SPECIAL SECTION: CLOSE-Up Photography

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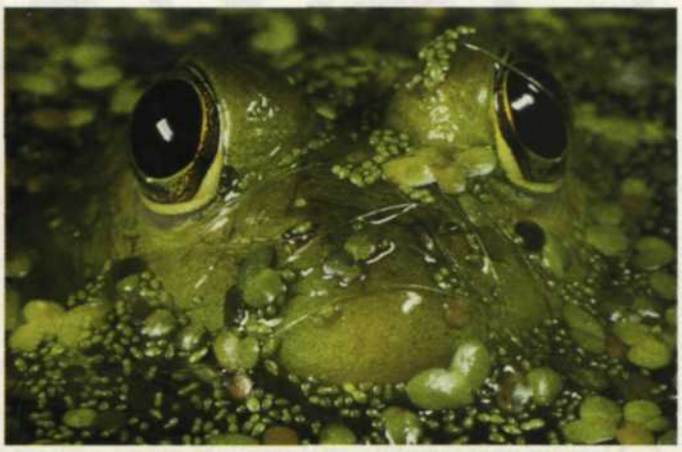

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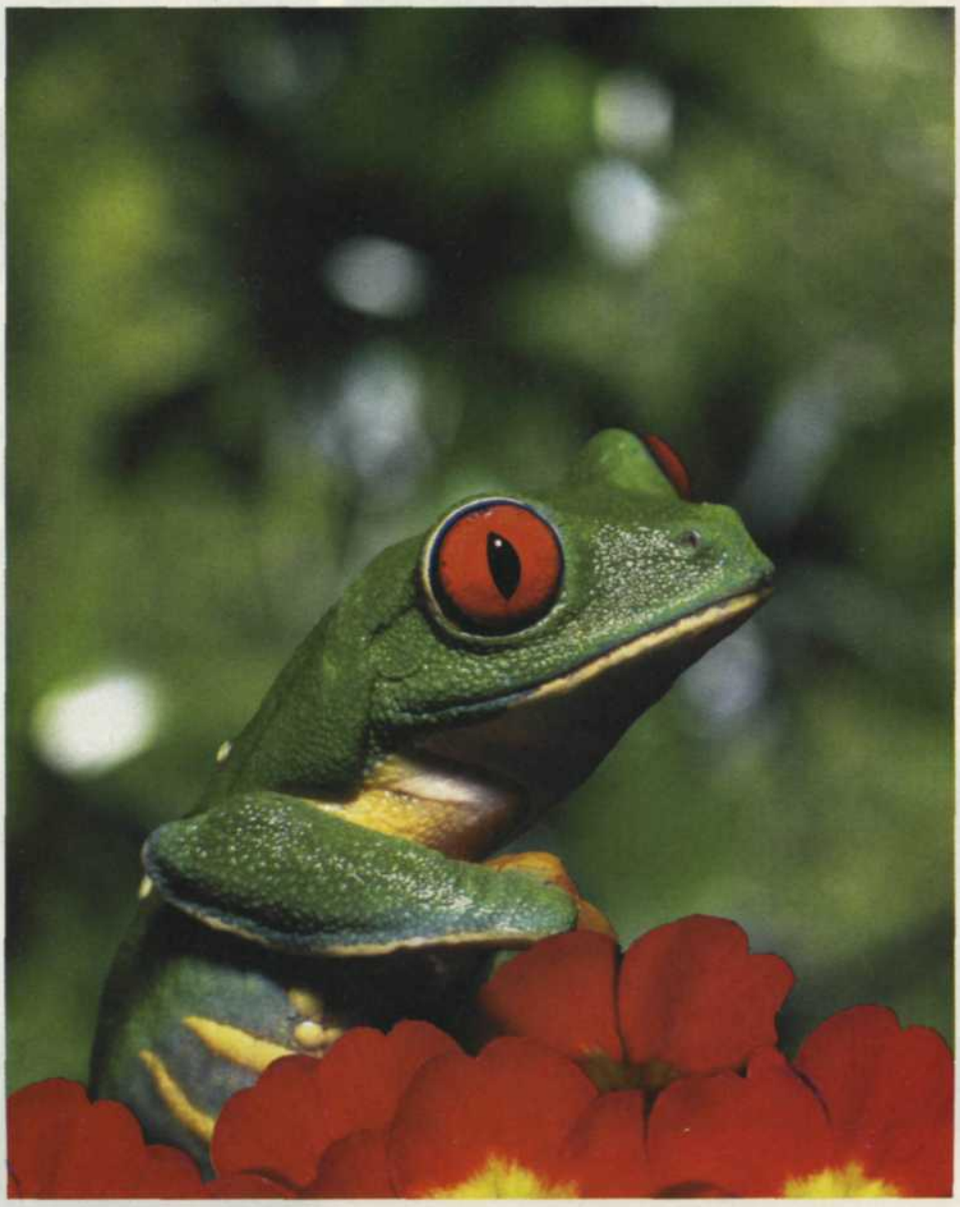
How to Get Close

The tools of the trade

by the Editors

Close-up photography—shooting subjects from closer than is possible with normal camera lenses—is a fascinating segment of the field. It lets you explore new worlds, and create exciting photos. You can zero-in on a small portion of a large subject to create an interesting abstract image, or fill the frame with a tiny subject. Either way, close-up photography enables you to produce images that you can't see with your unaided eye. The two accompanying articles will give you some great subject ideas. This section will introduce you to the equipment options available to help you get closer with your camera, then show you some ways to make better close-up photos once you do.

By definition, close-up photography does require some special equipment. But this equipment isn't necessarily costly. There are a number of ways to get closer: close-up lenses, extension tubes, bellows units, macro lenses and more.



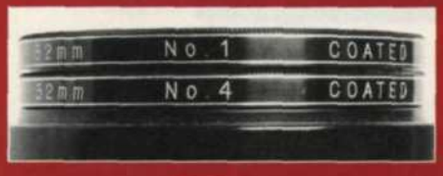
Right: Jim Zuckerman took advantage of the close-focusing capabilities of the built-in bellows of his Mamiya RZ67 and a 110mm normal lens to capture this red-eye tree frog and the flowers in separate shots, then combined them in Photoshop.

Close-Up Lenses

The simplest and least-expensive way to get your camera lens to focus closer than its normal minimum focusing distance is to attach a close-up lens. Close-up lenses are plus-diopter elements similar to those used in eyeglasses to correct farsightedness, and just as the eyeglasses enable the eyes to focus on closer objects than they normally can, close-up lenses enable the camera lens to focus on closer objects than it normally can.

Close-up lenses screw into the front of the camera lens, just like filters. The strength of a close-up lens is expressed as a diopter number. The diopter number indicates how close your camera lens can focus with the close-up lens attached, in fractions of a meter. A +2 close-up lens will let you focus ½ meter away, a +3 close-up lens ⅓ meter away, and so on. These distances apply regardless of the focal length of the camera lens—a +4 close-up lens will let you focus ¼ meter away whether attached to a 50mm lens or a 200mm lens. Note: These focused distances are based on the

Left: Bellows units with special bellows lenses let you get **really** close to your subjects. Photo by Jack & Sue Drafahl.



Top left: Close-up lenses screw onto the front of the camera lens, just like filters. **Middle left:** A No. 1 close-up lens lets you focus one meter away, a No. 2, ½ meter away, and a No. 4, ¼ meter away, and so on. A No. 1 plus a No. 4 equal a No. 5, letting you focus ⅕ meter away. **Bottom left:** A split-field lens is a close-up lens cut in half.

camera lens being set at infinity. When the camera lens is focused closer than its infinity setting, the combination of camera lens and close-up lens will focus even closer.

You can buy close-up lenses individually or in handy sets that contain three lenses: +1, +2 and +3 or +4. To focus even closer, you can combine close-up lenses: a +1 and a +4 equal a +5 (you can focus ⅕ meter away). Always attach the higher-numbered close-up lens to the camera lens, and the lower-numbered close-up lens to the higher-numbered one for best results.

Naturally, the longer the focal length of the camera lens, the larger the image at a given camera-to-subject distance. A +2 close-up lens attached to a 200mm camera lens will produce a much greater magnification than the same +2 close-up lens attached to a 50mm camera lens.

While close-up lenses offer the advantages of simplicity, relatively low cost and no exposure compensation required, they also have a couple of limitations. First, close-up lenses won't take you much closer than life-size (1:1), and second, close-up lenses do produce some loss of image quality, especially around the edges. This loss of sharpness becomes greater as the strength of the close-up lens increases. For really serious close-up work, extension tubes and bellows are better choices. (Note: Stopping the camera lens down improves sharpness when using close-up lenses. And there are two-element close-up lenses that provide better image quality, especially with telephoto lenses.)

Spit-field lenses are close-up lenses cut in half, allowing you to focus on a very near subject (through the close-up lens half) and a distant one (through the empty half) simultaneously.

Extension Tubes

Extension tubes are just light-tight spacers that fit between the camera body and the lens. They contain no glass elements; they merely increase the distance between the optical center of the lens and the film, thus producing magnification of the image. Since they contain no glass elements, extension tubes don't degrade image quality as close-up lenses do. For greater extension (and thus, greater magnification), you can combine two or more extension tubes.

The lens attaches to the extension tube. The degree of magnification depends on the length of the extension tube relative to the focal length of the lens being used with it. When the extension tube is the same length as the focal length of the lens attached to it (for example, a 50mm extension tube with a 50mm lens), a life-size or 1:1 reproduction ratio will be reproduced: the image of the subject will appear life-size on the film. If the extension tube is longer than the focal length of the lens, greater-than-life-size magnification is achieved.

It follows that the shorter the focal length of the camera lens, the greater the magnification produced by a given extension tube. A 50mm extension tube with a 50mm lens yields a life-size image on the film; the 50mm tube with a 24mm lens yields a twice-life-size (2:1) image. The instruction manual that comes with the extension tubes contains tables that indicate what the magnification will be

Left: Close-up photography lets you turn everyday subjects into abstract art. Photo by Jack & Sue Drafahl.

Extension tubes are just precise spacers that fit between camera body and lens. They increase the distance between the optical center of the lens and the film plane, thus producing closer focusing and greater magnification.

with a given tube and various camera-lens focal lengths, but it's simple to calculate for yourself: Just divide the length of the extension tube by the focal length of the lens, and the result is the magnification produced by the combination (for example, a 50mm tube divided by a 200mm lens focal length equals a ¼-life-size "magnification").

When you increase the distance between the film and the optical center of the lens (as is the case when you are using extension tubes or the soon-to-be-discussed bellows units), you also reduce the amount of light transmitted to the film, because the diameter of the lens opening is smaller relative to the overall focal length of the lens/extension combination. Fortunately, your camera's built-in through-the-lens exposure meter will automatically compensate for this loss of light. But if you use a hand-held meter, you must remember to compensate for the loss of light caused by using the extension tube(s) or bellows. The formula to do this is fairly simple: f = FL/A, where f is the effective f-number of the lens/extension-tube combination, FL is the effective focal length of the combination and A is the diameter of the lens aperture. Here's an example: If you're using a 50mm extension tube with a 50mm camera lens set at f/8, FL = 100mm (50mm lens plus 50mm tube), and A = 6.25mm (50mm lens divided by the set f number of f/8). Therefore, f = 16 (100 divided by 6.25). This means that, when the 50mm lens is set at f/8 and attached to a 50mm extension tube, the effective f-stop of the combination if f/16—two stops smaller than f/8. So you must give the shot two stops of additional exposure to compensate for the light lost due to the extension. Aren't you glad that 35mm SLRs come with built-in TTL meters that compensate for this light loss automatically?

Some extension tubes and bellows are not "automatic." This means the linkage between the camera and lens that tells the built-in meter which aperture the lens is set at is disconnected. With nonautomatic extension tubes, you must use stopped-down metering, whereby you stop the lens down manually to the selected aperture, so the meter can read the light actually transmitted by the lens/extension-tube combination at that aperture. See your camera or extension-tube manual for specifics.

Aside from the light loss caused by the extension, the only drawback to extension tubes is that the lens won't focus out to infinity when using a tube—but, then, you aren't using extension tubes to shoot distant subjects; you're using them for close-up work. Note: The camera lens won't focus out to infinity when a close-up lens or bellows is attached, either.

The quality of images produced when using extension tubes is limited only by the sharpness of your lens.

Bellows

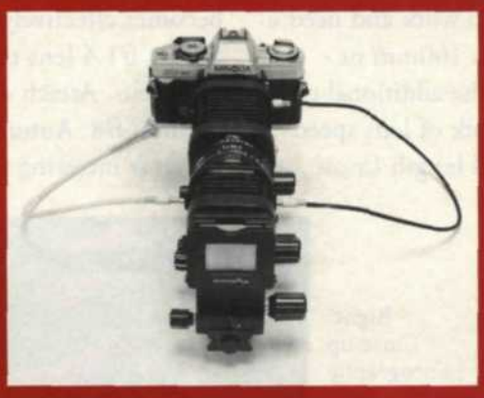
A bellows is, in effect, a flexible, variable-length extension

tube. It will provide magnifications up to about 4X life size on the film with a standard 50mm camera lens, and up to 25X life size with special bellows lens.

The camera body attaches to the bellows unit's rear standard. Some bellows permit the camera body to be rotated for easy vertical-format shots. The lens attaches to the bellows' front standard. With some bellows, a cable release connects the camera cable-release socket to the bellows cable-release socket as shown. A second cable release attaches to the bellows shutter-release button. When the button on this cable release is pressed, it causes the other cable release to fire the camera shutter.

The entire bellows assembly attaches to a focusing rail, which in turn attaches the assembly to a tripod. The knob on the focusing rail gradually moves the whole assembly forward or backward for minute control of focusing. The focusing rail is marked in millimeters so you can readily figure out how much extension is being used, and set the desired amount. Tables in the bellows instruction manual tell you how much extension to use to produce a given magnification with a given lens, and how much exposure compensation is necessary.

Some bellows have a rotating lens standard, so the lens can be reversed easily. Reversing the lens provides slightly greater magnification, and sharper results in close-up work.



Top: A bellows unit is in effect a flexible, variable-length extension tube. **Above:** A slide copier attaches to the bellows unit and permits not only copying slides, but adding special effects with filters.

Right: An extension tube equal in length to the focal length of the lens will result in a life-size image on the film. Photo by Jack & Sue Drafahl.

You can mount the bellows on the focusing rail sideways and use the focusing rail to move the camera to shoot several frames of a subject that is too large to cover in one shot, while retaining a precise magnification.

For extreme magnification, there are special bellows lenses. These have no focusing mounts of their own; they rely on physical movement toward or away from the subject for focusing. But in practice, so does any lens attached to a bellows. Bellows lenses are optimized for high-magnification work, and are a good choice for really serious macro shooters.

The main disadvantage of a bellows is the same as an extension tube's—loss of light due to the extension of the lens-to-film distance. As with extension tubes, a 35mm SLR's through-the-lens exposure meter will compensate for this. Also, the bellows instruction manual includes exposure-compensation tables for various magnifications.

Slide copiers attach to the bellows-mounted lens and permit not only copying slides, but cropping in on them and adding special effects with filters. Note: Simple self-contained slide-duplicators that attach directly to the camera are also available. These are less costly and less versatile than bellows slide copiers. Another very useful bellows accessory is the macro stand, which holds both bellows and subject in position for sharp, precise close-up images.

Macro Lenses

Macro lenses will focus much closer than standard lenses, and they're optically optimized for close shooting distances, so they produce great image quality in close-ups. Most macro lenses today will focus close enough to produce life-size (1:1) images on the film. Those that don't come with a short extension tube (a "life-size adapter") that enables them to do so.

The most commonly used macro lenses come in standard (50–60mm) and short tele (90–105mm) focal lengths. Longer macro lenses (180–200mm) will produce a given

magnification from farther away than a shorter macro lens will. A 180mm macro lens will produce a life-size image from 3.6X as far away as a 50mm macro lens—handy if your subject is a deadly snake or a skittish insect, and giving you more room to position your light source (if you're using artificial lighting). Nikon's 120mm f/4 IF Medical Nikkor is a 120mm 1:1 macro lens with a built-in ringlight flash unit for shadowless macrophotography. A specially designed close-up element provides focusing down to 2:1 (twice-life-size) magnification on the film.

Macro lenses are designed primarily for close-up work, and they produce excellent image quality at close focusing distances. But the image quality of today's macro lenses is excellent at normal shooting distances, too—and macro lenses are the only close-up devices that let you go from 1:1 to infinity focus. If you're interested in close-up work and need a telephoto lens as well, you should consider a 100mm or longer macro lens—it could be well worth the additional cost.

The disadvantages of macro lenses are lack of lens speed compared to nonmacro lenses of equal focal length (most have a maximum aperture of f/2.8, which is pretty slow for a 50–60mm lens), added weight and higher cost.

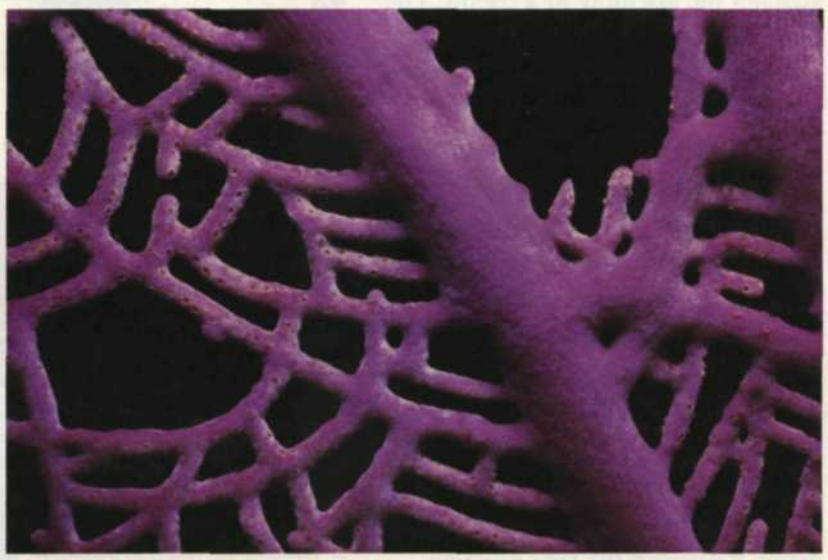
Many zoom lenses are touted as being "macro." Most really aren't—they'll focus only close enough to produce ¼- or ⅓-life-size images on the film. But there are a few that come close to true macro, including Nikon's AF Zoom-Micro Nikkor 70–180mm f/4.5–5.6D ED, which focuses down to 1:1.32 (3/4 life-size), and Sigma's 70–210mm f/3.5–4.5 APO Zoom Macro, which provides a 1:2 (half-life-size) image size at its macro setting.

Tele-Converters

The tele-converter (a.k.a. tele-extender) is a handy device that mounts between the camera body and lens and increases the effective focal length of the lens. If you attach a 2X tele-converter to a 50mm lens, you'll have a 100mm lens; attach a 200mm lens to the converter and you'll get a 400mm lens. The most popular converter strengths are 1.4X and 2X.

Most major-brand tele-converters produce good results. There is a slight loss of image quality, but not a lot. Some manufacturers offer matched tele-converters, made specifically for use with a particular lens (or a specific focal-length range). These can produce even better photographic results than general-purpose converters.

The main drawback of tele-converters is they cause a loss of lens speed. When you attach a 2X tele-converter, the lens becomes effectively two stops slower. For example, attach a 50mm f/1.4 lens to a 2X converter, and you've got a 100mm f/2.8 lens. Attach a 200mm f/4 lens, and it becomes a 400mm f/8. Automatic converters that connect to the the camera's metering system will automatically compensate for



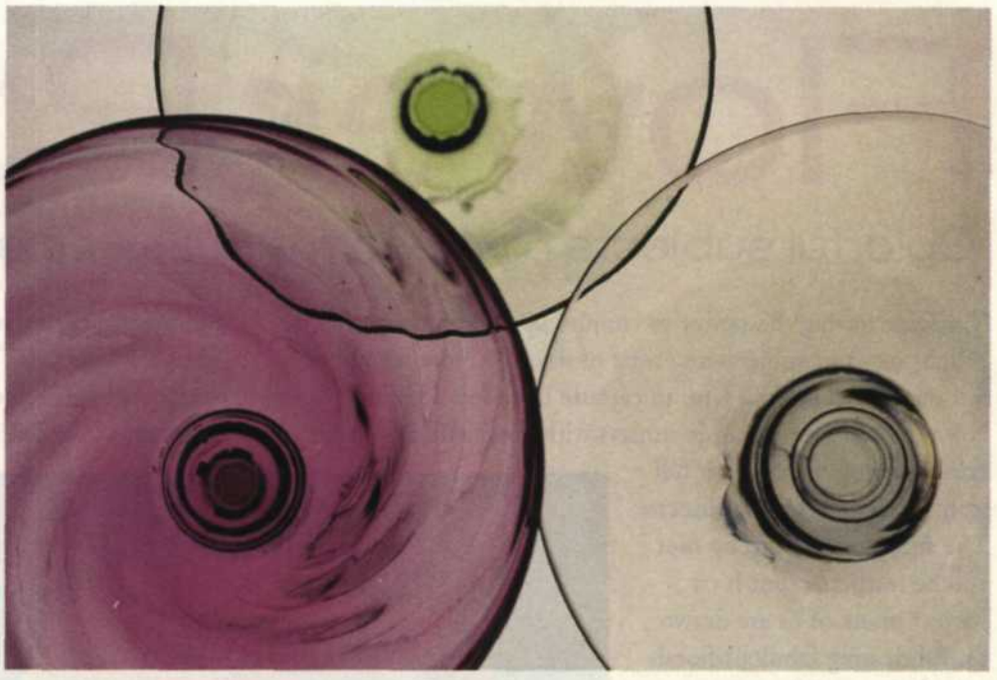
Right: Close-up photography is very popular with underwater photographers. Electronic flash provides an ideal light source. Photo by Jack & Sue Drafahl.

Reversing Rings

The lens-reversing ring has a camera-body mount on one side and a threaded ring into which the front of the camera lens screws on the other. The reversing ring attaches to the camera, extension tube or bellows, just like a lens. The front of the camera lens screws into the reversing ring.

Why use the lens reversed? Because standard (nonmacro) lenses are optically optimized for normal shooting distances, they produce somewhat below-optimum image quality at close-up distances—particularly edge softness due to curvature of field, as shown here. Reversing the lens produces better results for close-up work, and greater magnification with normal and wide-angle lenses.

Top left: Few zoom lenses touted as "macro" really are. One that is is this AF Zoom *Micro-Nikkor ED 70–180mm f/4.5–5.6, which focuses down to greater than half life size.*
Center: Macro lenses focus much closer than standard lenses of equal focal length. Longer ones, such as this Pentax SMCP-FA Macro 200mm f/4 ED[IF], produce a life-size magnification from farther away than a shorter macro lens, handy when photographing skittish subjects.
Right: Ringlight flash units that encircle the lens are popular close-up light sources.



Right: Here's another of a close-up abstract of common subjects (wine-glass bases shot looking straight down). Photo by Mary McGrath.

this loss of light transmission when the camera's through-the-lens metering is used. With other converters, you must meter in the stopped-down mode. When using a separate hand-held meter and a 2X tele-converter, set the lens to an aperture two stops larger than the meter reading calls for: If the meter calls for f/11, set the lens aperture ring to f/5.6 (or increase exposure two stops by slowing the shutter speed).

Another nice thing about tele-converters—and the reason they are included here—is that the lens's minimum focusing distance remains the same when a converter is used. If you have a 300mm lens that focuses down to 8.5 feet, it becomes a 600mm lens that focuses down to 4.5 feet when attached to a 2X tele-converter. Because of this, you can get some great close-up images by using a tele-converter.

A tele-converter mounts between the camera body and lens, and increases the lens's effective focal length. This Kenko 2X Teleplus converter works with Canon EOS AF SLRs, providing a 2X increase in focal length while maintaining the lens's original minimum focusing distance.

Close-Up Shooting Tips

Moving in close magnifies everything—the image, and the effects of camera and subject movement. To minimize camera movement, it's a good idea to attach the camera to a sturdy tripod for close-up work.

Trip the shutter with a cable release (or the camera's self-timer, if precise timing of the moment of exposure isn't essential)—the mere act of pushing the shutter button with your finger can introduce enough camera movement to reduce sharpness.

If your camera has a mirror prelock, use it to lock the mirror in the up position before shooting—the vibration caused by the mirror flipping up out of the way when the shutter is tripped can shake the camera enough to reduce image quality when working at high magnifications, especially at shutter speeds in the one second to 1/30 range. Note: You won't be able to see through the viewfinder with the mirror lock up, but for most close-up work, you'll have your composition locked in with the tripod before you make the exposure, so that won't matter.

To minimize blur due to subject movement, use the fastest shutter speed the light level will permit.

Depth of field is extremely limited at close-up shooting distances, so you'll generally want to shoot at the smallest aperture possible to maximize it.

Of course, short shutter speeds require larger apertures, and vice versa. One answer is fast film—today's ISO 400 films are by and large excellent.

If there's a breeze, you can use a sheet of poster board to shield your subject from it. White poster board makes a good reflector. Don't use colored poster board, or the board's color will reflect onto the subject. Dark poster board can be used to block harsh sunlight from the subject.

If you want to use slower, finer-grain (and richer-color) films, there is a way around the fast shutter speed/small lens aperture dilemma: electronic flash. Used at close range, a simple electronic flash unit provides enough light to permit stopping the lens way down to maximize depth of field, while its brief flash duration minimizes the effects of camera and subject movement. An off-camera sync cord lets you move the flash unit off the camera's hot-shoe for more lighting flexibility.

A ringlight flash literally surrounds the lens with light, providing soft, even, shadowless lighting on the subject when such lighting is desired. Some incorporate focusing lamps, and multiple flash tubes, which can be switched on or off individually for creative shadow control.

When using extension tubes or bellows, you'll find the image in the viewfinder quite dark because of the extension. To make focusing easier, don't use the central split-image—it will black out. Instead, use the plain groundglass area of the viewfinder. You might carry a small flashlight to help illuminate your subjects for easier focusing. ■