The Microscope

Its History

What it does?

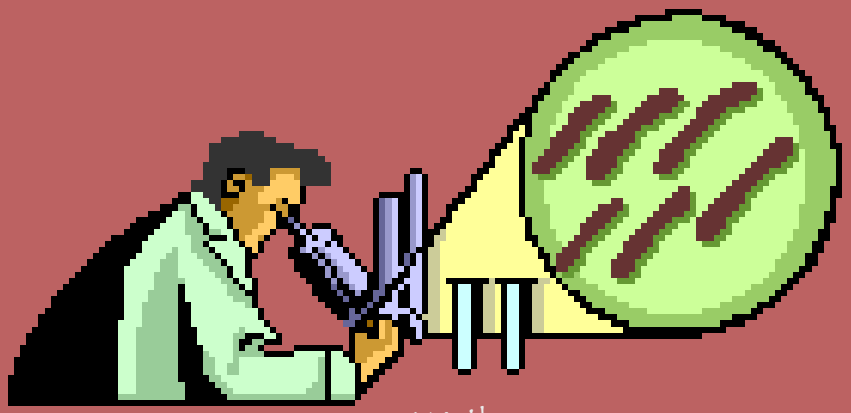
What are its parts?

How do you use a microscope?

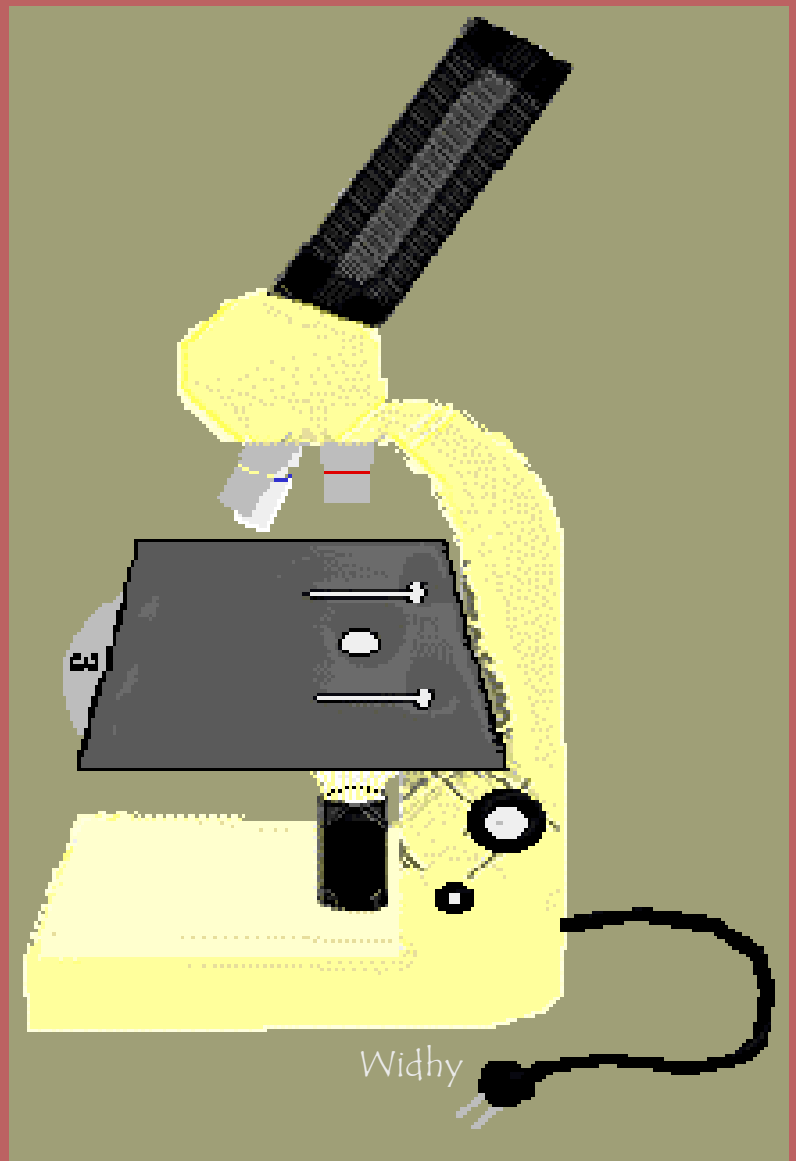
Preparing a Slide

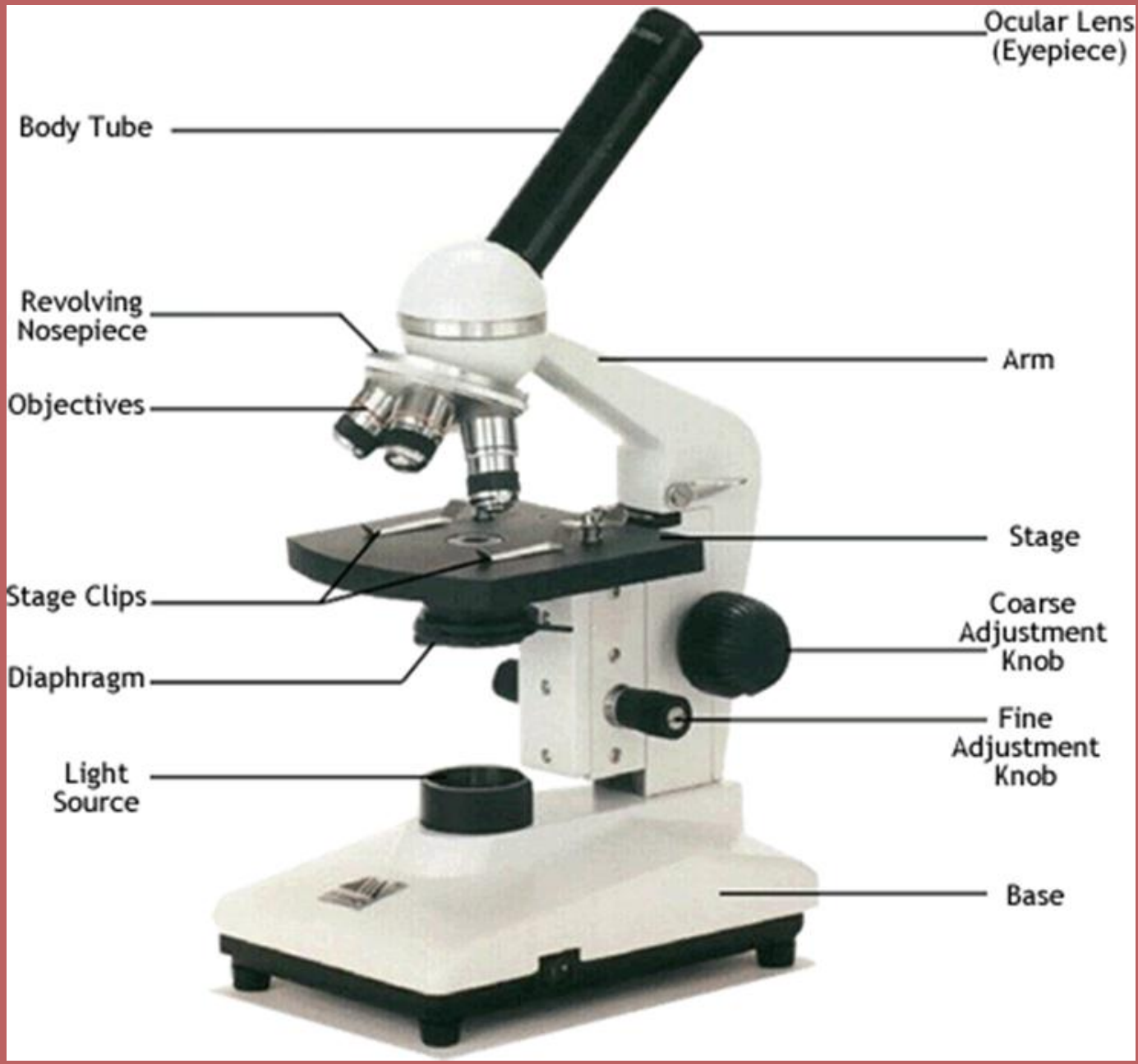
REMEMBER.....

The Microscope is a tool that allows viewing of objects that are too small to be seen easily by the naked eye.



The Parts of Microscope




Ocular Lens
(Eyepiece)
Body Tube
Revolving
Nosepiece
Arm
Objectives
Stage
Stage Clips
Coarse
Adjustment
Knob
Diaphragm
Fine
Adjustment
Knob
Light
Source
Base

Tasks

- Describe the function of each part
- Describe the use of microscope
- Describe differences between light and electron microscopes

Microscope parts

- Eyepiece
- Body tube
- Arm
- Nosepiece
- High power objective
- Low power objective
- Coarse adjustment
- Fine adjustment

- stage
- stage clips
- diaphragm
- mirror
- base

Tasks

- Describe the function of each part
- Describe the use of microscope
- Describe differences between light and electron microscopes

The function of microscope's parts

- Eyepiece : contain the magnifying lens you look through
- Body tube : maintains the correct distance between the eyepiece and objective lens
- Arm : supports the body tube
- Nosepiece : holds high and low power objectives, can be rotated to change magnification

Function (cont.)

- High power objective : provides the most magnification, usually 40 X
- Low power objective : provide the least magnification, usually 10 X
- Coarse adjustment : moves the body tube up and down for focusing
- Fine adjustment : used to sharpen the image, moves body tube only slightly

Function (cont.)

- Stage clips : hold the microscope slide in place
- Stage : supports the microscope slide
- Diaphragm : regulates the amount of light that enters the body tube
- Mirror : sends light upward through the diaphragm, the object, and the lenses
- Base : supports the microscope

Use of the microscope

- Always carry the microscope with both hands. Hold the arm with one hand. Place the other hand beneath the base.
- Place the microscope on the table gently with the arm toward you and the stage facing a light source. The top of the table should be cleared of other objects.
- Turn the nosepiece so that the low power objective lens clicks into place.

Use of the microscope (cont.)

- Look through the eyepiece and adjust the diaphragm so that light comes through the opening in the stage. The circle of light is called the field of view.
- Always focus first with the coarse adjustment and the low power objective lens. View the microscope from the side as you lower the objective. Raise the body tube and focus by turning the coarse adjustment.

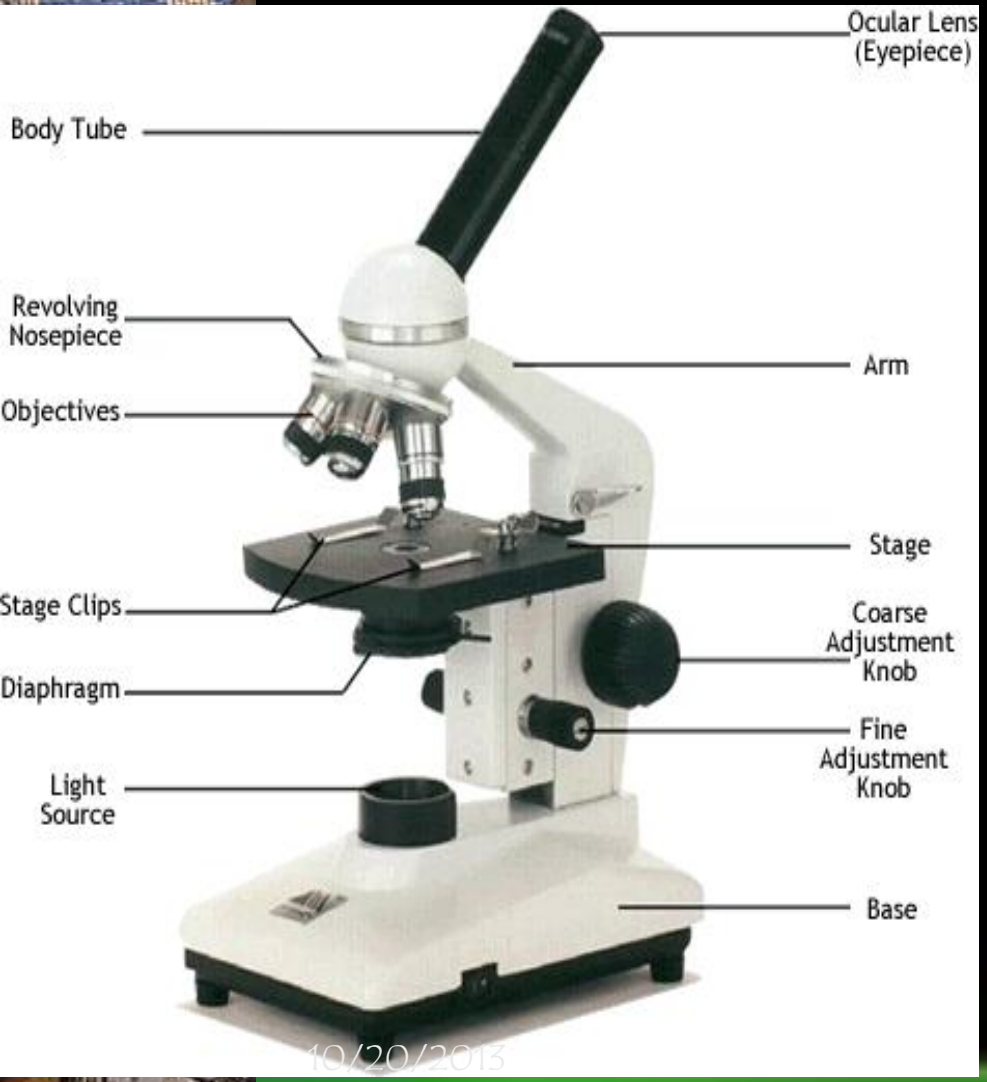
Use of the microscope (cont.)

- Turn the nosepiece until the high power objective lens clicks into place. *Use only the fine adjustment with this lens.* There will be less light coming through the objective.
- Be sure to keep your fingers from touching the lenses.
- Use only special lens paper to clean the lenses

Use of the microscope (cont.)

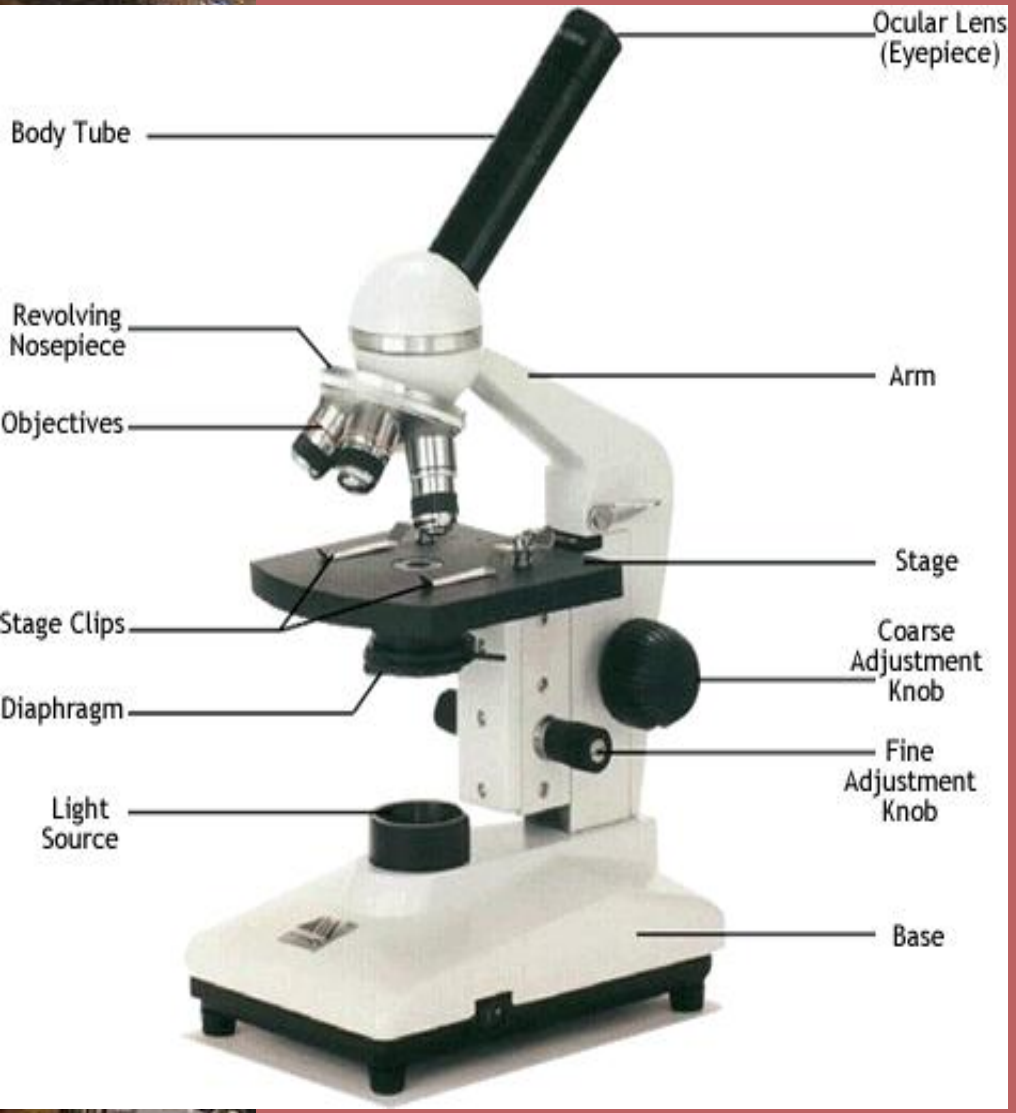
- Before putting the microscope away, always turn the low power objective into place over the stage.
- Raise the body tube until the low power objective is about 2 or 3 cm from the stage.
- An electron microscope uses a beam of electrons. Magnets, instead of lenses, focus the beam to form a picture.

The Microscope



- Eye piece- which is the first lens you look through
- Arm- supports it to the tube and connects it to the base
- Stage- Platform in the middle in which holds your slides
- Coarse Adjustment Knob-
- Fine Adjustment Knob-
- Base- Bottom of the microscope which is used for support
- Light Source-

The Microscope



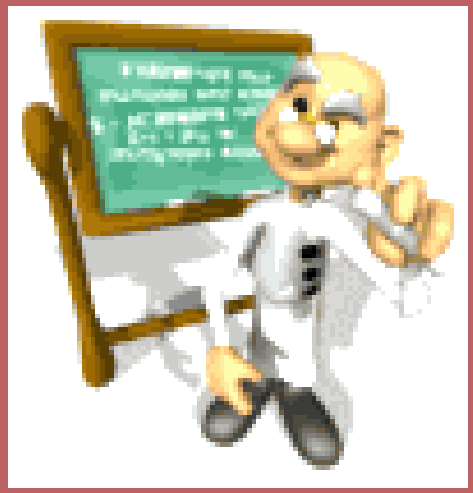
- Diaphragm-is used to regulate light
- Stage Clips- Holds the slides in place
- Objectives- there are normally 3 or 4 of these lenses that have different magnifications
- Nose Piece – the part that holds the objectives
- Body Tube-

TRANSPORTING THE MICROSCOPE

- The microscope should be carried with two hands.
  - One hand should be on the base or bottom.
  - One hand should be on the arm or handle.
- The microscope should be held close to your body when transporting it..

IMPORTANT

- Place the microscope about 3 inches from the edge of your table.
- Place the cord out of the walking path.
- Don't grab the microscope by the eyepiece.
  - Use the arm to move it.
  - Use the nosepiece to turn it.



DON'T DROP IT!

Types of Microscopes

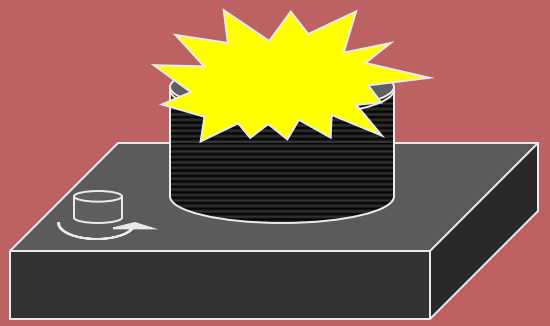
- **Light Microscope** – the models found in most schools, use compound lenses and light to magnify objects. The lenses bend or refract the light, which makes the object beneath them appear closer.
- **Scanning Electron Microscope** – allow scientists to view a universe too small to be seen with a light microscope. SEMs don't use light waves; they use electrons (negatively charged electrical particles) to magnify objects up to two million times.
- **Transmission Electron Microscope –** also uses electrons, but instead of scanning the surface (as with SEM's) electrons are passed through very thin specimens.

Preparing the Microscope

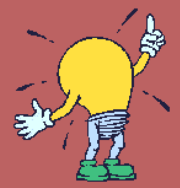
1. Remove the plastic cover, fold it, and put it to the side.
2. Use a small piece of 2.5 cm x 2.5 cm lens paper (not tissue or paper towels) and wipe the following areas:
    1. Eyepiece lens
    2. Light
    3. Diaphragm aperture (the hole in the stage)
    4. Objective lenses
3. Wipe gently and carefully.
4. Dirty lenses interfer with viewing.

TURN ON THE LIGHT

1. Find the light switch.
2. Turn on the light.



- When not using the microscope, turn off the light.



ADJUST THE

- The DIAPHRAGM Is a dial located below the stage.
- It adjusts the amount of light entering the microscope.
- Turn the dial so that the proper amount of light enters the microscope.
- Too much light makes the image to light and bright; too little light…make the image too dark.

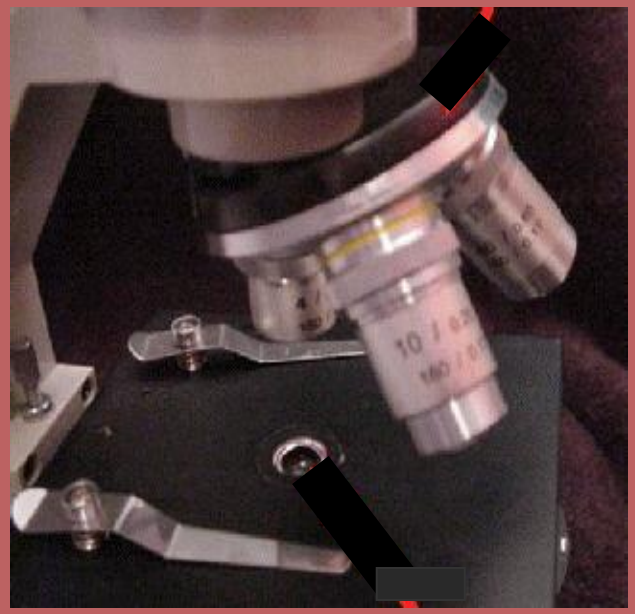
POSITION THE MICROSCOPE

1. Using the COARSE ADJUSTMENT KNOB, lower the stage.—all the way down.

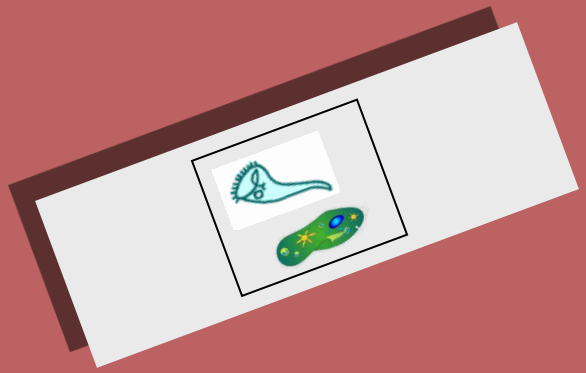
2. Position the scanning lens 4X over the APERTURE.

Getting Ready to View

- Once the scanning objective (4X) is clicked into place, you are on your way to viewing.
- Using this objective will make the specimen appear 40 times larger than it is.
- This objective has the least magnification, but the largest field of view.
- This is just a beginning point. Don't worry you will be able to see the image magnified more if needed.



PLACING A SLIDE ON THE MICROSCOPE



- Whether the slide is a prepared or a wet mount, handle it carefully.
- Prevent fingerprints on the slide be handling it at the edges.
- Move the stage clips, and place the slide on the stage.

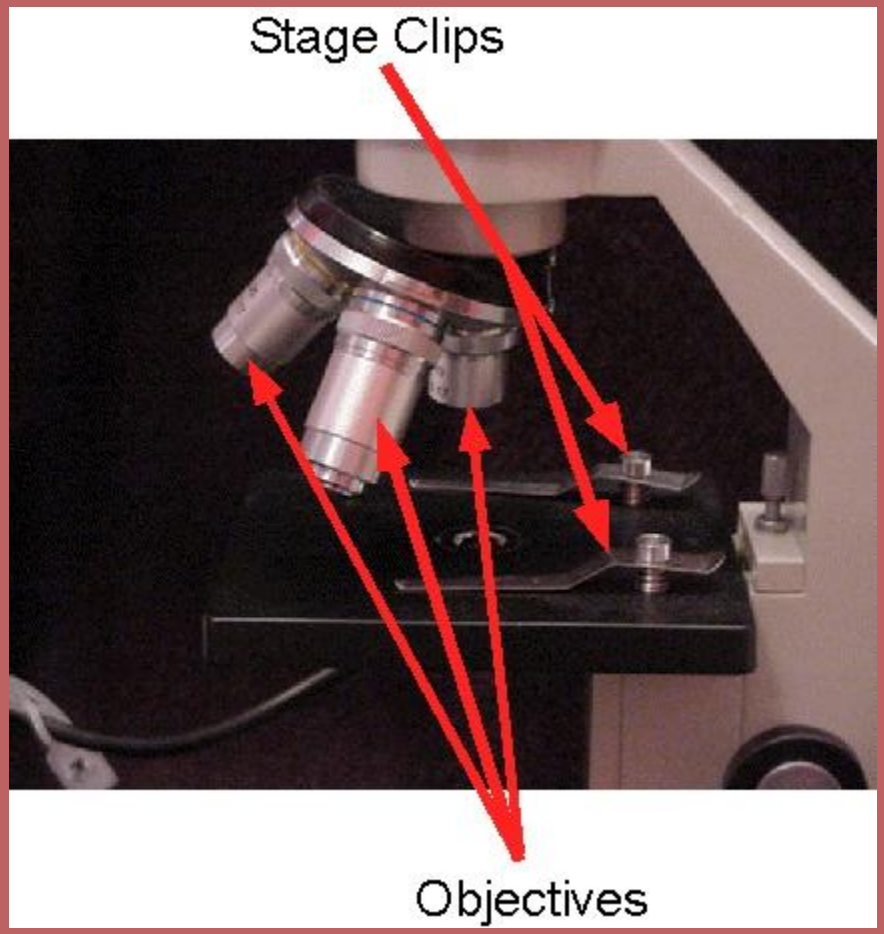
POSITION THE SLIDE

1. Once the stage clips are moved out, place the slide over the APERTURE, or hole.

2. If you can see the specimen, move it so it is directly over the aperture.

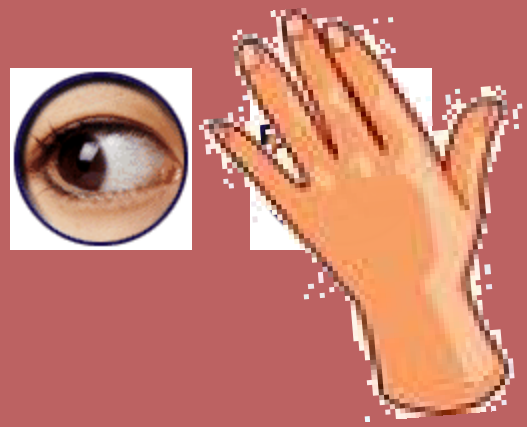
USING STAGE CLIPS

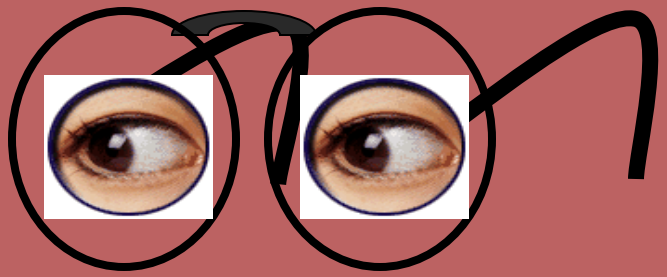
1. Stage clips can be nuisances. If you are going to be moving the slide often, do not use them.
2. However, if you are drawing an image, you may want to lock the slide in place using stage clips.



LOOKING INTO THE MICROSCOPE

- Use only one eye to look into the eyepiece.
- Gently place your <u>hand over the unused eye</u> to prevent eye strain.
- No need to wear glasses. Focusing will adjust the view.



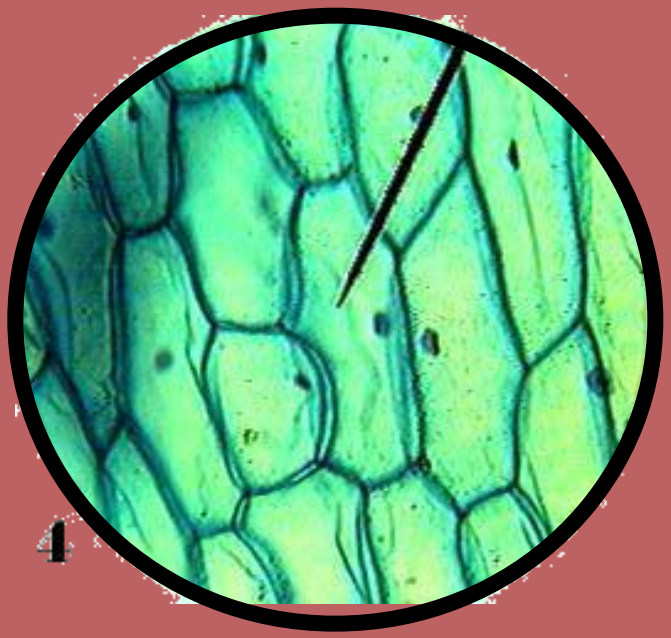


MICROSCOPE FIELD

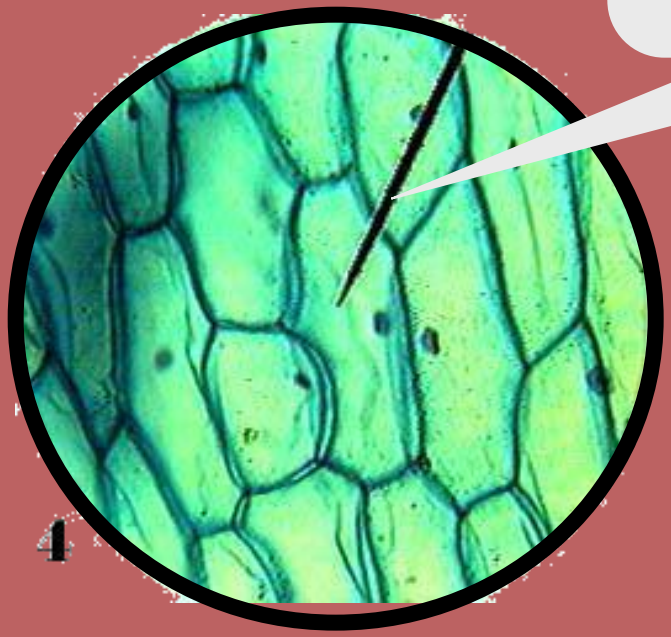
- When you look into the eyepiece, you will see a circle of light .

- The circle of light is called the

MICROSCOPE FIELD.



What's That Line in the Microscope?



It is a pointer and it moves by turning the eyepiece.

FOCUSING THE IMAGE

Click here

- Sometimes, the object is difficult to locate because it is not focused.
- Move the coarse adjustment knob to bring the specimen into view.

- You may also need to move the slide to find the object to focus.

BRINGING THE IMAGE TO VIEW

- The stage should be as high as it can be when you place the slide on the stage.
- To focus, you need to look into the microscope.
- Slowly, lower the stage by turning the coarse adjustment knob.

INCREASING THE MAGNIFICATION

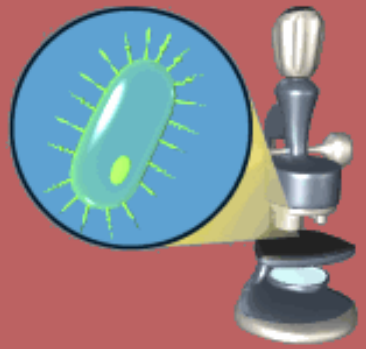
- Once the object is well focused, you may wish to magnify your specimen even more.
- Simply switch to the middle objective, called the low power objective.

LOW POWER = MAGNIFICATION 100 TIMES

- Using the low power objective increases the magnification to 100 times.
- Remember,
  - low power objective = 10X
  - eye piece = 10X
- 10 X 10 = 100 X

CHANGING TO LOW POWER

- When using the low power objective, you may need to refocus.
- To focus, you must keep your eye on the image into the microscope.
- Use the coarse adjustment knob to bring the image into clear view.
- If additional focusing is needed, try the fine adjustment knob.



INCREASING THE MAGNIFICATION EVEN MORE

1. Always center and focus the image before moving to the next magnification level.

2. Carefully move the high power objective over the aperture.

MOVING TO HIGH POWER

- Carefully turn the high power objective marked (40X) so it clicks into place over the aperture.
- If the high power objective magnifies 40 x and the eyepiece lens magnifies 10 x, total magnification is 400X

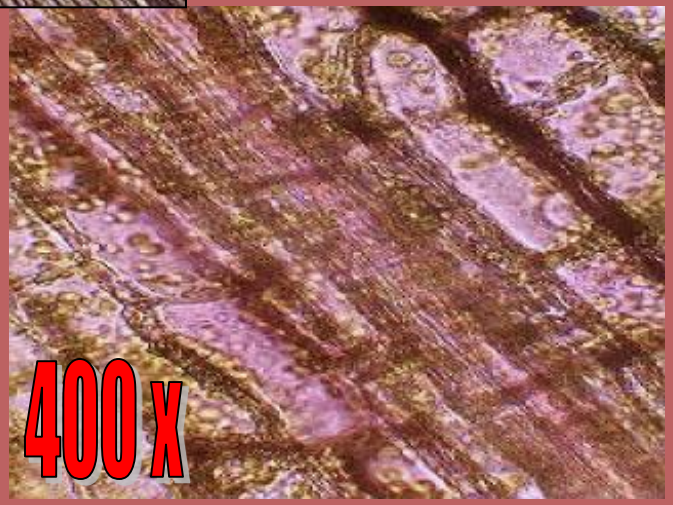
- NOTE: The objective lens is very, very close to the slide.

FOCUSING AT HIGH POWER

- Focusing, when using high power, should be done only with the fine adjustment knob.
- Do not use the coarse adjustment knob or the slide and/or objective lens may crack.

Caution is needed here!

How Do Images Look at Different Magnifications?



Low vs High Power

	Low Power	High Power
Area viewed	MORE	less
Magnification	less	MORE

Drawing Specimens

1. Use pencil - you can erase and shade areas
2. All drawings should include clear and proper labels (and be large enough to view details). Drawings should be labeled with the specimen name and magnification.
3. Labels should be written on the outside of the circle. The circle indicates the viewing field as seen through the eyepiece, specimens should be drawn to scale - ie..if your specimen takes up the whole viewing field, make sure your drawing reflects that.

How to make wet mount?

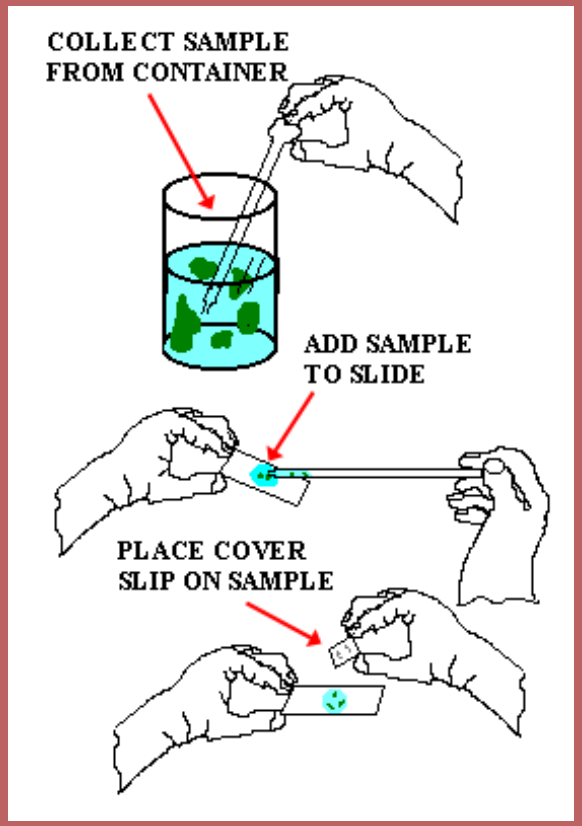
- Place a drop of saline in the center of the slide
- Place a sliver of onion in the center of the slide
- Add a small drop of methylene blue stain to the preparation and gently agitate
- Hold the cover slip so that its edge touches one side of the fluid
- Carefully lower the cover-slip onto the preparation – do not drop the cover-slip
- Secure your slide to the stage (with the spring clips)
- Focus on your cheek cells

Preparing Slides

Create slices eg water hyacinth stems transversely

Place slices on glass objects, used as water, and cover with glass.

Do not put the preparations without glass cover.



Preparations or slides should be numbered in one corner of the label.

Maintenance: no need to hold the object surface with a finger during the practicum

For cleaning preparations or slides with a dry brush, if a lot of adhesive material that can be used xylol disturbing observation.

Spesiesmen mounted tumb and microscopic animals kept in special wooden boxes equipped with mini-sized shelves glass objects. Storage arranged in parallel vertical and be kept dry.

Capture and storage would be done with caution.

Each spesiesmen preserved and stored with the label has arranged alphabetically for easy storage and uptake.

WORKING WITH A PARTNER

- Use the revolving nose piece to move the eyepiece so your partner can view.
- One partner must set up microscope for viewing. This cannot be done together.

Total Magnification:

X

=

4X Scanning Objective 10X Eyepiece

X

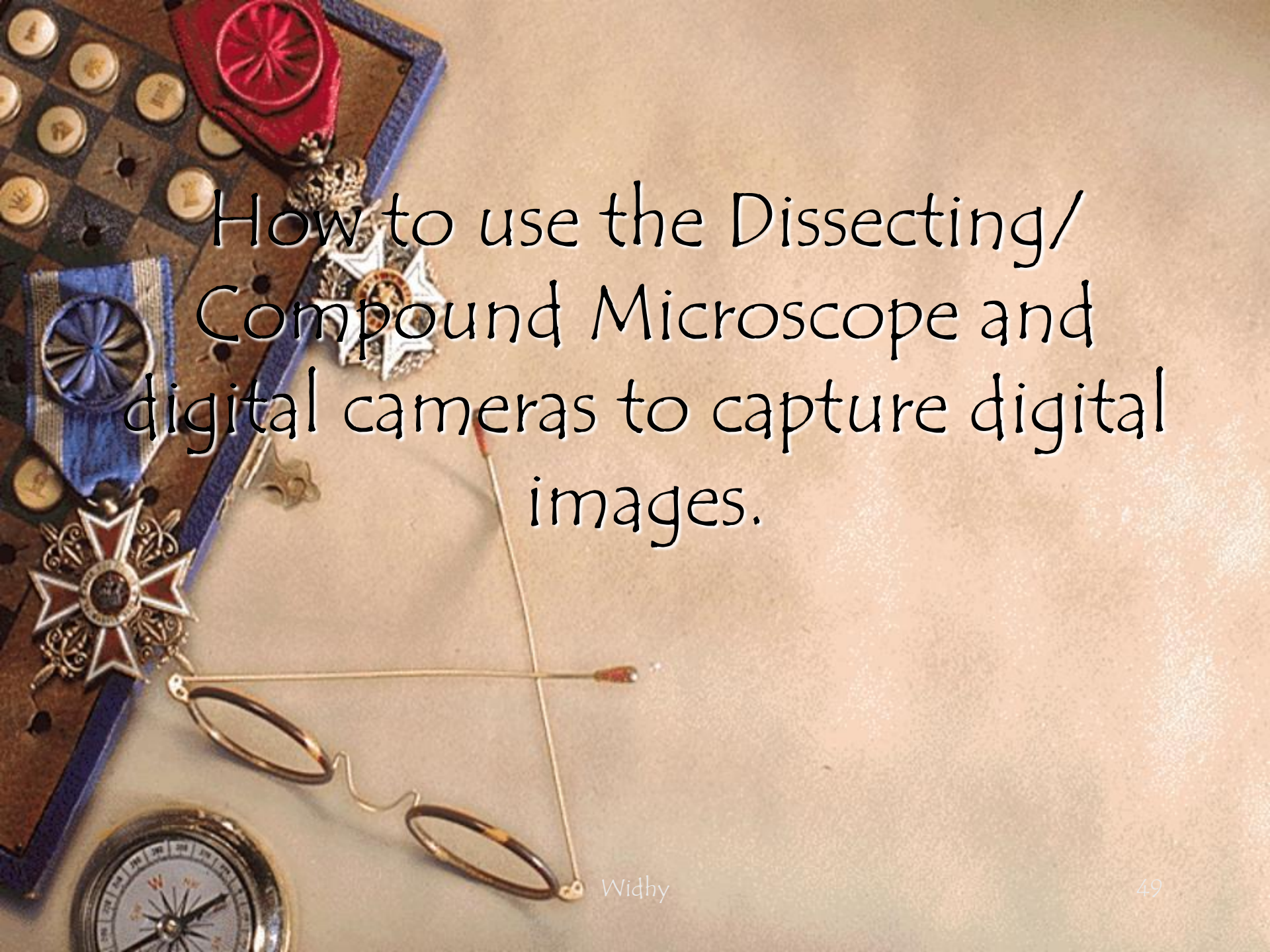
=

10X Objective 10X Eyepiece

X

=

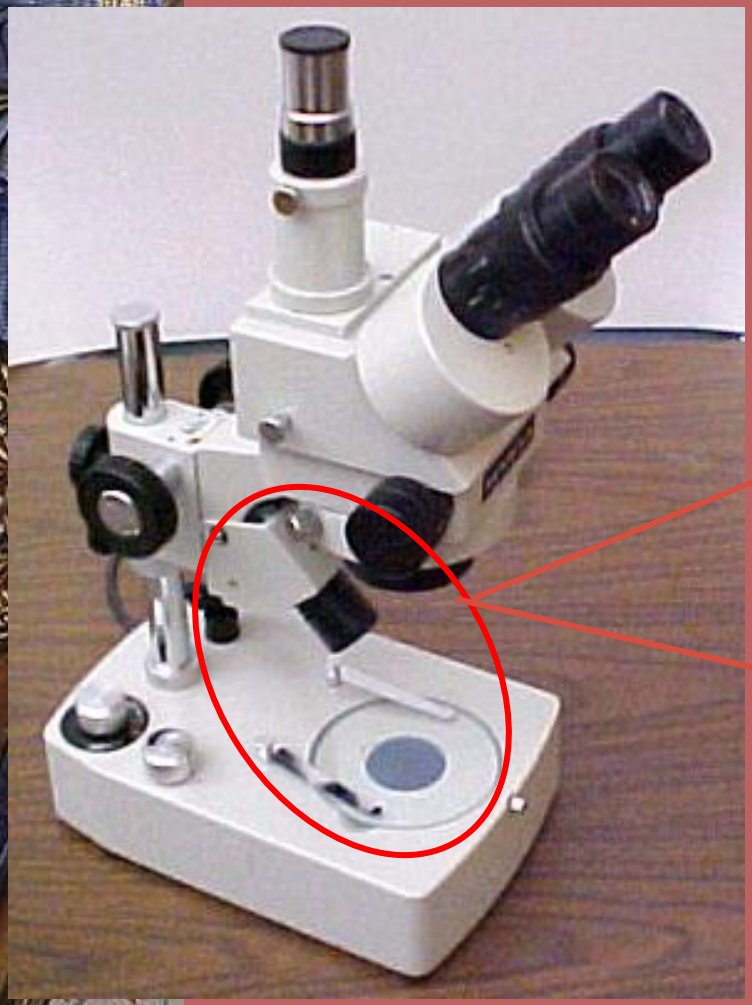
40X Objective 10X Eyepiece


How to use the Dissecting/ Compound Microscope and digital cameras to capture digital images.

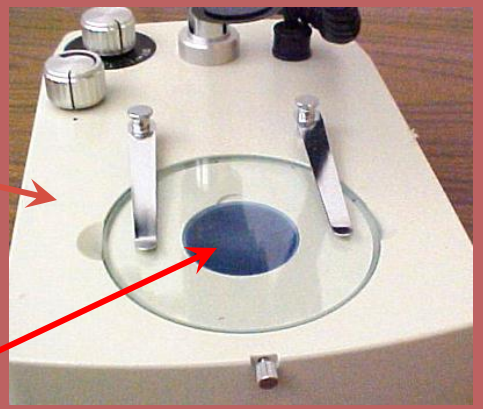
A stereo dissecting microscope is normally used to view relatively large specimens at magnifications from about 5X to about 50X. The scope provides a very large range of adjustment to accommodate a variety of specimen sizes and to allow many options for specimen illumination.

Setting up a trinocular dissecting microscope for best viewing

Specimens can be illuminated from two light sources; one below and one above, depending on needs of viewing a particular specimen

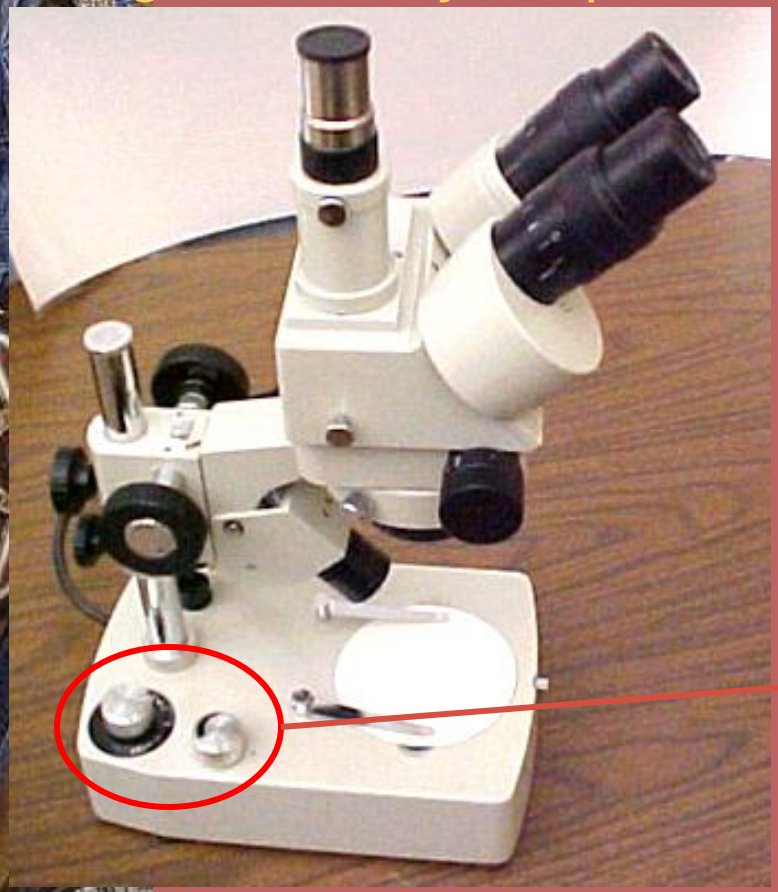


Upper illuminator for “incident light” viewing



Lower illuminator for “transmitted light” viewing

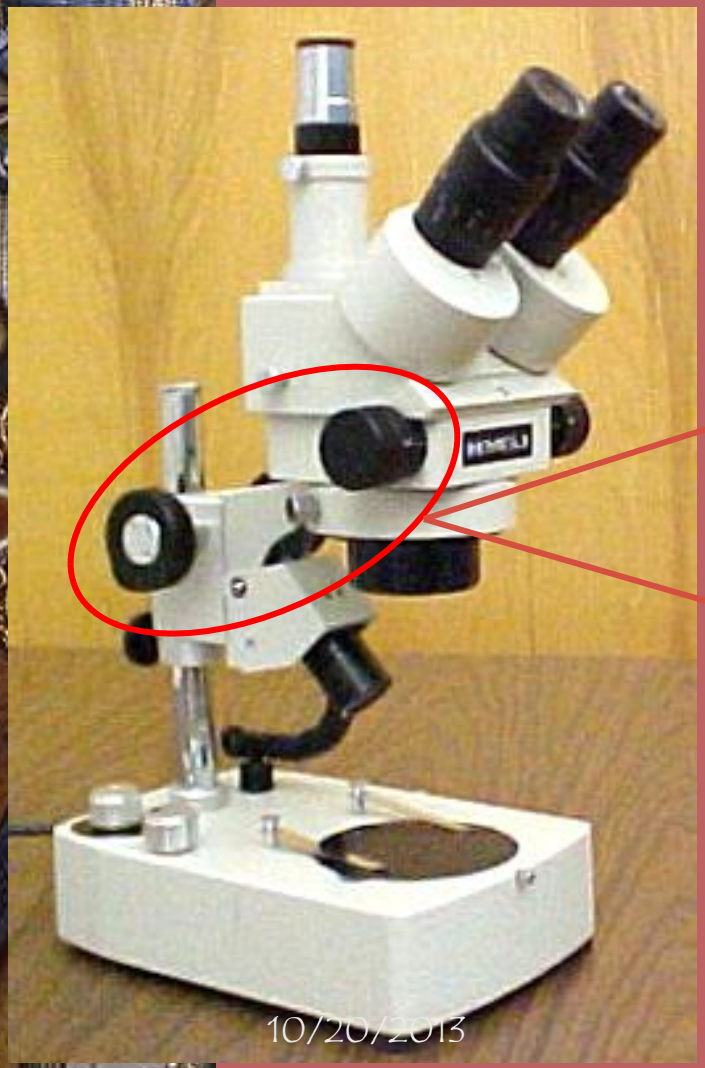
Illuminating specimens from below provides for “transmitted” light viewing and from above for “incident” light viewing. One control switch selects the light source and the other varies light intensity. To preserve bulb life, IT IS IMPORTANT to reduce current surge by turning the dimmer all the way down before operating the light-selection switch.

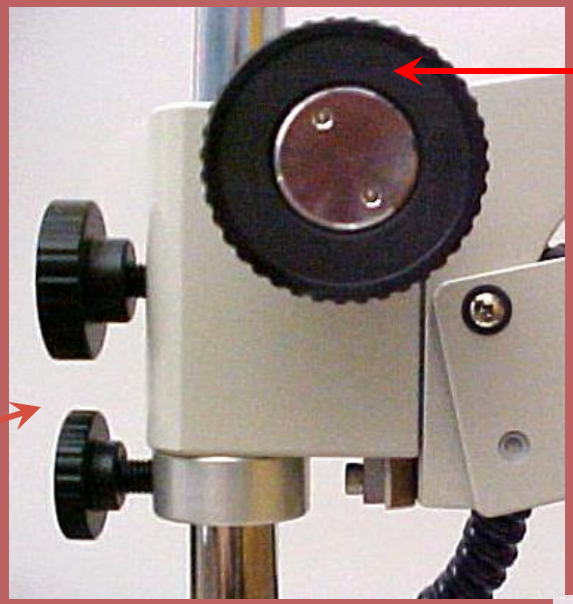


Light switch

Dimmer switch for lights

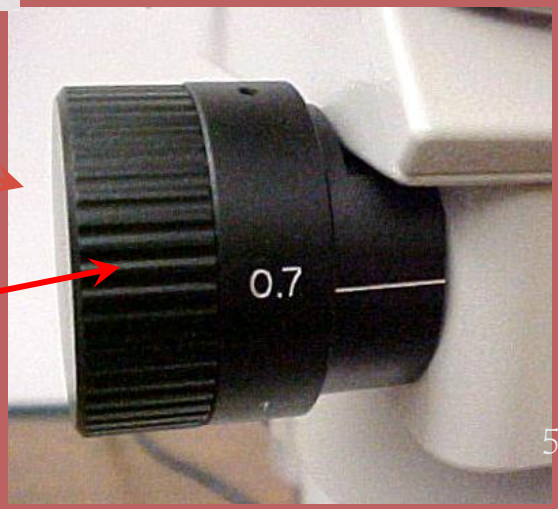
Focus and magnification can be varied to produce the best view of a specimen



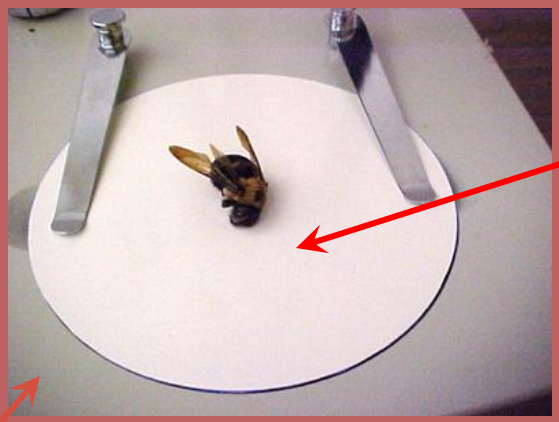


Focus control

Magnification zoom-control

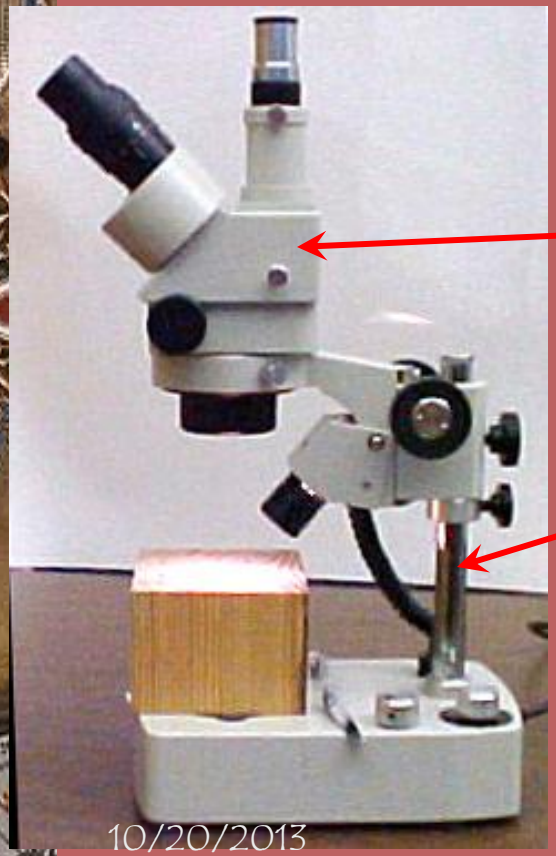


Specimens for incident-light viewing can be placed against various backgrounds to improve contrast and feature identification



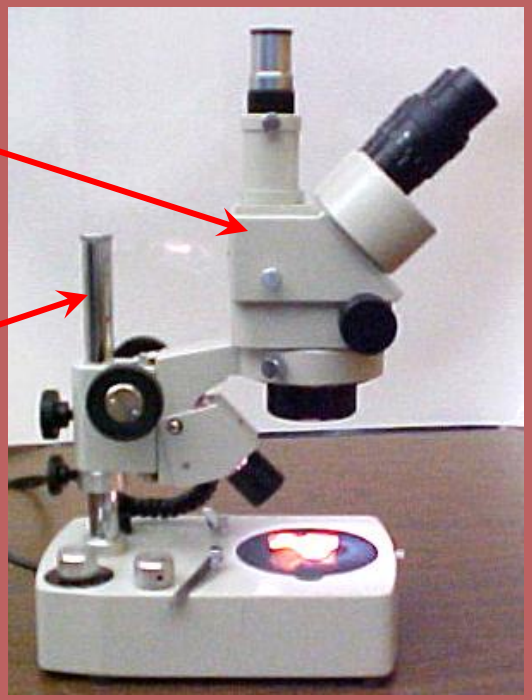
Light-colored stage for dark specimens and dark-colored stage for light ones

To accommodate large specimens, the entire focusing head of the scope can be raised on the support column. Small specimens can be accommodated by lowering the focusing head on the support column. The illuminator can be moved to provide light as needed for best viewing.



Focusing head

Support column



A compound microscope is normally used to view relatively small specimens at magnifications from about 40X to about 600X. Careful preparation of specimens is required in order to view critical features of interest. Changes in magnification are accommodated by using a variety of objective lens, each a different magnification. Light is concentrated on small specimens by a condenser lens to provide sufficient illumination at high magnification.

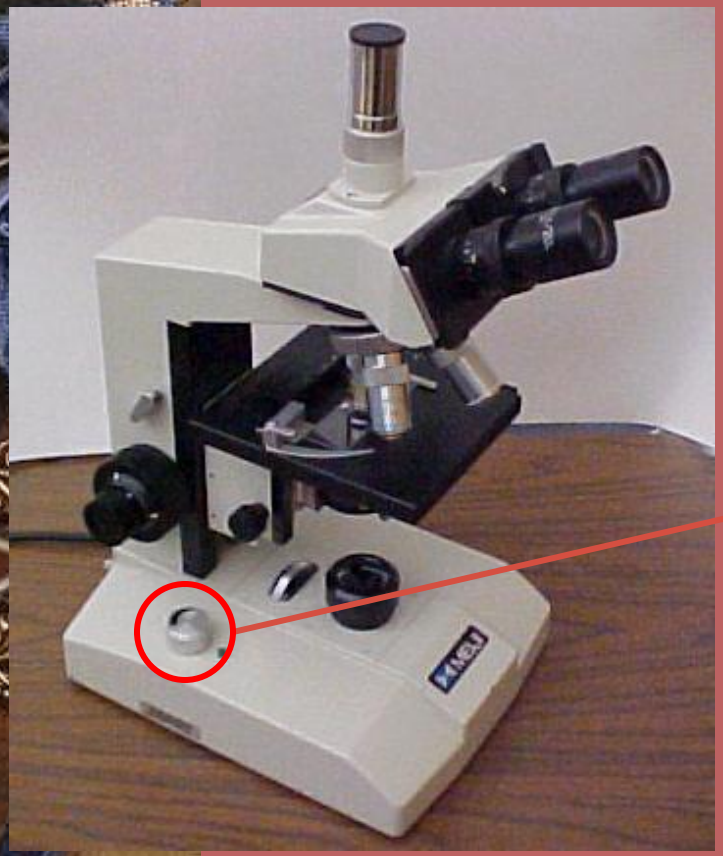
Setting up a trinocular compound microscope for best viewing

"Compound" means having multiple objective (lower) lenses mounted on a rotating turret (lens holder)

Rotating turret to hold objective lenses

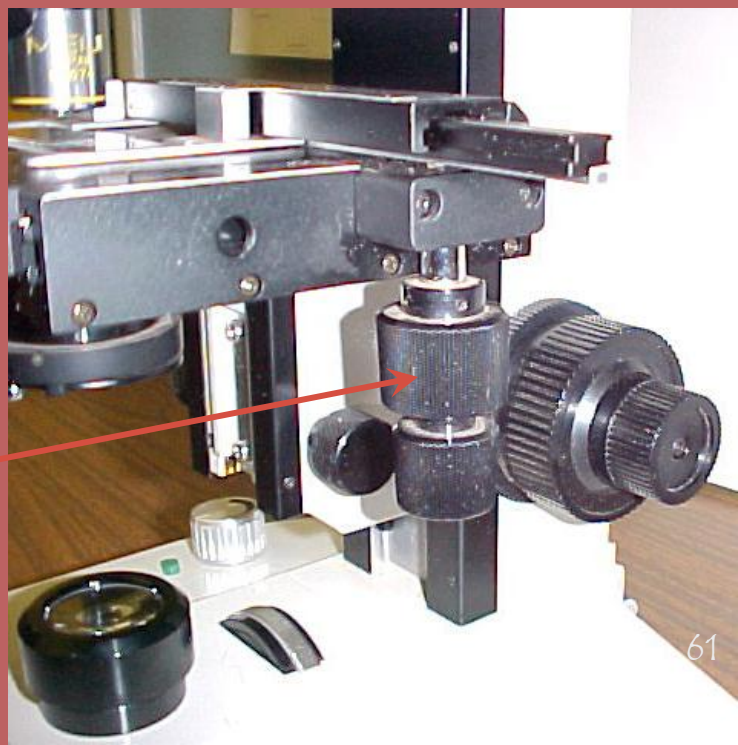
Objective lenses

Turn on microscope illuminator by rotating dimmer knob slowly clockwise. Fast turn-on shortens bulb life.

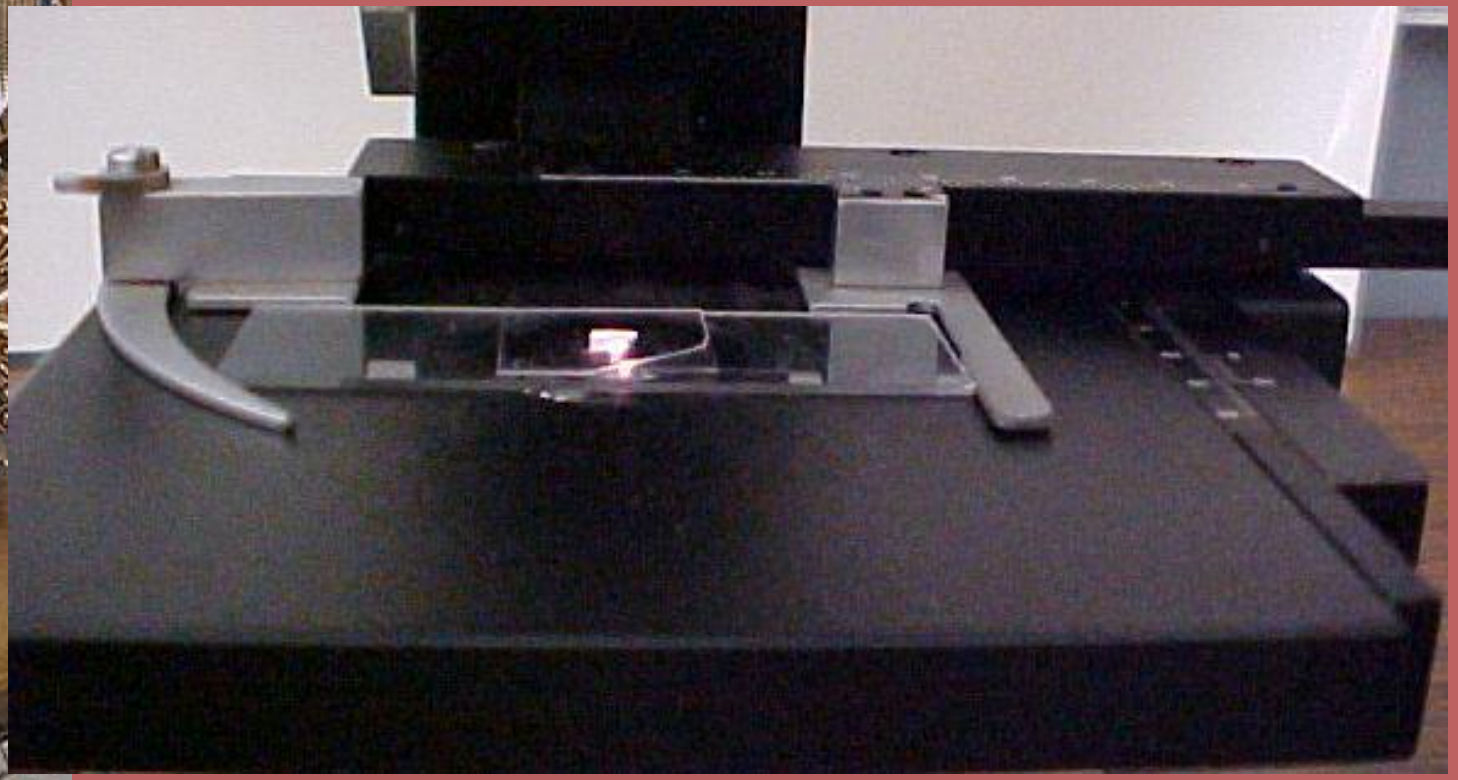


The “mechanical stage” holds specimen slides and allows them to be moved precisely under objective lenses to focus on any area of interest.

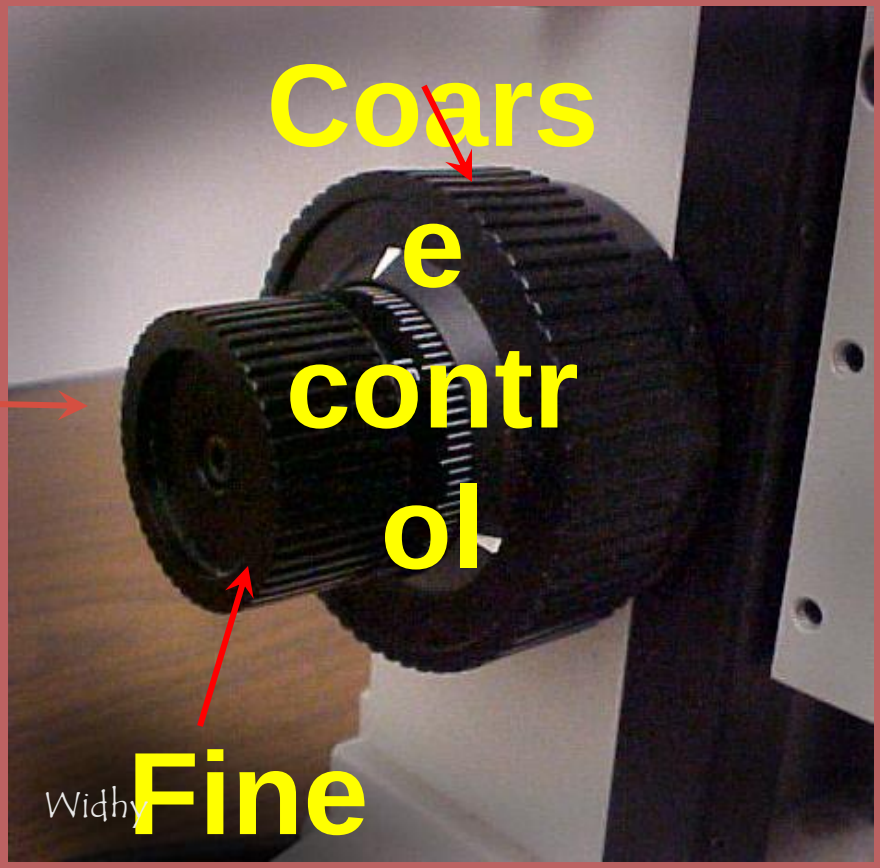
Stage positioning controls



Place a sample slide on the microscope stage under the lowest power objective lens.

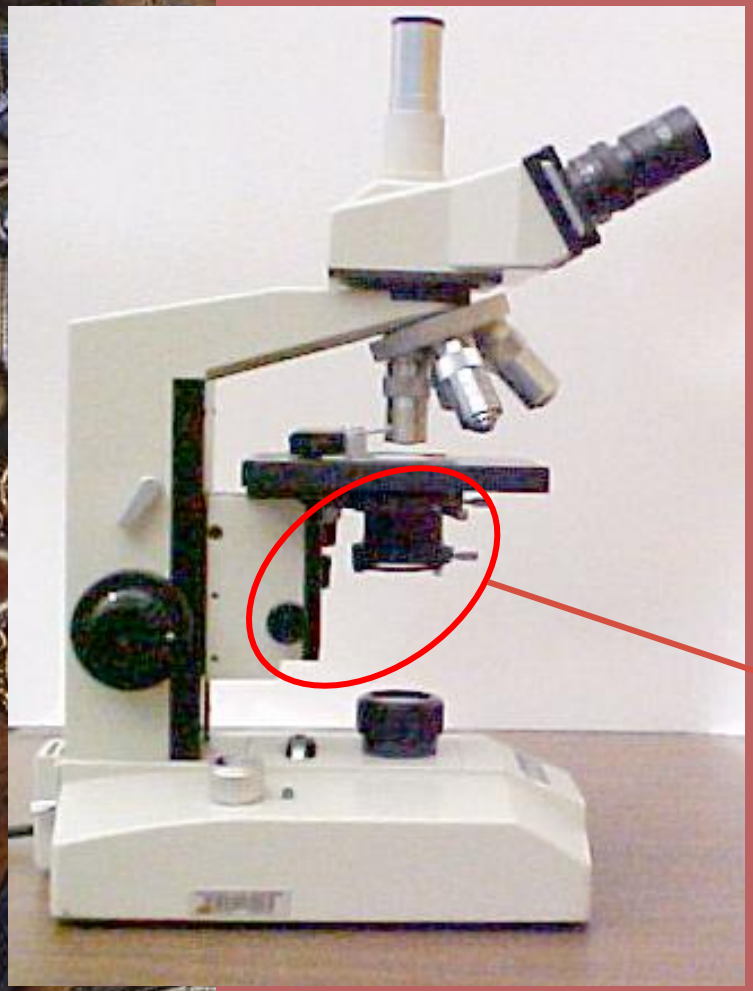


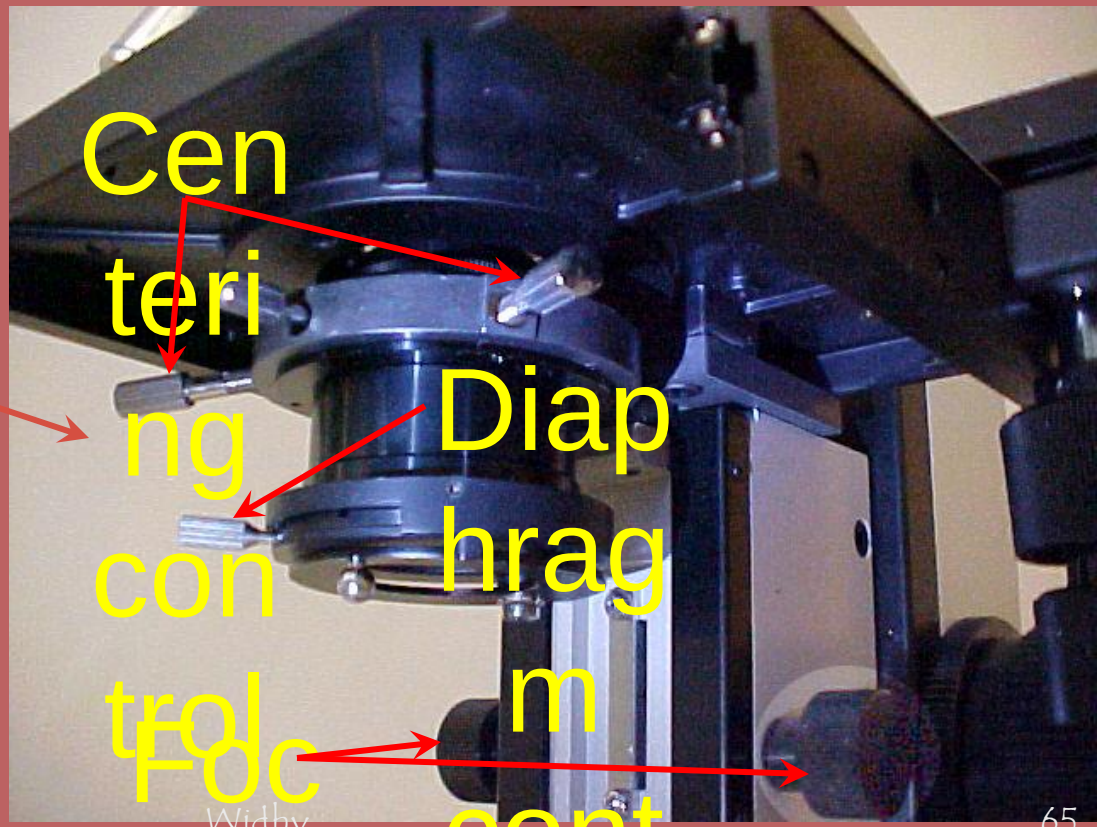
Focusing the microscope on specimen slides can be accomplished with a coarse adjustment control for rapid adjustment, and a fine control for small adjustments, particularly necessary at high magnification levels.



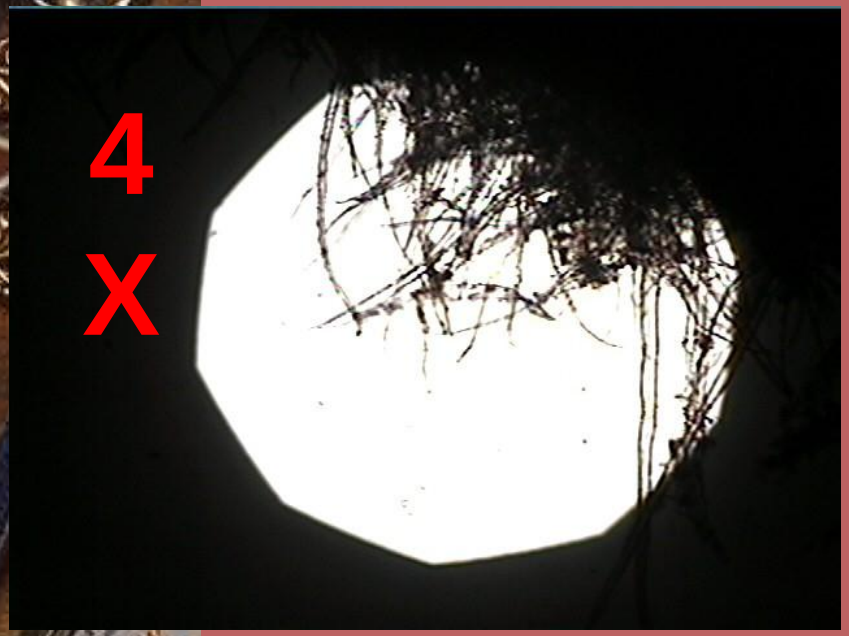
The microscope illuminator, or light source, provides light for transmission through the specimen for viewing its structure. The amount of light is modified with a shutter or diaphragm using a control knob to open or close it for more or less light.

The condenser focuses light from the illuminator onto the specimen slide to provide the best lighting for viewing. It can be raised or lowered and centered for precise focusing as necessary. It has its own shutter diaphragm too, for varying the amount of light reaching the specimen slide.





Rotate the illuminator diaphragm control until the diaphragm is closed all the way. Using the focusing knob on the condenser, bring the diaphragm image into as sharp focus as possible. Using the centering controls, be sure the diaphragm image is positioned in the center of the field of view.



Adjust the condenser diaphragm so that the specimen features are as clearly visible as desired.

Condenser diaphragm closed

Condenser diaphragm wide open

The nature of light and lenses results in a plane of focus which becomes thinner as magnification increases. That means for a particular specimen slide, it becomes possible to focus through the thickness of a specimen. Some parts will be in focus while others will not, as in these wood cells focused at different “depths” through the slide.

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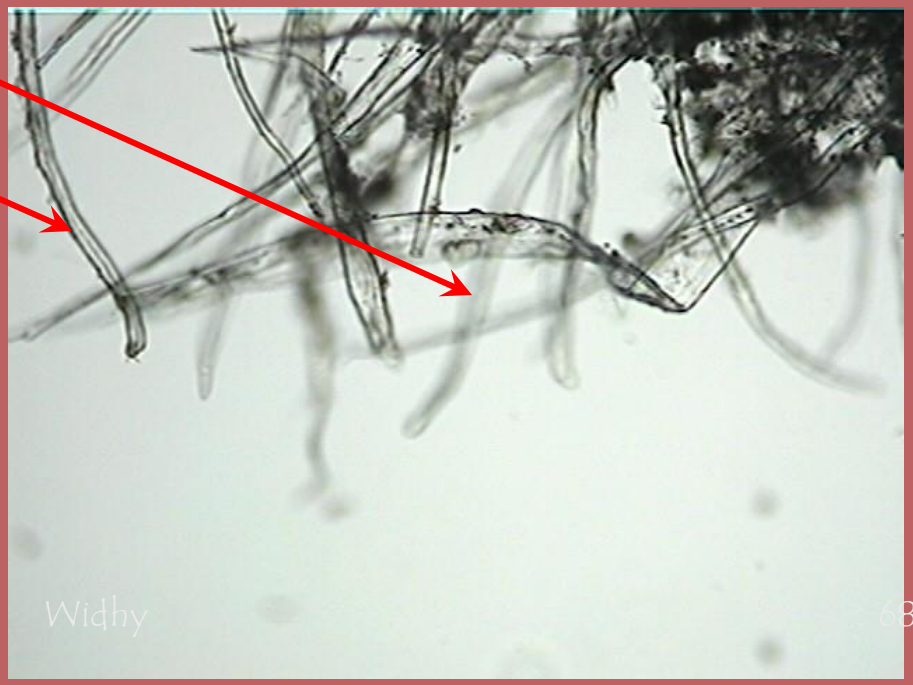


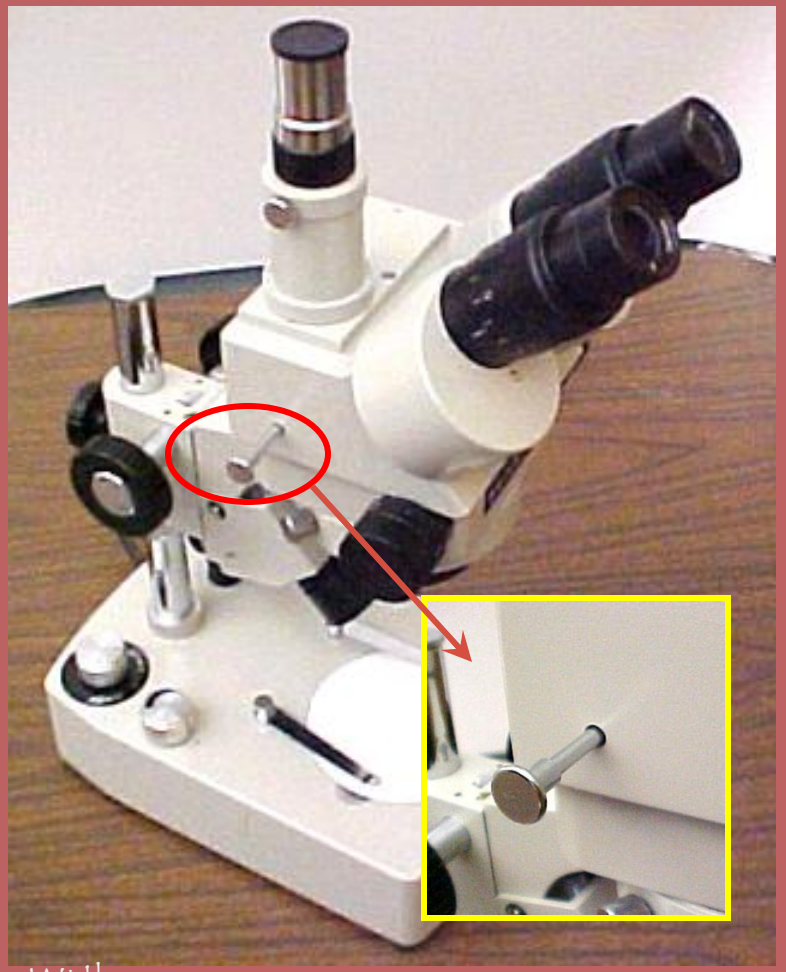
Capturing Microscope Images

An analog video camera can be adapted to a microscope and individual video frames captured and converted to digital image files. Images at least 640x480 pixels in size are best, saved as JPG files. (Digital video cameras are now available too, with USB output.)

Capturing Microscope Images (continued)

Many hand-held digital cameras can be adapted to capture images from microscopes. Very high resolution images produce unnecessarily large image files, so the camera should be set to a lower resolution and to JPG file type for this process.

To send light from the microscope to a camera mounted on the third ocular tube, a diverter-prism is moved into the field of view by pulling out its control arm.



Microscope to Computer….

- Once the camera is mounted and hooked up to the computer
  - Adjust the image on your computer screen. Remember, what you see in the camera or on the image-capture viewer is what will be captured to a digital file. NOT NECESSAEILY what you see by eye through the eyepieces.

Dissecting Microscope Review

- Be sure illuminator dimmer is turned all the way down before selecting a light source on the scope.
- Once the light source is selected, turn dimmer control up slowly.
- Move focusing head to a position on the support column that allows appropriate focusing.
- Focus on specimen at desired magnification
- Adjust eyepieces for best viewing
- Adjust illuminator for best lighting
- "Zoom" to a different magnification if desired, refocus and readjust light
- Divert image to camera, reposition specimen and fine focus on camera or image-capture viewer.
- Capture and save desired image
  - Always save images as a JPEG. This is the only format which is accepted in the DDDI system.

Compound Microscope Review

- Turn on microscope illuminator slowly
- Place specimen slide on mechanical stage
- Focus on specimen at desired magnification
- Adjust eyepieces for best viewing
- Adjust condenser for best lighting
- Adjust condenser diaphragm for best contrast
- Refine focus for depth of field
- Refine focus for image capture
- Capture and Save desired image
  - Always save images as a JPEG. This is the only format which is accepted in the DDDI system.