SCIENCE MICROSCOPES MANUAL

BAUSCH & LOMB

You have become the owner of a fine quality instrument. There is no similar instrument made anywhere in the world that will give you greater satisfaction or more dependable service. From the raw materials used in making optical glass to the final inspection of finished instruments, Bausch & Lomb products are made under the rigid control of optical, electronic, and mechanical experts. The formulae for the glass, and the design and manufacture of all parts contribute to one purpose—a product which will afford the highest satisfaction.

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Reference Manual

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SCIENCE MICROSCOPES

Made in U.S.A.

Officially approved by educational consultants and used in science education at all levels of grade and junior high schools.

R1900–Recommended for children 8-10 years old for their first experience with the microscope.

R8900–Recommended for children over 10 years old and for children who have had previous experience with the microscope.

SSM15–Stereo Microscope for three dimensional viewing of rocks, crystals, marine life, insects, plants, etc.

STZ100–Zoomscope with continuously variable magnification from 25× through 100×.

STZ200–Zoomscope with continuously variable magnification from 50× through 200×.

Rite-Lite Microscope Illuminator–For both transmitted and reflected light of uniform, ample brilliance.

BAUSCH & LOMB INCORPORATED
ROCHESTER, NEW YORK 14602

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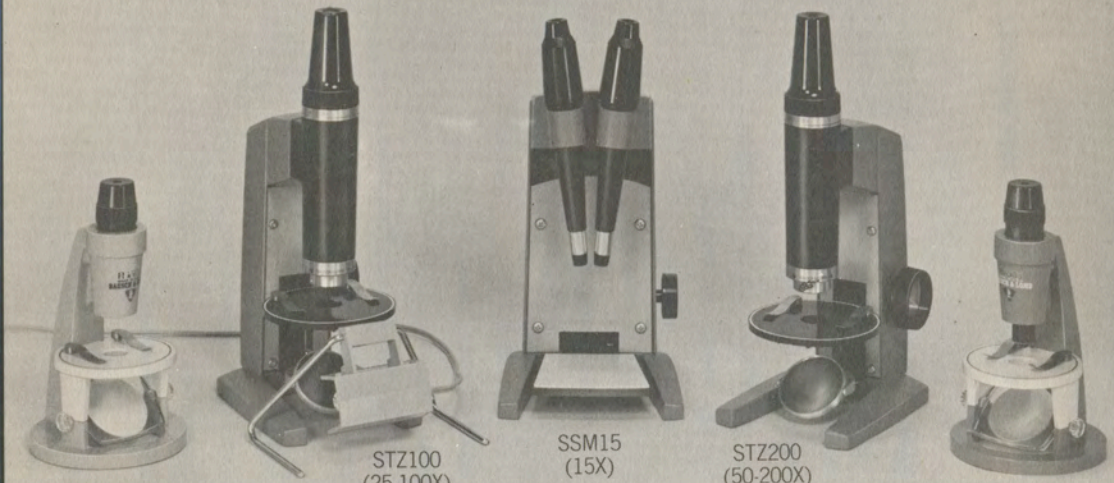
BAUSCH & LOMB SCIENCE MICROSCOPES



R1900

STZ100
(25-100X)
RITE-LITE

SSM15
(15X)

STZ200
(50-200X)

R8900

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SCIENCE MICROSCOPES

Introduction

Your microscope is a precision instrument, designed to the same rigid performance standards which make BAUSCH & LOMB professional microscopes famous for their excellence in scientific, medical, commercial and military laboratories around the world.

With an entirely new concept in microscope design BAUSCH & LOMB has provided students and hobbyists with low cost, high quality, precision instruments. Their rugged construction and simple operation ensure a long, trouble-free life.

R1900 and R8900 MICROSCOPES

These microscopes are primarily designed for use by the hobbyist and elementary school students. Construction is as simple and as durable as modern technology can devise. These instruments resist chipping, staining and the corrosive action of most common laboratory chemicals. They are designed to present a clear, definitive picture of objects and details too small for the eye to perceive without the aid of magnification. They will serve as your passport to the invisible world in the air you breathe; in the soil; and even in the bodies of plants, organisms and objects around you.

Two models are available; both having a wide field of view and a long working distance. These characteristics make it easy to adjust and position the specimen for study.

R1900 and R8900

WHAT DO THE NUMBERS MEAN?

Microscopes have, in the past, been rated by a figure representing their magnifying power. However, this tells only a part of the story about an instrument's performance. In fact, it can be very easily used to influence purchasers to pay for magnification they cannot use or which is designed into the optical system to the detriment of other even more important qualities.

Therefore, BAUSCH & LOMB rates these fine instruments according to their "resolving power per inch of specimen." Consider a white card on which either 1900 or 8900 black parallel lines have been ruled on a one-inch wide space. The BAUSCH & LOMB microscope with matching number will deliver an image large enough to see single lines separated from their neighbors. With the naked eye you would, of course, see only a solid black area.

Such is the true mission of a microscope. And you are fortunate to own such a truly high image quality instrument.

R1900 MICROSCOPE

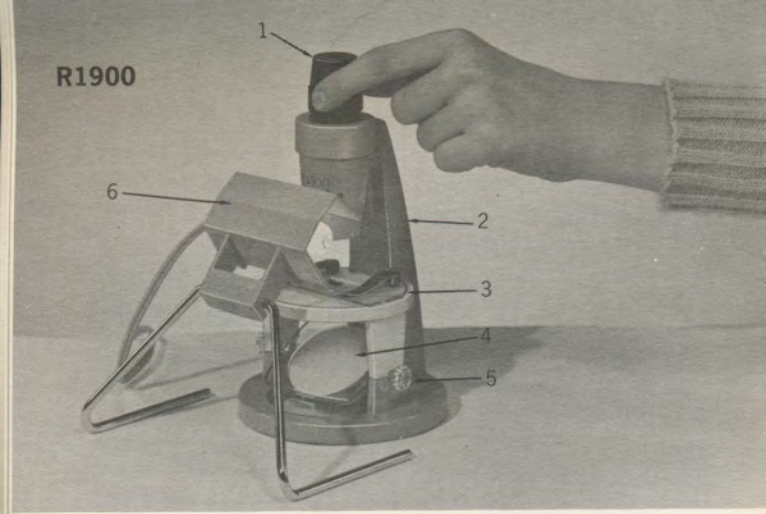
The R1900 is primarily designed for the observation of insects, leaves, stamps, coins, pieces of cloth or other relatively large specimens.

Each specimen has depth. A fly's body is thicker than its wing. An ideal focus may be made on the whole fly; the body alone; and the wing alone. Each part has its own plane of focus. The great depth of field of the R1900, combined with its ability to hold the various planes in focus with great stability, are features of great value to the beginning microscopist.

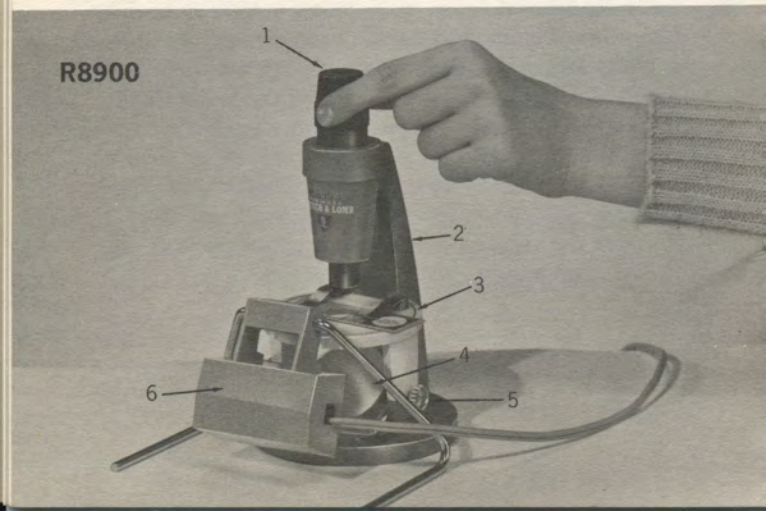
This is also an ideal instrument for the examination of relatively gross objects at low magnifications, particularly when the relationship of one structure to another is important. For example, the relationship of a fly's leg to the fly's body may be studied quite satisfactorily with the R1900.

R8900 MICROSCOPE

The R8900 is most useful in applications where the examination of much finer detail is desired. Observations of this type might include the study of the internal structure of very tiny plants (algae), molds (fungi), and animals (Daphnia or water flea). In these applications, slide mounted specimens are generally used and are best observed by passing transmitted light through the specimen from below. The use of the BAUSCH & LOMB RITE-LITE ILLUMINATOR is recommended to achieve the steady, uniform illumination which is most desirable. For a more detailed discussion, see the sections entitled ILLUMINATION, and the RITE-LITE ILLUMINATOR, pages 26-28.



1. Focusing Tube. 2. Base and Arm. 3. Stage. 4. Mirror. 5. Mirror Adjusting Knob. 6. Rite-Lite Illuminator (Above, positioned for top illumination: Below, for pass-through, reflected light).



GENERAL PROCEDURES

1. *Placing of the Specimen*

On both models, unmounted specimens should be placed on a clear glass slide or watch glass directly over the stage aperture. When a particular point of interest is found, the specimen should then be moved so that this point is positioned in the center of the field of view. In doing this, it should be remembered that a movement of the specimen in any direction causes movement of the image in the opposite direction. This occurs because the objective forms an inverted image of the object, a characteristic common to most biological microscopes. After a little practice, one automatically moves the object in the direction opposite to that which the eye seems to indicate. In viewing whole specimens such as a fly, first observe the unmounted specimen dry. Then moisten the object with a few drops of mineral oil or glycerin and notice that glare has been reduced on certain parts of the body and that the finer detail of the specimen is accentuated.

2. *Use of the Mirror*

Both models are equipped with a reversible mirror. This mirror has a white diffusion surface on one side and a highly reflecting concave mirror on the reverse face. The mirror is adjusted by two knobs, one at either side of the mirror so that it may be positioned with either hand.

a. The R1900 will usually perform best when the white surface is used, whether you are employing top lighting or substage illumination or whether you are using a natural or artificial light source. This surface produces a most uniform and glare-free field of view.

When you are using an overhead light source or natural light to view large opaque specimens, the white surface should be adjusted until it is parallel to the stage. When you are using substage illumination, either rotate the entire instrument toward your light source (a window) or position the illuminator and tilt the white diffusion side until you observe the moderately bright, uniformly lit, full field of view. Wtih the specimen on the glass slide and centered directly over the aperture, look from the side, and make any adjustment necessary so that the object appears bathed in light. As you look through the eyepiece, you may wish to make a final delicate adjustment by tilting the mirror slightly again.

b. The R8900 is normally used in making more detailed observations. The white surface should always be used when observing large opaque objects with overhead illumination. However, the greater magnification of this model encourages the use of slide-mounted specimens which require substage lighting. The concave mirrored surface is recommended for substage illumination with the R8900, whether you are using artificial (Rite-Lite Illuminator), or natural light.

When using natural illumination, it is best to direct the reflective surface at a patch of blue sky, being careful to aim your mirror so as to eliminate window bars or other objects which might serve as a distraction to good viewing. Aim the mirror by rotating the entire instrument toward your light source. Then, tilt the mirror itself until the uniformly lighted, full field of view is observed. With the specimen slide directly over the stage aperture, and, looking from the side, adjust your mirror so that the object appears bathed in light. Then proceed to focus the microscope.

3. *Focusing Procedure*

a. The R1900 model has the objective fully recessed in the microscope tube. Focus is accomplished by grasping the base with one hand while rotating the grooved eyepiece tube with the other. Rotate the tube to the right or to the left, thereby moving the microscope tube up or down, until the sharpest image appears in the field of view. The average specimen varies in depth, and the experienced microscopist will shift the focus slightly and observe various details at each slight variation from the sharpest over-all image.

Relax your eyes as though looking at distant hills. Do not strain to see, and keep both eyes open. When you have proper illumination and a sharp focus, and your lenses and mirror are clear, your microscope will be performing properly.

b. R8900 owners should read the preceeding section on the R1900 as it applies to this model as well, except for a slight change in focusing procedure. The objective of the R8900 protrudes from the body tube. To prevent accidents when viewing thick objects, it is best to look from the side and lower the objective until it is approximately ⅛" above the specimen. Do this by turning the grooved portion of the microscope tube to the right. Stop the rotation above the specimen. Now look through the eyepiece and focus by rotating the tube to the left. This procedure will eliminate all possibility of accidentally forcing the objective into the specimen and possibly damaging both the specimen and the microscope.

USE OF A COVER GLASS

When examining fluids, always use a cover glass. A drop or small quantity of fluid placed upon a slide assumes a spherical form and, on viewing, particularly with the R1900 model, will be found to give a distorted field and cause disagreeable reflections and shadows. By merely placing a cover glass upon it, this objection is overcome.

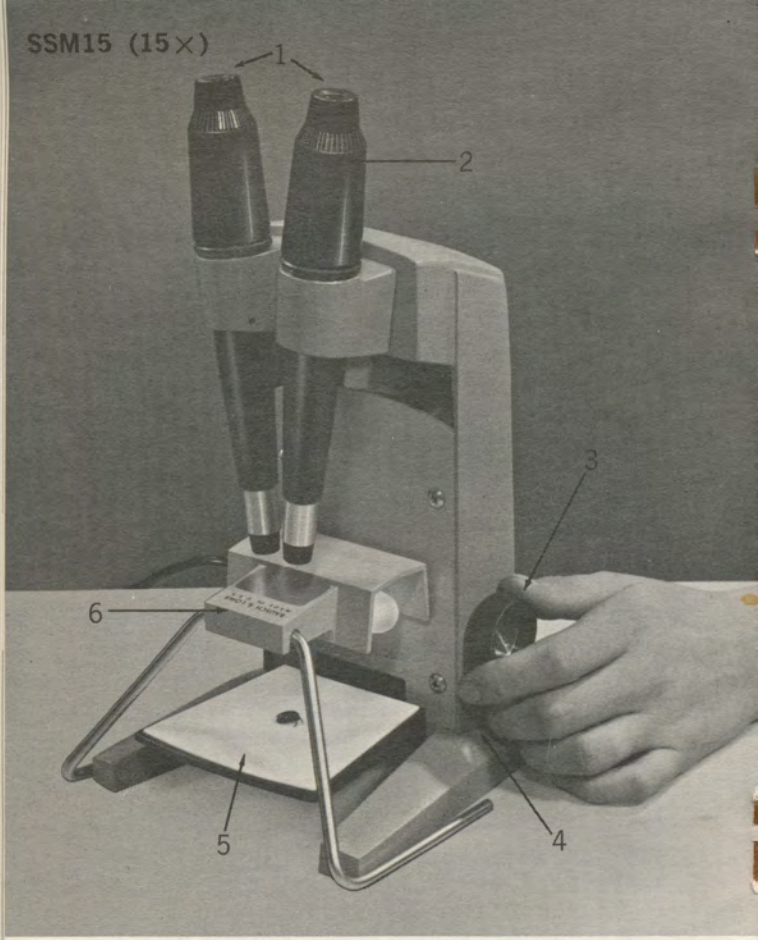
A No. 2 cover glass (0.17 to 0.25mm thick) is recommended; and these may be obtained from any biological supply house.

SSM15 STEREO MICROSCOPE (15×)

The SSM15 Stereo Microscope is primarily designed for high school students and those in the upper elementary grades. This instrument brings binocular design and three-dimensional viewing to the classroom at moderate cost. These same characteristics make the SSM15 exceptionally adaptable to a wide range of industrial and commercial inspection applications.

Basically, this instrument is two separate 15× (15 times magnification) microscopes, accurately aligned and incorporated into one structure. The accurate alignment of these two microscopes permits the brain to interpret the separate images received by each eye as one fused image with a stereoscopic effect.

The SSM15 is the ultimate in simplicity of design. The eyepieces are parfocalized (preadjusted) so that it is necessary to manipulate only one knob, which controls the height of the stage, to bring your SSM15 into perfect focus. This model is equipped with a stain resistant white stage which is raised and lowered by the knob located on the left, leaving the right hand free to manipulate the specimen or to take notes. A Safety Focusing Clutch is incorporated into the SSM15 which prevents damage from occurring to the stage mechanism if rotation of the knob is accidentally continued after the stage has reached its limit of travel. This feature also protects both microscope tubes and specimen in the event of accidental contact. Once the stereo microscope is focused, it is possible to adjust



1. Eyepieces. 2. Pivotal Tube (left). 3. Stage Focusing Knob. 4. Base and Arm. 5. Stage. 6. Rite-Lite Illuminator.

instantly the distance of the eyepieces to the eye-spacing (interpupillary distance) of any individual by moving the pivoted (left) microscope tube.

Stereo microscopes are meant to complement the use of regular microscopes. The SSM15 is designed for the study of whole objects of small size. Insects, parasites, leaves, seeds, coins, stamps, engraving, fingerprints and a host of other items fall into this category. Any object which you might wish to subject to three-dimensional (3-D) inspection at low magnification is a suitable subject for the SSM15.

The advantages of your SSM15 are readily apparent in the high quality of the image; the smoothness of operation; and in the ease with which it is possible to carry out dissecting procedures and evaluation with 3-D. The working distance of this stereo microscope is extremely long to allow greater freedom to work with the specimen, and the stage is ample enough to accommodate most laboratory glassware. The binocular design allows the use of both eyes in a natural and easy manner. Comfortable viewing is assured, as the SSM15 is instantly adjustable to each individual's eye-spacing. The pronounced stereoscopic effect achieved as you fuse both images endows your object with depth and roundness as well as length and breadth.

The image obtained with the SSM15 is erect and unreversed so that movements of the specimen are normal, unlike the usual biological microscope. A movement of the specimen in one direction produces a movement of the image in the same direction.

SSM15 MICROSCOPE PROCEDURE

1. Place your specimen on the center of the stage.
2. Illuminate the specimen from above by taking advantage of natural lighting or by use of an illuminator. (See section on Illumination and RITE-LITE ILLUMINATOR; pages 26-28.)

   When using the SSM15 for observations which require extremely uniform and concentrated illumination, the RITE-LITE ILLUMINATOR may be positioned directly over the stage specimen. A specially designed opening in the RITE-LITE allows the SSM15 to be focused directly through the illuminator housing; see illustration, page 14.
3. Looking from the side, turn the stage adjusting knob on the left until the specimen is raised to approximately 2⅝" below the microscope tubes (objectives).
4. Look through the right eyepiece and adjust the stage downward until the specimen comes into focus. Focusing downward is normal procedure with this stereo microscope and prevents accidental contact between the specimen and the objectives.
5. When the right eyepiece is in sharp focus, and the specimen or area of the specimen you wish to study is centered in the field of view, grasp the left tube and move to left or right until each eye sees a distinct image. The two images will at first appear to overlap.

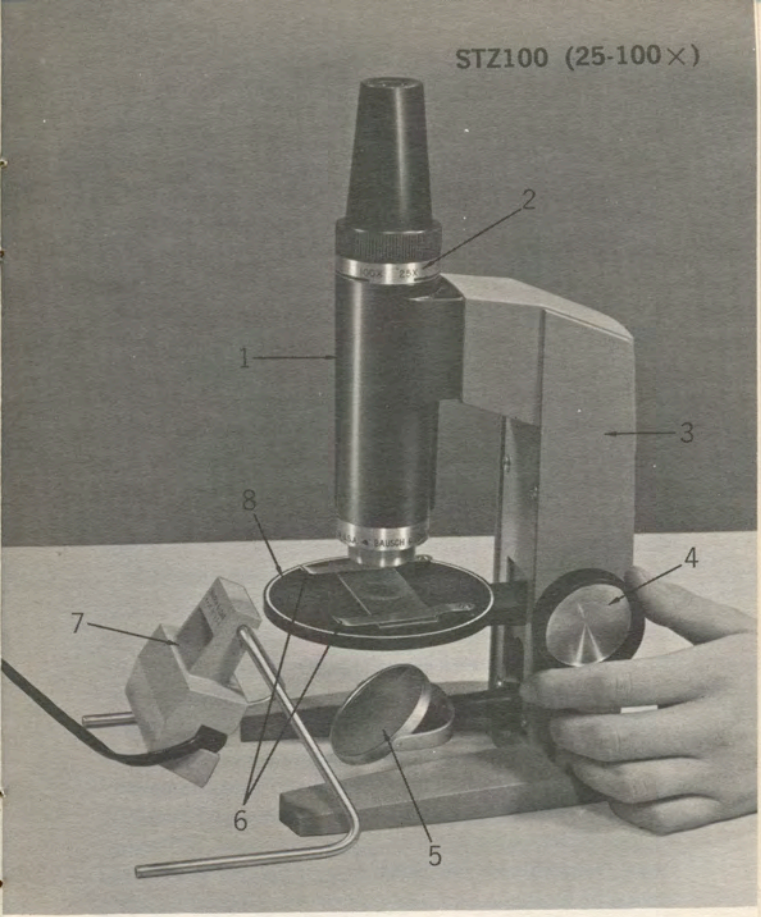
6. Continue to shift the left tube carefully with delicate movements back and forth until both images fuse into one. The microscope tubes are now correctly set for three dimensional viewing.
7. Make a final delicate stage adjustment to secure the sharpest possible image.

SCIENCE ZOOMSCOPES
STZ100 (25-100×)
STZ200 (50-200×)

The STZ microscopes are primarily designed for high school students and for those in the upper elementary grades. The higher magnification of these instruments makes them most suitable for extremely detailed observation. Except for the fact that the STZ200 allows observation of finer detail, both models operate identically in all other respects.

The STZ is called a ZOOMSCOPE because this instrument enables the operator to focus upon a specimen and then smoothly and continuously change the magnification with which the specimen is being observed, throughout the range of the instrument. The effect is comparable to the television camera which can adjust from close-ups to distant views with no break in the continuity of the image. Each degree of magnification offers a new perspective of the specimen, which can be viewed as rapidly as one wishes to change the degree of magnification. For example, you may be observing the entire object at low magnification and, by rotating the magnification scale, instantly compare it to the internal structure observed under high magnification.

There are no distractions with the STZ. The operator does not have to turn a revolving nosepiece or change objectives or be forced to search for the area he was formerly observing under some other magnifi-



1. Microscope Tube. 2. Magnification Scale and Rotatable Selector. 3. Base and Arm. 4. Stage Adjusting Knob. 5. Mirror. 6. Stage Clips. 7. Rite-Lite Illuminator. 8. Stage.

cation. Once the ZOOMSCOPE is adjusted, no shifting of the specimen is required unless you wish to examine a different area. The area which you observed at low magnification is never lost when you change to other powers. Your area of interest remains directly in your field of view until you intentionally change the position of the specimen.

Both STZ microscopes have a Safety Focusing Clutch incorporated in their stage drive mechanism. This feature prevents damage to the stage mechanism if you should accidentally rotate the knob after the stage has reached its limit of travel. The clutch also serves to protect the objective and specimen if accidental contact should occur. Both of these models have a long working distance which permits easy placement and manipulation of the specimen.

One of the finest features of your STZ instrument is the constant matching of the Numerical Aperture (N.A.) to the degree of magnification. The N.A. is of prime importance in achieving high resolution from a microscope. The N.A. is a measure of the resolving power of the objective; it is this resolving power which determines the amount of detail your instrument can reveal. Where the conventional microscope is limited by the variety of objectives available, your STZ provides a continuous range of magnification, and automatically matches each degree of magnification with the correct N.A., constantly producing the finest image possible within the capabilities of the instrument.

Because of the high range of magnification, slide

mounted specimens are generally used with the STZ. The slide is normally secured to the stage under two removable spring stage clips. However, in the event that the object is so large that the clips interfere with proper observation, they can be easily lifted off, leaving the entire area of the stage free for the specimen.

STZ MICROSCOPE PROCEDURE

1. Place the slide mounted specimen on the stage, slipping the slide under the spring clips. (If using an unmounted specimen, slip a clear glass slide over the stage aperture. Remember, in observing fluids, a cover glass must be used to prevent distortion.) Slides up to 3mm thickness may be used.
2. Center the specimen over the stage aperture. Remember that the movement of the specimen in any direction causes movement of the image in the opposite direction. This is due to the fact that the microscope objective forms an inverted image of the specimen, a characteristic common to most biological microscopes. After a little practice, one automatically moves the specimen in the direction opposite to that which the eye seems to indicate.
3. Illuminate your specimen. (See general section on Illumination and RITE-LITE ILLUMINATOR pages 26-28.)
4. Your STZ is equipped with a precision concave mirror which concentrates your light source to permit you to see the greatest possible detail. Slide mounted specimens require the use of the mirror

for sub-stage illumination whether you are using a natural or artificial light source. When using natural illumination, direct your mirror at a patch of blue sky, being careful to aim the mirror to eliminate window bars or other objects which might serve as a distraction to good viewing. Continue to tilt and adjust your mirror until a uniformly illuminated field of view appears. With the specimen centered over the stage aperture, grasp the knurled ring above the magnification scale and rotate this scale until the lowest magnification is at the white index dot on the microscope arm. It is always easier to locate the area of the specimen you wish to investigate with the lowest possible magnification.

5. Look from the side and raise the stage by turning the adjusting knob at the left until the specimen is approximately ¼" to ⅝" below the objective. Now, looking through the eyepiece tube, adjust the stage downward until the specimen comes into focus. By focusing downward, one eliminates the possibility of any accidental contact between the specimen and the objective which might cause damage to both the slide and the instrument.
6. Now, rotate the scale so that the highest degree of magnification appears at the white index dot. Make a delicate stage adjustment to secure the sharpest possible focus. You may now dial any desired magnification within the range of the instrument with, at most, a slight "touch-up" of the stage adjustment to maintain the sharpest possible image.

GENERAL

CARE OF THE MICROSCOPE

Proper care of your instrument is as important as the ability to operate it correctly. Your microscope is made of material of the highest quality and durability. If properly cared for, it will show little or no wear in appearance or in the operation of its working parts, even after many years of normal use.

CARE OF THE STAND

The microscope should be kept under cover at all times when not in use. Dust is an enemy of this instrument. Keep your microscope in a locker, box or in the container in which it was received. You might also protect it with a plastic cover or a close-mesh cloth such as cotton or velvet. Handle the instrument gently. Avoid placing it upon the table with force or giving it a sudden jar or bump. Grasp it firmly and carefully so that it will not be dropped accidentally. Your microscope is impervious to practically all common solvents used in the laboratory. The finish is stain and chip resistant. However, it may become soiled and should be wiped with a damp cloth. If soil is stubborn, a cloth moistened with a mild detergent solution may be used, taking care to prevent any detergent from coming in contact with the lenses. The moving parts of your microscope are permanently lubricated and need no further attention under normal conditions.

CARE OF THE MIRROR AND LENSES

No dust should be permitted to settle upon either the lenses or mirror of your microscope nor should they be touched with the fingers. It is most important to remove any particles of dust or grit before polishing these surfaces to prevent scratching of the lenses or mirror.

The R1900 and the R8900 models are equipped with a mirror of acrylic material. The silvered reflective surface is covered with a protective coating on which surface scratching may appear due to improper cleaning methods. The following cleaning procedure is recommended to avoid scratching of this coating. Particles of dirt which accumulate on this surface should be blown off with the breath or with a hand syringe. Do not attempt to rub dust or stains from this mirror with a dry cloth. When further cleaning becomes necessary, such as the removal of grease or finger prints, use only an absorbent cotton pad which has been saturated with a mild detergent solution to gently swab and flush away any remaining dust or stains. A mild detergent is the only recommended cleaning solution. The mirror should then be rinsed with a clean pad of absorbent cotton saturated with clean water, after which it should be patted dry with another dry absorbent cotton pad. Any remaining lint should be blown, not rubbed, off the surface.

The lenses of all five microscopes and the mirrors used on the ZOOMSCOPES are made of highly polished, precision ground optical glass. A camel's hair brush (child's paint brush) and a well washed piece of linen

are recommended to clean these surfaces. Dust which settles on the eyelens of the eyepiece will appear as indistinct spots upon the field of view. Always remove the dust particles from the lens or mirror before polishing by brushing the surface gently with the camel's hair brush. Polishing may be done with a piece of lens paper or linen cloth. Use the brush again to remove any remaining traces of lint.

If spots on the lenses or the glass mirrors prove to be stubborn, breathe on the surface and immediately wipe, using the condensed moisture of the breath before it can evaporate. A moistened lens tissue may also be used. If grease is present on the lens or mirror surface, a cotton tipped stick moistened with alcohol may be used, taking care to press very gently so that the surface will not be scratched. Wipe again with a clean cloth and remove any lint with the brush.

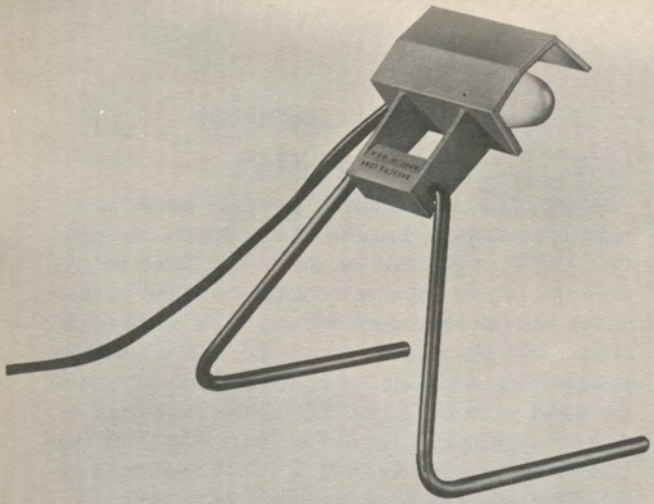
When you have finished using the microscope, clean all objects, including slides as well as the instrument itself. Carefully return the microscope to its storage location and cover it. Put away all papers, books, slides and clean up your work area. Cleanliness and order are the first rules of scientific laboratory practice.

ILLUMINATION

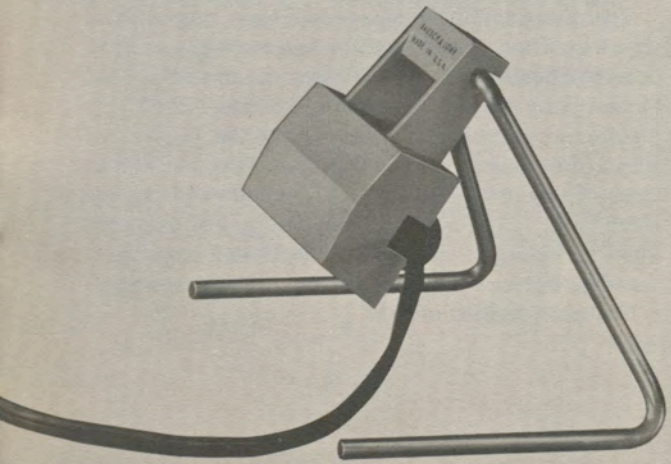
The proper illumination of specimens is a most important detail in microscope procedure. Unless your object is carefully illuminated, you may fail to obtain the sharp image which is necessary for clear viewing and accurate examination. Daylight may be used as a source of illumination, although the constancy and convenience of an electric illuminator is preferred. If daylight is selected, place the microscope directly in front of and as close to a window as possible. Illumination should be neither so dim that it causes strain in trying to see detail, nor so bright that it drowns out detail with glare. A moderate steady light is best.

Direct sunlight is intolerably bright, and if it falls anywhere near the microscope, the glare is exceedingly uncomfortable, and detrimental to good observation. Use light reflected off a sheet of white or blue paper, if necessary. You can often see more detail with less light, so use the least amount of light necessary for sharp viewing. When you look down the microscope tube and observe a moderately bright, uniform circle of light (field of view), your microscope is properly adjusted for good illumination.

In viewing large, opaque objects, the specimen should be normally lighted from above. Natural light from a window or from a table or desk lamp provides suitable illumination, although the use of an illuminator such as the Rite-Lite is most desirable.



Rite-Lite Illuminator (above, positioned for top illumination: below, for pass-through reflected light).



RITE-LITE ILLUMINATOR

Cat. No. 31-33-03

The use of an illuminator is generally preferred by most microscopists, because of its uniform illumination, day or night, rain or shine. The Rite-Lite has been specially designed as a companion to the Science Series, and can be plugged into any 115V 50-60 Cycle outlet. This illuminator is equipped with a specially designed 9¾ watt bulb for optimum illumination. In the event of bulb failure, this special bulb may be ordered by Bausch & Lomb Cat. No. 31-31-40. If this bulb is not readily available, a 7C7W bulb may be secured from your local hardware or variety store. The 7C7W is a common nightlight replacement and is recommended only as a temporary substitute, as this bulb is noticeably dimmer and is not designed to produce the brightness of the No. 31-31-40.

The illuminator rotates on its base support and serves as a top illuminator for large opaque objects, or as a reflected light source when the mirror is used to pass light through mounted specimens.

Aim the illuminator directly into the mirror for substage illumination. The mirror is then adjusted to direct the light through the stage aperture and provide a full field of concentrated illumination. For overhead illumination, the Rite-Lite is located at a convenient working distance and adjusted so that the specimen is uniformly bathed in light.

GUARANTEE: If a product of our manufacture proves defective in material or workmanship, an appropriate adjustment will be made . . . parts not of B&L manufacture, carry the guarantee of their manufacturers. This guarantee does not cover damage in transit; damage caused by carelessness, misuse, or neglect; or unsatisfactory performance as a result of conditions beyond our control.

—Bausch & Lomb Incorporated

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