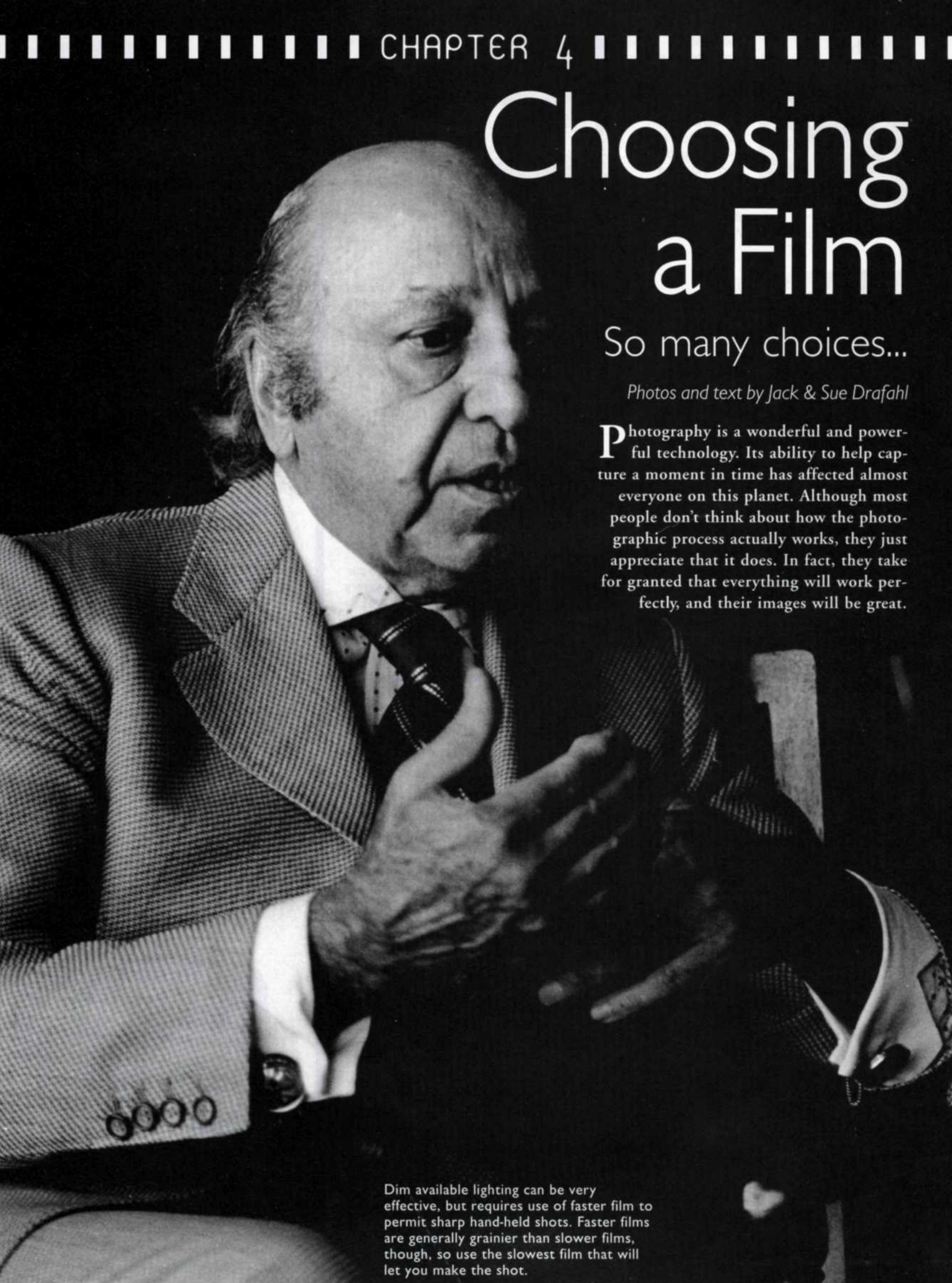
CHAPTER 4

Choosing a Film

So many choices...

Photos and text by Jack & Sue Drafahl

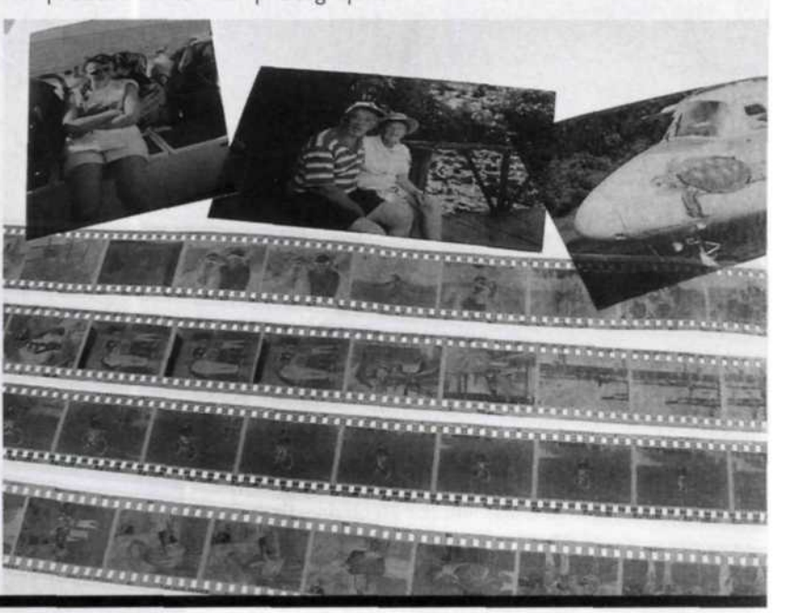
Photography is a wonderful and powerful technology. Its ability to help capture a moment in time has affected almost everyone on this planet. Although most people don't think about how the photographic process actually works, they just appreciate that it does. In fact, they take for granted that everything will work perfectly, and their images will be great.



Dim available lighting can be very effective, but requires use of faster film to permit sharp hand-held shots. Faster films are generally grainier than slower films, though, so use the slowest film that will let you make the shot.

Left: When you expose film, a latent ("hidden") image forms on the light-sensitive silver-halide emulsion. When the film is developed, that image becomes visible as a negative image, in which tones are reversed: what was light in the original scene appears dark, and what was dark appears light (top). When the negative is printed on photographic paper (which contains an emulsion similar to that on the film), a positive image results (bottom). (With color-slide films, the image is reversed into a positive one during rilm procesing.)

Below: Black-and-white and color-negative films produce strips of negative images, which can be printed on photographic paper to produce the familiar photographs.



The most popular method of recording images is with film. The problem is that there is no one film that can solve all the photographic situations a photographer may encounter. Therefore, film manufacturers have developed a variety of color-negative, color-slide and black-and-white films that feature a choice of film speeds and contrast or saturation options.

Since most people don't have the time, money or expertise to make a full comparison of every film, they depend on recommendations from magazine articles and experienced photographers. Some of the problems of film selection have been resolved since almost every film made today provides excellent results. Sophisticated computer-aided technology used to design new emulsions, and the free-enterprise system of friendly competition, allows you to get the best possible products. To help you with your film choices, we'll take you through the whole film-selection process, starting with explaining just how the miracle of film works.

Photographic Theory

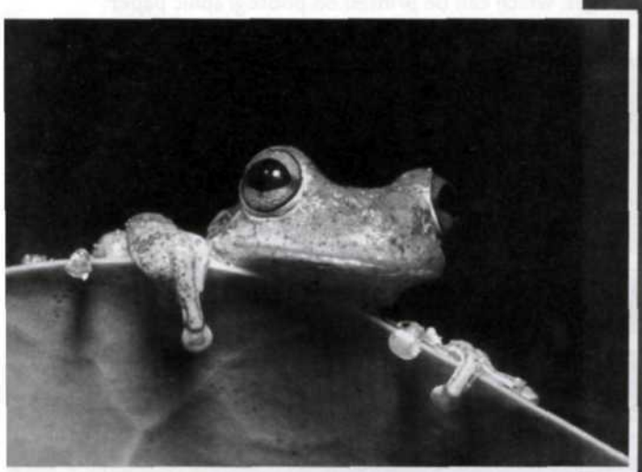
The concept of photography has been the same since its inception. A light-tight box housed a light-sensitive material that captured an image that was projected through a hole in the front of the box. In time, a plastic or glass lens was used to focus and improve the quality of the captured image. Until recently, this light-sensitive material was primarily film, but now includes the CCD and CMOS chips found in today's digital cameras.

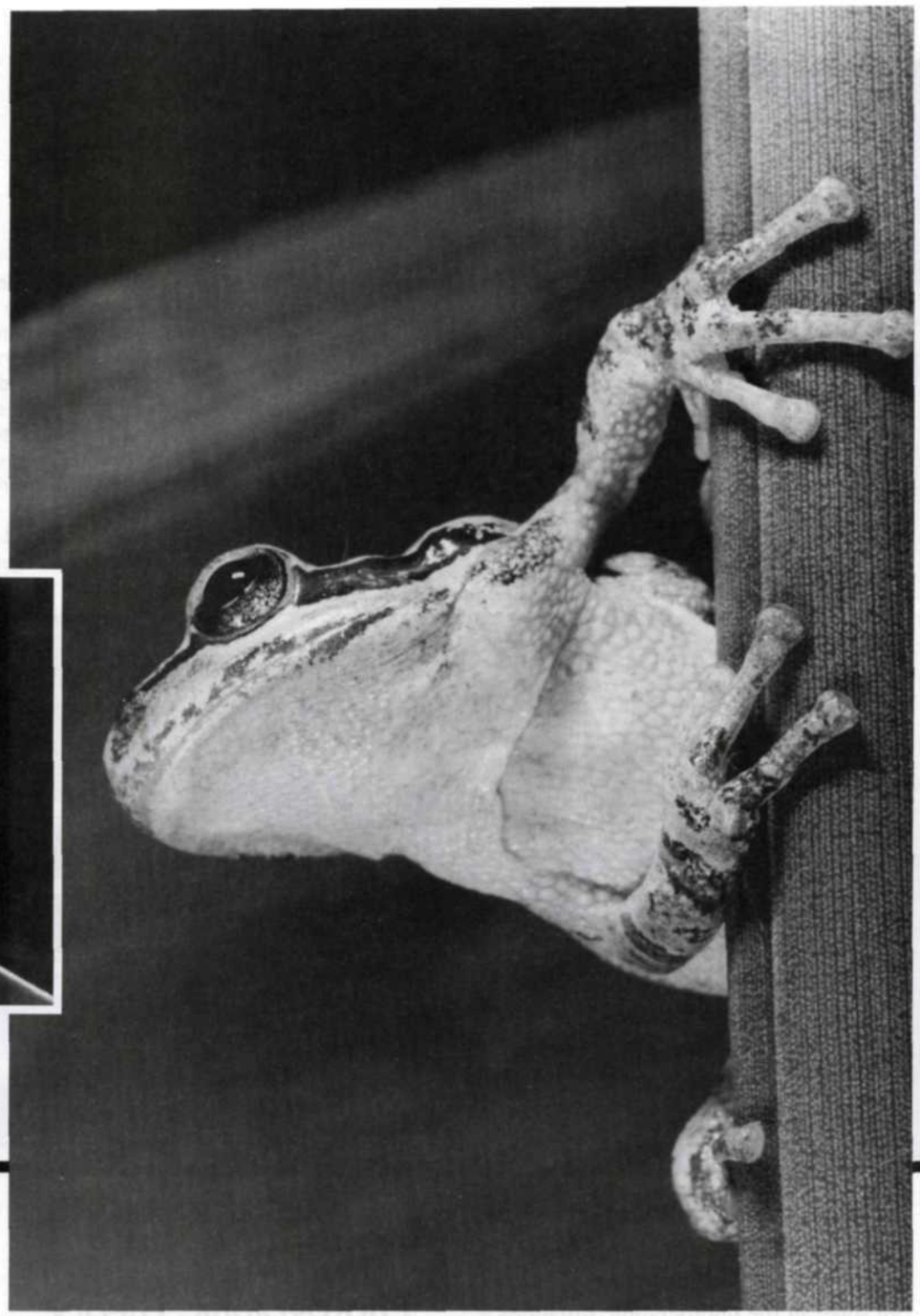
In order to correctly expose the scene, the amount of light striking the film must be carefully balanced by adjusting the camera's shutter speed and f-stop. Most cameras today are fairly automated, so much of this guesswork is eliminated.

The problem is that successful photography is not that easy. Many variables play a part in the collection of image data on a light-sensitive emulsion. Color temperature, light levels, lens designs, and subject movement all become a part of the photographic equation. Most of your image control comes from the film type you use to record the scene. When you look at all the films available, you will see that they fall into three basic groups: black-and-white, slides, and color negative. Let's take a closer look into each category to which one is right for you.

Black-and-White Films

Black-and-white film comes in two flavors: traditional and chromogenic. Both start out as silver-halide-based emulsions. When the camera shutter is opened, light is focused and passes through the lens aperture, striking the light-sensitive silver-halide crystals, forming a hidden or latent image. Bright areas in a scene expose the silver-halide crystals a lot, while dark areas in the original scene will have little effect. Once the film is exposed, the film is processed,





High-magnification photography magnifies camera and subject motion along with the image, so a fast film (or electronic flash for close-up subjects) is needed to permits motion-freezing exposure times.

and here is where the two film types differ. Traditional black-and-white films are developed in a conventional black-and-white developer—quite often in a home darkroom.

When processed in the black-and-white developer, the exposed image is amplified or increased in intensity. Areas with a lot of exposure become dark, while those with little exposure stay almost clear and unaffected, resulting in a reversed, or negative image of the original scene. A stop-bath halts the action of the developer, while the fixer removes the unexposed silver and hardens the film. Once the film is dried, the resulting silver-based negatives can be placed in an enlarger and printed onto black-and-white paper, which contains a light-sensitive emulsion similar to the one on the film. Lots of light passes through the low-density areas of the negative, exposing those areas of the paper a lot. Dense areas in the negative block the light, creating light areas in the final print. Once exposed, the print is then processed in chemicals similar to those used for the film, washed and dried. Silver-based black-and-white films can range in ISO speeds from 25–3200. Most allow you to control contrast through a wide range by adjusting development times.

With chromogenic black-and-white films, the exposed silver-halide crystals are directly coupled to one or more monochromatic dye layers during processing in C-41 color-negative-film processing chemistry. During the bleach and fix, all the silver-halide crystals and the unused dye are removed. Once the film is dried, you can print the resulting dye-based negatives in home darkroom on black-and-white paper, color-negative paper, or specially designed chromogenic papers.

The biggest advantage of chromogenic black-and-white film is that you can send it to a one-hour processor and have it processed and printed right along with your color-negative film. Chromogenic films also have more latitude (leeway for exposure error) than conventional black-and-white films.

The biggest difference between the two types of black-and-white films is the grain pattern. Since there are no silver-halide crystals remaining with chromogenic film, you will have the same dye-cloud pattern that you see in color-negative prints. Chromogenic films have an ISO speed of 400, and are available from Ilford, Kodak and Konica

Color Slides

Color-slide film results in a finished image that can be directly viewed, printed, or projected as a positive image.

Underwater photography by existing light also requires faster films. Most UW work is done using flash, but near the surface, you can get great shots by ambient light.

Slide-film emulsions contain three light-sensitive layers: one sensitive to blue light, one to green and one to yellow. A yellow filter under the blue-sensitive layer keeps blue from penetrating to the green- and red-sensitive layers, which are also sensitive to blue light. After the silver halides in the layers are processed in the first developer, the reversal and color developer reverse the image and develop the coupled dyes into a positive image. Once that is completed, the bleach and fix remove all the silver-halide crystals and the unused dye from the film emulsion.

Slide films are commonly used for projection and publication, and can be printed on special reversal color printing paper or scanned directly into your computer. The advantage of slide film is its ability to show detail throughout a greater range of densities than prints are able to show, and the fact that it gives you what you shot—there's no printing step in which colors may be undesirably altered). Slide film features ISO speeds that can range from ISO 50-1600.

Color-Negative Film

Color-negative film (also known as color-print film, because the negatives are generally printed for viewing) is the most popular film type among amateur photographers (and also with pro portrait and wedding photographers), with a 95% share of the photographic pie. The reason for its popularity is that color-negative film has a very wide exposure latitude, produces great prints, and offers a wide assortment of emulsion choices.

Like slide films, color-negative films have three emulsion layers, sensitive to blue, green and red, respectively (some print films have a fourth, cyan-sensitive, emulsion layer to provide better color accuracy under difficult lighting, such as fluorescents and mixed light sources). During processing, the exposed filtered layers are directly coupled to the cyan, magenta, and yellow color dyes, but without the reversal step necessary with slide films. During the final processing steps, all silver halide and any unused dyes are removed. The remaining film has an orange mask and consists of negative colors. When the images are printed on color-print paper, any cyan in the negative prints red, magenta prints green, and yellow prints blue.

Color Negative ISO film speeds range from ISO 50 to 1600 (until a few years ago, there were ISO 25 and 3200 color-print films, too). The grain structure is a little larger than comparable slide films, but the overall image quality is much the same.

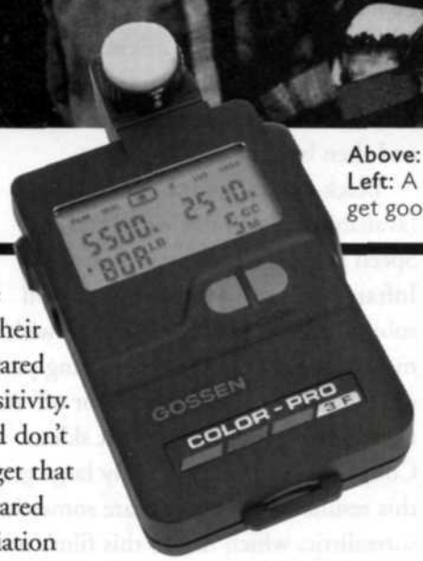
Infrared Films

Infrared films can be found in both the slide and black-and-white groups but really need to be considered separately. They have their own set of special problems, especially when it comes to exposure. Each of these films is given a suggested film speed, but since the camera meter is not designed to meter infrared, your metered exposure calculations may not be accurate. Your best bet is to start with the meter reading for that ISO film and then bracket your exposure.

Black-and-white infrared film (available from Kodak as HIE High Speed Infrared, and from Konica as Infrared 750nm) records chlorophyll subjects like healthy green plants with more exposure than the remaining part of the scene. The result is white or off-white trees and grass with very dark skies. Coupled with the film's fairly large grain, this results in photos that are somewhat surrealistic, which makes this film's use mainly creative.

Kodak's Ektachrome Infrared EIR is a color slide film in which the blue-sensitive top layer has been replaced with an infrared-sensitive layer; thus the film gives false color renditions with chlorophyll-rich objects turning red to magenta, and skies turning green to black. The results are not always predictable, so it will require some experimentation and lots of exposure bracketing. EIR can be processed in standard E-6 chemicals as slides, or cross processed in standard C-41 chemicals as color negatives.

Infrared films must be loaded into the camera and unloaded in total darkness,



Above: Photojournalists prefer negative films for their great latitude (or shoot digitally, these days). **Left:** A color-temperature meter measures the color of the light, and tells you what filter(s) to use to get good color with daylight- and tungsten-balanced color films.

due to their infrared sensitivity. And don't forget that infrared radiation doesn't focus the same as visible radiation (light), so use the infrared focus settings on your camera lens. If your lens doesn't show the settings, you will have to experiment and can shift the focus slightly towards a closer point.

Film Speeds

When choosing a film, one of the most important considerations is the film-speed rating or ISO (for International Standards Organization). This number rating will tell you just how sensitive the film is to light. The higher the number, the more sensitive it is. Today's 35mm cameras will automatically read and set the film speed when you load a DX-coded film cassette (all commonly used films today have DX coding). Some current cameras also let you set an ISO speed manually should you wish to rate a film at a different speed. With older non-DX cameras, you must set the film speed manually.

Low ISO ratings, like ISO 100, indicate that the film has very small silver-halide crystals that take a considerable amount of light to achieve an accurate exposure. On the other end of the scale, ISO 3200 films have very large silver-halide crystals and only require a small amount of light to expose them.

The question of which ISO film speed to choose is a balancing act for all photographers alike. When the sun is very bright and the action is controlled, you can use one of the low ISO films and achieve excellent image quality. As the light level drops or the action increases, you will have to use a faster film so you can use fast enough shutter speeds. The thing to keep in mind is that the grain in the final image increases with film speed.

Fortunately, film manufacturers have been working hard to minimize this problem. Today the lower ISO films are virtually without grain and ISO 400-1600 films have as fine grain as the previous versions of ISO 200 films. Your film choice will depend on your subject matter, shooting conditions and personal preference. For best results, you will want to use the lowest ISO film possible for the given shooting conditions. If you find yourself in a situation where the light level changes from minute to minute, you may have to compromise and load a film from the middle of the rating scale, like ISO 400.

Grain

One of the methods used for comparing one film to another is a grain structure system called RMS. You will find the RMS granularity number located on the film data sheet. The smaller the number, the finer the grain pattern, and

Slower films provide fine grain and great detail, when the light level permits their use. A tripod can be used to steady the camera at slower shutter speeds.

the opposite applies to the larger RMS numbers. When comparing RMS numbers, make sure that you are comparing slide films only to other slide films, and negative films only to other negative films for an accurate comparison of graininess.

To visually compare what a grain pattern looks like for specific films, look in either the blue sky or an out-of-focus area. This is where grain is most apparent, and should provide a good comparison from one film type to the next.

Latitude

When you hear the term film latitude, it refers to just how much you can be off from the correct exposure with a specific film and still achieve an acceptable image. The least forgiving of the three film groups is slide film, because what you shoot is what you get. If your exposure is off by even ½ stop, you'll see it in the resulting image. Most slide shooters who want to insure that they get the shot will use a camera's automatic exposure bracketing (AEB) system, or manually bracket the exposure. This will often require that they run a test roll using various bracket options to find the best settings. Just how much you bracket your exposures will depend on how confident you are of your system, and just how badly you want the shot.

Both black-and-white and color negative films have very wide exposure latitudes. Some may be as wide as seven stops (three or four stops of overexposure, two or three stops of underexposure), and most will have at least five stops of usable exposure. If you assume that your camera's automatic exposure system can get you within a couple of f-stops of norm, you should never miss a shot because of exposure with these films. Overexposed images become more contrasty, have higher color saturation, and show a very slight increase in grain. Underexposures become very flat with low color saturation, and the grain will definitely increase.

The bottom line is that when you're not sure, lean towards overexposure with negative film, and slightly toward underexposure with slide film.

Color Temperature

One of the major differences between the human eye and film is the way they see color. The human brain has an incredible white-balancing system that can efficiently color correct almost any scene. Color film, on the other hand, is locked into one color temperature, and will exhibit extreme color shifts when exposed under alternate lighting. Fortunately, most lighting situations are balanced at around 5500–5600 Kelvin color temperature, which encompasses sunlight and flash images. Since most color films are balanced for daylight, most of the problems are solved.

If you do find yourself photographing under tungsten lighting (around 3200 K), you can use one of the few color films balanced for tungsten. The other option is to use a color conversion filter specifically designed for this task. Fluorescent lighting is the most difficult to work with since tubes can emit more than 40 different color temperatures, but they all range in the greenish area.

Another color-temperature problem occurs when the camera ventures into the deep shade. This will increase the color temperature to as high as 10,000 K, so again filtration is the solution. You can use one of the 81-series warming filters. They range from 81A to 81EF and get gradually stronger as the letters increase. Since the color temperature will vary as you go deeper into the shade, you will have to experiment with the different filters and your film to get an exact color temperature match.

If you find yourself constantly working in a variety of situations with changing color temperatures, you should consider getting yourself a color-temperature meter. It works like a hand-held light meter, except that it will tell you what the color temperature is and what filter(s) you should use with your film choice.

Color slide film is the most susceptible to color-temperature shifts, and can be corrected with a color

compensating (CC) filter. Most of these CC filters come in acetate gel form in small color increments so you fine-tune your correction. They can easily be mounted to the front of your camera lens with a filter holder.

If you still get a shift in your processed film, you can still save the image. Many film images today are being converted to digital, so you can scan the off-color image into your computer, and then use color-balancing tools in the image editor to fix the problem.

Color-negative film is another story. Since the negative is not the final product, you still have the option of making a color correction when color printing, or in a film scanner, if you are bringing the image into your computer system. You can shoot in both tungsten and fluorescent lighting, and correct the color after the fact. We have found though, that if you do have the filters, use them, as it will be easier to color-balance your final prints.

Black-and-white film is not really a problem, but will exhibit some loss of detail when photographing under certain color temperatures. For that reason, manufacturers have created a couple of tungsten black-and-white films to provide better tonal response under tungsten lighting.

Black-and-white infrared film turns healthy foliage white and skies black when exposed through a red No. 25 filter. The film must be handled in total darkness, including loading and unloading the camera.

Color Contrast/Saturation

In order to give photographers more control with their films, manufacturers have started to offer films with varying contrast and color-saturation levels. Most of the films with lower contrast and saturation values are targeted toward the portrait market where subtle flesh tones and pastel colors are the key to a pleasing image. Films with higher contrast and saturation are created for fashion, advertising, and other creative applications where images go beyond the norm. Most of these films are in the ISO 160 to 400 range and generally are not designed for push-processing unless looking to achieve additional creative effects.

Pushing

One method for getting a higher film speed out of a specific emulsion is with a processing technique called pushing. This is done by increasing the developer time beyond the recommendation of the film manufacturer. As you increase the speed, the effective sensitivity, grain structure, and contrast all increase. Black-and-white and color-slide films easily push using this method, but often require some testing to accurately determine the proper processing time for the increase in effective speed.

Color-negative film does not push very well, as the color mask also increases in density and eventually it makes the negative unprintable. You can cross-process your color-negative film in E-6 chemistry and vice-versa to increase speed. From more on cross-processing, see our article in the May 2003 issue of *PHOTOgraphic* Magazine.

Exposure

No matter what film you decide to use, your best images will occur when you have a good exposure. That may sound like a simple task considering the automatic exposure features of today's cameras, and film's wide exposure latitude. It isn't always just a simple chore, though, as several factors come into play when trying to achieve an accurate exposure.

If you remember back to Photography 101, you learned that a good exposure is a successful combination of shutter speed, f-stop and film speed. The shutter speed controls the amount of time that light strikes the film, while the aperture controls the quantity of the light coming through the lens. Since the film speed is set when you load the film into the camera, the final exposure will be determined by how well you balance the shutter speed and f-stop.

If you like full automation, which enables you to point and shoot, then the program (P) mode on your camera will be your best bet. In this mode, the camera will pick a suitable shutter speed to enable a sharp image, even when the camera is hand-held, and the

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Right: Slow color-slide films (color image reproduced here in black-and-white) are popular with outdoor photographers, for their colors and great image quality.

Below: Chromogenic black-and-white films produce negatives, just like conventional black-and-white films. But they're processed in C-41 color-print-film chemicals, and consist of dyes.

corresponding f-stop needed for a correct exposure.

If depth of field is your prime concern, then you should select the aperture-priority (A or Av) mode, so that you can set a specific f-stop to best fit your photo situation. The shutter speed will then shift to a combination that maintains a good exposure. As you adjust your f-stop, care must be taken to watch the shutter speed so that it does not get so low that you get camera movement.

When the action become high, the shutter-priority (S or Tv) mode will allow you to select the best shutter speed to stop the action. The camera will then compute and set the corresponding f-stop to achieve a correct exposure. When the light level starts to drop, make sure you closely monitor the camera as it may require a wider f-stop setting than you have on your lens, and thus create an underexposure.

For those who love to control the situation, there is the old reliable manual (M) mode. When you use manual, you will see the correct setting inside the viewfinder on a +/– bar graph. It will then be up to you to balance both the shutter speed and f-stop to match the exposure value determined by the camera metering system (or by a hand-held meter, if you prefer that method).

Reciprocity

Another term you may see on a film technical sheet is reciprocity compensation. Remember that we said that obtaining a good exposure is a balance of film speed, shutter speed, and f-stop. Well, that concept starts to fall apart when the shutter speed becomes very long or very short and causes reciprocity failure. This is where the lengthened or shortened exposure results in a loss of film speed, causing underexposures.

Often photographers have reciprocity failure and don't even know it. For example, macro nature photographers using flash may find that they keep getting underexposures, so they may blame it on the flash or the film. In truth, most flash units have very short flash durations when held close to the subject, which results in reciprocity failure and a loss of film speed.

Not to worry as the solution is easy. Just add exposure back into the image using the exposure-compensation dial on the camera. Be sure to remember and set it back when you go back to capturing normal scenes.

With most films the speed loss is minimal at shutter speeds from one second to 1/1000, and generally will not be more than one stop. Exposures up to 10 seconds can result in as much as a full stop loss in film speed. Points beyond that are very unpredictable, and no amount of metering and exposure charts can tell you the exact correction.

Black-and-white and color-negative film users need not to worry, as they can increase the exposure by 1–2 stops and let the latitude of the film cover any variations. Slide shooters will have to make several bracketed exposures toward the overexposure area to get the best results. Slide-film users have an additional problem of slight color shifts when using very long exposures. For more on reciprocity failure, see our article in the January 2003 issue of *PHOTOgraphic* Magazine.

The Digital Factor

Just a few years ago, whatever you shot on negative or slide film was the final image. Now you can import your images into the computer via a film scanner and make further corrections. Today many film scanners have the Digital ICE technology from Applied Science Fiction, which can remove scratches (Digital ICE), correct color shifts due to fading (Digital ROC), and even reduce the appearance of grain (Digital GEM).

There are sophisticated image-editing programs like Adobe Photoshop that enable you to color-correct and modify your images. Additionally, there are Photoshop plug-in filters that can help you further enhance your images by removing imperfections, minimizing lens distortion or simplifying creative effects. ■