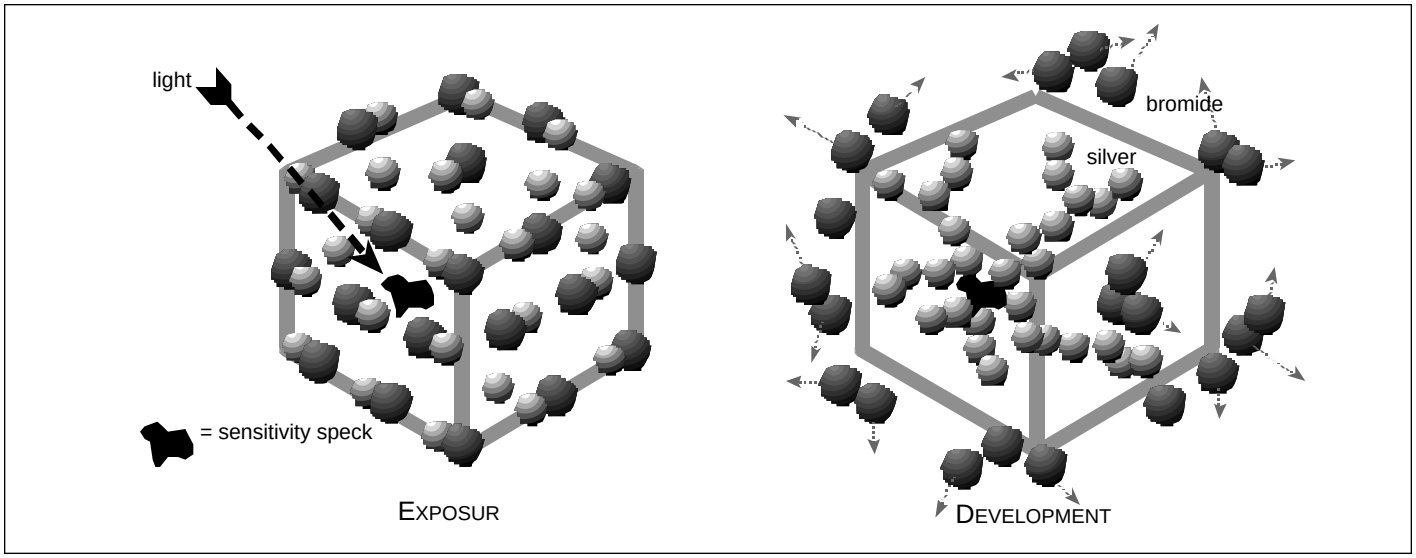


FIGURE 6-22
Photographic development. When film or paper is processed, developing agents convert the exposed silver halide crystal to metallic silver and then spin out filament-like strands of metallic silver to create a visible silver grain.

FILM DEVELOPMENT

During the process of development, the developing agent adds negatively charged particles (electrons) to those crystals that have been struck by light. The result of this reaction is the formation of a black, metallic silver image and the release of by-products into the developer (Figure 6-22). Chemists recognize this as an oxidation-reduction type of process, since silver is reduced to its metallic form while the developer is oxidized. Development is extraordinarily efficient at amplifying the effects of light on film. By making the sensitivity speck visible, development increases its size by well over a million times.

When developing film in daylight tanks, development requires periods of agitation followed by intervals where the tank is allowed to stand undisturbed. The agitation cycles introduce fresh quantities of processing solutions to the emulsion and remove waste products from it—the chemical action involves every part of the image during agitation. The quiet cycles allow the development of the highlights to slow down, since the relatively large areas of reduction liberate a commensurate quantity of waste products that prevent further highlight development from occurring. The regions of the film that have less exposure release fewer waste products and are thus permitted to continue development during the still interval.

As with any other chemical reaction, time and temperature play crucial roles. The reaction occurs more quickly at higher temperatures, and as the time increases, so do the number of silver halide crystals that are developed.

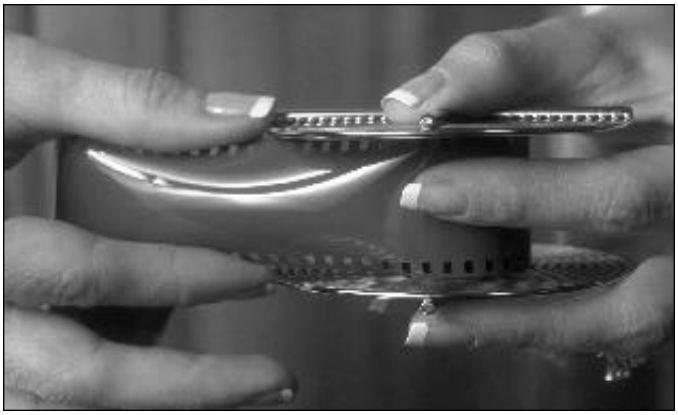
As development continues, contrast rises. Contrast denotes the separation between tones. The dark tones in a high-contrast image are extremely dark, the light tones are very bright, and the visual separation among the intermediate tones is likewise expanded. This fact is essential to the nature of black and white film materials; just as exposure creates density, development influences contrast. Excessive times or temperatures are harmful, however, since unexposed crystals may be converted to silver as well as those that were struck by light. This results in a "fogged" image of inferior quality. The physical size of the metallic sil-

A

B

C

D



E

FIGURE 6-23
Film loading, using stainless steel reels. First, assemble the tank, film, reels, opener. and scissors on the countertop (A). Next, open the flat end of the cassette (B). Cut off the leader (C), and insert the cut end into the center of the reel (D). Gently squeeze the film's width into a convex curve as you roll the film onto the reel and be sure to lightly feel the film to ensure proper tracking (E). Finally, cut off the film spool, place the reel into the tank, and cover with the top.

spool by rotating the top and bottom flanges of the reel in alternate directions. The film will automatically feed into the reel.

To gain confidence and accuracy in loading film, repeatedly practice with a scrap roll of film until you can load the reel successfully (with your eyes closed!), allowing your fingers to provide you with all the information you need. Treat the film gently; avoid bending or crimping the film while loading it, since these acute pressures to the film's surface will result in small curved lines in the image itself, known as "cinch marks."

Table 6-5. Angiographic Zone System

Zone	*Tonal/Pictorial Representation*	*Angiographic Representation*
I	Total black	Area adjoining angiographic image
II	First visible tone above black	Retroilluminated vessels in late phase
III	First texture in dark greys	Early choroidal fluorescence visualized through retinal pigment epithelium
IV	Normal grey value of skin in shadow	Vessels in recirculation phase
V	Middle grey (18% reflectance)	Later choroidal fluorescence
VI	Average caucasian skin (36% reflectance)	Diffuse dye from neovascular tissue
VII	Light grey	Near maximal dye in tissues or vessels
VIII	Lightest tone with texture	Drusen, microaneurysms, areas within neovascularization
IX	Paper base white (clear film)	Maximal dye concentration in filled vessels or in florid leakage sites (i.e., ICSC, NV)

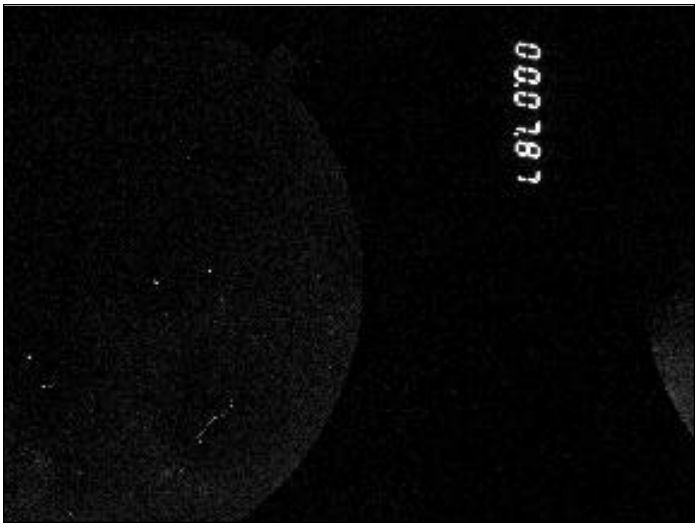


FIGURE 6-26.
Dust spot artifacts. The tiny white spots that form on lithographic-type printout materials are caused by dust and dirt that is sandwiched between the negative and the printout medium. Besides their poor appearance, these may be mistaken for hyperfluorescent lesions. Notice that the dust spots are inside and outside the image area. (Courtesy of J. Balza.)

Continuous tone or line films are less likely to produce these spots than lithographic films.

Sheet film contact sheets provide an overview of the patient's angiographic status. By reproducing the angiographic series in total, contact sheets portray, in same-size positive format, every image originally captured on the negative.

To prepare for producing sheet film contact sheets, first set up the tray line. Assuming that four 8" × 10" trays will be used, fill the first tray with at least 1 liter of diluted paper developer. Many photographers use Kodak Dektol developer, diluted 1:1 with water. Fill the second tray with 1 liter of indicator stop-bath, and the third tray with with at least 1 liter of fixer. Finally, set up the last tray as the wash tray, or set up and fill the print washer if available. Turn on the safelight and extinguish the room lights.

Your enlarger is a fine light source for contact printing. To use it in this manner, first turn on the lamp and adjust the height of the enlarger so that its light shines onto the baseboard in a large enough area to cover the size of the contact frame. Roughly focus the lens to produce a sharp edge of the negative carrier. You may want to mark the projected area on the baseboard with black tape to aid in positioning the contact printing frame when you are ready to expose. Once this has been checked, turn the enlarger lamp off temporarily.

If you use a simple contact frame, place a sheet of printout film (emulsion side up) onto the frame. Next, carefully position the angiographic

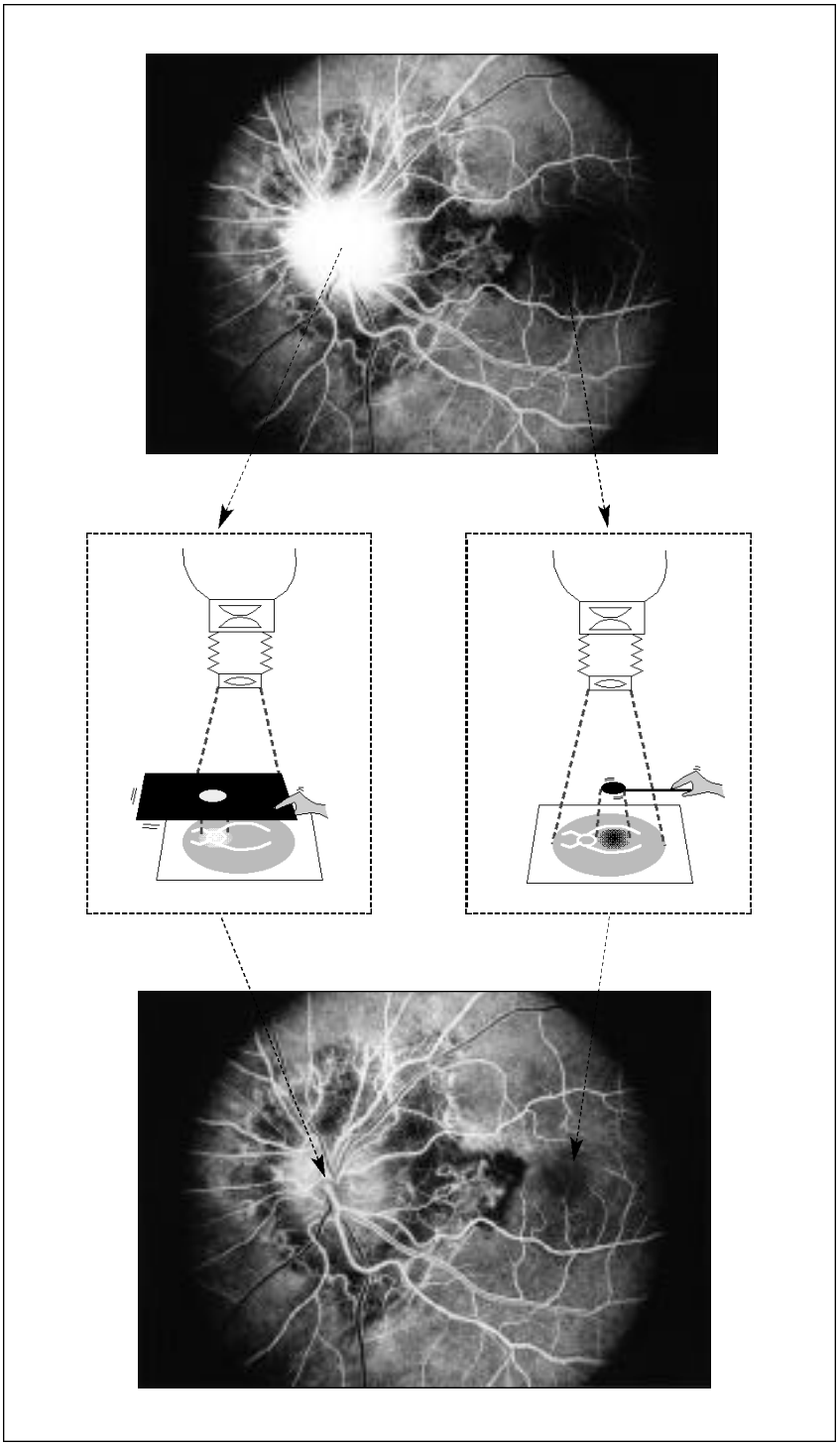


FIGURE 6-29
Presumed ocular histoplasmosis syndrome with choroidal neovascular membrane. Depending on the distribution of dye and the negative's processing, at times a straight print will show an optic nerve that is too bright and a macular region that is too dark. This can be corrected by applying extra exposure (burning) to the nerve head, while a portion of the base exposure is subtracted from the macular area (dodging) to bring the photo into better tonal balance.

closer alignment with the abilities of the paper to depict them[12] but do not solve this problem completely.

Split filter printing employs two filters: a high-contrast (magenta) filter (i.e., grade 5) and a low-contrast (yellow) filter (e.g., a grade 0 or a –1). The low-contrast filter has its greatest effect on the highlights, and the high-contrast filter influences the contrast in the darkest values.

For split filter printing, first place the lower contrast filter in the enlarger. Make a test print (by sequentially exposing strips across the print), develop, fix, wash, and dry. Examine only the lightest tones; choose the