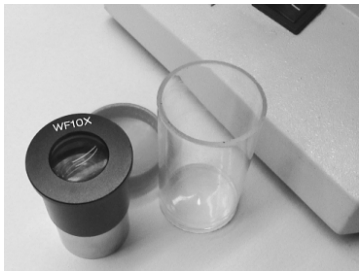
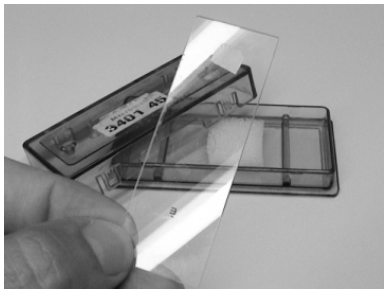
How to use the micrometer eyepiece to measure objects observed in a microscope

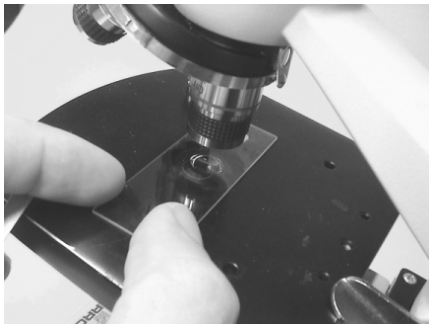
STEP 1: First, carefully remove the present eyepiece of your microscope and replace it with the eyepiece which has a ruler etched inside like the one shown in the photos:



all images by A. Damon

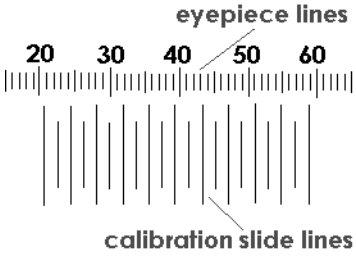
STEP 2: Calibrate the microscope. To do this, a calibration slide must be used. This is a glass slide with one one-hundredth of a millimeter, 0.01mm, engraved on to its top surface (see photo to the right). Use care when handling this little piece of glass - it costs a lot of money to replace! Since a hundredth of a millimeter is very small and difficult to see, a circle is drawn around it. This slide allows us to find out how big things are as we look at them through the microscope at different powers of magnification. Put the slide on the stage as shown in the photo. Be sure that the top of the slide (the surface with the microscopic lines engraved on it) is pointing up.





Set the microscope to low power and focus on the lines engraved on the surface of the calibration slide. You should see the following:

Note that you should also see very small lines between the calibration slide lines. These are too small to be counted at low power.



STEP 3: The number of lines must be counted. As shown in the figure, the eyepiece lines have numbers on them whereas the calibration slide's lines do not. The total number of eyepiece lines (which will be called **X**) are from line 21 to 59. That's a total of 38 lines. The number of calibration slide lines (which will be called **Y**) show a total of 10 lines (note that the shorter lines mark off half spaces and that the first line is not counted because is shows the zero mark).

STEP 4: Calculate how much each line of the eyepiece measures. In other words find out what distance is shown between each line of the eyepiece. To do so, use this equation:

$$\frac{Y}{X} \times 10\ \mu m = \text{measurement between 2 lines on the eyepiece}$$

If we plug in the numbers from the example in step 3, we get 10/38 x 10µm = 2.63 µm. That means that as you are looking through the microscope at low power, the space between each line on the micrometer eyepiece measures **2.63µm**.
If a cell is 7 lines wide when observed on low power, that means that in reality, it measures 7 x 2.63µm = 18.4µm. Typically animal cells are supposed to be between 10 and 30µm but some plant cells can be over 100µm.

STEP 5: After calibrating for low power observations, medium power should be calibrated.
STEP 6: Do the same for high power if you think you will be using high power.
STEP 7: Now it is possible to use the microscope to observe and measure things. Take the calibration slide out and carefully put it back in its protective box so that it does not get damaged. Now place the slide of what you would like to look at on the stage. There should only be one slide on the stage at any given point - we never stack up one on top of the other

Note that if you change microscopes, the calibration process must be done again for each of the objective lenses that you are using. Why? Because the magnification is different on different microscopes. To save time, only calibrate the eyepiece for the objective lenses that you will be using.

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