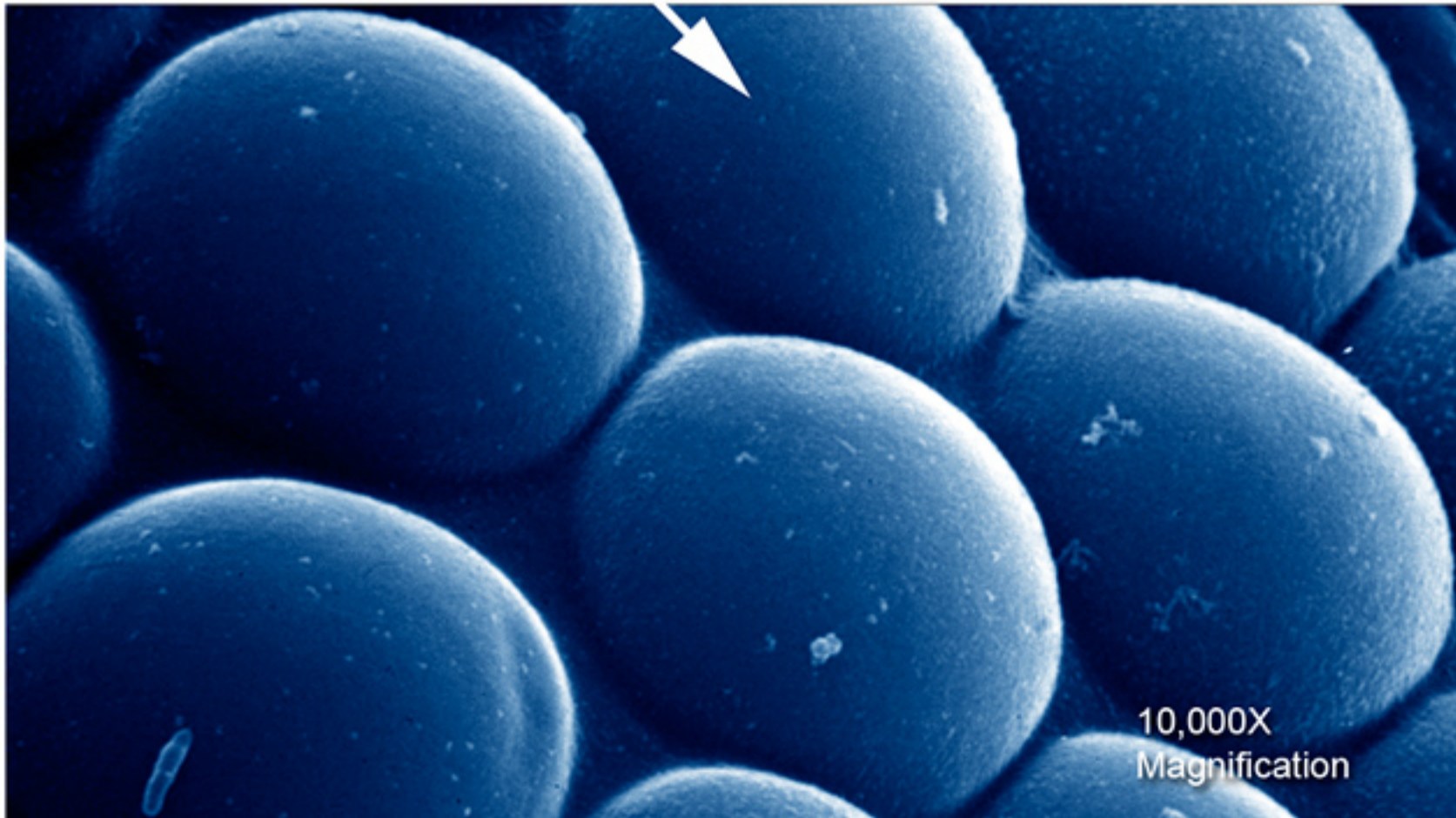
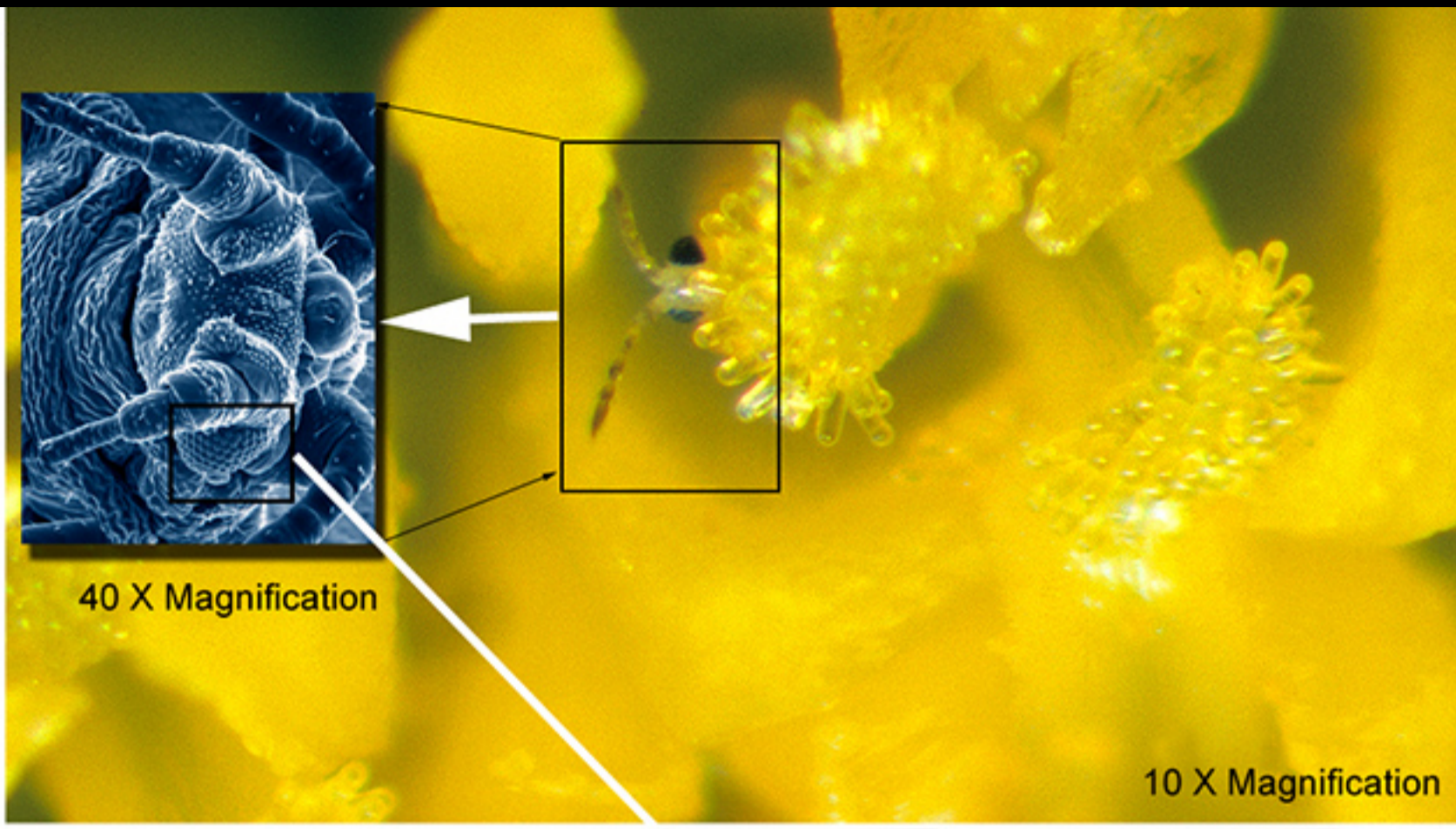


Macrophotography
by
Robert Berdan



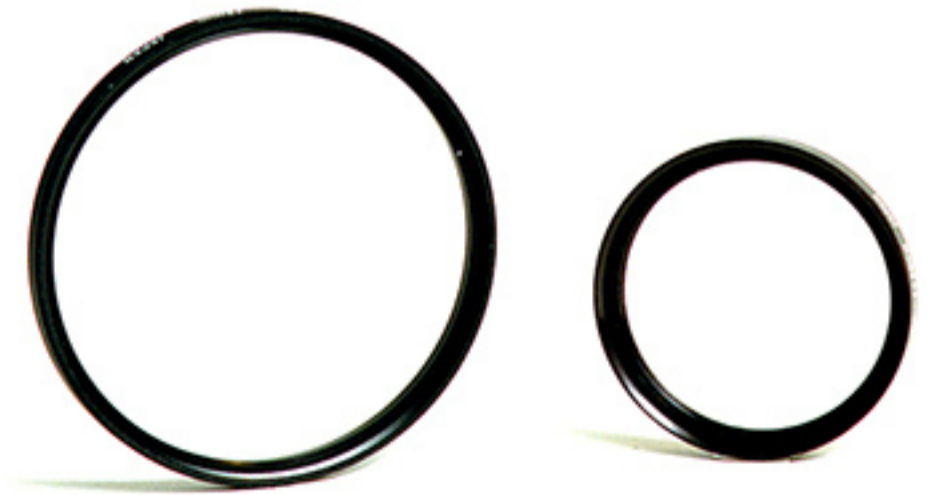


How to achieve Magnification

1. Normal camera lenses about 0.1 to 0.5X
2. Close-up Filters 0.2 to 2.0X
3. Teleconverters 1.0 to 2.0X the lens magnification
3. Extension tubes 0.5 to 5.0X
4. Bellows Extension up to 10X
5. Macro-lenses 0.5 to 5.0X
6. Stereomicroscope 1 to 50X
7. Light microscope 5 to 1000X
8. Scanning electron microscope 5 to 500,000X



Normal 35-50 mm lens



Close-up Filters

Closeup Filters

Closeup Filters

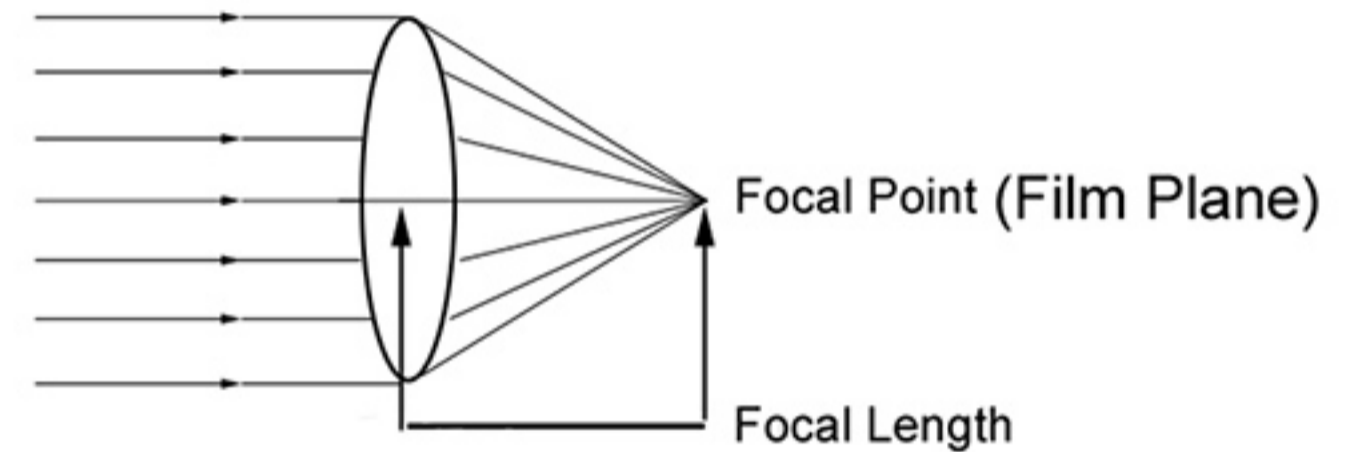


Dual
Element Lens
\$150-\$200 each

Single Element Filters
Set of 3 \$75-\$100

Focal Length & Diopters

The focal length of the lens is defined as the distance from the middle of the lens to its focal point.



$$\text{Diopter} = \frac{1000 \text{ mm}}{\text{Focal length in mm}}$$

$$\text{E.g. } +2 \text{ Diopter} = \frac{1000 \text{ mm}}{500 \text{ mm}}$$

$$+4 \text{ Diopter} = \frac{1000 \text{ mm}}{250 \text{ mm}}$$

Can combine +1 and +2 to get a +3 Diopter

Determining Magnification with Close-up Filters

$$\text{Magnification} = \frac{\text{Focal length of camera lens}}{\text{Focal length of close-up filter}}$$

$$\text{E.g. } \frac{50 \text{ mm Normal Lens}}{250 \text{ mm (+4 Diopter Close-up)}} = 0.25 \text{ X}$$

$$\frac{200 \text{ mm Telephoto lens}}{500 \text{ mm (+2 Diopter Close-up)}} = 0.4 \text{ X}$$

Teleconverters\Extenders



Nikon 1.7 X
loses 1.5 F-stops



Nikon 2.0X
loses 2 F-stops



Canon
1.4X loses 1 F-stop



Canon
2X loses 2 F-stops

Extension Tubes



Magnification Achieved by Extension (Tubes or Bellows)

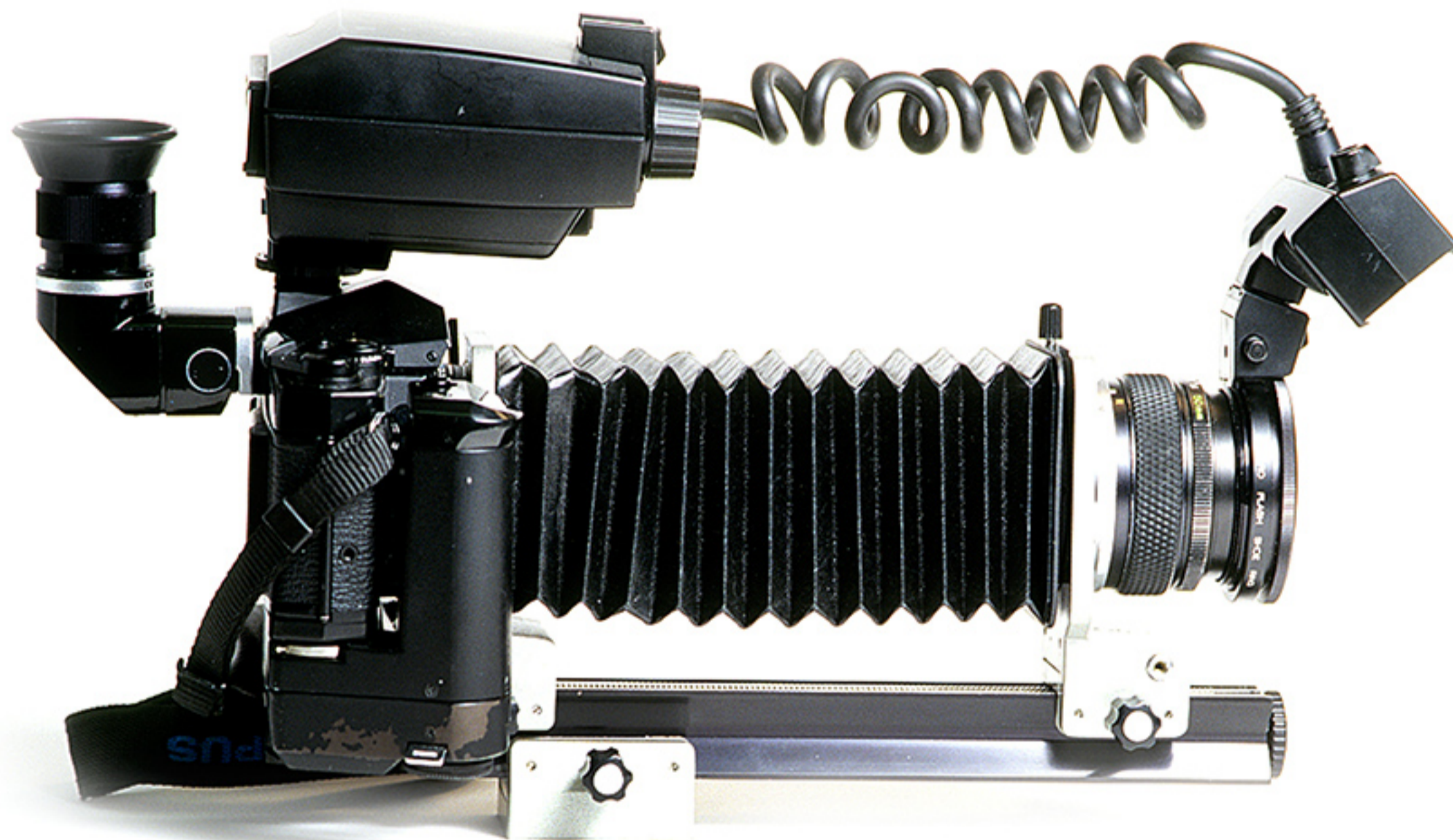
$$\text{Magnification} = \frac{\text{Extension distance in mm}}{\text{Focal length of lens in mm}}$$

E.g. $\frac{50 \text{ mm Extension tube}}{50 \text{ mm Normal lens}} = 1.0 \text{ X Magnification}$

$$\frac{50 \text{ mm Extension tube}}{200 \text{ mm Telephoto lens}} = 0.25 \text{ X Magnification}$$

The more extension the greater the magnification achieved, however longer focal length lenses require more extension to achieve the same magnification.

Extension with Bellows



Macro Lenses



60mm F2.8



105mm F2.8



100mm F2.8



105mm F2.8 VR



200mm F4

There are a few macro-zoom lenses (e.g. 70~180mm f/4.5~5.6s ED), the longer the focal length the greater working distance you have from your subject. Also keep in mind the actual focal length will vary depending on whether you are using a full frame camera or digital camera with 1.5-1.6X sensor.

Macro Lenses have built in Extension



Note some macro lenses the extension occurs internally e.g Canon 100 mm,
Also you can add an extension tube for even more magnification.

Canon MP-E 65 mm 1-5X Macro Lens



Canon Macro Twin Lite
MT-24 EX Flash

Primarily for Studio work - requires flash or very bright lights
also requires macro focusing stage to move the lens back and forth.



Use Extension tube
& Telephoto lens

75-150 Zoom,
T-32 Flash &
Variable extension



Achieving Very High Magnification

Stereo Microscope



Magnification 1-50 X

Light Microscope



Magnification 5-1000X

Stereo Microscope



Tiger Beetle 10X

Light Microscope



Dog Flea 50X

Lighting for Macrophotography



Natural Light



Flash

Soft overcast light - especially after rainfall is often the best for flowers

Vary the Depth of Field when you take Macro Photos



60 mm Macro lens at F2.8



60 mm Macro lens at F22

Mist & Dew



If there is no natural dew on the web or flower you can add it with a spray bottle

Simplify the Background



Flash only - background is distracting



Flash and black card used

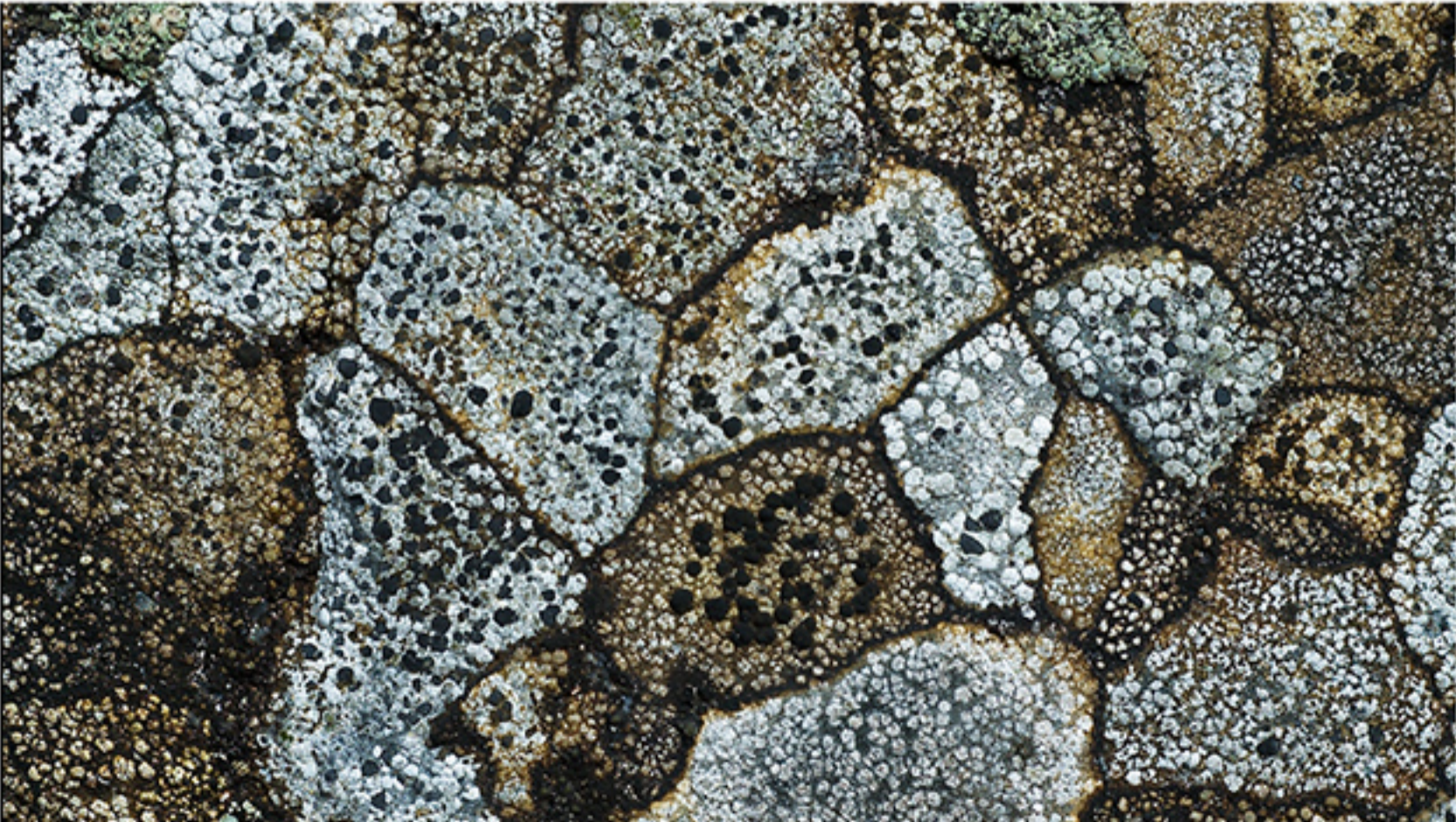


Tripod that goes flat to the ground or use Bean Bag



Also to reduce vibration use your self timer or electronic cable release















Summary

1. You can take close-up shots with a normal & telephoto lens, to get even closer attach closeup filters, a teleconverter, extension tubes, bellows or use a macro lens.
2. Macro-photography requires a good support - a tripod, bean bag and use a cable release or self timer to get the sharpest pictures. If you hand hold - use flash.
3. Macro shots are always available - just get low to the ground or up close to rocks and vegetation and explore the scene through your viewfinder.
4. Soft light is best for flowers and subdued subjects while side light is best for emphasizing texture.
5. If there is nothing else to shoot you can almost always find something interesting to capture with a macro-lens.