

# Microscopy for Beekeepers: Summary sheet

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1. What you can do with each of the two main types of light microscope:
    - a. Dissection type:
      - a.i. –Learn bee anatomy
      - a.ii. –Examine bees for tracheal mites
      - a.iii. –Look for *Varroa* scars and other injuries to the exoskeleton
      - a.iv. –Study any structure at the *organ* or *whole animal* level.
    - b. Compound type:
      - b.i. –Identify *Nosema* and estimate infection load
      - b.ii. –Identify amoeboid cysts
      - b.iii. –Look at different kinds of pollen
      - b.iv. –Examine any structure at the *tissue* and *cellular* level.
  2. The microscope's *resolution*, or its ability to display detail, is enhanced by:
    - a. Better lighting
    - b. Higher quality lenses
    - c. Stronger lenses (greater magnifying power)
    - d. No dirt in the light path between your eye and the object you are looking at
    - e. Uniform wavelengths from the light source (less color range, or frequency)
  3. The microscope's resolution is degraded, or worsened, by:
    - a. Dirt on the lenses or other surfaces light passes through
    - b. Dim light
    - c. Highly scattered, broadband light (wide color range)
    - d. Poor quality optics or scratched lenses
  4. The ideal microscope
    - a. •Has high quality optics
    - b. •Is well-machined so that it stays in focus when you adjust it
    - c. •Has a wide field of view
    - d. •Has a versatile range of magnifications
    - e. •Has a well-designed stage (place to put your specimen)
    - f. •Is easy to use
  5. Important features of the dissection microscope:
    - a. Good depth of field or “working distance”.
- \*\*This means that the 3-D contours of the specimen are all in focus at the same time over a generous observation “depth”.
- b. Allows manipulation of the specimen while you are looking at it.
6. Optional features of the dissection microscope...not essential, but nice to have:
  - a. •Binocular...both eyes can observe the specimen
  - b. •Two light sources: One above, and one below your specimen. These can be used together, or one at a time, and the intensity of the light may be increased or decreased.
  - c. •LED light source is cool (doesn't heat the specimen) and uses little power.

- d. •Zoom lens allows you to choose exactly the magnification that works best for what you are doing.
7. Important features of the compound microscope:
  - a. Has enough objective lenses to allow you the range of magnifications you need
  - b. Has high quality, wide field of view optics
  - c. Has a stable, tight stage that doesn't drift out of focus
  - d. Has an adjustable sub-stage condenser to allow you to direct and concentrate the light where you need it
8. Optional, but handy features in a compound scope:
  - a. •Binocular....both eyes can observe the specimen at once. The ocular lenses are independently adjustable to accommodate intraocular disparities of the observer.
  - b. •Clips on the stage hold the specimen slide, and two worm gears allow precise movements of the stage, smoothly moving different parts of the slide into view.
  - c. •A generous range of objective lenses that achieve several levels of magnification
9. Basic rules of use:
  - a. •Don't touch the lenses
  - b. •Carry the microscope by the base and body
  - c. •Keep the stage clean
  - d. •Use ONLY lens paper to clean the lenses, and a small amount of alcohol or water.
  - e. •Get professional servicing if the instrument is damaged, if you can't clean the lenses of dirt, or if the light path is out of alignment.
10. Basic operation of the compound microscope (steps to take to get correct lighting and focus on the glass slide)
  1. Turn on the light source.
  2. Place your slide into the clip on the stage
  3. Always begin to focus your specimen using the lowest power objective.
  4. Never try to do your initial focus while looking through the oculars. Always look directly at the stage at first, so that you don't accidentally jam the objective lens into your slide specimen. Raise the stage until the objective is close to the specimen, then look through the oculars and lower the stage until the object is in focus.
  5. Center and focus the substage condenser (to be demonstrated)
  6. Adjust the substage diaphragm (to be demonstrated)
  7. Increase magnification, refocus, and readjust the substage diaphragm as needed.

Acknowledgments:

•Wells College, in Aurora, NY has loaned the Zeiss Stemis and the Bausch and Lomb microscopes to the Bee Wellness workshops

•A grant from the USDA NIFA Beginning Farmers and Ranchers Development Program, Grant # 2011-494400-30631, and matching funds from the Empire State Honey Producers Association.

•Hardworking volunteers and members of the Empire State Honey Producers Association have planned, organized and facilitated these workshops for the benefit of beekeepers throughout New York State.