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Troubleshooting Clinical Microscopes©

A Comprehensive Guide to the Proper Use, Daily Care, Troubleshooting, and Repair of Clinical Microscopes

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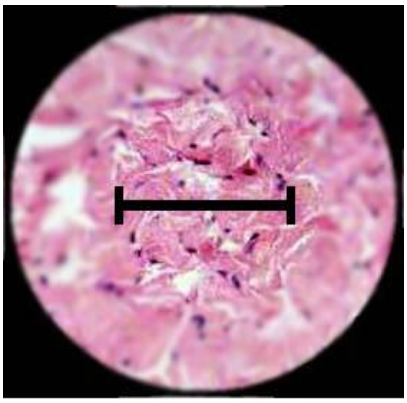
Objectives – Levels of Quality

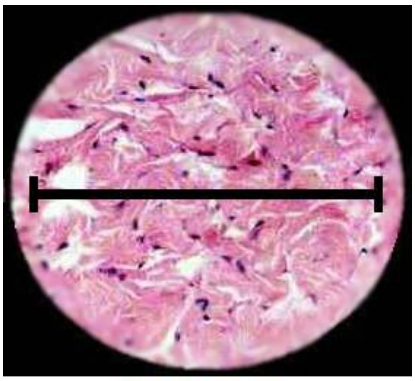
Achromat (Cheap)



50% In Focus

An objective manufactured with only the middle 50% of the image field is in focus. These objectives are difficult to work with, since you must bring every specimen to the middle of the field to see a quality image. May be suitable for a Blood Bank or Urinalysis where little or no screening of the slide takes place. The manufacturer usually does not label these objectives as "Achromats;" they don't like to advertise a lower quality objective.

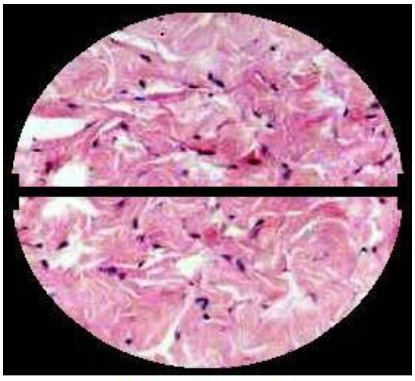
Neoplanachromat "Semi-planachromat"



95% In Focus

An objective manufactured with about 90 - 95% of the image field in focus. This design is an economical alternative to more expensive Planachromats, and still provides a wide "in-focus" area to screen slides. Neoplanachromats are recommended for Microbiology, and possibly Hematology.

Planachromat (also called a "Flat-field" objective)



100% In Focus

An objective manufactured with 100% of the image field is in focus. This design is more expensive, but is essential to applications where the entire slide is screened, such as in Cytology and Pathology.

Apoplanachromat (Very Expensive)

This objective is the same as a planachromat, however the manufacturer also guarantees that the image will be "Color True." Pathologists may wish to take microphotographs of specialty stains where accurate coloration is vital.*

* Spending $5,000 to $30,000 on a single Apoplanachromat objective may be useless if the color temperature of the bulb is not managed properly. (The hue of the image seen through a microscope will vary slightly as the bulb intensity is changed.)

Cleaning Oculars – The Procedure

Before you begin …

- Don't even think about cleaning oculars until you have read pages 6,8 &10 in this guide.
- Hopefully you are cleaning your ocular because it is dirty, and not because of some misguided daily maintenance effort (See page 12).
- Normally, you will not take an ocular apart to clean it unless there is dirt on an internal surface. (See page 34).

Supplies you will need …

- Q-Tip™ brand cotton-tipped applicators*
- Lens Cleaning solution (see page 10).
- Coordination and patience

The Procedure …

1. Slightly dampen the tip of the applicator with lens cleaning solution. The applicator should not be saturated with solution; if you shake the applicator, no solution should drip off. (If you are not careful with this, the cleaner solvent may run down inside the ocular and possibly damage the internal lenses.)

2. "Rub Your Belly & Pat Your Head" Time. Seriously, you are now required to do three things simultaneously to properly clean your ocular; this will take some practice.
    a. Start by touching the dampened applicator to the center of the ocular lens and begin to make ever-expanding concentric circles as you move the applicator toward the outside rim of the ocular. When you get to the outside rim you must STOP and discard the applicator. You will probably need 3 to 10 applicators to properly clean one ocular. Never re-use applicators, even if they look clean!
    b. While you are completing step 2a, simultaneously and slowly rotate the applicator to always bring fresh cotton to the surface of the lens.
    c. Finally, while all this is happening, you must gently blow across the surface of the ocular lens. This is to evaporate the lens cleaner before it can leave a smudge mark.

Word of caution ... you must make sure that your container of lens cleaner does not get contaminated with dirt and grime. Avoid taking used applicators back to the lens cleaning solution; this is why you discard them after each use.

* When Q-Tip™ brand cotton-tipped applicators are made, the cotton is wrapped onto the cardboard shaft – as opposed to being snipped to create the shape of an applicator. Using lesser quality applicators, those have been snipped, will leave hundreds of fibers all over your optics. Not a good hair day!

Parfocality … what is it?

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Parfocality relates to the ability to move from objective to objective with minimal refocusing. Think of "par" in terms of hitting par on a golf course. Par is the expected comparative score for that golf course; in the case of microscopes it is the expected focusing point between objectives. Specifically, if you focus an image under the 10X objective and move to any higher magnification objective, you should not have to rotate the fine adjustment mechanism more than ½ of 1 revolution. (Remember that any oil immersion objective will need immersion oil on the slide to bring the image into focus.) Microscopes are manufactured to be parfocal in all magnifications 10X and higher. Objectives with a magnification below 10X are often manufactured to NOT be parfocal with the higher magnification objectives.*

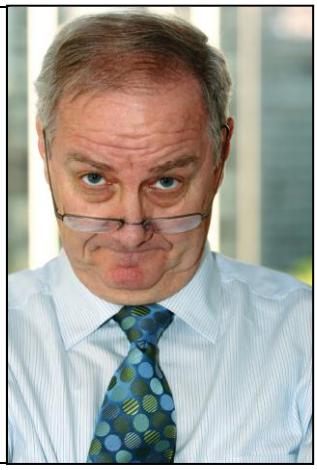
There are only a few common reasons why a particular objective would not be parfocal …

1. The objective has come unscrewed somewhat from the nosepiece of the microscope. This would alter the relative height of the optics in that objective and require additional focus mechanism adjustment.

2. The objective is actually from a different microscope or manufacturer. Many, but not all, objectives are compatible on other manufacturers' microscopes. If they are compatible, they will produce an image within about 6 full revolutions of the fine focus mechanism. (The fine focus knob can be rotated either clockwise or counterclockwise to bring the image into focus.) Remember, objectives should never strike the slide; always go slowly if you attempt to swap objectives between microscopes. If you switch objectives and the image is not in focus within the 6 full revolutions of the fine focus mechanism, the objective is not likely compatible on that microscope. (Go to page 23 to discover how to reduce the amount of rotations of the fine focus mechanism by parfocaling an objective.)

3. Immersion oil has begun to leak internally into the objective. If immersion oil leaks inside any objective, it will alter the focusing point of that objective as well as the resolution (sharpness) of the image.

*"You may not want to do that!" Parfocality vs. Parcentration



A rather obstinate pathologist once asked me to correct a parfocaling problem on his new microscope; the 2X objective had been made by the manufacturer not to be parfocal, and he wanted it corrected. I explained that the objective was not parfocal to prevent the higher magnification objectives from hitting the slide. I explained the optical design reasoning for such a situation, and that if I corrected his parfocaling problem by adding an excessive number of parfocaling shims to the objectives, that in turn might create a parcentration problem! He quickly changed his mind. Bottom line … don't try to make low magnification objectives (less than 10X) parfocal with higher magnification objectives; they were made that way for a worthy purpose.