CLOSE-UP AND MACRO PHOTOGRAPHY

PRESENTED BY:
MINNESOTA NATURE PHOTOGRAPHY CLUB

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This copy was scanned from an original 1997 document, converted to text with OCR software and processed in MS Word to mirror the original as much as possible. The document was authored by Brian Loflin who also developed and coordinated the multi-session, multi-presenter workshop on the subject held at the Minnesota Valley National Wildlife Refuge Visitor Center. This document was the primary hand-out at the workshop. Many sessions, such as wildflower photography, covered material not included here. Also, this was written before the popular use of digital cameras but still contains much useful information.

Information about the Minnesota Nature Photography Club is available at:
http://www.minnesotanature.org/

Ron Cleveland - June 15, 2005

MEMBER CLUB OF TWIN CITIES AREA CAMERA CLUB COUNCIL
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FUNDAMENTALS OF CLOSE-UP PHOTOGRAPHY

Through close-up photography we can see how a drop of water splashes or the fantastic structures of veins in a leaf. Close-ups give a magnified and intensified view of our world. We experience a land of magic when we see a spectacular close-up photograph of something shown in far greater detail than our eyes would have noticed. When the camera moves in to give it more impact, we see the subject of that image in a new way.

Taking close-up photographs is even more exciting than viewing them. The photographer who begins to isolate details through close-up photography leams a whole new way of "seeing." He leams to study the details and parts of what we habitually see as total objects. He leams to look about him with eyes sharpened to the possibilities of imagery in a magnified world.

Taking close-ups today can be as simple as finding a subject, bringing a macro lens into sharp focus, and pressing the shutter release. Specialized equipment is available, but not always necessary. Many of the simpler cameras on the market offer close focusing, though not to the extremes possible with more sophisticated equipment, of course. Very few people are aware of how close they can actually focus with their cameras. In actuality, even instant and fixed-lens cameras often will move in to approximately a foot or two and give a large image size that is a "close-up" in terms of this equipment.

Before you decide to invest in special equipment, look at the camera you've got, and try to bring it to its point of closest focus. Your results could be just what you had hoped for. More is plenty of room in photography for you to determine what is a close-up in terms of your equipment.

Whatever your equipment choice, you can easily produce stunning close-ups in the environment around you. Once you've gotten your choice of close-up equipment, it is just a matter of learning to "see" close-ups in a photographic way.

BASIC CONCEPTS OF CLOSE-UP PHOTOGRAPHY

Taking close-up photographs is easy, but before you start there are some basic concepts that will help you take successful pictures.

Magnification

In basic terms, close-up photography refers to being able to focus on subjects that are very close to the lens. Physical proximity results in magnification, of course, since the closer your camera gets to something the more it fills the 35mm frame. You can think in terms of ratios: If the image of the subject on film is exactly the same size as the subject itself, then the ratio is 1:1. This “one to one” relationship is commonly described as “life-size” and often stipulated as “IX”. A ratio of 1:2 means that the image on film is half the size of the actual subject, and this is defined as “0.5X. Normal close-up photography covers the range from 0.1X to IX, or 1/10 life-size to full life-size. When the image on film becomes larger than the actual size of the subject, the term “high-magnification photography” is used.

Lens Focal Length

To a certain extent, lens focal length determines magnification. A subject photographed from the same distance with a 100mm lens will produce an image which is twice as large as that produced by a 50mm lens. Move up to a 200mm lens and the image becomes four times as large. You might think that all you need to do in order to shoot close-ups is use a telephoto lens. Unfortunately, the longer the focal length, the farther away the minimum focusing distance becomes. For example, the closest focusing distance of a typical 50mm f7l.8 is 0.45m/1.5 ft. while that of a 200mm f71.8L is 2.5m/8.2 ft. Thus, in terms of doing close-up photography, the 4X gain in magnification offered by the telephoto lens is erased by the loss of minimum focusing distance.

Aperture and f-stop

Aperture, in the context of 35mm SLR photography, is the adjustable lens opening through which light passes on its way to the film. The size of the aperture opening is expressed in f-stops. The “f numbers tell us the size of the aperture relative to the focal length of the lens. You do not have to stop at the common f numbers. You may stop your “f at any place permitted by your lens. Usng a 100mm lens as an example, the following list shows the common f-stops and how they relate to the size of the aperture.

f-stop	**1/f x focal length**		**=**	**Actual size of aperture in millimeters**
1.4	1/1.4	x 100mm	=	71.43mm - wide open, lots of light allowed
2	1/2	x 100mm	=	50.00mm
2.8	1/2.8	x 100mm	=	35.71mm
4	1/4	x 100mm	=	25.00mm
5.6	1/5.6	x 100mm	=	17.86mm
8	1/8	x 100mm	=	12.50mm
11	1/11	x 100mm	=	9.09mm
16	1/16	x 100mm	=	6.25mm
22	1/22	x 100mm	=	4.55mm
32	1/32	x 100mm	=	3.13mm stopped way down, little light allowed

Point of Closest Focus
Any lens has a range of distance at which it can register a subject in sharp focus. This is usually engraved on the lens barrel. The shortest camera-to-subject distance that will render the subject sharp is the point of closest focus for that particular lens.

Lens-to-Film Plane Distance
If you move a lens further from the film plane with the use of an accessory such as an extension tube, you will produce a larger image of the subject on the film.

Magnification
Lenses can, at their point of closest focus, render a subject on film from about 1/10 life-size (standard 55mm lens) to 1/2 life-size (55mm macro lens) to life-size (55mm macro lens with an extension tube). The difference, then, between standard lenses and macro lenses is the ratio in which they represent the actual size of a subject on film. If you have been thinking that close-up photography is confined to special lenses and accessories, you might consider this: When you are using an interchangeable lens camera, such as a 35mm SLR, it is fairly safe to assume that any lens you own can be used-with a little help-in a way that will produce larger images on the film than it is primarily designed to do.

Definition of Close-up
Though the word "close-up" is generally used in a rather open-ended fashion, there are more precise guidelines for the serious photographer. For our purpose here, close-up is defined as the range of 1/10 up to 1/2 life-size, or image ratios of 1:10 to 1:2. A close-up made at the closest focusing point of a standard lens or with a macro lens can fall in this category. At times in this text you will find the term "medium close-up" used to refer to a subject falling midway in this range. Close-up, in general terms, implies that you literally work close to your subject. The lens may be only inches or feet from your subject.

Extreme close-up
The subject is recorded on the film from half to full life-size. The majority of close-up images taken in nature studies are one half to full life-size pictures of the subjects, which means that their image ratios fall between 1:2 (half life-size) and 1:1 (life-size).

Macro
Technically, this means rendering an image on film at life-size (1:1) or larger than the actual subject. However, most macro lenses achieve an image of at most half to full life-size, which means their product falls in the previous category.

Photomacrography
A specialized area of close-up work that means making images that are larger than the actual subject on film, from more than life-size up to about 35 times life-size.

Photomicrography.
Close-up work using a microscope, with very large magnifications of the actual subject on film.

DEPTH OF FIELD IN CLOSE-UP PHOTOGRAPHY

Depth of field, or the zone of sharp focus in the photograph, is minimal for the close-up photographer. For example, if you took a picture of a flower garden with a 55mm lens and you were about 10 feet (305 cm) away from the flowers, all the plants falling into a zone about 3 feet (91 cm) deep would be m sharp focus. But, if you added an extension tube to the same lens and moved in to take a life-size picture of just one flower in the garden, at a distance of about 2 inches (5 cm) from the flower, the depth of field would be a zone only about 1/16 inch (. 16 cm) deep even at f716; it could be only about 1/64 inch (. 04 cm) at *f/4.* This means that understanding and working with limited depth of field is one of the greatest challenges in close-up photography.

Depth of Field
Depth of field refers to how much of the subject from front to back is acceptably sharp. This is also called the "zone of focus". Depth of field decreases rapidly as subject magnification or aperture size increases. Conversely, stopping down the aperture and reducing the magnification increases depth of field. Thus, with any lens there is far more depth of field at f716 than there is at f72.8. Learning how to control depth of field through the balance of magnification and aperture value is a very important part of close-up photography.

Factors Affecting Depth of Field

Focal length of the lens
The apparent depth of field is inversely proportional to the focal length of the lens. The smaller the focal length number of the lens, the greater the depth of field appears. For example, a 28mm lens has the ability to render more of the picture in sharp focus than a 100mm lens because the wide-angle lens reduces the scale of the subject on the film.

Distance from the camera to the subject
Depth of field is directly proportional to distance. A subject at a greater distance will have greater depth of field than a close-up subject. Therefore, you need not worry as much about a distant subject being out of focus.

The size of the aperture or (f-stop)
While changing the aperture (f-stop) will not have a striking effect on the depth of field for a distant subject or a wide angle (short focal length) lens, it can make a great deal of difference in a close-up or a photo taken using a telephoto or zoom lens.

A wide aperture (smaller f-stop number) will result in a narrow depth of field. You can use this to keep either the foreground or background out of focus while maintaining the subject in focus. When changing the aperture setting, adjust the shutter also to maintain the correct exposure.

No matter what method you use to make your close-up pictures, you'll find that depth of field is very shallow. Since small lens openings increase depth of field, it's a good idea to use the smallest lens opening that the lighting conditions will allow. For optical as well as depth-of-field considerations, it's wise not to use lens openings larger than f78 with +1, +2, and +3 close-up lenses, or larger than f711 with more powerful lenses. You can compute depth of field for +1, +2, and +3 close-up lenses with the Depth-of-Field Computer in the KODAK Pocket Photo Guide.

Programmed-exposure cameras that have depth-of-field modes are useful in close-up worksince they will automatically give preference to small apertures. Similarly, auto-exposure cameras with an aperture- priority mode allow you to pick a small aperture to increase depth of field in close-ups.

For on-line DOF calculators and extended discussion of depth of field, see:

http://www.goldcanyon.com/photo/dof.html

http://fox.nstn.ca/~hmmerk/DOFR.html

http://www.dofmaster.com/

http://www.outsight.com/hyperfocal.html

COMPOSITION FOR CLOSE-UP PHOTOGRAPHY

Composition is a matter of organizing visual elements inside the image area of your negativeor slide so that they have the most pleasing visual effect. Though the subject areas of the real world isolated for close-up photography may be very small, composition is just as much a part of close-up picture-taking as in taking any other kind of photograph

These concepts, which photographers should employ when taking any kind of picture, are: balance, positive and negative space, horizon and the rule of thirds, motion and counter motion, and lines of strength.

FOCUSING TECHNIQUES IN CLOSE-UP PHOTOGRAPHY

You should bear in mind that using a lens attached to an extension tube or bellows generally precludes normal focusing procedures. You will need to physically move the camera toward or away from the subject to achieve focus. This can be awkward when the camera is on a tripod, since you also have to move the tripod. You can either move camera and tripod together or buy a tripod that offers a special focusing rail, which moves the camera and lens assembly toward or away from the subject without actuary having to move the tripod itself.

When a bellows system is used, the same problem arises and the same procedure of physically moving the assembly should be followed. There is an accessory you can buy that attaches to the extension track of the more elaborate bellows. This tool is a focusing rail and the bellows sits on top of it. Turning a knob moves the entire camera and bellows assembly in and out and allows for ease of continuous focusing.

When using an extension tube, the photographer must physically move the camera toward or away from the subject to achieve focus.

The term close-up in the context here refers to the product of any number of cameras, be they fixed-lens or interchangeable lens types. Naturally close-ups depend upon the closest point any lens is capable of focusing. Thus, if you have a 35mm fixed-lens camera, which has a closest focusing distance of, say, 3.5 feet (107 cm), it will render the size of a subject on film at most approximately 1/10 life-size (an image ratio of 1:10). This, then, is the close-up capability of that particular camera. With this in mind you should also remember that pictures shot at this focusing distance may differ from camera to camera and lens to lens.

If your camera is a 35mm SLR, then the same would apply to the so-called standard 50mm lens. However, since you are able to change the lenses on 35mm SLR cameras, you can remedy this by changing to a lens whose point of closest focus suits your concept of close-up. Where the camera is capable of using interchangeable lenses, then the close focusing ability of the camera is governed by the lens in use. Because of the opportunity to use macro lenses, a camera capable of taking different lenses is, without doubt, best for large magnification in close-up images, but you should not rule out using simpler equipment for pictures that are closer than those you ordinarily take.

When the close-focusing ability of any lens, fixed or interchangeable, is changed by the addition of a series of close-up lenses, such as a set of diopters on a fixed lens or any of the following options: diopters, a reversing ring, an extension tube, or bellows for interchangeable lenses, then the situation is drastically changed. These accessories provide much larger image size and therefore make any given lens focus "closer."

The following discussions will provide a basic understanding of all the possible ways there are to take close-ups and leave the specific choice of equipment and technique up to you.

CLOSE-UPS WITH INTERCHANGEABLE-LENS CAMERAS

Most people do not realize what a wonderfully versatile and simple camera a single lens reflex (SLR) is until they want to take pictures other than snapshots.

The 35mm single-lens-reflex camera has been called "the king of cameras" because of its incredible versatility and the number of different focal-length lenses available for it. Even the least expensive 35mm SLR has at its command lenses ranging from, say, super-wide-angle to wide-angle lenses, up through the standard 50mm optics to telephoto and super-telephoto lenses. Roughly, the range would be from about 7.5mm to 2000mm-quite an arsenal at the disposal of the 35mm SLR photographer.

Close-up work with almost any SLR is easy. The use of a macro lens, an extension tube, a bellows outfit, or diopters presents no problems with framing the image since on a SLR,, what you see in the focusing screen is what you get in the final shot. Also, most 35mm systems offer automatic exposure calculation, which makes close-up photography extremely simple with meter-coupled lenses.

Because the 35mm SLR camera is so versatile a picture-taking tool, many equipment options have been devised for taking close-ups with this kind of camera. The basic options are: the macro lens, extension tube, bellows unit, reversing ring, and diopters.

The choice of how you arrive at your close-up picture is entirely up to you. You will hear arguments from some photographers that one method or system is better than another, but each of these options works and one will suit you best.

Macro Lens

Simply stated, a macro lens is a lens specifically designed to focus closer than most lenses without special adapters such as diopters, extension tubes, reversing rings, or a bellows unit. The macro lens is constructed so that the lens barrel is capable of much longer extensions than a more conventional lens. If a normal 50mm lens will focus, from, say, 3 feet (91cm) to infinity, a 50mm macro lens will focus from several inches to infinity. Macro lenses are, by their nature and design, highly corrected for close-up photography and, naturally, cost a little more.

A true macro lens has an image ratio of 1:1. That is, a subject is reproduced on the film at Life-size. Many so-called macro lens features such as those often found on zoom lenses are not true macro. They are usually very close-focus settings: 1:4, 1:3, 1:2, etc.

A macro lens has its own extension tube built in; the lens barrel will allow you to focus down to a few inches and thus produce a correspondingly larger image on the film. Exactly how much larger? That depends upon the lens and the way the manufacturer designed it. Certainly most macro lenses will produce images of at least a 1:2 ratio, that is, about 1/2 life-size. Some will produce an image that is 1:1, which is life-size. For example, the butterfly you photograph at 1:1 will fill the frame on the film.

Macro lenses come in a number of focal lengths, generally 50mm, 100mm, and 200mm. The 50mm and 100mm macro lenses are the ones most commonly used. There are some special macro lenses that are designed solely to work on a bellows unit.

Why so many focal lengths? Because some photographers like to use a longer focal length lens to be able to "stand off" farther from a subject. The longer focal lengths permit you to get a bigger image than shorter focal length macro lenses. This is useful if the subject is shy or hostile, or if you need to use a supplemental fighting source such as flash.

As stated, some macro lenses will focus close enough to allow you a full 1:1 image ratio, that is, life-size. Some require a short extension tube to achieve 1:1. If the latter is the case, you will probably find that the macro lens you buy comes as a two-part kit: a lens and its extension tube. This is no ordinary extension tube. It is designed to couple to the lens and totally maintain any and all automatic features of the lens it is intended for. The extension tube may also be used with your other lenses, so you get a bonus when you buy a macro lens that comes as a set. However, not all macro lenses require an extension tube. It depends upon who makes the lens and the camera it is designed for. You may also use your macro lens with almost any extension tube and even on a bellows.

Diopters or Supplementary Lenses

If you can use most of your conventional lenses to take close-ups, why would you need a special macro lens? You don't, unless you are intent on getting even closer and achieving the very best definition not allow the lens to focus at its original infinity. In fact, in many ways it makes the lens on the camera somewhat shortsighted!

Diopters are single focus lenses that screw on the front of the camera lense like a filter. They come in a variety of powers (or diopters, from which the lens takes its name). The most widely used are +1, +2, +3, and sometimes +4. The higher the number, the more powerful theclose-up lens.

Diopters are relatively inexpensive, they are light and easy to carry, they work well, and they do not slow the lens down as do extension tubes and bellows units. For the most part they are highly corrected optically and do not change the image-making characteristics of the lens they are screwed in front of, except that they make it see a bigger, more magnified image.

CLOSE-UPS WITH SLR NON-MACRO LENSES

It has been stated that close-up photographs can be taken simply by bringing the lens on your camera to its point of closest focus. The following will explain how to take close-ups with any of the standard interchangeable lenses for a 35mm SLR.

Close Focus with Normal Lenses

The so-called normal lens for the 35mm SLR camera is usually around 50mm in focal length. This focal length is considered to roughly approximate the way our eyes perceive a scene. A 50mm lens will, depending upon its design and the manufacturer's specifications, usually focus as close as 2 1/2 or 3 1/2 feet (76-107cm). At 3 1/2 feet (107cm), for example, your close-up of a person would be a fairly tight head-and-shoulders picture. It is difficult to specify exactly how close any lens will focus because, as stated, every manufacturer has different ideas of how close a lens should focus.

Close Focus with Wide-Angle Lenses

Many photographers use a wide-angle lens incorrectly. They buy the lens to "get everythingin the picture," and of course, this is what a wide- or super-wide-angle lens will most certainly do. Pointing a wide-angle lens at a landscape will include everything the lens can see as determined by its angle of view horizontally and vertically. Of course, a wide-angle lens does this by reducing the image size of any and all objects in its field of view just as a telephoto and super-telephoto lens sees a narrower angle because it magnifies whatever it sees.

A second common misconception about a wide-angle lens is that it has greater depth of field for a given lens aperture than a longer or telephoto lens. Actually depth of field is a constant of any aperture irrespective of the focal length. fl6, for example, provides the same depth of field whether the lens is a 28mm wide-angle or a 300mm telephoto lens. If the focal length is short enough however, everything appears pin sharp from about 3 feet (91cm) through to infinity because the wide-angle lens reduces the scale of the subject on the film.

Consider a fish-eye lens (that peculiar, extremely wide-angle lens that produces a circular image on the film). It does not usually have a focusing ring. It is generally a true fixed-focus optic. Yet if you use a small enough aperture, you can almost place an object on its mushroom-shaped front element and have it and the rest of the scene quite sharp. It makes for some strange pictures, but it is still close-up photography and often, both funny andeffective. Take a close-up portrait of a friend this way and you will see what we mean!

Of course the fish-eye, be it the circular frame type or the full-frame fish-eye, is an extremely wide-angle lens that does not correct the bending of the lines of a subject at the edges of the frame. If you use the super-wide 17mm, it produces a well-corrected image of a non fish-eye type, but you can move it in very close and come away with some spectacular pictures. Choose a fairly small lens aperture and focus the lens as close as its barrel will allow. Now frame a flower, for example, in the foreground and maybe toward the bottom of the focusing screen, and you will find that the sharpness will sweep right back from, say, a few inches to infinity. The effect is striking and gives the picture high visual impact.

You can play this game with almost any wide-angle lens but as the focal length increases the effect decreases and so it is only really spectacular with very wide-angle optics. Much longer than about 24mm and the apparent depth of field simply will not stretch that far. It is not really a good idea to try sticking a wide-angle lens on an extension tube. There is just no point to it.

Close Focus with Telephoto Lenses

We have mentioned the various methods for making a lens get in closer than it is designed to do, but so far we have stayed in the area of about 17mm to 50mm in focal length. What may surprise you is that a lot oftelephoto and super-telephoto lenses are able to focus remarkably close even without extension tubes or other accessories. In fact, some of the super-telephotos like 500mm, 600mm, and 1000mm mirror (catadioptric) lenses often have lens barrels that will extend tremendously and produce high magnifications of relatively small subjects at a range of several feet. Indeed, it is a fact that the telephoto and super-telephoto lenses are more amenable than lenses of shorter focal length to the use of a short extension tube between them and the camera. Why? Because having a narrow angle of view they tend not to vignette; that is, the tube does not cut off the comers of the picture.

Let's say you have a 200mm or 300mm telephoto lens and you add a short extension tube behind it. What happens? Everything that happens when you move any lens farther away from the film plane than it is designed to work at. It won't focus at its old infinity and it will lose speed. But what it will do is allow you to shoot huge images of a small subject from a distance of several feet. It's a useful thing to know if you are trying to photograph a rattlesnake that's fully awake, for example. And of course, the longer the focal length of the lens you are using, the farther away you can stand, which is also handy if the subject is small and inaccessible. What you have in fact created when using a long lens at a short working distance is a low-powered microscope that can reach in from a considerable distance.

Close Focus with Zoom Lenses

Zooms are no different from single focal length lenses in what you can do with them for close-up work. They are handy because you can zoom and frame and crop the subject from one position, which is, to say the least, convenient. Many zooms have a so called "macro" mode, but few are truly macro in the sense of producing images at a ratio of 1:1 (life-size). So what you generally get in the so-called macro mode of a zoom lens is between a close-up and an extreme close-up.

Can you add an extension tube to a zoom lens? For the most part yes, although some zooms will perform poorly. You can even reverse some zooms with a reversing ring and of course you can use diopters over the front element as well. Again, this is a matter for experimentation because zoom lenses differ from type to type and from manufacturer to manufacturer.

CLOSE-UPS WITH FIXED-LENS CAMERAS

It is not that easy to use fixed-lens, rangefinder-type cameras for any close-up work other than for the closest point that the lens built into the camera can focus at. This varies, but is generally in the area of 2 1/2 to 3 1/2 feet (76-107cm).

You can, however, get some impressive close-up pictures with a fixed-lens camera and a set of diopters. You can make a fixed lens appear to focus a lot closer by adding a +1, +2, or even a +3 diopter in front of the working lens on the camera. Diopters are good options when you cannot change the lens on your camera.

If your camera is a fixed-lens type it is probably a rangefinder or zone-focusing type. The problem with rangefinders is that the viewfinder will not be seeing what the camera lens is seeing. By adding a diopter, you have changed the way the camera lens sees but not the way the viewfinder sees. The vertical displacement between the camera lens and the viewfinder with rangefinder cameras is called parallax, and you have to be aware of it or your picture will be framed correctly in the viewfinder but not in the actual lens or on the film.

There are some close-up kits made for this type of camera where a set of diopters comes with a special viewfinder attachment that corrects the problem. The simplest solution is to use a special device comprised of an arm with a frame on the end of it attached to the camera. The frame extends to the point where each lens should be focused according to the power of the diopter supplied with the kit. You put the frame over the object and what lies within it is what you get on the film-simple and quite efficient. Check with your local photo supplier for these kits. A more elaborate device is a viewfinder correction device, which is like a pair of spectacles that, when fitted over the viewfinder, bends the light rays to the viewfinder to accommodate the now shortsighted camera lens.

FILM FOR CLOSE-UP PHOTOGRAPHY

Which film is best for close-up photography? The short answer is that any film you use for any other type of photography may be used for close-up work. On the other hand, you may wish to resolve much finer detail m the subject especially if it is tiny and has fine detail. If so, the slower the film, the finer the grain, and the better the fine detail will be resolved. This philosophy applies to both black-and-white and color film.

The problem is that when you go to high image magnifications with slow, fine-grain film you encounter the problem of shutter speed limitation, so you must choose your film with the subject in mind. On bright sunny days or with flash, the problem is not critical and slower films offer the best advantage. Films with speeds from about ISO 12 to 64 offer excellent resolution characteristics and often the best color rendition. The latter, however, is a matter of personal choice. The faster films (ISO 100 and above) deliver the speed inherent both in themselves and in higher shutter speeds. They too may be used with daylight or flash.

What about films designed to work with tungsten light? You can shoot small subjects with tungsten light, such as a high-intensity desk lamp, photofloods, or even microscope lamps, but this type of lighting not only illuminates the subject but applies heat as well. It is all very well to chill an insect in the refrigerator to keep it still awhile, but the heat from the lamps will soon bring it back up to full mobility! It is better to photograph an insect by daylight or with flash. The most important aspect of film choice for the close-up photographer is that film speed can help to control aperture width and shutter speeds.

Remember that when you add an extension tube, bellows system, or reversing ring you are decreasing the transmission of fight through the lens. This may cause your meter to select a lens aperture that will deliver insufficient depth of field or even shutter speeds too slow for hand holding.

You can, of course, use a light-weight tripod and a cable release to compensate for slow shutter speed, but using a faster film is a simple solution to avoiding the extremely shallow depth of field caused by a larger aperture in close-up photography.

FLASH AND CLOSE-UP PHOTOGRAPHY

Since most close-up work is done with the lens stopped down in order to maintain an adequate zone of focus, less light enters the lens. Similarly, close focusing involves extending the lens further than normal from the film, which also reduces the amount of light reaching the film. As a result, close-up photography often requires very slow shutter speeds or the use of flash as a supplemental light source. The electronic flash unit (strobe) is both portable and versatile, and it's easy to use for close-up work. Most flash units are automatic self sensing types that figure out the exposure for themselves.

However, if the lens is extended beyond its normal working range, its light transmission falls off. If this happens, then will the flash exposure be correct? No, unless your camera offers true through-the-lens metering for flash. Then it will simply accommodate the extension and still correctly expose the image by allowing the flash to pump in light until the meter says "enough."

How does the flash and its sensor eye know how much extension on the lens is in use? The answer is that it does not know, you have to tell it. On many macro lenses you will find a scale engraved on the lens barrel that will tell you quite simply how much exposure to add for compensation. If the flash has no provision for altering the data to accommodate the exposure change due to lens extension, there is a simple solution— "lie" to your flash unit!

Here is the simplest way to deceive an automatic flash unit. Imagine you are using an ISO 200 film and you know from the lens barrel of the macro lens or the ratio scale of the bellows that you need to add at least 1 additional stop of compensation to derive a correct exposure for the flash and the cameras system. Decreasing the film speed setting on the flash unit to ISO 100 will deceive the flash unit into pouring twice as much light (one stop's worth) than it normally would onto the subject. This will compensate for the light loss through lens

extension. If you need a 2-stop compensation, turn the film speed setting down again on the flash unit, in this case to ISO 50. Playing around like this takes a little practice and it's a good idea to bracket exposures in this manner until you become adept at this simple exposure compensation technique.

A specialized flash option for close-up work is a ring flash, which mounts on your lens and produces flash illumination from its circular, light-emitting element. There are specialized macro lenses that have a ring flash built in; these are generally used for medical and other areas of photography. For the most part, these are manual flash units.

The Advantages of Using Flash

The chief advantage of an electronic flash unit for close-up and macro work lies as much in the speed of the flash as it does in the simple portability of a modem flash unit. A self-sensing

flash unit, be it externally sensed or metered through the lens, is quite capable of delivering flash illumination for durations as long as about 1/500 sec. to as short as 1/30,000 sec. These latter speeds generally occur at close range and their action-stopping capability is incredible. Imagine having a shutter speed of 1/30,000 sec. It is more than rapid enough to stop a high-velocity bullet in flight. You will appreciate then that it is a relatively simple matter to catch a raindrop failing from a twig or to stop a ladybug as it scurries across a leaf with flash.

Parallax and Flash in Close-up Photography

If you are using a self-sensing flash unit where the flash sensor is built into the flash itself, parallax is a small problem you should be aware of. If you mount the flash in the camera hot shoe, the flash and its sensing eye may not be looking at the same part of the scene as the camera lens. This is called "flash-to-lens parallax" and it is troublesome only at close and very close ranges.

To understand the nature of this problem, draw an imaginary line through the axis of the lens and the axis of the flash sensor. If the lens is aimed at the subject, you will see that the sensor eye is actually aimed above the subject. Incorrect exposure may result. To correct this when you have set up the shot, hold your hand or a gray card above the subject and in line with the flash sensor and let the sensor eye read that.

CLOSE-UPS PRODUCED AFTER THE FACT

Almost everyone is aware that a photographer can isolate a portion of a slide or negative and create a close-up by blowing this portion of an image up to much larger size. Though this is, of course, possible, it is not preferable to taking close-ups by recording larger image ratios on the film in the first place.

On the whole we would argue against this idea unless you are prepared to put up with an increase in the grain structure and the enlargement of focusing errors and the like. It's best to try to fill the frame with the subject to begin with to minimize the overall image enlargement in the darkroom.

METRO AREA LOCATIONS FOR NATURE PHOTOGRAPHY

Although the Minneapolis-St. Paul metropolitan area has over two million people and is still growing, there are also many parks and wild areas for the nature photographer. This outline will list many of those areas within and nearby the metro area, give a brief description of the area, and list a contact for more information.

MINNESOTA STATE PARKS

AFTON - spring flora, prairies, Birding.
FORT SNELLING - flood plain forest, perched bogs.
WILLIAM O'BRIEN - upland & flood plain forest, savanna, prairie, wet meadow.
INTERSTATE - scenery, large-flowered Trillium.
LAKE MARIA - maple-basswood forest.
WILD RIVER - Large-flowered Trillium, Bottle Gentian.
FRONTENAC - spring flora, birding, scenery, fall colors and fungi.
NERSTRAND BIG WOODS - spring flora, raccoons, stream with waterfall.
SAKATAH LAKE - hardwoods, remnant prairie.

For more information on these and other state parks: DNR, Div. of Parks & Recreation, Information Center, Box 40, 500 Lafayette Rd., St. Paul, MN 55146. Phone: 612/ 296-2553.

SCIENTIFIC & NATURAL AREAS

WOLSFELD WOODS - spring flora, "Big Woods" remnant.
BLACK DOG - mesic tallgrass prairie; calcareous fen (by permit only).
CRAWFORD WOODS - spring flora, "Big Woods" remnant.
HELEN ALLISON SAVANNA - oak savanna, dry prairie.
BOOT LAKE - variety of plant communities.
HASTINGS - spring flora, ferns, liverworts, mosses.

For more information on Scientific & Natural Areas throughout the state, write: Scientific & Natural Areas Program, Minnesota DNR, Box 7, 500 Lafayette Rd., St. Paul, MN 55155.

THE NATURE CONSERVANCY

SCHAEFER PRAIRIE, McLeod Co. - wet and dry prairie, 160 acres.
KASOTA PRAIRIE, LeSueur Co. - thin-soil prairie.
OTTAWA BLUFFS, LeSueur Co. - dry prairie.
LAIBLE WOODS, McLeod Co. - spring flora.

For more information on Nature Conservancy areas, call: Minnesota Chapter, 612/ 379-2134.

NATIONAL WILDLIFE REFUGES

MINNESOTA VALLEY - wetlands, flood plain forest, prairie, oak savanna, birding.
Refuge Mgr., Minnesota Valley National Wildlife Refuge, 4101 East 7th St., Bloomington, MN, 55420. Phone: 612/ 854-5900.

SHERBURNE - wetlands, waterfowl, woods.
Refuge Mgr., Sherbume Nat. Wildlife Refuge, Rt. 2, Zimmerman, MN 55398.

HENNEPIN COUNTY PARKS

ELM CREEK - Spring Beauty, hardwoods, lakes, marshes, streams.
CROW-HAS SEN tallgrass prairie, oak savanna.
LAKE REBECCA waterfowl.
CARVER - Bloodroot, tamarack swamp, lakes, marshes, hardwoods.
HYLAND LAKE - restored prairie, hardwoods.
MURPHY-HANREHAN - birding.
COON RAPIDS DAM - flood plain, oak savanna remnant prairie.

For more information on the Hennepin County Park system, call 612/ 559-9000.

NATURE CENTERS

WOOD LAKE - cattail marsh, waterfowl, birding, restored prairie.
WESTWOOD HILLS - hardwoods, marsh, restored prairie, birding.
SPRINGBROOK - prairies, oak savanna, marsh, Bottle Gentian.
TAMARACK - tamarack swamp, oak forest, marsh, two lakes, prairie.
MAPLEWOOD - marshes, oak forest, prairie.
MINNESOTA RIVER VALLEY - flood plain forest.
RIVER BEND (Faribault) - spring flora, Minnesota Trout-lily.

OTHER NATURE AREAS

U of M LANDSCAPE ARBORETUM - 4000 species of trees, shrubs, herbs and cultivars. Phone 612/ 443-2460.
BUTLER WILDFLOWER GARDEN - native and non-native plant species. Phone 612/348-5702.
MINNESOTA ZOOLOGICAL GARDEN - native and exotic animals, indoors and out. Phone: 612/432-9010.
LEBANON HILLS and SPRING LAKE REGIONAL PARKS, Dakota Co.- flowers and fungi. Dakota County Parks, Phone 612/43 7-6608.
BUNKER HILLS PARK, Anoka Co. - prairie and oak savanna. Anoka Co. Parks, Phone 612/ 757-3920.
NINE MILE CREEK-CENTRAL PARK - Pasque flowers. Skunk Cabbage, spring flora, prairie. Bloomington Parks & Recreation, Phone 612/ 887-9601.

THE NATURE PHOTOGRAPHERS
CODE OF PRACTICE

INTRODUCTION

The Nature Division of the Photographic Society of America, in order to help protect all nature subjects and the environment, has adopted this Code of Practice as a guide-line for all photographers to follow.

GENERAL

Always be considerate of your subjects, be they animal, vegetable or mineral. Killing or injuring any living thing is not a proper part of our nature photography.

Be courteous to your fellow photographer.

For the good name of nature photography, observe normal courtesies. Permission should be obtained instead of trespassing on land on which there is not customarily free access.

Be familiar with the life history and the geographic or geologic setting of your subject. The more complex the life form and rarer the species, the greater your knowledge, care and respect should be.

Abide by all requests of rangers and wardens in National and State Parks and wildlife refuges.

BIRDS AND OTHER SMALL ANIMALS

Try to observe birds and other small animals so they are unaware of your presence. Thus, you are provided an opportunity to leam their interesting everyday habits.

When photographing a nest, don't keep it unduly exposed to the sun, cold, rain or snow, which may cause death to the eggs or young and/or desertion by the parents. This protocol also applies to the burrows or dens of small animals, reptiles and lower life forms as well.

Instead of cutting off branches or grasses near a nest or den, tie the branches back or lay the grass down with rocks or sticks. Before tying back branches, provide temporary shade, if needed. When you have finished photographing, place everything back properly, the way you found it, as a protection for the inhabitants.

Generally, do not keep a blind set up on a nest or burrow if the parents do not return within a half hour—especially on extremely hot or cold days.

Do not frighten birds from a nest to get a picture of them retuming.You may cause the eggs or young to die.The normal intervals on the nest will not be too long.

It is preferable not to take longer than 15 minutes to set up a blind at a nest or burrow. It will be that much longer before the parents return. It is better to set your blind up at the car and carry it in.

Do not approach a blind by car or foot if it is occupied. You may frighten the animal subject from the other photographer's spot and spoil his/her picture.

Beware of approaching a nest, den or burrow too closely. This could cause abandonment of the young by some parents, and expose the area to predation. Careful judgment is necessary.

Do not handle young birds or other small animals. Some parents may abandon them.

Human tracks to and from a nest, den or burrow should be very inconspicuous. As far as possible, the area should be restored to its natural state after you are through photographing.

Blinds should not be positioned along a regularly used approach line to the nest, den or burrow and should not be allowed to flap in the wind.

For cold-blooded animals and invertebrates, temporary removal from the wild to a studio or aquarium for photography should be undertaken with caution, as some states and countries have laws against this practice without a permit. Subsequent release in any case, should be to the original habitat as soon as possible.

A competent photographer never needs to pick wildflowers. In many states and all National Parks and Monuments it is not only illegal to pick flowers, but a true nature photographer should be the first to protect them.

If rocks or logs or other objects natural to the area are brought in to provide scientifically correct, but a more photogenic background, these should be returned to their original place.

While "gardening" is often desirable to simplify the immediate environment, this should not include pulling up, cutting off or otherwise destroying other plants in the picture area. Knee-holes, heel or toe scuffing, etc., should be prevented.

Avoid trampling fragile habitats, especially grasslands, marshes and wildflower patches. Remember, damage to the habitat affects all species in the ecosystems.

INSECTS

Insects or spiders, captured for photographic purposes should be released at the point of capture within a reasonably short time.

Day flying insects, particularly butterflies and wasps, are most suitably controlled by working in-a darkened room at night, focusing by means of a weak flash light.

Chilling is suitable for such insects as beetles and grasshoppers only. Butterflies, many moths and almost all insect larvae, may be irreparably damaged by such treatment.

Freezing should not be attempted. The photographer should not endanger the lives of the insects. Bear in mind that they also play a part in the balance of nature.

Photographing insects and arachnids in the field would probably tell a more accurate story.

TIDAL SUBJECTS

Tidepool animals have a definite ecological niche. Animals that live on top of rocks, and those that live underneath, will die if rocks turned over for photographic purposes are not replaced the way they were found. All marine life moved for any purpose should be returned to its original location. Certain tidepool creatures such as Brittle Stars are extremely fragile. Handle them with great care.

Marine animals require large amounts of frequently replaced oxygen, and may die rather quickly if placed in aquaria without artificial oxygenation and temperature control.

NEWTS, SALAMANDERS & OTHER AMPHIBIANS

While this group of animals makes delightful aquaria subjects, they should not be held for more than a few hours while being photographed, unless they are provided with proper food, and kept in well simulated nature conditions.

If chilling is used for partial control it should be used carefully and for brief periods only. This practice applies to all animal subjects.

REPTILES

It is preferable that lizards and snakes be held for no more than very brief periods, since artificial feeding is usually not successful with a number of these species. If held over night for photography next morning, they should be given protection roughly equivalent to that which they would find for themselves in the wild.

Snakes should never be picked up by the neck alone, as this may permanently injure their spinal column. Similarly, they should never be controlled by lifting them by their tail end.

GEOLOGY

Pictographs and petroglyphs should never be altered for photographic reasons by applying any substance.

When photographing fragile cave formations or crystals, or similar material, do not move or break these features. Others may follow and want to see them. Remember, a damaged plant may well recover in a few days, but a damaged crystal or cave formation took tens of thousands of years to grow, and present geologic conditions may make repair impossible on any time scale. Delicate erosion features must also be left untouched. Let Nature do the rearranging.

MISCELLANEOUS

It is unethical to throw rocks at an animal to cause it to change position or area. Thoughtless conduct could force a creature to leave its accustomed surroundings because it finds the photographer an unbearable nuisance. If the animal in question is forced to move into territory occupied by another animal, friction is bound to arise. The dislodged animal may find unfavorable conditions in regard to food and water.

RESOURCES FOR CLOSE-UP & MACRO PHOTOGRAPHY EQUIPMENT AND ACCESSORIES

B&H Photo & Video

119 West 17 th Street, New York, NY 10011 Phone: 800/947-8803
Mail-order supplier of photographic equipment, accessories and film at deep discounts.

Kirk Enterprises

107 Lange Lane, Angola, IN 46703 Phone: 800/626-5074
Manufactures and sells a fine line of customized camera mounts, macro flash brackets, focusing rails and a wide variety of specialized accessories.

A. Laird Photo Accessories

P.O. Box 1250, Red Lodge, MT 59068 Phone: 406/446-2168
Manufactures and sells tripod leg covers and camera/lens rain hoods

Leonard Rue Enterprises

138 Millbrook Road, Blairstown, NJ 07825-9534 Phone: 908-362-6616
Catalog supplier of very specialized equipment and accessories for the nature photographer.

Really Right Stuff

P.O. Box 6531, Los Osos, CA 93412 Phone: 805/528-6321
Designers and manufacturers of improved mounting plates, clamps and braces for tripod mounting.

GLOSSARY OF
CLOSE-UP PHOTOGRAPHIC TERMS

APERTURE Strictly, the opening that limits the amount of light reaching the film and hence the brightness of the image. In some cameras the aperture is of a fixed size; in others it is in the form of an opening in a barrier called the diaphragm and can be varied in size. (An iris diaphragm forms a continuously variable opening, while a stop plate has a number of holes of varying sizes.) Photographers, however, generally use the term "aperture" to refer to the diameter of this opening. See also **F-NUMBER.**

ASA American Standards Association, which devised one of the the two most commonly used systems (ISO is the other) for rating the speed of an emulsion (i.e., its sensitivity). A film rated at 400 ASA would be twice as fast as one rated at 200 ASA and four times as fast as one rated at 100 ASA.

BACK LIGHTING Lighting from behind the subject directed towards the camera position.

BELLOWS Light tight folding bag made of pleated fabric used on some cameras to join the lens to the camera body. Found on large studio cameras.

BRACKETING A method of compensating for uncertainties in exposure, by making a series of different exposures of a single subject, each varying by a progressive amount from the estimated correct aperture/speed setting.

CABLE RELEASE Simple camera accessory used to reduce camera vibrations when the shutter is released, particularly when the camera is supported by a tripod and a relatively long exposure is being used. It consists of a short length of thin cable attached at one end to the release button of the camera; the cable is encased in a flexible rubber or metal tube and is operated by a plunger.

CAMERA SHAKE Unintentional movement of the camera however slight during exposure, causing unsharpness in the image.

CLOSE-UP LENS Simple positive lens placed over the normal lens to magnify the image. The strength of the close-up lens is measured in diopters. Also known as **SUPPLEMENTARY** LENS.

COLOR NEGATIVE FILM Film giving color negatives intended for producing prints.

COLOR REVERSAL FILM Film giving color positives (i.e., slides or transparencies) directly. Prints can also be made from the positive transparencies.

CONVERTER Auxiliary lens, usually fitted between the camera body and the principal lens, giving a combined focal length that is greater than that of the principal lens alone. Most converters increase focal length by a factor of two or three.

DAYLIGHT FILM Color film balanced to give accurate color rendering in average daylight, that is to say, when the color temperature of the light source is around 6500 kelvins. Also suitable for use with electronic flash and blue flashbulbs.

DEPTH OF FIELD Zone of acceptable sharpness extending in front of and behind the point of the subject which is exactly focused by the lens.

ELECTRONIC FLASH Type of flashgun which uses the flash of light produced by a high-voltage electrical discharge between two electrodes in a gas-filled tube. Also called **STROBE**

EXPOSURE Total amount of light allowed to reach the lightsensitive material during the formation of the latent image. The exposure is dependent on the brightness of the image, the camera **APERTURE,** and on the length of time for which the photographic material is exposed.

EXPOSURE METER Instrument for measuring the intensity of light so as to determine the correct **SHUTTER** and **APERTURE** settings.

EXTENSION TUBES Accessories used in close-up photography, consisting of metal tubes (without glass) that can be fitted between the lens and the camera body, thus increasing the lens-to-film distance and image magnification.

FILM SPEED A film's degree of sensitivity to light. Usually expressed as a rating on either the ASA, or the ISO scales.

FLARE Light reflected inside the camera or between the elements of the lens, giving rise to irregular marks on the negative and degrading the quality of the image. It is to some extent overcome by using coated lenses.

F-NUMBER Number resulting when the focal length of a lens is divided by the diameter of the aperture. A sequence off-numbers, marked on the ring or dial which controls the diaphragm, is used to calibrate the aperture in regular steps (known as STOPS) between its smallest and largest settings. The f-numbers generally follow a standard sequence such that the interval between one stop and the next represents a halving or doubling in the image brightness. As f-numbers represent fractions, the numbers become progressively higher as the aperture is reduced to allow in less light.

GRAIN Granular texture appearing to some degree in all processed photographic materials. In black and white photographs the grains are minute particles of black metallic silver which constitute the dark areas of a photograph. In color photographs the silver has been removed chemically, but tiny blotches of dye retain the appearance ofgraininess. The faster the film, the coarser the texture of the grain.

INCIDENT LIGHT Light falling on the subject. When a subject is being photographed, readings may be taken of the incident light instead of the reflected light.

INCIDENT LIGHT READING Exposure measurement of the light source that illuminates the subject (of reflected light reading). It is therefore independent of the subject's own characteristics.

ISO (International Standards Organization). The commonly used scale for a film's sensitivity to light.

LENS FLARE Non-image forming light reflected from lens surfaces that degrades the quality of the image.

LENS **HOOD** Simple lens accessory, usually made of rubber or light metal, used to shield the lens from light coming from areas outs'de the field of view. Such light is the source of **FLARE**

MACRO LENS Strictly, a lens capable of giving a 1:1 magnification ratio (a life-size image); the term is generally used to describe any close-focusing lens. Macro lenses can also be used at ordinary subject distances.

MACROPHOTOGRAPHY Close-up photography in the range of magnification between life-size and about ten times lifesize.

MAGNIFICATION RATIO Ratio of image size to object size. The magnification ratio is sometimes useful in determining the correct exposure in close-up and macrophotography.

MICROPHOTOGRAPHY Technique used to copy documents and similar materials onto very small-format film, so that a large amount of information may be stored compactly. The term is sometimes also used to refer to the technique of taking photographs through a microscope, otherwise known as **PHOTOMICROGRAPHY.**

NEGATIVE Photographic image with reversed tones (and reversed colors if color film), used to make a positive image, normally a print by projection.

NORMAL LENS Lens with a focal length equal to the diagonal of the film format. It produces an image which appears to have normal perspective and angle of view.

PHOTOMACROGRAPHY Close-up photography with magnifications in the range of IX to 10X.

PHOTOMICROGRAPHY Photography at great magnifications using the imaging systems of a microscope.

POLARIZING FILTER Thin transparent filter used as a lens accessory to cut down reflections from certain shiny surfaces (notably glass and water) or to intensity the color of a blue sky. Polarizing filters are made of a material that will polarize light passing through it and which will also block a proportion of light that has already been polarized: rotating the filter will vary the proportion that is blocked.

REFLECTED LIGHT READING Exposure measurement of the light reflected from the subject (vs. incident light reading). Through-the-lens meters use this method, and it is well suited to subjects of average reflectance.

RESOLVING POWER Ability of an optical system to distinguish between objects that are very close together; also used in photography to describe this ability in a film or paper emulsion.

REVERSAL FIIM Photographic emulsion which, when developed, gives a positive image (commonly called a transparency). So called because of one stage in the development when the film is briefly re-exposed, either chemically or to light thus reversing the image which would otherwise be negative.

REVERSING RING Camera accessory which enables the lens to be attached back to front. Used in close-up photography to achieve higher image quality and greater magnification.

RING FLASH Type of electronic flash (strobe) unit which fits around the lens to produce flat, shadowless lighting; particularly useful in close-up work.

SHUTTER Camera mechanism which controls the duration of the exposure. The two principal types of shutters are betweenthe-lens shutters and focal-plane-shutters.

SINGLE-LENS REFLEX (SLR) **CAMERA** One of the most popular types of camera design. Its name derives from its viewfinder system, which enables the user to see the image produced by the same lens that is used for taking the photograph. A hinged mirror reflects this image onto a viewing screen where the picture may be composed and focused; when the shutter is released, the mirror flips out of the light path while the film is being exposed.

SPEED The sensitivity of an emulsion as measured on one of the various scales (see ASA); or the maximum aperture of which a given lens is capable.

STANDARD LENS Lens of focal length approximately equal to the diagonal of the negative format for which it is intended. In the case of 35mm cameras the standard lens usually has a focal length in the range of50-55mm, slightly greater than the actual diagonal of a full-frame negative (about 43mm).

STOP Alternative name for aperture setting or **F-NUMBER.**

STOPPING DOWN Colloquial term for reducing the apperture of the lens.

SUPPLEMENTARY LENS Simple, positive lens used as an accessory for close-ups. The supplementary lens fits over the normal lens, producing a slightly magnified image.

TRANSPARENCY A photograph viewed by transmitted, rather than reflected light. When mounted in a rigid frame for projection, the transparency is called a slide.

TTL METER Through-the lens meter. Built-in exposure meter which measures the intensity of light in the image produced by the main camera lens. Principally found in more sophisticated designs **of SINGLE-LENS REFLEX CAMERAS.**

ZOOM LENS Lens of variable focal length whose focusing remains unchanged while its focal length is being altered. Zooming is accomplished by changing the relative positions of some of the elements within the lens.

SELECTED BIBLIOGRAPHY
CLOSE-UP AND MACRO PHOTOGRAPHY

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