



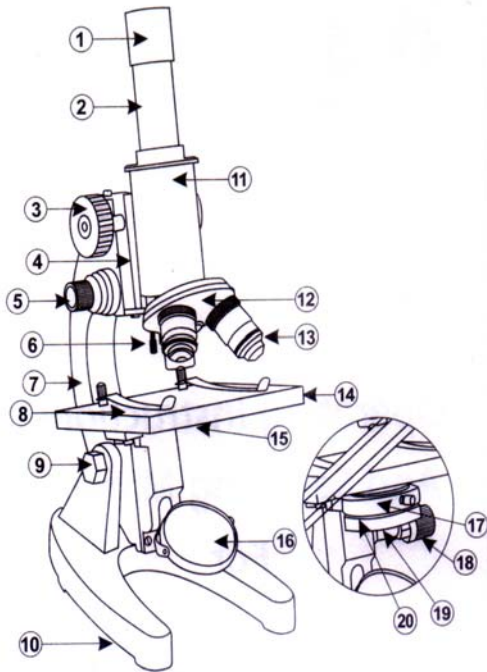
Instructions
for the use of the
600 Power
Microscope

Denver Area 303-679-6252 Toll Free 866-206-0773

www.AtHomeScience.com

Using the Microscope

Your microscope is a precision instrument that requires some skill and understanding to use properly. This short introduction to the microscope will give you the basic information you will need in order to operate it effectively. With some practice it will become a simple matter to enter the wondrous world of microscopy, and with proper care and maintenance your microscope will provide a lifetime of insight into the inner world of the microscopic.

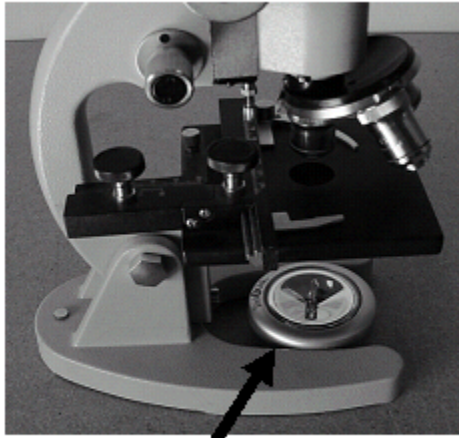


The Parts of a Light Microscope

- | | |
|----------------------|---------------------|
| 1. Eyepiece | 11. Main Tube |
| 2. Eye Piece Tube | 12. Nosepiece |
| 3. Coarse Adjustment | 13. Objective Lens |
| 4. Metal Block | 14. Stage |
| 5. Fine Adjustment | 15. Disc Diaphragm |
| 6. Stopper Set Screw | 16. Mirror |
| 7. Arm | 17. Condenser Lens |
| 8. Stage Clips | 18. Filter Holder |
| 9. Inclination Joint | 19. Iris Diaphragm |
| 10. Base | 20. Condenser Screw |

A compound light microscope has the following basic systems and parts:

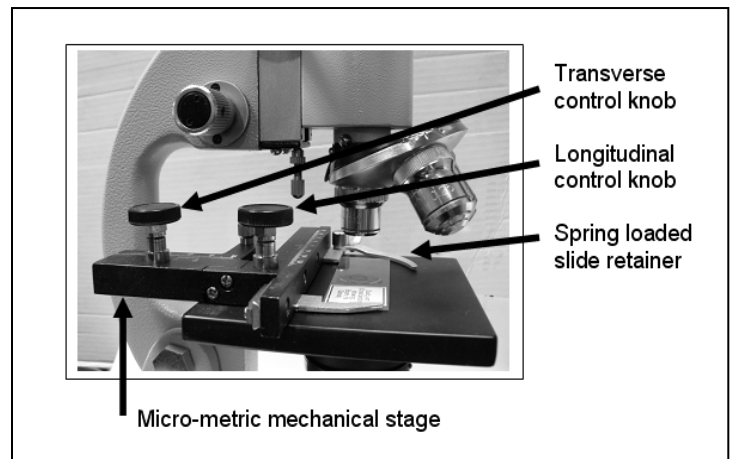
- **Specimen controls** - hold and manipulate the specimen.
 - **Stage** – a square platform where the specimen rests.
 - **Stage clips** - hold the specimen still on the stage. Because you are looking at a magnified image the smallest movement of the specimen can move parts of the image out of your field of view.
- **Illumination** - sheds light on the specimen. The simplest illumination system is a mirror that reflects room light up through the specimen.
 - **Mirror** – held by a C-shaped bracket that plugs into a hole in the base of the microscope, under the stage. The mirror is flat on one side and concave on the other, and the concave side focuses the light more strongly.
 - **Battery operated illuminator** - produces sufficient light where other light sources are not sufficient to see the specimen clearly. The illuminator is used with the microscope by placing it at the base of the microscope directly underneath the stage in place of the mirror bracket (see the picture below).



Battery Operated Illuminator Light

- **Condenser** - a lens system under the stage that aligns and focuses the light from the lamp onto the specimen. The condenser unit can be removed for cleaning by loosening the set screw on its side.
- **Iris diaphragm** – built into the condenser unit in the path between the light source (mirror or lamp) and the condenser lenses to alter the amount of light that reaches the specimen. Moving the lever on the side of the condenser unit changes the diameter of the aperture of the diaphragm, varying the amount of light reaching the specimen. This alters the contrast in the image and significantly affects the visual quality of the image.
- **Filter** – a circular bracket swings out from under the condenser to hold filters that can change the color quality of the light. A blue filter supplied with the microscope makes the color of the illumination from an electric lamp more like natural light or sunlight.
- **Lenses** - form the image.
 - **Objective lens** - gathers and focuses light from the specimen. A typical student microscope has 4, 10 and 40 power objective lenses.
 - **Eyepiece** - transmits and magnifies the image from the objective lens to your eye. A typical student microscope has 10 or 15 power eyepieces. A Wide Field eyepiece allows the viewer to see a wider area of the specimen.
 - **Oil immersion lens** – a special type of high-powered objective lens (often 100X) that is designed to focus by lightly touching the specimen slide with a drop of oil forming a seal between the slide and the lens.
- **Focus** - to position the objective lens at the proper distance from the specimen.
 - **Coarse-focus knob** - brings the object approximately into the focal plane of the objective lens.
 - **Fine-focus knob** - makes fine adjustments to focus the image.
- **Support and alignment**
 - **Arm** - the curved portion of the microscope frame that holds all of the optical parts at a set distance from the stage.

- **Base** - supports the weight of all of the microscope parts.
- **Inclination joint** – connects the arm to the base and allows the arm to tilt toward the viewer for a better viewing position.
- **Nosepiece** - a rotating mount at the bottom of the tube that holds three objective lenses.
- **Tube** – blocks out stray light and holds the **eyepiece** at its top and the **nosepiece** with **objective lenses** at its bottom a specific distance apart (for this microscope 160 mm) in order to make the lenses work together optically.
- **Rack and pinion gear and block** - connects the **tube** to the **arm** of the microscope. It is controlled by the coarse focus knobs and allows the tube to move relative to the arm, changing the distance from the lens to the specimen to focus the image or to move the assembly away from the stage in order to change lenses or slides.
- **Stop set screw** – located at the base of the focusing rack and pinion block and behind the rotating nosepiece, the stop set screw can be set to keep the coarse focus from placing the objective lens so low that it strikes and damages the specimen. **IMPORTANT** - If the stop set screw is set too tight it will be impossible to lower the tube enough to focus the microscope and the user may think the microscope is not working. If the set screw is too loose you may damage the lenses or the slide (see the adjustment instructions on page 6).
- **Adjustable stage microscope** – If you purchased the adjustable stage microscope, it has a spring loaded slide retainer, holder for the slide being viewed. In addition, it includes a micro-metric mechanical stage which includes transverse and longitudinal control knobs to permit the smooth positioning of the specimen slide, and an x-y measurement grid to allow recording a specific location on the slide, and easy return to a specific viewing area on the slide.



Some Microscope Terms:

- **Magnification** - the product of the magnifying powers of the objective and eyepiece lenses (e.g., a 15X eyepiece and a 40X objective lens will together produce $15 \times 40 = 600$ power magnification).
- **Resolution** - the closest two objects can be before they are no longer detected as separate objects (usually measured in nanometers). Resolution is related to the numerical aperture of the objective lens (the higher the numerical aperture, the better the resolution) and by the wavelength of light passing through the lens (the shorter the wavelength, the better the resolution).



- **Brightness** – refers to how light or dark the image is. It is related to the illumination system and can be changed by changing the strength of the source of light and by adjusting the condenser diaphragm aperture. Brightness is also related to the numerical aperture of the objective lens; the larger the numerical aperture, the brighter the image.
- **Focus** – refers to if the image is blurry or well-defined. It is related to focal length and can be controlled with the focus knobs. The thickness of the cover glass on the specimen slide can also affect your ability to focus the image if it is too thick for the objective lens.
- **Contrast** – refers to the difference in lighting between adjacent areas of the specimen. It is related to the illumination system and can be adjusted by changing the intensity of the light and the diaphragm aperture. Chemical stains applied to the specimen can enhance contrast.
- **Numerical aperture** - the measure of the light-collecting ability of the lens.
- **Field of view** - the area of the specimen that can be seen through the microscope with a given eyepiece and objective lens.
- **Focal length** - the distance a particular lens requires to bring the light to a focus (usually measured in millimeters).
- **Focal point or focal plane** - the point or plane at which the rays of light from a lens converge in a point.
- **Depth of field** - the vertical distance, from above to below the focal plane, that yields an acceptable image.

Care and Handling of the Microscope

- When you move your microscope, you should always use two hands. Place one hand around the arm, lift the scope, and put your other hand under the base of the scope for support. If you learn to carry the scope in this way, it will force you to carry it carefully, ensuring that you do not knock it against anything while moving from one place to another.
- When you put the scope down, do so gently. If you bang your scope down on the table eventually you could jar lenses and other parts loose. Your microscope seems like a simple instrument but each eyepiece and objective is actually made up of a number of lenses, put together in a wonderful way to create wonderful magnification. If you bang your scope around, you are shaking upwards of 15 to 20 lenses.
- Always have clean hands when handling your scope. It would be a shame to damage your scope with too much peanut butter!

Using the Microscope

- Remove the microscope body from the case. Remove the plastic cap closing the top of the tube, remove the eyepiece from its plastic container and insert the eyepiece into the opening in the tube.
- Remove the objective lenses from their individual containers, unscrew the plastic caps on the revolving nosepiece and screw the objective lenses into the revolving nosepiece, placing each in the color coded position that corresponds to the color band on the lens.
- Adjust the tension on the coarse focus control knobs to suit your touch or to compensate for normal wear over time. To increase tension, hold one knob firmly in each hand and turn them in opposite directions, each clockwise with reference to the microscope. Turning the knobs counter-clockwise relative to the microscope will loosen the coarse focus tension.
- Unplug the rotating mirror bracket from the base of the microscope, insert the mirror (packaged separately with the microscope) into the bracket, firmly spreading the arms of the bracket so that the points on the inside of the tips of the bracket can fit into the depressions on the rim of the mirror. When the mirror swivels freely plug the bracket back into the base of the microscope.
- Tilt the arm of the microscope back until it is at a position where you can comfortably look into the microscope eyepiece (not recommended, however, when using a wet mounted specimen with no cover glass).
- Slide placement on the microscope depends on the type of microscope that you have:
 - **NORMAL MICROSCOPE.** Place a slide under the clips on the stage with the area you wish to view over the center of the hole in the stage. For your first try use either the focusing slide or select a specimen that is relatively large and has some bright color that will be easy to find in the view.
 - **ADJUSTABLE STAGE MICROSCOPE.** To get started, use a prepared microscope glass slide, and place it into position of the center of the microscope Stage, by opening the spring-loaded Slide Retainer Lever of the Micrometric Mechanical Stage and gently letting it pivot closed on the edge of the slide. The spring tension will hold the slide in place. Transverse and Longitudinal Control Knobs permit the smooth positioning of the specimen slide. A vernier scale is provided to permit accurate measurements to be made. An Attachment Screw permits the Micrometric Mechanical Stage to be removed, if desired. Move the area you wish to view over the center of the hole in the stage using the Transverse and Longitudinal Control Knobs.
- Turn the nosepiece of the microscope to select the longest lens (usually the highest power or 40X lens). Lower the tube of the microscope with the coarse-focus knob until it almost touches the slide. **If it will not go that far unscrew the stop set screw** behind the rotating nosepiece of the microscope by turning the set screw clockwise as you look down from the top until it will let you move the tube down (**slowly!**) so that the lens can almost touch the slide. While it is in that position lightly tighten the screw by turning the

knurled nut on the shaft of the set screw counter-clockwise as you look down from above and lock it in place.

IMPORTANT – If the set screw is not adjusted as described above so that the 40X objective lens can almost touch the slide you may not be able to focus your microscope properly. **Also**, if the set screw is not adjusted as described above the objective lens will be able to be lowered too far towards the slide and the microscope stage and **this could damage the slide, the lens in the stage, and/or the objective lens.**

- Place a light source in front of the microscope, use the small lever on the sub-stage condenser to open the diaphragm fully, and adjust the mirror so that the light is brightest as seen through the microscope. Alternately, use the battery operated illuminator light.
- Rotate the nosepiece to select the lowest lens (4X). Lower the tube with the coarse-focus knob until it reaches the stop that is set (which you have just set above) and will not go further. Raise the barrel slowly with the coarse-focus knob until you see an image from the slide. Finish the focus with the fine-focus knob.
- Looking through the microscope, and with thumb and forefinger on each end of the slide, move the slide slowly on the stage until the object you wish to study is centered in your field of view.
- Rotate the nosepiece of the microscope to select the objective lens that will give you whatever magnification you need. Once one lens is focused properly any other objective lens on the nosepiece rotated into position will be roughly in focus, requiring only fine focus or very slight movement of coarse focus to bring the image with the new lens into correct focus.
- Move the lever for the diaphragm through its full range to select the amount of light that gives you the best contrast. Many details will be visible with good contrast which are otherwise lost with too much or too little light.

Using an Electric Illuminator (NOTE – *Electric Illuminators are not provided with this microscope since they can get very hot. The battery operated illuminator that is provided is safer since it does not get hot. See the precautions below if you do obtain an electric illuminator for your microscope.*)

Grasp the mirror bracket with your fingers behind it and pull the bracket to unplug it from the base of the microscope. Insert the metal plug tip of the electric illuminator into the hole from which you have unplugged the mirror bracket. Rotate the fixture so that the glass opening over the bulb points up toward the light condenser under the stage. Plug the electric cord into a 120 volt outlet and turn on the switch in the cord.

IMPORTANT – Turn the illuminator off when you are not using it! The illuminator gets very hot. Turning it off when not in use will protect you from possible burns and will increase the life of the illuminator bulb.

WARNING – Use care in handling the illuminator after it has been on for some time since it will get hot. Handle the illuminator by the end farthest from the light source.

Using an Oil Immersion Lens

Install the oil immersion 100X objective lens in place of any of the other objective lenses. The 4X lens is a good choice. Apply a drop of oil on the specimen slide and turn the revolving nosepiece to bring the 100X objective into position. If the barrel is too low to allow the 100X lens to move into position raise it with the coarse focus very slightly, position the lens, and then lower the barrel until the tip of the 100X lens touches the oil and the slide.

The tip of the lens is able to move a short distance into the lens against a spring in order to keep from putting too much pressure on the slide. With the lens tip touching the oil and slide, focus with the fine-focus knob. The working distance of the lens is very short so do not use the coarse-focus knob other than to carefully position the lens. After using the oil immersion lens wipe off the oil carefully with alcohol.

Cleaning the Microscope

- The first step in keeping your microscope clean is to keep it from getting dirty. Always keep your microscope covered with the dust cover when it is not in use.
- Your eyepiece will need cleaning from time to time. Due to its position on the scope, it will have a tendency to collect dust and even oil from your eyelashes. The eyepiece lens should be cleaned with the microfiber cloth that comes with your microscope, with a high quality lens paper, or with a cotton swab. Brush any visible dust from the lens and then wipe the lens. You may wish to use a bit of lens solution, applied to a cotton swab, but do not use facial tissues to clean your lenses.
- If the eyepiece should collect dust on the interior surfaces it can be disassembled for cleaning. Slowly unscrew the two parts of the eyepiece, carefully noticing the positions of the lenses (e.g., convex surface up or down) as you open it so that you can reassemble them in the same positions.
- You will need occasionally to clean the objective lenses. Use a clean surface of the microfiber cloth or a fresh cotton swab each time so that you don't transfer dust from one lens to another.
- Clean the lenses in the glass condenser under the stage by loosening the set screw to remove the condenser assembly. The assembly can be unscrewed to remove the lenses, but be sure to notice the positions of the lenses (e.g., convex surface up or down) as you open it so that you can reassemble them in the same positions
- Finally, clean the mirror or the glass lens over your illuminator so that an optimal amount of light can shine through. You can also follow up by wiping down the whole microscope with a soft, clean cotton towel.

Storing the Microscope

- The best place to store your scope is on a stable desk, table or shelf where the scope will not be disturbed or bumped. Dust is an enemy to your lenses so when not in use always keep your scope covered with the vinyl cover that comes with it.
- If you are unable to find a safe place where you can leave your scope out, store it in the fitted foam case in which it came.